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M.DCC.XCVIII.

ENCYCLOPÆDIA.

MIEL (Jan), called *Giovanni della Vite*, a most eminent painter, was born in Flanders in 1599. He was at first a disciple of Gerard Seghers, in whose school he made a distinguished figure; but he quitted that artist, and went to Italy, to improve himself in design, and to obtain a more extensive knowledge of the several branches of his art. At Rome he particularly studied and copied the works of the Caracci and Corregio; and was admitted into the academy of Andrea Sacchi, where he gave such evident proofs of extraordinary merit and genius, that he was invited by Andrea to assist him in a grand design which he had already begun. But Miel, through some disgust, rejected these elevated subjects which at first had engaged his attention, refused the friendly proposal of Sacchi, and chose to imitate the style of Bamboccio, as having more of that nature which pleased his own imagination. His general subjects were huntings, carnivals, gypsies, beggars, pastoral scenes, and conversations; of those he composed his easel-pictures, which are the finest of his performances. But he also painted history in a large size in fresco, and in oil; which, though they seem to want elevation of design, and a greater degree of grace in the heads, yet appear superior to what might be expected from a painter of such low subjects as he generally was fond of representing. His pictures of huntings are particularly admired: the figures and animals of every species being designed with uncommon spirit, nature, and truth. The transparence of his colouring, and the clear tints of his skies, enliven his compositions; nor are his paintings in any degree inferior to those of Bamboccio either in their force or lustre. His large works are not so much to be commended for the goodness of the design as for the expression and colouring; but it is in his small pieces that the pencil of Miel appears in its greatest delicacy and beauty. The singular merit of this master recommended him to the favour of Charles Emanuel duke of Savoy, who invited him to his court, where he appointed Miel his principal painter, and afterwards honoured him with the order of St Mauritius, and made him a present of a cross set with diamonds of a great value, as a particular mark of his esteem. He died in 1664.

MIERIS (Francis), the *Old*, a justly celebrated painter, was born at Leyden in 1635; and was at first placed under the direction of Abraham Toorne Vliet, one of the best designers of the Low Countries, and afterwards entered himself as a disciple with Gerard Douw. In a short time he far surpassed all his companions, and was by his master called the prince of his disciples. His manner of painting silks, velvets, stuffs, or carpets, was so singular, that the different kinds and fabric of any of them might easily be distinguished. His pictures are rarely to be seen, and as rarely to be sold; and when they are, the purchase is extremely high, their intrinsic value being so incontestably great. Beside portraits, his general subjects were conversations, persons performing on musical instruments, patients attended by the apothecary or doctor, chymists at work, mercers shops, and such like; and the usual valuation he set on his pictures was estimated at the rate of a ducat an hour. The finest portrait of this master's hand is that which he painted for the wife of Cornelius Plaats, which is said to be still preserved in the family, although very great sums have been offered for it. In the possession of the same gentleman was another picture of Mieris, representing a lady fainting, and a physician applying the remedies to relieve her. For that performance he was paid (at his usual rate of a ducat an hour) so much money as amounted to fifteen hundred florins when the picture was finished. The grand duke of Tuscany wished to purchase it, and offered three thousand florins for it, but the offer was not accepted. However, that prince procured several of his pictures, and they are at this day an ornament to the Florentine collection. One of the most curious of them is a girl holding a candle in her hand, and it is accounted inestimable. This painter died in 1681.

MIERIS (John), son of the former, was born at Leyden in 1660, and learned the art of painting from his father. The young artist unhappily was severely afflicted with the gravel and stone; and by those complaints was much hindered in the progress of his studies. But, after the death of his father, he travelled to Germany, and from thence to Florence, where the fame of his father's merit procured him a most honourable reception from the grand duke, who, when he saw some of his paintings, endeavoured to retain him in his service. But Mieris politely declined it, and proceeded to Rome, where his great abilities were well known before his arrival, and his works were exceedingly coveted. In that city his malady increased; yet at the intervals of ease he continued to work with his usual application, till the violence of his distemper ended his days in 1690, when he was only thirty years old. He was allowed to have been as eminent for painting in a large size as his father had been for his works in small.

MIERIS (William), called the *Young Mieris*, was brother to the former, and born at Leyden in 1662. During the life of his father, he made a remarkable progress: but, by being deprived of his director when he was only arrived at the age of nineteen, he had recourse to nature, as the most instructive guide; and by studying with diligence and judgement to imitate her, he approached near to the merit of his father. At first he took his subjects from private life, in the manner of Francis; such as tradesmen in their shops, or a peasant selling vegetables and fruit, and sometimes a woman looking out at a window; all which he copied minutely after nature, nor did he paint a single object without his model. As Mieris had observed the compositions of Gerrard Lairesse, and other great historical painters, with singular delight, he attempted to design subjects in that style; and began with the story of Rinaldo sleeping on the lap of Armida, surrounded with the loves and graces, the fore-ground being enriched with plants and flowers; a work which added greatly to his fame, and was sold for a very high price. This master also painted landscapes and animals with equal truth and neatness; and modelled in clay and wax, in so sharp and accurate a manner, that he might justly be ranked among the most eminent sculptors. In the delicate finishing of his works, he imitated his father; as he likewise did in the lustre, harmony, and truth, of his paintings, which makes them to be almost as highly prized; but they are not equal in respect of design, or of the striking effect, nor is his touch so very exquisite as that of the father. The works of the old Mieris are better composed, the figures are better grouped, and they have less confusion; yet the younger Mieris is acknowledged to be an artist of extraordinary merit, although inferior to him, who had scarcely his equal. He died in 1747.

Mieris (Francis), called the *Young Francis*, was the Son of William, and the grandson of the celebrated Francis Mieris; and was born at Leyden in 1689. He learned the art of painting from his father, whose manner and style he always imitated; he chose the same subjects, and endeavoured to resemble him in his colouring and pencil. But with all his industry he proved far inferior to him: and most of those pictures which at the public sales are said to be of the young Mieris, and many also in private collections ascribed to the elder Francis, or William, are perhaps originally painted by this master, who was far inferior to both; or are only his copies after the works of those excellent painters, as he spent abundance of his time in copying their performances.

MIEZA, (anc. geog.), a town of Macedonia which was anciently called *Strymonium*, situated near Stagira. Here, Plutarch informs us, the stone seats and shady walks of Aristotle were shown. Of this place was Peucestes, one of Alexander's generals, and therefore surnamed *Miezæus*, (Arrian.)

MIGDOL, or Magdol, (anc. geog.), a place in the Lower Egypt, on this side Pihahiroth, or between it and the Red Sea, towards its extremity. The term denotes a tower or fortress. It is probably the *Magdolum* of Herodotus, seeing the Septuagint render it by the same name.

MIGNARD (Nicholas), a very ingenious French painter, born at Troyes in 1628; but, settling at Avignon, is generally distinguished from his brother Peter by the appellation of *Mignard of Avignon*. He was afterwards employed at court and at Paris, where he became rector of the royal academy of painting. There are a great number of his historical pieces and portraits in the palace of the Thuilleries. He died in 1690.

Mignard (Peter), the brother of Nicholas, was born at Troyes in 1610; and acquired so much of the taste of the Italian school, as to be known by the name of the *Roman*. He was generally allowed to have a superior genius to his brother Nicholas; and had the honour of painting the popes Alexander VII. and Urban VIII. besides many of the nobility at Rome, and several of the Italian princes: His patron, Louis, sat ten times to him for his portrait, and respected his talents so much as to ennoble him, make him his principal painter after the death of Le Brun, and appoint him director of the manufactories. He died in 1695, and many of his pieces are to be seen at St Cloud.

MIGNON, or Minjon, (Abraham), a celebrated painter of flowers and still life, was born at Frankfort in 1639; and his father having been deprived of the greatest part of his substance by a series of losses in trade, left him in very necessitous circumstances when he was only seven years of age. From that melancholy situation he was rescued by the friendship of James Murel, a flower-painter in that city; who took Mignon into his own house, and instructed him in the art, till he was 17 years old. Murel had often observed an uncommon genius in Mignon: he therefore took him along with him to Holland, where he placed him as a disciple with David de Heem; and while he was under the direction of that master he laboured with incessant application to imitate the manner of De Heem, and ever afterwards adhered to it; only adding daily to his improvement, by studying nature with a most exact and curious observation.—"When we consider the paintings of Mignon, one is at a loss (Mr Pilkington observes) whether most to admire the freshness and beauty of his colouring, the truth in every part, the bloom on his objects, or the perfect resemblance of nature visible in all his performances. He always shows a beautiful choice in those flowers and fruits from which his subjects are composed: and he groups them with uncommon elegance. His touch is exquisitely neat, though apparently easy and unlaboured; and he was fond of introducing insects among the fruits and flowers, wonderfully finished, so that even the drops of dew appear as round and as translucent as nature itself." He had the good fortune to be highly paid for his works in his lifetime; and he certainly would have been accounted the best in his profession even to this day, if John Van Huysum had not appeared. Weyerman, who had seen many admired pictures of Mignon, mentions one of a most capital kind. The subject of it is a cat, which had thrown down a pot of flowers, and they lie scattered on a marble table. That picture is in every respect so wonderfully natural, that the spectator can scarce persuade himself that the water which is spilled from the vessel is not really running down from the marble. This picture is distinguished by the title of *Mignon's Cat*. This painter died in 1679, aged only 40.

MIGRATION, the passage or removal of a thing out of one place into another.

Migration *of Birds*.—It has been generally believed, that many different kinds of birds annually pass from one country to another, and spend the summer or the winter where it is most agreeable to them; and that even the birds of Britain will seek the most distant southern regions of Africa, when directed by a peculiar instinct to leave their own country. It has long been an opinion pretty generally received, that ſwallows reſide during the winter-ſeaſon in the warm ſouthern regions; and Mr Adanſon particularly relates his having ſeen them at Senegal when they were obliged to leave this country. But beſides the ſwallow, Mr Pennant enumerates many other birds which migrate from Britain at different times of the year, and are then to be found in other countries; after which they again leave theſe countries, and return to Britain. The reaſon of theſe migrations he ſuppoſes to be a defect of food at certain ſeaſons of the year, or the want of a ſecure aſylum from the perſecution of man during the time of courtſhip, incubation, and nutrition. The following is his liſt of the migrating ſpecies.

1. *Crows.* Of this genus, the hooded crow migrates regularly with the woodcock. It inhabits North Britain the whole year: a few are ſaid annually to breed on Dartmoor, in Devonſhire. It breeds alſo in Sweden and Auſtria: in ſome of the Swediſh provinces it only ſhifts its quarters, in others it reſides throughout the year. Our author is at a loſs for the ſummer retreat of thoſe which viſit us in ſuch numbers in winter, and quit our country in the ſpring; and for the reaſon why a bird, whoſe food is ſuch that it may be found at all ſeaſons in this country, ſhould leave us.

2. *Cuckoo.* Diſappears early in autumn; the retreat of this and the following bird is quite unknown to us.

3. *Wryneck.* Is a bird that leaves us in the winter. If its diet be ants alone, as ſeveral aſſert, the cauſe of its migration is very evident. This bird diſappears before winter, and reviſits us in the ſpring a little earlier than the cuckoo.

4. *Hoopoe.* Comes to England but by accident: Mr Pennant once indeed heard of a pair that attempted to make their neſt in a meadow at Selborne, Hampſhire, but were frightened away by the curioſity of people. It breeds in Germany.

5. *Grous.* The whole tribe, except the quail, lives here all the year round: that bird either leaves us, or elſe retires towards the ſea-coaſts.

6. *Pigeons.* Some few of the ring-doves breed here; but the multitude that appears in the winter is ſo diſproportioned to what continue here the whole year, as to make it certain that the greateſt part quit the country in the ſpring. It is moſt probable they go to Sweden to breed, and return from thence in autumn; as Mr Ekmark informs us they entirely quit that country before winter. Multitudes of the common wild pigeons alſo make the northern retreat, and viſit us in winter; not but numbers breed in the high cliffs in all parts of this iſland. The turtle alſo probably leaves us in the winter, at leaſt changes its place, removing to the ſouthern counties.

7. *Stare.* Breeds here. Poſſibly ſeveral remove to other countries for that purpoſe, ſince the produce of thoſe that continue here ſeems unequal to the clouds of them that appear in winter. It is not unlikely that many migrate into Sweden, where Mr Berger obſerves they return in ſpring.

8. *Thruſhes.* The fieldfare and the redwing breed and paſs their ſummers in Norway and other cold countries; their food is berries, which abounding in our kingdoms, tempts them here in the winter. Theſe two and the Royſton crow are the only land-birds that regularly and conſtantly migrate into England, and do not breed here. The hawfinch and croſsbill come here at ſuch uncertain times as not to deſerve the name of birds of paſſage.

9. *Chatterer.* The chatterer appears annually about Edinburgh in flocks during winter; and feeds on the berries of the mountain-aſh. In South Britain it is an accidental viſitant.

10. *Groſbeaks.* The groſbeak and croſsbill come here but ſeldom; they breed in Auſtria. The pine groſbeak probably breeds in the foreſts of the Highlands of Scotland.

11. *Buntings.* All the genus inhabits England throughout the year; except the greater brambling, which is forced here from the north in very ſevere ſeaſons.

12. *Finches.* All continue in ſome parts of theſe kingdoms, except the ſiskin, which is an irregular viſitant, ſaid to come from Ruſſia. The linnets ſhift their quarters, breeding in one part of this iſland, and remove with their young to others. All finches feed on the ſeeds of plants.

13. *Larks, fly-catchers, wagtails, and warblers.* All of theſe feed on inſects and worms; yet only part of them quit theſe kingdoms; though the reaſon of migration is the ſame to all. The nightingale, blackcap, fly-catcher, willow-wren, wheat-ear, and white-throat, leave us before winter, while the ſmall and delicate golden-creſted wren braves our ſevereſt froſts. The migrants of this genus continue longeſt in Great Britain in the ſouthern counties, the winter in thoſe parts being later than in thoſe of the north; Mr Stillingfleet having obſerved ſeveral wheat-ears in the iſle of Purbeck on the 18th of November. As theſe birds are incapable of very diſtant flights, Spain, or the ſouth of France, is probably their winter-aſylum.

14. *Swallows and goat-ſucker.* Every ſpecies diſappears at the approach of winter.

WATER-FOWL.

Of the vaſt variety of water-fowl that frequent Great Britain, it is amazing to reflect how few are known to breed here: the cauſe that principally urges them to leave this country, ſeems to be not merely the want of food, but the deſire of a ſecure retreat. Our country is too populous for birds ſo ſhy and timid as the bulk of theſe are: when great part of our iſland was a mere waſte, a tract of woods and fen, doubtleſs many ſpecies of birds (which at this time migrate) remained in ſecurity throughout the year.—Egrets, a ſpecies of heron now ſcarce known in this iſland, were in former times in prodigious plenty; and the crane, that has totally forſaken this country, bred familiarly in our marſhes: their place of incubation, as well as of all other cloven-footed water-fowl (the heron excepted), being on the ground, and expoſed to every one. As rural economy increaſed in this country, theſe animals were more and more diſturbed; at length, by a ſeries of alarms, they were neceſſitated to ſeek, during the ſummer, ſome lonely ſafe habitation.

On the contrary, thoſe that build or lay in the almoſt inacceſſible rocks that impend over the Britiſh ſeas, breed there ſtill in vaſt numbers, having little to fear from the approach of mankind: the only diſturbance they meet with in general being from the desperate attempts of some few to get their eggs.

Cloven-footed Water-Fowl.

15. *Herons.* The white heron is an uncommon bird, and visits us at uncertain seasons; the common kind and the bittern never leave us.

16. *Curlews.* The curlew breeds sometimes on our mountains; but, considering the vast flights that appear in winter, it is probable that the greater part retire to other countries: the whimbrel breeds on the Grampian hills, in the neighbourhood of Invercauld.

17. *Snipes.* The woodcock breeds in the moist woods of Sweden, and other cold countries. Some snipes breed here, but the greatest part retire elsewhere; as do every other species of this genus.

18. *Sandpipers.* The lapwing continues here the whole year; the ruff breeds here, but retires in winter; the redshank and sandpiper breed in this country, and reside here. All the others absent themselves during summer.

19. *Plovers and oyster-catcher.* The long-legged plover and sanderling visit us only in winter; the dottrel appears in spring and in autumn; yet, what is very singular, we do not find it breeds in south Britain. The oyster-catcher lives with us the whole year. The Norfolk plover and sea-lark breed in England. The green plover breeds on the mountains of the north of England, and on the Grampian hills.

We must here remark, that every species of the genera of curlews, woodcocks, sandpipers, and plovers, that forsake us in the spring, retire to Sweden, Poland, Prussia, Norway, and Lapland, to breed: as soon as the young can fly, they return to us again, because the frosts which set in early in those countries totally deprive them of the means of subsisting; as the dryness and hardness of the ground, in general, during our summer, prevent them from penetrating the earth with their bills, in search of worms, which are the natural food of these birds. Mr Ekmark speaks thus of the retreat of the whole tribe of cloven-footed water fowl out of his country (Sweden) at the approach of winter; and Mr Klein gives much the same account of those of Poland and Prussia.

20. *Rails and gallinules.* Every species of these two genera continue with us the whole year; the land-rail excepted, which is not seen here in winter. It likewise continues in Ireland only during the summer months, when they are very numerous, as Mr Smith tells us in the *History of Waterford*, p. 336. Great numbers appear in Anglesea the latter end of May; it is supposed that they pass over from Ireland, the passage between the two islands being but small. As we have instances of these birds lighting on ships in the channel and the Bay of Biscay, we may conjecture their winter quarters to be in Spain.

Finned-footed Water-Birds.

21. *Phalaropes.* Visit us but seldom; their breeding place is Lapland, and other arctic regions.

22. *Grebes.* The great-crested grebe, the black and white grebe, and little grebe, breed with us, and never migrate; the others visit us accidentally, and breed in Lapland.

Web-Footed Birds.

23. *Avoset.* Breed near Fosdike in Lincolnshire; but quit their quarters in winter. They are then shot in different parts of the kingdom, which they visit, not regularly, but accidentally.

24. *Auks and guillemots.* The great auk or pinguin sometimes breeds in St Kilda. The auk, the guillemot, and puffin, inhabit most of the maritime cliffs of Great Britain, in amazing numbers, during summer. The black guillemot breeds in the Bass Isle, and in St Kilda, and sometimes in Llandidno rocks. We are at a loss for the breeding place of the other species; neither can we be very certain of the winter residence of any of them, excepting of the lesser guillemot and black-billed auk, which, during winter, visit in vast flocks the Frith of Forth.

25. *Divers.* These chiefly breed in the lakes of Sweden and Lapland, and in some countries near the pole; but some of the red-throated divers, the northern and the imber, may breed in the north of Scotland and its isles.

26. *Terns.* Every species breeds here; but leaves us in the winter.

27. *Petrels.* The fulmar breeds in the Isle of St Kilda, and continues there the whole year except September and part of October: the shearwater visits the Isle of Man in April; breeds there; and, leaving it in August or the beginning of September, disperses over all parts of the Atlantic ocean. The stormfinch is seen at all distances from land on the same vast watery tract; nor is ever found near the shore except by some very rare accident, unless in the breeding season. Mr Pennant found it on some little rocky isles, off the north of Skie. It also breeds in St Kilda. He also suspects that it nestles on the Blasquet Isles off Kerry, and that it is the gourder of Mr Smith.

28. *Mergansers.* This whole genus is mentioned among the birds that fill the Lapland lakes during summer. Mr Pennant has seen the young of the red-breasted in the north of Scotland: a few of these, and perhaps of the goosanders, may breed there.

29. *Ducks.* Of the numerous species that form this genus, we know of few that breed here: The swan and goose, the shield-duck, the eider duck, a few shovelers, garganies, and teals, and a very small portion of the wild ducks.

The rest contribute to form that amazing multitude of water-fowl that annually repair from most parts of Europe to the woods and lakes of Lapland and other arctic regions, there to perform the functions of incubation and nutrition in full security. They and their young quit their retreat in September, and disperse themselves over Europe. With us they make their appearance the beginning of October; circulate first round our shores; and, when compelled by severe frost, betake themselves to our lakes and rivers. Of the web-footed fowl there are some of hardier constitutions than others: these endure the ordinary winters of the more northern countries; but when the cold reigns there with more than common rigour, they repair for shelter to these kingdoms: this regulates the appearance of some of the diver kind, as also of the wild swans, the swallow-tailed shield-duck, and the different sorts of goosanders which then visit our coasts. Barentz found the barnacles with their nests in great numbers in Nova Zembla. (*Collect. Voy. Dutch East-India Company*, 8vo. 1703, p. 19.) Clusius, in his *Exot.* 368. also

Migration. alſo obſerves, that the Dutch diſcovered them on the rocks of that country and in Waygate Straits. They, as well as the other ſpecies of wild-geeſe, go very far north to breed, as appears from the hiſtories of Greenland and Spitzbergen, by Egede and Crautz. Theſe birds ſeem to make Iceland a reſting place, as Horrebow obſerves: few continue there to breed, but only viſit that iſland in the ſpring, and after a ſhort ſtay retire ſtill farther north.

30. *Corvorants*. The corvorant and ſhag breed on moſt of our high rocks: the gannet in ſome of the Scotch iſles, and on the coaſt of Kerry: the two firſt continue on our ſhores the whole year. The gannet diſperſes itſelf all round the ſeas of Great Britain, in purſuit of the herring and pilchard, and even as far as the Tagus to prey on the ſardina.

But of the numerous ſpecies of fowl here enumerated, it may be obſerved how very few intruſt themſelves to us in the breeding ſeaſon, and what a diſtant flight they make to perform the firſt great dictate of nature.

There ſeems to be ſcarcely any but what we have traced to Lapland, a country of lakes, rivers, ſwamps, and alps, covered with thick and gloomy foreſts, that afford ſhelter during ſummer to theſe fowls, which in winter diſperſe over the greateſt part of Europe. In thoſe arctic regions, by reaſon of the thickneſs of the woods, the ground remains moiſt and penetrable to the woodcocks, and other ſlender-billed fowl: and for the web-footed birds the waters afford larvæ innumerable of the tormenting knat. The days there are long; and the beautiful meteorous nights indulge them with every opportunity of collecting ſo minute a food: whilſt mankind is very ſparingly ſcattered over that vaſt northern waſte.

Why then ſhould Linnæus, the great explorer of theſe rude deſarts, be amazed at the myriads of water-fowl that migrated with him out of Lapland? which exceeded in multitude the army of Xerxes; covering, for eight whole days and nights, the ſurface of the river Calix! His partial obſervation as a botaniſt, would confine their food to the vegetable kingdom, almoſt denied to the Lapland waters; inattentive to a more plenteous table of inſect food, which the all-bountiful Creator had ſpread for them in the wilderneſs. It may be remarked, that the lakes of mountainous rocky countries in general are deſtitute of plants: few or none are ſeen on thoſe of Switzerland; and Linnæus makes the ſame obſervation in reſpect to thoſe of Lapland; having, during his whole tour, diſcovered only a ſingle ſpecimen of a *lemma triſulca*, or "ivy-leaved duck's meat," *Flora Lap.* n° 470.; a few of the *ſcirpus lacuſtris*, or "bullruſh," n° 18.; the *alopecurus geniculatus*, or "flote foxtail graſs," n° 38.; and the *ranunculus aquatilis*, n° 234.; which are all he enumerates in his *Prolegomena* to that excellent performance.

Under the article Swallow will be found the principal arguments for and againſt the migration of ſwallows. Here we ſhall give a ſhort abſtract of the arguments uſed by the Hon. Daines Barrington againſt the migration of birds in general, from a paper publiſhed by him in the 62d volume of the Philoſophical Tranſactions. This gentleman denies that any well-atteſted inſtances can be produced of this ſuppoſed migration; which, he thinks, if there were any ſuch periodical flight, could not poſſibly have eſcaped the frequent obſervation of ſeamen. It has indeed been aſſerted that birds of paſſage become inviſible in their flight, becauſe they riſe too high in the air to be perceived, and becauſe they chooſe the night for their paſſage. The author, however, expreſſes his doubts "whether any bird was ever ſeen to riſe to a greater height than perhaps twice that of St Paul's croſs;" and he further endeavours to ſhow, that the extent of ſome of theſe ſuppoſed migrations (from the northern parts of Europe, for inſtance, to the line) is too great to be accounted for, by having recourſe to the argument founded on a nocturnal paſſage.

Migration.

The author next recites, in a chronological order, all the inſtances that he has been able to collect, of birds having been actually ſeen by mariners when they were croſſing a large extent of ſea; and he endeavours to ſhow that no ſtreſs can be laid on the few caſual obſervations of this kind that have been produced in ſupport of the doctrine of a regular and periodical migration.

Mr Barrington afterwards proceeds to invalidate M. Adanſon's celebrated obſervation with reſpect to the migration of the ſwallow in particular, and which has been conſidered by many as perfectly deciſive of the preſent queſtion. He endeavours to ſhow that the four ſwallows which that naturaliſt caught, on their ſettling upon his ſhip, on the 6th of October at about the diſtance of 50 leagues from the coaſt of Senegal, and which he ſuppoſes to have been then proceeding from Europe to paſs the winter in Africa, could not be true European ſwallows; or, if they were, could not have been on their return from Europe to Africa. His objections are founded principally on ſome proofs which he produces of M. Adanſon's want of accuracy on this ſubject, which has led him in the preſent inſtance, to miſtake two African ſpecies of the ſwallow-tribe, deſcribed and engraved by Briſſon, for European ſwallows, to which they bear a general reſemblance; or granting even that they were European ſwallows, he contends, that they were flitting from the Cape de Verd Iſlands to the coaſt of Africa; "to which ſhort flight, however, they were unequal, and accordingly fell into the ſailor's hands." See the article Swallow.—We ſhall here only add, in oppoſition to the remarks of Mr Barrington, the following obſervations of the Rev. Mr White * in a letter to Mr Pennant on this ſubject.

* Natural Hiſtory of Selborne, Letter ix. p. 139.

"We muſt not (ſays he) deny migration in general; becauſe migration certainly does ſubſiſt in ſome places, as my brother in Andaluſia has fully informed me. Of the motions of theſe birds he has ocular demonſtration, for many weeks together, both ſpring and fall: during which periods myriads of the ſwallow kind traverſe the Sraits from north to ſouth, and from ſouth to north, according to the ſeaſon. And theſe vaſt migrations conſiſt not only of hirundines, but of bee-birds, hoopoes, oro pendolos, or golden thruſhes, &c. &c. and alſo of many of our ſoft-billed ſummer birds of paſſage; and moreover of birds which never leave us, ſuch as all the various ſorts of hawks and kites. Old Belon, 200 years ago, gives a curious account of the incredible armies of hawks and kites which he ſaw in the ſpring-time traverſing the Thracian

Migration cian Bosphorus from Asia to Europe. Besides the abovementioned, he remarks, that the procession is swelled by whole troops of eagles and vultures.

"Now it is no wonder that birds residing in Africa should retreat before the sun as it advances, and retire to milder regions, and especially birds of prey, whose blood being heated with hot animal food, are more impatient of a sultry climate: but then I cannot help wondering why kites and hawks, and such hardy birds as are known to defy all the severity of England, and even of Sweden and all north Europe, should want to migrate from the south of Europe, and be dissatisfied with the winters of Andalusia.

"It does not appear to me that much stress may be laid on the difficulty and hazard that birds must run in their migrations, by reason of vast oceans, cross winds, &c.; because, if we reflect, a bird may travel from England to the equator without launching out and exposing itself to boundless seas, and that by crossing the water at Dover and again at Gibraltar. And I with the more confidence advance this obvious remark, because my brother has always found that some of his birds, and particularly the swallow kind, are very sparing of their pains in crossing the Mediterranean: for when arrived at Gibraltar, they do not,

————"rang'd in figure, wedge their way,
————————"and set forth
"Their airy caravan high over seas
"Flying, and over lands with mutual wing
"Easing their flight:" MILTON.

but scout and hurry along in little detached parties of six or seven in a company; and sweeping low, just over the surface of the land and water, direct their course to the opposite continent at the narrowest passage they can find. They usually slope across the bay to the south-west, and so pass over opposite to Tangier, which it seems is the narrowest space.

"In former letters we have considered whether it was probable that woodcocks in moon-shiny nights cross the German ocean from Scandinavia. As a proof that birds of less speed may pass that sea, considerable as it is, I shall relate the following incident, which, though mentioned to have happened so many years ago, was strictly matter of fact:—As some people were shooting in the parish of Trotton, in the county of Sussex, they killed a duck in that dreadful winter 1708-9, with a silver collar about its neck (I have read a like anecdote of a swan), on which were engraven the arms of the king of Denmark. This anecdote the rector of Trotton at that time has often told to a near relation of mine; and, to the best of my remembrance, the collar was in the possession of the rector.

"At present I do not know any body near the seaside that will take the trouble to remark at what time of the moon woodcocks first come. One thing I used to observe when I was a sportsman, that there were times in which woodcocks were so sluggish and sleepy that they would drop again when flushed just before the spaniels, nay just at the muzzle of a gun that had been fired at them: whether this strange laziness was the effect of a recent fatiguing journey, I shall not presume to say.

"Nightingales not only never reach Northumberland and Scotland, but also, as I have heen always told, Devonshire and Cornwall. In those two last counties we cannot attribute the failure of them to the want of warmth: the defect in the west is rather a presumptive argument that these birds come over to us from the continent at the narrowest passage, and do not stroll so far westward."

Migration of Fishes. See Clupea.

St Miguel. ST MIGUEL, one of the Azore islands, situated in W. Long. 22. 45. N. Lat. 38. 10. This island appears to be entirely volcanic. The best account we have of it hath been published in the 68th volume of the Philosophical Transactions by Mr Francis Masson. According to him the productions differ greatly from those of Madeira, insomuch that none of the trees of the latter are found here, except the faya: it has a nearer affinity to Europe than Africa. The mountains are covered with the erica vulgaris, and an elegant ever-green shrub very like a phillyrea, which gives them a most beautiful appearance.

It is one of the principal and most fertile of the Azorian islands, lying nearly east and west. Its length is about 18 or 20 leagues; its breadth unequal, not exceeding five leagues, and in some places not more than two. It contains about 80,000 inhabitants.

Its capital, the city of Ponta del Guda, which contains about 12,000 inhabitants, is situated on the south side of the island, on a fine fertile plain country, pretty regularly built; the streets straight, and of a good breadth. It is supplied with good water, which is brought about the distance of three leagues from the neighbouring mountains. The churches and other religious edifices are elegant and well built for such an island. There is a large convent of Franciscan friars and one of the order of St Augustin, four convents for professed nuns, and three Recolhimentos for young women and widows who are not professed. The vessels anchor in an open road; but it is not dangerous, as no wind can prevent their going to sea in case of stormy weather.

The country round the city is plain for several miles, well cultivated, and laid out with good taste into spacious fields, which are sown with wheat, barley, Indian corn, pulse, &c. and commonly produce annually two crops; for as soon as one is taken off, another is immediately sown in its place. The soil is remarkably gentle and easy to work, being for the most part composed of pulverised pumice-stone. There are in the plains a number of pleasant country-seats, with orchards of orange-trees, which are esteemed the best in Europe.

The second town is Ribeira Grande, situated on the north side of the island, containing about as many inhabitants as the city; a large convent of Franciscan friars, and one of nuns. It gives title to a count, called the *Conde Ribeira Grande*, who first instituted linen and woollen manufactories in the island.

The third town is Villa Franca, on the south side of the island, about six leagues east of Ponta del Guda. It has a convent of Franciscan friars, and one of nuns, which contains about 300. Here, about half a mile from the shore, lies a small island (Ilhao), which is hollow in the middle, and contains a fine bason with only one entrance into it, fit to hold 50 sail of vessels secure from all weather; at present it wants cleaning out, St Miguel. out, as the winter rain washes down great quantities of earth into it, which has greatly diminished its depth. But vessels frequently anchor between this island and the main.

Beside these towns are several smaller, *viz.* Alagoa, Agoa de Pao, Brelanha, Fanaes de Ajuda, and a number of hamlets, called *lugars* or *places*.

About four leagues north-east from Villa Franca, lies a place called the *Furnas*, being a round deep valley in the middle of the east part of the island, surrounded with high mountains, which, though steep, may be easily ascended on horseback by two roads. The valley is about five or six leagues in circuit. The face of the mountains, which are very steep, is entirely covered with beautiful ever-greens, *viz.* myrtles, laurels, a large species of bilberry called *uva de serra*, &c. and numberless rivulets of the purest water run down their sides. The valley below is well cultivated, producing wheat, Indian corn, flax, &c. The fields are planted round with a beautiful sort of poplars, which grow into pyramidal forms, and by their careless, irregular disposition, together with the multitude of rivulets, which run in all directions through the valley, a number of boiling fountains throwing up clouds of steam, a fine lake in the south-west part about two leagues round, compose a prospect the finest that can be imagined. In the bottom of the valley the roads are smooth and easy, there being no rocks but a fine pulverised pumice stone that the earth is composed of.

There are a number of hot fountains in different parts of the valley, and also on the sides of the mountains: but the most remarkable is that called the *chaldeira*, situated on the eastern part of the valley, on a small eminence by the side of a river, on which is a bason about 30 feet diameter, where the water continually boils with prodigious fury. A few yards distant from it is a cavern in the side of the bank, in which the water boils in a dreadful manner, throwing out a thick, muddy, unctuous water several yards from its mouth with a hideous noise. In the middle of the river are several places where the water boils up so hot, that a person cannot dip his finger into it without being scalded; also along its banks are several apertures, out of which the steam rises to a considerable height, so hot that there is no approaching it with one's hand: in other places, a person would think that 100 smiths bellows were blowing altogether, and sulphureous steams issuing out in thousands of places; so that native sulphur is found in every chink, and the ground covered with it like hoar-frost; even the bushes that happen to lie near these places are covered with pure brimstone, condensing from the steam that issues out of the ground, which in many places is covered over with a substance like burnt alum. In these small caverns, where the steam issues out, the people often boil their yams.

Near these boiling fountains are several mineral springs; two in particular, whose waters have a very strong quality, of an acid taste, and bitter to the tongue.

About half a mile to the westward, and close by the river side, are several hot springs, which are used by sick people with great success. Also, on the side of a hill west of St Ann's church, are many others, with three bathing-houses, which are most commonly used. St Miguel. These waters are very warm, although not boiling hot; but at the same place issue several streams of cold mineral water, by which they are tempered, according to every one's liking.

About a mile south of this place, and over a low ridge of hills, lies a fine lake about two leagues in circumference, and very deep, the water thick, and of a greenish colour. At the north end is a plain piece of ground, where the sulphureous steams issue out in many places, attended with a surprising blowing noise. Our author could observe strong springs in the lake, but could not determine whether they were hot or cold: this lake seems to have no visible evacuation. The other springs immediately form a considerable river, called *Ribeira Quente*, which runs a course about two or threee leagues, through a deep rent in the mountains, on each side of which are several places where the smoke issues out. It discharges itself into the sea on the south side, near which are some places where the water boils up at some distance in the sea.

This wonderful place had been taken little notice of until very lately: so little curiosity had the gentlemen of the island, that scarcely any of them had seen it, until of late some persons, afflicted with very virulent disorders, were persuaded to try its waters, and found immediate relief from them. Since that time it has become more and more frequented; several persons who had lost the use of their limbs by the dead palsy have been cured; and also others who were troubled with eruptions on their bodies.

A clergyman who was greatly afflicted with the gout, tried the said waters, and was in a short time perfectly cured, and has had no return of it since. When Mr Masson was there, several old gentlemen, who were quite worn out with the said disorder, were using the waters, and had received incredible benefit from them; in particular, an old gentleman about 60 years of age, who had been tormented with that disorder more than 20 years, and often confined to his bed for six months together: he had used these waters about three weeks, had quite recovered the use of his limbs, and walked about in the greatest spirits imaginable. A friar also who had been troubled with the said disorder about 12 years, and reduced to a cripple, by using them a short time was quite well, and went a-hunting every day.

There are several other hot springs in the island, particularly at Ribeira Grande; but they do not possess the same virtues, at least not in so great a degree.

The east and west part of the island rises into high mountains; but the middle is low, interspersed with round conic hills, all of which have very recent marks of fire; all the parts below the surface consisting of melted lava lying very hollow.

Most of the mountains to the westward have their tops hollowed out like a punch-bowl, and contain water. Near the west end is an immense deep valley like the Furnas called the *Sete Cidades*. This valley is surrounded with very abrupt mountains, about seven or eight leagues round; in the bottom is a deep lake of water, about three leagues in circuit, furnished with great numbers of water-fowls. This water has no mineral quality; neither are there any hot springs in the valley. All these mountains are composed of a

Milan. white crumbly pumice-ſtone, which is ſo loose, that if a perſon thruſt a ſtick into the banks, whole wag-gon loads of it will tumble down. The inhabitants of the iſland relate a ſtory, that he who firſt diſcover-ed it obſerved an extraordinary high peak near the weſt end; but the ſecond time he viſited it, no ſuch peak was to be ſeen, which he ſuppoſed muſt have certainly ſunk: but, however improbable this ſtory may be, at ſome period or another it muſt have cer-tainly been the caſe.

MILAN, or the duchy of the Milaneſe, a country of Italy, bounded on the weſt by Savoy, Piedmont, and Montferrat; by Switzerland on the north; by the territories of Venice, the duchies of Mantua, Parma, and Placentia, on the eaſt; and by the territories of Genoa on the ſouth.

Anciently this duchy, containing the north part of the old Liguria, was called *Inſubria*, from its inhabitants the *Inſubres;* who were conquered by the Romams, as theſe were by the Goths; who in their turn were ſubdued by the Lombards. Di-dier, the laſt king of the Lombards, was taken priſoner by Charlemagne, who put an end to the Longobardic empire, and appointed governors of Milan. Theſe go-vernors, being at a diſtance from their maſters, ſoon began to aſſume an independency, which brought a dreadful calamity on the country; for, in 1153, the capital itſelf was levelled with the ground by the em-peror Frederic Barbaroſſa, who committed great de-vaſtations otherwiſe throughout the duchy. Under this emperor lived one Galvian, a nobleman who was deſcended from Otho a Milaneſe. Galvian, along with William prince of Montferrat, ſerved in the cruſade, when Godfrey of Boulogne took Jeruſalem: he killed in ſingle combat the Saracen general, whom he ſtripped of his helmet, which was adorned with the image of a ſerpent ſwallowing a youth; and this ever afterwards was the badge of that family. His grand-ſon Galvian, having oppoſed the emperor, was taken priſoner, and carried in irons into Germany, from whence he made his eſcape and returned to Milan, died in the ſervice of his country. From him deſcend-ed another Otho, at the time that Otho IV. was em-peror of Germany, and who ſoon diſtinguiſhed him-ſelf by the accompliſhments both of his mind and bo-dy. When he grew up, he was received into the family of cardinal Octavian Ubaldini at Rome. This prelate, who was himſelf aſpiring at the popedom, was in a ſhort time greatly taken with the addreſs and accompliſhments of young Otho, and predicted his future greatneſs. In the mean time, one Torreſs, or Torriano, a Milaneſe nobleman of unbounded ambi-tion, was attempting to make himſelf maſter of Mi-lan. The popular faction had ſome time before been caballing againſt the nobility; and at laſt, Torriano, putting himſelf at their head, expelled the biſhop, and put to death or baniſhed, all the nobility: by which means the popular government was fully eſtabliſhed; and Torriano, under this pretence, ruled every thing as he pleaſed. He was, however, ſoon oppoſed by one Franciſco Sepri, who formed a great party, pre-tending to deliver the city from Torriano's haughti-neſs and cruelty. But while the two parties were collecting their forces againſt each other, cardinal Ubaldini was projecting the deſtruction of both, by means of his favourite Otho. This prelate had for ſome time borne an implacable hatred to Torriano, becauſe he had been by him prevented from carrying out of the treaſury of St Ambroſe's church at Mi-lan, a carbuncle or jewel of great value, which he pretended to reſerve for adorning the papal tiara; for which reaſon he now determined to oppoſe his ambition.

Ubaldini began with naming Otho archbiſhop of Milan; which, as the pope's legate, he had a right to do. This nomination was confirmed by Pope Ur-ban IV.; and the party of the nobility having now got a head from the pope himſelf, began to gather ſtrength. Otho in the mean time employed himſelf in collecting troops; and had no ſooner procured a ſhow of an army, than he advanced towards Lago Mag-gione, and took poſſeſſion of Arona, a ſtrong poſt near that lake: but Torriano, marching immediately againſt him with all his troops, obliged him to aban-don the place, and leave his party to make the beſt terms they could with the conqueror. This was fol-lowed by the deſtruction of the caſtles of Arona, Anghiari, and Brebia: ſoon after which Torriano died, and was ſucceeded by his brother Philip, who had ſufficient intereſt to get himſelf elected podeſta, or prætor of Milan, for ten years. During his lifetime, however, the party of the nobility increaſed conſide-rably under Otho, notwithſtanding the check they had received. Philip died in 1265, having loſt ground con-ſiderably in the affections of the people, though he ob-tained a great reputation for his courage and con-duct. His ſucceſſor Napi rendered himſelf terrible to nobility, whom he proſcribed, and put to death as of-ten as he could get them into his power. He pro-ceeded ſuch lengths, and acted with ſuch fury againſt that unfortunate party, that pope Clement IV. who had ſucceeded Urban, at laſt interdicted Milan, and excommunicated Napi and all his party. By this Napi began to loſe his popularity, and the public diſ-affection towards him was much heightened by the natural cruelty of his temper. But in the mean time, the party of the nobility was in the utmoſt diſtreſs. Otho himſelf and his friends, having ſpent all their ſubſtance, wandered about from place to place; the pope not being in a capacity of giving them any aſ-ſiſtance. Otho, however, was not diſcouraged by his bad ſucceſs, but found means ſtill to keep up the ſpi-rits of his party, who now choſe for their general Squar-cini Burri, a man of great eminence and courage, whoſe daughter was married to Matthew Viſconti, af-terwards called *Matthew the great.* At the ſame time they renewed their confederacy with the marquis of Montferrat, who was ſon-in-law to the king of Spain. The marquis agreed to this confederacy chief-ly with a view to become maſter of the Milaneſe.

The nobility now again began to make head; and having collected an army, which was joined by 600 Spaniſh cavalry and a body of foot, gained ſome ad-vantages. But in the mean time Napi, having gather-ed together a ſuperior army, ſuddenly attacked Otho and Burri, and defeated them. After this diſaſter Otho applied to the pope; from whom, however, he did not obtain the aſſiſtance he deſired; and in the mean time Napi invited the emperor Rodolph into Italy, with the promiſe of being crowned at Milan. This invitation was accepted of with great readineſs by

Milan. by Rodolph; who constituted Napi his governor and vicar-general in Lombardy, sending to him at the same time a fine body of German horse, the command of which was given to Cassoni, Napi's nephew. On this Otho again applied to the pope (Gregory X.); but he was so far from granting him any assistance, that he is said to have entered into a scheme of assassinating him privately; but Otho escaped the danger, and in 1276 began to recover his affairs. The reason of pope Gregory's enmity to him was, that he and his party were thought to be Gibelines, and were opposed by great numbers of the nobility themselves; but after that pope's death, the Milanese exiles being united under one head, soon became formidable. They now chose for their general Godfrey count of Langusio, a noble Pavian, and an inveterate enemy of the Torriano family. This nobleman being rich and powerful, enlisted many German and other mercenaries, at whose head he marched towards the Lago Maggiore. All the towns in that country opened their gates to him, through the interest of the Visconti family, who resided in these parts. But this success soon met with a severe check in an unfortunate engagement, wherein Godfrey was defeated and taken prisoner; after which he and 34 nobles had their heads struck off, and sent from the field of battle piled up in a common waggon.

This defeat greatly affected Otho; but having in a short time recovered himself, he again attacked his enemies, and defeated them; but, suffering his troops to grow remiss after their victory, the fugitives rallied, and entirely defeated him. The next year, however, Otho had better success, and totally defeated and took prisoner Napi himself. After this victory Cassoni was obliged to abandon Milan to his competitor, who kept possession of it till his death, which happened in 1295, in the 87th year of his reign.

Otho was succeeded by Matthew Visconti abovementioned; and Milan continued in subjection to that family without any very memorable occurrence till the year 1378, when, by the death of Galeazzo II. his brother Barnabo became sovereign of Milan. He was of a brave and active disposition; but excessively profuse in his expences, as his brother Galeazzo had also been; and to procure money to supply his extravagancies, was obliged to oppress his subjects. Galeazzo had engaged in an enterprize against Bologna, and the siege of it was continued by Barnabo. It lasted for nine years; and during this time is said to have cost 300 millions of gold, a prodigious sum in those days, near 40 millions sterling; the lowest gold coin being in value somewhat more than half-a-crown English. Both the brothers were excessively fond of building. Barnabo erected a bridge over the Adda, consisting of three stories; the lowest for chariots and heavy carriages, the middle for horses, and the uppermost for foot-passengers. He built also another bridge, which was carried over houses without touching them. To accomplish these, and many other expensive schemes, he became one of the greatest tyrants imaginable, and every day produced fresh instances of his rapacity and cruelty. He instituted a chamber of inquiry, for punishing all those who had for five years before been guilty of killing boars, or even of eating them at the table of another. They who could not redeem themselves by money, were hanged, and above 100 wretches perished in that manner. Those who had any thing to lose were stripped of all their substance, and obliged to labour at the fortifications and other public works. He obliged his subjects to maintain a great many hunting-dogs, and each district was taxed a certain number. The overseers of his dogs were at the same time the instruments of his rapacity. When the dogs were poor and slender, the owners were always fined; but when the dogs were fat, the owners were also fined for suffering them to live without exercise.

The extravagant behaviour of Barnabo soon rendered public affairs ready for a revolution, which was at last accomplished by his nephew John Galeazzo. He affected a solitary life, void of ambition, and even inclining to devotion; but at the same time took care to have his uncle's court filled with spies, who gave him information of all that passed. He reduced his table and manner of living, pretending that he took these steps as preparatives to a retirement from the world, which was soon to take place, after he had paid a religious vow. In short, he acted his part so well, that even Barnabo, though abundantly cautious, had no suspicion of his having any designs against him; and so entirely did he conceal his ambition, that he several times made application to his uncle for his interest to procure him a quiet retreat as soon as his religious vows were performed. One of these was to pay a visit to the church of the blessed Virgin upon mount Varezzio. This was to be done with so much secrecy that all kinds of eye-witnesses were to be excluded; and it was with difficulty that Barnabo himself and two of his sons were allowed to accompany our devotee. But, in the mean time, the hypocritical Galeazzo had soldiers advancing from all quarters; so that Barnabo and his sons were immediately seized, and the houses of those who had sided with them given up to be plundered. The booty in plate, money, and all kinds of rich furniture, was immense. The ministers of the late government were dragged from their hiding-places, and put to death; and at last the citadel itself fell into the hands of Galeazzo, who found in it an immense sum of money. Barnabo was carried prisoner to Tritici, a castle of his own building, where he had the happiness to find one person still faithful to him. This was his mistress, named *Doninia Porra;* who, when he was abandoned by all the world, shut herself up a voluntary prisoner in his chamber, and remained with him as long as he lived, which was only seven months after his degradation.

John Galeazzo was the first who took upon him the title of the *duke of Milan*, and was a prince of great policy and no less ambition. He made war with the Florentines, became master of Pisa and Bologna, and entirely defeated the emperor in 1401, so that he entertained hopes of becoming master of all Lombardy, and cutting off all possibility of invading it either from France or Germany; but his designs were frustrated by death, which happened in 1402, in the 55th year of his age. After his decease the Milanese government fell into the most violent distractions, so that it could not be ſupported, even in time of peace, without an army of 20,000 foot and as many horſe. In the year 1421, however, Philip duke of Milan became maſter of Genoa; but though he gained great advantages in all parts of Italy, the different ſtates ſtill found means to counterbalance his ſucceſſes, and prevent him from enſlaving them: ſo that Milan never became the capital of any extenſive empire; and in 1437 Genoa revolted, and was never afterwards reduced.

Philip died in 1448, and by his death the male line of the Viſconti family was at an end. The next lawful heir was Valentina his ſiſter, who had married the duke of Orleans ſon to Charles V. of France. By the contract of that marriage, the lawful progeny of it was to ſucceed to the duchy of Milan in failure of the heirs-male of the Viſconti family; but this ſucceſſion was diſputed by Sforza, who had married Philip's natural daughter. It is certain, however, that the rightful ſucceſſion was veſted in the houſe of Orleans and the kings of France; and therefore though the Sforza family got poſſeſſion of the duchy for the preſent, Louis XII. afterwards put in his claim, as being grandſon to John Galeazzo. For ſome time he was ſucceſsful; but the French behaved in ſuch an inſolent manner, that they were driven out of the Milaneſe by the Swiſs and Maximilian Sforza. The Swiſs and Milaneſe were in their turn expelled by Francis I. who obliged the Sforza family to relinquiſh the government for a penſion of 30,000 ducats a-year. Francis Sforza, the ſon of Maximilian, however, being aſſiſted by the emperor and the pope, regained the poſſeſſion of the Milaneſe about the year 1521; and, eight years after, the French king, by the treaty of Cambray, gave up his claim on the duchy.

But, in fact, the emperors of Germany ſeem to have had the faireſt title to the Milaneſe in right of their being for a long time ſovereigns of Italy. On the death of Francis Sforza, therefore, in the year 1536, the emperor Charles V. declared the Milaneſe to be an imperial fief, and granted the inveſtiture of it to his ſon Philip II. king of Spain. In his family it continued till the year 1706, when the French and Spaniards were driven out by the Imperialiſts, and the emperor again took poſſeſſion of it as a fief. It was confirmed to his houſe by the treaty of Baden in 1714, by the quadruple alliance in 1718, and by the treaty of Aix-la-Chapelle in 1748.

The duchy of Milan is one of the fineſt provinces in Italy. It is bounded on the ſouth by the Appenine mountains, and the territory of Genoa; on the north by Switzerland; on the eaſt by the Venetian territories, and the duchies of Mantua, Parma, and Placentia; and on the weſt by Savoy, Piedmont, and Montferrat; extending from north to ſouth about 100 miles, and from eaſt to weſt about 108. It is well watered by the Teſſino, the Seſia, the Adda, the Po, the Oglio, the Lombro, Serio, &c. and alſo by ſeveral canals and lakes. Of the latter the Lago Maggiore is between 30 and 40 miles in length, and in ſome places ſix or ſeven miles broad. In it lie the *Boromean Iſlands*, as they are called, viz. Iſola Bella and Iſola Madre, the beauty of which almoſt exceeds imagination: art and nature ſeem to have vied with one another in embelliſhing them. In each of them is a palace with delicious gardens, belonging to the Boromean family. The water of the lake is clear and of a greeniſh colour, and abounds with fiſh. The hills with which it is ſurrounded preſent a moſt charming landſcape, being planted with vines and cheſnut-trees, interſperſed with ſummer-houſes. There is a canal running from it towards Switzerland, with which the city of Milan has a communication. It was anciently called *Lacus Verbanus*. The Lago de Como, which was called by the Latin poets *Lacus Larius*, but had its modern name from the city, near which it lies, extends itſelf about 30 miles northward from Como, but its greateſt breadth is not above five miles. From the Lago Maggiore iſſues the Teſſino; and from that of Como the Adda. Of the other lakes, that of Lugano and Guarda are the chief: that of Guarda was anciently called *Benacus*.

The trade and manufactures of this duchy conſiſt principally in ſilks, ſtuffs, ſtockings, gloves, and handkerchiefs, linen and woollen cloth, hardware, curious works of cryſtal, agate, hyacinths, and other gems; but their exports are uſually far ſhort of their imports.

As to the revenue of the duchy, it muſt without doubt be very conſiderable. It is ſaid to have amounted to 2,000,000 of dollars while the duchy was in the hands of Spaniards.

In the year 1767, the Auſtrian government of Milan publiſhed a law, by which all the rights which the pope or the biſhops had till then exerciſed over eccleſiaſtics, either with regard to their effects or perſons, is transferred to a council eſtabliſhed for that purpoſe at Milan. By the ſame edict, all eccleſiaſtics were obliged to ſell the eſtates which they had become poſſeſſed of ſince the year 1722; and no ſubject, whether eccleſiaſtic or ſecular, was to go to Rome to ſolicit any favour, except letters of indulgence, without the conſent of the ſaid council.

Milan, the capital of the duchy of that name, in Latin *Mediolanum*, is a very large city, and has a wall and rampart round it, with a citadel; yet is thought to be incapable of making any great reſiſtance.—The gardens within the city take up a great deal of ground. In the citadel is a foundery for cannon, and an arſenal furniſhed with arms for 12,000 men. The governor of it is quite independent of the governor-general of the Milaneſe, who reſides in the city, in a large but old and ill-contrived palace. The yearly income of the governor of Milan is ſaid to be 200,000 guilders. The council belonging to the city is compoſed of a preſident and 60 doctors of law, who are all nobles, and independent of the governor-general. Milan hath experienced a great variety of fortune, having been ſubject ſometimes to the French, ſometimes to the Spaniards, and ſometimes to the Germans. A great number of perſons of rank and fortune live in it, eſpecially during the winter. The ladies in France are not allowed more liberty than thoſe of this city: even the auſterities of the monaſtic life are ſo far mitigated here, that gentlemen have not only the liberty of talking with the nuns, and of rallying and laughing at the grate, but alſo of joining with them in concerts of muſic, and of ſpending whole afternoons in their company. The place where the *beau monde* take the air, either in their coaches or on foot, is the rampart betwixt the Porta Orientale and the Porta Toſa, where it is ſtraight and broad, and extremely pleaſant, Milan.

pleaſant, being planted with white mulberry-trees, and commanding a proſpect on one ſide of the open country, and on the other of the gardens and vineyards between the ramparts and the city. Milan, which is ſaid to have been built by the Gauls about 200 years after the foundation of Rome, contains a great number of ſtately edifices, as churches, convents, palaces, and hoſpitals. The cathedral is a vaſt pile, all of marble; and though ſomething has been doing for near 400 years towards the outward or inward ornament thereof, it is not yet finiſhed. Of the great number of ſtatues about it, that of St Bartholomew, juſt flead alive, with his ſkin hanging over his ſhoulders; and of Adam and Eve, over the main portal, are the fineſt. The pillars ſupporting the roof of the church are all of marble, and the windows finely painted. This church contains a treaſure of great value, particularly a ſhrine of rock-cryſtal, in which the body of St Charles Boromæo is depoſited. The other churches moſt worthy a ſtranger's notice are thoſe of St Alexander, St Jerom, St Giovanni de Caſarotti della Paſſione, that of the Jeſuits, and of St Ambroſe, in which lie the bodies of the ſaints and of the kings Pepin and Bernard. In the Ambroſian college, founded by Frederic Boromæo, 16 profeſſors teach gratis. In the ſame college is alſo an accademy of painting, with a muſeum, and a library containing a vaſt number of printed books and manuſcripts; among the laſt of which is a tranſlation of Joſephus's Hiſtory of the Jews, done by Rufinus about 1200 years ago, and written on the bark of a tree; St Ambroſe's works on vellum, finely illuminated; the orations of Gregory Nazianzen, and the works of Virgil, in folio, with Petrarch's notes. In the muſeum are Leonardi da Vinci's mathematical and mechanical drawings, in 12 large volumes. The ſeminary for ſciences, the college of the nobles, the Helvetian college, and the mathematical academy, are noble foundations and ſtately buildings. Of the hoſpitals, the moſt remarkable are the Lazaretto, and that called the *great hoſpital;* the latter of which receives ſick perſons, foundlings, and lunatics, and has ſix ſmaller hoſpitals depending on it, with a revenue of 100,000 rixdollars.

The number of the inhabitants of this city is ſaid to be about 200,000. It has been 40 times beſieged, taken 20 times, and four times almoſt entirely demoliſhed; yet it has always recovered itſelf. It is ſaid that gunpowder is ſold here only by one perſon, and in one place. The court of inquiſition is held in the Dominican convent, near the church of Madonna della Gratia. The houſes of entertainment, and the ordinaries here, are repreſented as very indifferent. Mr Keyſler ſays, it is not unuſual for young travellers, when they go to any of the taverns in Milan, to be aſked. "whether they chooſe a *letto fornito*, or female bed-fellow," who continues maſked till ſhe enters the bed-chamber. Milan is deſcribed as inferior to Turin both in beauty and conveniency: many of the ſtreets being crooked and narrow, and paper-windows much more frequent than in that city; even in grand palaces, the windows are often compoſed promiſcuouſly of glaſs and paper. Two large canals extend from hence, the one to the Teſſino, and the other to the Adda; the Teſſino having a communication with the Lago Maggiore, and, by a canal, with the Seſia; and the Adda iſſuing from the Lago di Como, and having a communication by canals with the Lambro and Serio. In a void ſpace in one of the ſtreets of Milan, where ſtood the houſe of a barber who had conſpired with the commiſſary of health to poiſon his fellow-citizens, is erected a pillar called *Colonna Infame*, with an inſcription to perpetuate the memory of the execrable deſign. The environs of this city are very pleaſant, being adorned with beautiful ſeats, gardens, orchards, &c. About two Italian miles from it, at the ſeat of the Simonetti family, is a building, that would have been a maſter-piece of its kind had the architect deſigned it for an artificial echo. It will return or repeat the report of a piſtol above 60 times; and any ſingle muſical inſtrument, well touched, will have the ſame effect as a great number of inſtruments, and produce a moſt ſurpriſing and delightful concert.

Milan, Milborn.

According to Dr Moore, "there is no place in Italy, perhaps in Europe, where ſtrangers are received in ſuch an eaſy hoſpitable manner as at Milan. Formerly the Milaneſe nobility diſplayed a degree of ſplendor and magnificence, not only in their entertainments, but in their uſual ſtyle of living, unknown in any other country in Europe. They are under a neceſſity at preſent of living at leſs expence, but they ſtill ſhow the ſame obliging and hoſpitable diſpoſition. This country having, not very long ſince, been poſſeſſed by the French, from whom it devolved to the Spaniards, and from them to the Germans, the troops of thoſe nations have, at different periods, had their reſidence here, and, in the courſe of theſe viciſſitudes, produced a ſtyle of manners, and ſtamped a character on the inhabitants of this duchy, different from what prevails in any other part of Italy; and nice obſervers imagine they perceive in Milaneſe manners the politeneſs, formality, and honeſty imputed to thoſe three nations, blended with the ingenuity natural to Italians. The great theatre having been burnt to the ground laſt year, there are no dramatic entertainments, except at a ſmall temporary play-houſe, which is little frequented; but the company aſſemble every evening in their carriages on the ramparts, and drive about, in the ſame manner as at Naples, till it is pretty late. In Italy, the ladies have no notion of quitting their carriages at the public walks, and uſing their own legs, as in England and France. On ſeeing the number of ſervants, and the ſplendor of the equipages which appear every evening at the Corſo on the ramparts, one would not ſuſpect that degree of depopulation, and diminution of wealth, which we are aſſured has taken place within theſe few years all over the Milaneſe; and which proceeds from the burdenſome nature of ſome late taxes, and the inſolent and oppreſſive manner in which they are gathered." E. Long. 15. 35. N. Lat. 38. 32.

MILBORN-PORT, a town of Somerſetſhire in England, ſeated on a branch of the river Parret, 115 miles from London. Though it is repreſented in parliament, it is no market-town nor corporation; but it appears in Domeſday-book to have had a market once, and 56 burgeſſes. It is in a manner ſurrounded by Dorſetſhire. Here are nine capital burgeſſes, who yearly choose two bailiffs, that have the government of the borough under them, and jointly return the members of parliament with the two stewards, who are chosen yearly out of nine commonalty stewards, and have the custody of the corporation-seal. These two stewards also distribute the profits of the lands given to the poor here, of which the said commonalty stewards are trustees. The inhabitants are about 1100, the houses not much above 200. There are two fairs, June 6th and October 28th.

MILBROOK, a town of Cornwall, on the west side of Plymouth-Haven. It has a good fishing-trade, and has formerly furnished the British fleet with many able hands.

MILDENHALL, a town of Suffolk, seven miles from Newmarket, 12 from Bury, and 70 from London. It is a large populous town on the river Lark, a branch of the Ouse, with a harbour for boats. It has a well-frequented market on Friday, especially for fish and wild-fowl. Its church has a tower or steeple 120 feet high.

MILDEW, is said to be a kind of thick, clammy, sweet juice, exhaled from, or falling down upon, the leaves and blossoms of plants. By its thickness and clamminess it prevents perspiration, and hinders the growth of the plant. It sometimes rests on the leaves of trees in form of a fatty juice, and sometimes on the ears of corn. It is naturally very tough and viscous, and becomes still more so by the sun's heat exhaling its more fluid parts; by which means the young ears of corn are so daubed over, that they can never arrive at their full growth. Bearded wheat is less subject to the mildew than the common sort; and it is observed that newly-dunged lands are more liable to mildew than others. The best remedy is a smart shower of rain, and immediately afterwards a brisk wind. If the mildew is seen before the sun has much power, it has been recommended to send two men into the field with a long cord, each holding one end; and drawing this along the field through the ears, the dew will be dislodged from them, before the heat of the sun is able to dry it to that viscous state in which it does the mischief. Some also say, that lands which have for many years been subject to mildews, have been cured of it by sowing soot along with the corn, or immediately after it.

Mr J. S. Segar, the author of a treatise upon this subject, observes, that the mildew is of such a sharp corrosive nature, that it raises blisters on the feet of the shepherds who go barefoot, and even consumes the hoofs of the cattle. He suspects that it possesses some arsenical qualities, though he does not pretend to affirm this positively. Its pernicious influence, according to him, is rendered still more powerful by a variety of circumstances; such as sending the cattle into the fields too early in the spring; their drinking water mixed with ice, or but lately thawed; their being kept in stables that are too close and filthy, and which are not sufficiently aired. The same author considers the mildew as a principal cause of epidemical distempers among the cattle. The mildew producing these diseases, he says, is that which dries and burns the grass and leaves. It falls usually in the morning, particularly after a thunder-storm. Its poisonous quality (which does not continue above 24 hours) never operates but when it has been swallowed immediately after its falling. The disorder attacks the stomach, is accompanied with pimples on the tongue, loss of appetite, a desiccation of the aliments in the stomach, a cough, and difficulty of respiration. As a preservative, the author prescribes purging in spring and in winter. The medicine he advises is composed of 30 grains of sulphur of antimony, and 60 grains of resin of jalap. He is against vomiting, and every thing that is of a heating nature.

MILE, a measure of length or distance, containing eight furlongs. The English statute-mile is 80 chains, or 1760 yards; that is, 5280 feet.

We shall here give a table of the miles in use among the principal nations of Europe, in geometrical paces, 60,000 of which make a degree of the equator.

	Geometrical paces.
Mile of Russia	750
of Italy	1000
of England	1200
of Scotland and Ireland	1500
Old league of France	1500
The small league, *ibid.*	2000
The mean league, *ibid.*	2500
The great league, *ibid.*	3000
Mile of Poland	3000
of Spain	3428
of Germany	4000
of Sweden	5000
of Denmark	5000
of Hungary	6000

MILETUS (anc. geog.), a town of Crete mentioned by Homer; but where situated does not appear. It is said to be the mother-town of Miletus in Caria, whither a colony was led by Sarpedon, Minos's brother, (Ephorus, quoted by Strabo). *Milesii*, the people, (Ovid).

MILETUS (anc. geog.), a celebrated town of Asia Minor, on the confines of Ionia and Caria. It was the capital city of all Ionia, and famous both for the arts of war and peace. It was situated about 10 stadia south of the mouth of the river Mæander, near the sea-coast. It was founded by a Cretan colony under Miletus, the companion of Bacchus; or (according to others) by Neleus the son of Codrus; or by Sarpedon a son of Jupiter. It has successively been called *Lelegeis*, *Pithyusa*, and *Anactoria*. The inhabitants, called *Milesii*, were very powerful, and long maintained an obstinate war against the kings of Lydia. They early applied themselves to navigation; and planted no less than 80 colonies, or (according to Seneca) 380, in different parts of the world. It was the only town that made head against Alexander, and was with much difficulty taken. It gave birth to Thales, one of the seven wise men, and the first who applied himself to the study of nature. It was also the country of Anaximander, the scholar and successor of Thales, the inventor of sun-dials and the gnomon, and the first that published a geographical map; of Anaximance, scholar and successor to the foregoing; and of other great men. It was noted for its excellent wool, according to Virgil; and was also celebrated for a temple and oracle of Apollo Didymæus. This famous people, from being powerful, becoming

becoming afterwards opulent and abandoned to pleasures, lost both their riches and their power.—At present it is called by the Turks *Melas*, and not far distant from it runs the river Mæander. St Paul going from Corinth to Jerusalem passed by Miletus, and as he went by sea, and could not take Ephesus in his way, he caused the bishops and priests of the church of Ephesus to come to Miletus (Acts xx. 15. &c.), which was about 12 leagues from them.

MILFOIL, or YARROW. See ACHILLEA.

MILFORD, a town of Sussex-county in the Delaware state, is situated at the source of a small river, 15 miles from Delaware bay, and 150 southward of Philadelphia. This town, which contains about 100 houses, has been built, except one house, since the revolution. It is laid out with much taste, and is by no means disagreeable. The inhabitants are Episcopalians, Quakers, and Methodists.

MILFORD-Haven, one of the finest harbours in Europe, and indisputably the best in Britain, is situated in Pembrokeshire in South-Wales, and lies on the north side of the Bristol Channel. It is very large, safe, and deep; there is no danger of going in or out with the tide, or almost with any wind. If a ship comes in without a cable or anchor, she may run ashore on the ooze, and there lie safe till she is refitted; and in an hour's time she may get out of the harbour into the open sea. It lies extremely convenient for ships bound from the English or Bristol Channels to Ireland, or farther west, and from thence to the Channels. It is said, that 1000 sail of any size may ride secure in this haven. It has 16 deep and safe creeks, five bays, and 13 roads, all distinguished by their several names. The spring tide rises 36 feet; so that ships may at any time be laid ashore. Dale harbour is a ready out-let for small vessels, where they may ride in two or three fathoms at low-water.—In the reign of Queen Elizabeth, before the Spanish invasion, two forts were begun at the entrance of Milford-Haven; one on each side, called *Nangle* and *Dale* blockhouses; but they were not then finished.—The Stack-rock rises here above water, lying near the middle of the entrance between Nangle and Dale. Penermouth is the opening of that branch of the haven on which the town of Pembroke is seated, and where the custom-house of Milford is kept. The breadth of the entrance between rock and rock is but 200 yards at high-water, and 112 at low-water. There is a ridge of rocky ground that has the name of *Carrs*, which runs almost across Milford-Haven, from Peter church towards Llanstadwell, where it renders the landing place difficult to strangers, from its not appearing at low-water. The great convenience of this harbour is, that in an hour's time a ship may be in or out of it, and in the way between the Land's end and Ireland. As it lies near the mouth of the Severn, a ship in eight or ten hours may be over on the coast of Ireland, or off the Land's-End in the English Channel; and a vessel may get out hence to the west much sooner than from either Plymouth or Falmouth. This harbour has been greatly improved by new works, at the expence of the government. The parliament, on April 14, 1759, granted 10,000 l. for fortifying the harbour of Milford, all of which was expended on the fort at Neyland, which, however, still remains unfinished.

MILIARY, in general, something resembling millet-seed.

MILIARY-Fever. See MEDICINE, n° 229.

MILITANT, or CHURCH-MILITANT, denotes the body of Christians while here on earth.

MILITARY, something belonging to the soldiery or militia.

MILITARY-Discipline, the training of soldiers, and the due enforcement of the laws and regulations instituted by authority for their conduct.

Next to the forming of troops, military discipline is the first object that presents itself to our notice: it is the soul of all armies; and unless it be established amongst them with great prudence, and supported with unshaken resolution, they are no better than so many contemptible heaps of rabble, which are more dangerous to the very state that maintains them than even its declared enemies.

MILITARY-Execution, the ravaging or destroying of a country or town that refuses to pay the contribution inflicted upon them.

MILITARY-Exercise. See EXERCISE and WORDS *of Command*.

MILITARY-State, in British polity, one of the three divisions of the laity. See LAITY.

This state includes the whole of the soldiery, or such persons as are peculiarly appointed among the rest of the people for the safeguard and defence of the realm.

In a land of liberty, it is extremely dangerous to make a distinct order of the profession of arms. In absolute monarchies, this is necessary for the safety of the prince; and arises from the main principle of their constitution, which is that of governing by fear: but, in free states, the profession of a soldier taken singly and merely as a profession, is justly an object of jealousy. In these no man should take up arms but with a view to defend his country and its laws: he puts not off the citizen when he enters the camp; but it is because he is a citizen, and would wish to continue so, that he makes himself for a while a soldier. The laws, therefore, and constitution of these kingdoms, know no such state as that of a perpetual standing soldier, bred up to no other profession than that of war; and it was not till the reign of Henry VII. that the kings of England had so much as a guard about their persons.

In the time of the Anglo-Saxons, as appears from Edward the Confessor's laws, the military force of England was in the hands of the dukes or heretochs, who were constituted through every province and county in the kingdom; being taken out of the principal nobility, and such as were most remarkable for being *sapientes, fideles, et animosi.* Their duty was to lead and regulate the English armies, with a very unlimited power; *prout eis visum fuerit, ad honorem coronæ et utilitatem regni.* And because of this great power they were elected by the people in their full assembly, or folkmote, in the same manner as sheriffs were elected: following still that old fundamental maxim of the Saxon constitution, that where any officer was entrusted with such power, as, if abused, might

Military. Military.

ted to the oppreſſion of the people, that power was delegated to him by the vote of the people themſelves. So too, among the ancient Germans, the anceſtors of our Saxon forefathers, they had their dukes, as well as kings, with an independent power over the military, as the kings had over the civil ſtate. The dukes were elective, the kings hereditary: for ſo only can be conſiſtently underſtood that paſſage of Tacitus, *Reges ex nobilitate, duces ex virtute ſumunt*. In conſtituting their kings, the family or blood-royal was regarded: in chooſing their dukes or leaders, warlike merit: juſt as Ceſar relates of their anceſtors in his time, that whenever they went to war, by way either of attack or defence, they elected leaders to command them. This large ſhare of power, thus conferred by the people, though intended to preſerve the liberty of the ſubject, was perhaps unreaſonably detrimental to the prerogative of the crown: and accordingly we find a very ill uſe made of it by Edric duke of Mercia, in the reign of king Edmond Ironſide; who, by his office of duke or heretoch, was intitled to a large command in the king's army, and by his repeated treacheries at laſt transferred the crown to Canute the Dane.

It ſeems univerſally agreed by all hiſtorians, that king Alfred firſt ſettled a national militia in this kingdom, and by his prudent diſcipline made all the ſubjects of his dominions ſoldiers: but we are unfortunately left in the dark as to the particulars of this his ſo celebrated regulation; though, from what was laſt obſerved, the dukes ſeem to have been left in poſſeſſion of too large and independent a power: which enabled duke Harold, on the death of Edward the Confeſſor, though a ſtranger to the royal blood, to mount for a ſhort ſpace the throne of this kingdom, in prejudice of Edgar Etheling the rightful heir.

Upon the Norman conqueſt, the feodal law was introduced here in all its rigour, the whole of which is built on a military plan. In conſequence thereof, all the lands in the kingdom were divided into what were called *knight's fees*, in number above 60,000; and for every knight's fee a knight or ſoldier, *miles*, was bound to attend the king in his wars, for 40 days in a year; in which ſpace of time, before war was reduced to a ſcience, the campaign was generally finiſhed, and a kingdom either conquered or victorious. By this means the king had, without any expence, an army of 60,000 men always ready at his command. And accordingly we find one, among the laws of William the conqueror, which in the king's name commands and firmly enjoins the perſonal attendance of all knights and others; *quod habeant et teneant ſe ſemper in armis et equis, ut decet et oportet: et quod ſemper ſint prompti et parati ad ſervitium ſuum integrum nobis explendum et peragendum, cum opus adfuerit, ſecundum quod debent de feodis et tenementis ſuis de jure nobis facere.* This perſonal ſervice in proceſs of time degenerated into pecuniary commutations or aids; and at laſt the military part of the feodal ſyſtem was aboliſhed at the Reſtoration, by ſtatute 12 Car. II. c 24. See *Feodal-Syſtem*.

In the meantime, we are not to imagine that the kingdom was left wholly without defence in caſe of domeſtic inſurrections, or the proſpect of foreign invaſions. Beſides thoſe who by their military tenures, were bound to perform 40 days ſervice in the field, firſt the aſſize of arms, enacted 27 Hen. II. and afterwards the ſtatute of Wincheſter, under Edward I. obliged every man, according to his eſtate and degree, to provide a determinate quantity of ſuch arms as were then in uſe, in order to keep the peace; and conſtables were appointed in all hundreds by the latter ſtatute, to ſee that ſuch arms were provided. Theſe weapons were changed, by the ſtatute 4 & 5 Ph. & M. c. 2. into others of more modern ſervice; but both this and the former proviſions were repealed in the reign of James I. While theſe continued in force, it was uſual from time to time for our princes to iſſue commiſſions of array, and ſend into every county officers in whom they could confide, to muſter and array (or ſet in military order) the inhabitants of every diſtrict; and the form of the commiſſion of array was ſettled in parliament in the 5 Hen. IV. But at the ſame time it was provided, that no man ſhould be compelled to go out of the kingdom at any rate, nor out of his ſhire, but in caſes of urgent neceſſity; nor ſhould provide ſoldiers unleſs by conſent of parliament. About the reign of king Henry VIII. and his children, lord-lieutenants began to be introduced, as ſtanding repreſentatives of the crown, to keep the counties in military order; for we find them mentioned as known officers in the ſtatute 4 & 5 Ph. & M. c. 3. though they had not been then long in uſe; for Cambden ſpeaks of them in the time of Queen Elizabeth as extraordinary magiſtrates, conſtituted only in times of difficulty and danger.

In this ſtate things continued till the repeal of the ſtatutes of armour in the reign of king James I.; after which, when king Charles I. had, during his northern expeditions, iſſued commiſſions of lieutenancy, and exerted ſome military powers which, having been long exerciſed, were thought to belong to the crown, it became a queſtion in the long-parliament, how far the power of the militia did inherently reſide in the king; being now unſupported by any ſtatute, and founded only upon immemorial uſage. This queſtion, long agitated with great heat and reſentment on both ſides, became at length the immediate cauſe of the fatal rupture between the king and his parliament: the two houſes not only denying this prerogative of the crown, the legality of which claim perhaps might be ſomewhat doubtful; but alſo ſeizing into their hands the entire power of the militia, the illegality of which ſtep could never be any doubt at all.

Soon after the reſtoration of king Char. II. when the military tenures were aboliſhed, it was thought proper to aſcertain the power of the militia, to recogniſe the ſole right of the crown to govern and command them, and to put the whole into a more regular method of military ſubordination: and the order in which the militia now ſtands by law, is principally built upon the ſtatutes which were then enacted. It is true, the two laſt of them are apparently repealed; but many of their proviſions are re-enacted, with the addition of ſome new regulations, by the preſent militia-laws; the general ſcheme of which is to diſcipline a certain number of the inhabitants of every county, choſen by lot for three years, and officered by the lord-lieutenant, the deputy lieutenants, and other principal landholders, under a commiſſion from the crown. They are not compellable to march out of their counties, unleſs

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Military. in case of invasion or actual rebellion, nor in any case compellable to march out of the kingdom. They are to be exercised at stated times: and their discipline in general is liberal and easy; but, when drawn out into actual service, they are subject to the rigours of martial law, as necessary to keep them in order. This is the constitutional security which the laws have provided for the public peace, and for protecting the realm against foreign or domestic violence; and which the statutes declare is essentially necessary to the safety and prosperity of the kingdom.

When the nation was engaged in war, more veteran troops and more regular discipline were esteemed to be necessary, than could be expected from a mere militia; and therefore at such times more rigorous methods were put in use for the raising of armies and the due regulation and discipline of the soldiery: which are to be looked upon only as temporary excrescences bred out of the distemper of the state, and not as any part of the permanent and perpetual laws of the kingdom. For martial law, which is built upon no settled principles, but is entirely arbitrary in its decisions, is, as Sir Mathew Hale observes, in truth and reality no law, but something indulged rather than allowed as a law. The necessity of order and discipline in an army is the only thing which can give it countenance; and therefore it ought not to be permitted in time of peace, when the king's courts are open for all persons to receive justice according to the laws of the land. Wherefore, Thomas earl of Lancaster being convicted at Pontefract, 15 Edw. II. by martial law, his attainder was reversed 1 Edw. III. because it was done in time of peace. And it is laid down, that if a lieutenant, or other, that hath commission of martial authority, doth in time of peace hang or otherwise execute any man by colour of martial law, this is murder; for it is against *magna charta*. And the petition of right enacts, that no soldier shall be quartered on the subject without his own consent; and that no commission shall issue to proceed within this land according to martial law. And whereas, after the Restoration, king Ch. II. kept up about 5000 regular troops, by his own authority, for guards and garrisons; which king James II. by degrees increased to no less than 30,000, all paid from his own civil list; it was made one of the articles of the bill of rights, that the raising or keeping a standing army within the kingdom in time of peace, unless it be with consent of parliament, is against law.

But as the fashion of keeping standing armies (which was first introduced by Charles VII. in France, 1445) has of late years universally prevailed over Europe (though some of its potentates, being unable themselves to maintain them, are obliged to have recourse to richer powers, and receive subsidiary pensions for that purpose), it has also for many years past been annually judged necessary by the legislature, for the safety of the kingdom, the defence of the possessions of the crown of Great Britain, and the preservation of the balance of power in Europe, to maintain even in time of peace a standing body of troops, under the command of the crown; who are however *ipso facto* disbanded at the expiration of every year, unless continued by parliament. And it was enacted by statute 10 W. III. c. 1. that not more than 12,000 regular forces should be kept on foot in Ireland, though paid at the charge of that kingdom: which permission is extended by stat. 8. Geo. III. c. 13. to 16,235 men in time of peace. Military.

To prevent the executive power from being able to oppress, says baron Montesquieu, it is requisite that the armies with which it is intrusted should consist of the people, and have the same spirit with the people; as was the case at Rome, till Marius new-modelled the legions by enlisting the rabble of Italy, and laid the foundation of all the military tyranny that ensued. Nothing then, according to these principles, ought to be more guarded against in a free state, than making the military power, when such a one is necessary to be kept on foot, a body too distinct from the people. Like this, therefore, it should wholly be composed of natural subjects; it ought only to be enlisted for a short and limited time; the soldiers also should live intermixed with the people; no separate camp, no barracks, no inland fortresses, should be allowed. And perhaps it might be still better, if, by dismissing a stated number, and enlisting others at every renewal of their term, a circulation could be kept up between the army and the people, and the citizen and the soldier be more intimately connected together.

To keep this body of troops in order, an annual act of parliament likewise passes, "to punish mutiny and desertion, and for the better payment of the army and their quarters." This regulates the manner in which they are to be dispersed among the several inn-keepers and victuallers throughout the kingdom; and establishes a law-martial for their government. By this, among other things, it is enacted, that if any officer or soldier shall excite, or join any mutiny, or, knowing of it, shall not give notice to the commanding officer, or shall desert, or list in any other regiment, or sleep upon his post, or leave it before he is relieved, or hold correspondence with a rebel or enemy, or strike or use violence to his superior officer, or shall disobey his lawful commands; such offender shall suffer such punishment as a court-martial shall inflict, though it extend to death itself.

However expedient the most strict regulations may be in time of actual war, yet in times of profound peace, a little relaxation of military rigour would not, one should hope, be productive of much inconvenience. And, upon this principle, though by the standing laws (still remaining in force, though not attended to) desertion in time of war is made felony without benefit of clergy, and the offence is triable by a jury, and before the judges of the common law; yet, by the militia laws beforementioned, a much lighter punishment is inflicted for desertion in time of peace. So, by the Roman law also, desertion in time of war was punished with death, but more mildly in time of tranquillity. But the mutiny-act makes no such distinction: for any of the faults abovementioned are, equally at all times, punishable with death itself, if a court-martial shall think proper. This discretionary power of the court-martial is indeed to be guided by the direction of the crown; which, with regard to military offences, has almost an absolute legislative power. "His Majesty (says the act) may form articles of war, and constitute courts-martial, with power to try any crime by such articles, and inflict such penalties as the articles direct."

direct." A vast and most important trust! an unlimited power to create crimes, and annex to them any punishments not extending to life or limb! These are indeed forbidden to be inflicted, except for crimes declared to be so punishable by this act; which crimes we have just enumerated, and among which, we may observe, that any disobedience to lawful commands is one. Perhaps in some future revision of this act, which is in many respects hastily penned, it may be thought worthy the wisdom of parliament to ascertain the limits of military subjection, and to enact express articles of war for the government of the army, as is done for the government of the navy; especially as, by the present constitution, the nobility and gentry of the kingdom, who serve their country as militia officers, are annually subjected to the same arbitrary rule during their time of exercise.

One of the greatest advantages of the law is, that not only the crimes themselves which it punishes, but also the penalties which it inflicts, are ascertained and notorious: nothing is left to arbitrary discretion; the king by his judges dispenses what the law has previously ordained, but is not himself the legislator. How much, therefore, is it to be regretted, that a set of men, whose bravery has so often preserved the liberties of their country, should be reduced to a state of servitude in the midst of a nation of freemen; for Sir Edward Coke will inform us, that it is one of the genuine marks of servitude, to have the law, which is our rule of action, either concealed or precarious; *Misera est servitus, ubi jus est vagum aut incognitum.* Nor is this state of servitude quite consistent with the maxims of sound policy observed by other free nations. For the greater the general liberty is which any state enjoys, the more cautious has it usually been in introducing slavery in any particular order or profession. These men, as baron Montesquieu observes, seeing the liberty which others possess, and which they themselves are excluded from, are apt (like eunuchs in the eastern seraglios) to live in a state of perpetual envy and hatred towards the rest of the community, and indulge a malignant pleasure in contributing to destroy those privileges to which they can never be admitted. Hence have many free states, by departing from this rule, been endangered by the revolt of their slaves; while, in absolute and despotic governments, where no real liberty exists, and consequently no invidious comparisons can be formed, such incidents are extremely rare. Two precautions are therefore advised to be observed in all prudent and free governments: 1. To prevent the introduction of slavery at all: or, 2. If it be already introduced, not to intrust those slaves with arms, who will then find themselves an overmatch for the freemen. Much less ought the soldiery to be an exception to the people in general, and the only state of servitude in the nation.

Blackst. Comment.

But as soldiers, by this annual act, are thus put in a worse condition than any other subjects; so, by the humanity of the standing laws, they are in some cases put in a much better. By statute 43 Eliz. c. 3. a weekly allowance is to be raised in every county for the relief of soldiers that are sick, hurt, and maimed: not forgetting the royal hospital of Chelsea for such as are worn out in their duty. Officers and soldiers, that have been in the king's service, are by several statutes, enacted at the close of several wars, at liberty to use any trade or occupation they are fit for, in any town in the kingdom (except the two universities), notwithstanding any statute, custom, or charter to the contrary. And soldiers in actual military service may make nuncupative wills, and dispose of their goods, wages, and other personal chattels, without these forms, solemnities, and expences, which the law requires in other cases. Our law does not indeed extend this privilege so far as the civil law; which carried it to an extreme that borders upon the ridiculous: for if a soldier, in the article of death, wrote any thing in bloody letters on his shield, or in the dust of the field with his sword, it was a very good military testament.

Military Court. See Chivalry (*Court of*).

Military Tenures. See Tenure, Feodal System, and Knight.

Military Ways (*viæ militares*), are the large Roman roads which Agrippa procured to be made through the empire, in the time of Augustus, for the more convenient marching of troops and conveyance of carriages. N. Bergier has written the history of the origin, progress, and amazing extent, of these military roads, which were paved from the gates of Rome to the extreme parts of the empire. See Way.

MILITIA, in general, denotes the body of soldiers, or those who make profession of arms.

In a more restrained sense, militia denotes the trained bands of a town or country, who arm themselves, upon a short warning, for their own defence. So that, in this sense, militia is opposed to regular or stated troops. See *Military State*, and *Feodal System*.

MILIUM, millet, in botany; A genus of the digynia order, belonging to the triandria class of plants; and in the natural method ranking under the 4th order, *Gramina*. The calyx is bivalved, and uniflorous; the corolla is very short: the stigmata pencil like.— There are five species; of which the most remarkable is the panicum, or common millet. This is a native of India, but is now commonly cultivated in many parts of Europe as an esculent grain. It rises, with a reed-like stalk, three or four feet high, and channelled: at every joint there is one reed-like leaf, which is joined on the top of the sheath, and embraces and covers that joint of the stalk below the leaf; this sheath is closely covered with soft hairs, but the leaf which is expanded has none. The top of the stalk is terminated by a large loose panicle, which hangs on one side, having a chaffy flower, which is succeeded by a small round seed. There are two varieties; one with white, and the other with black seeds; but they do not differ in any other particular. This plant is greatly cultivated in the oriental countries, and from whence we are annually furnished with it. It is seldom cultivated in Britain but in small gardens, for feeding of poultry, where the seeds generally ripen very well. It is used as an ingredient in puddings, and is by some people greatly esteemed. The seeds must be sown in the beginning of April, upon a warm dry soil, but not too thick because the plants divide into several branches, and should have much room. When they come up they should be cleaned from weeds; after which they

Milk.

will in a short time get the better of them, and prevent the future growth. In August the seeds will ripen, when the plant must be cut down, and the seeds beaten out, as is practised for other grain; but if it is not protected from birds, they will devour it as soon as it begins to ripen.

MILK, a well-known fluid, prepared by nature in the breasts of women, and the udders of other animals, for the nourishment of their young.—According to Dr Cullen *, milk is a connecting and intermediate substance between animals and vegetables. It seems immediately to be secreted from the chyle, both being a white liquor of the same consistence: it is most copiously secreted after meals, and of an acescent nature. In most animals who live on vegetables, the milk is acescent; and it is uncertain, though at the same time no observation proves the contrary, whether it is not so likewise in carnivorous animals. But, whatever be in this, it is certain, that the milk of all animals who live on vegetables is acescent. Milk being derived from the chyle, we thence conclude its vegetable nature; for in those who live on both promiscuously, more milk is got, and more quickly, from the vegetable than the animal food. Milk, however, is not purely vegetable; though we have a vegetable liquor that resembles its taste, consistence, colour, acescency, and the separability of the oily part, viz. an emulsion of the nuces oleosæ and ferinaceous substances. But these want the coagulable part of milk, which seems to be of animal-nature, approaching to that of the coagulable lymph of the blood. Milk, then, seems to be of an intermediate nature, between chyle taken up from the intestines and the fully elaborated animal-fluid.

* Lect. on Mat. Med.

Its contents are of three kinds: first, an oily part, which, whatever may be said concerning the origin of other oils in the body, is certainly immediately derived from the oil of the vegetables taken in, as with these it agrees very exactly in its nature, and would entirely if we could separate it fully from the coagulable part. Another mark of their agreement is the separability, which proves that the mixture has been lately attempted, but not fully performed. 2dly, Besides this oily, there is a proper coagulable part; And, 3dly, Much water accompanies both, in which there is dissolved a saline saccharine substance. These three can be got separate in cheese, butter, and whey; but never perfectly so, a part of each being always blended with every other part.

Nothing is more common, from what has been said of its immediate nature, than to suppose that it requires no assimilation; and hence has been deduced the reason of its exhibition in the most weakly state of the human body. But wherever we can examine milk, we always find that it coagulates, suffers a decomposition, and becomes acesent. Again, infants, who feed entirely on milk, are always troubled with eructations, which every body observes are not of the same quality with the food taken; and therefore it appears, that, like all other food, milk turns naturally acescent in the stomach, and only enters the chyle and blood in consequence of a new recomposition. It approaches then to the nature of vegetable aliment, but is not capable of its noxious vinous fermentation, and therefore has an advantage over it: neither from this quality, like animal-food, is it heating in the stomach, and productive of fever; though at the same time, from its quantity of coagulable matter, it is more nourishing than vegetables.

Milk is the food most universally suited to all ages and states of the body; but it seems chiefly designed by nature as the food of infants. When animals are in the fœtus-state, their solids are a perfect jelly, incapable of an assimilatory power. In such a state nature has perfectly assimilated food, as the albumen ovi in the oviparous, and in the viviparous animals certainly somewhat of the same kind, as it was necessary the vessels should be filled with such a fluid as would make way for an after-assimilation. When the infant has attained a considerable degree of firmness, as when it is separated from the mother, yet such a degree of weakness still remains as makes somewhat of the same indication necessary, it behoves the infant to have an alkalescent food ready prepared, and at the same time its noxious tendency to be avoided. Milk then is given, which is alkalescent, and at the same time, has a sufficient quantity of acidity to correct that alkalescency. As the body advances in growth, and the alkalescent tendency is greater, the animal, to obviate that tendency, is led to take vegetable food, as more suited to its strength of assimilation.

Dr Cullen observes, that milk is almost suited to all temperaments; and it is even so to stomachs disposed to acescency, more than those substances which have undergone the vinous fermentation; nay, it even cures the heart-burn, checks vinous fermentation, and precipitates the lees, when, by renewal of fermentation, the wine happens to be fouled. It therefore very properly accompanies a great deal of vegetable aliment; although sometimes its acescency is troublesome, either from a large proportion taken in, or from the degree of it; for, according to certain unaccountable circumstances, different acids are formed in the stomach in different states of the body; in a healthy body, *e. g.* a mild one; in the hypochondriac disease, one sometimes as corrosive as the fossil acid. When the acidity of milk is carried to a great degree, it may prove remarkably refrigerent, and occasion cold crudities, and the recurrence of intermittent fevers. To take the common notion of its passing unchanged into the blood, it can suffer no solution. But if we admit its coagulum in the stomach, then it may be reckoned among soluble or insoluble foods, according as that coagulum is more or less tenacious. Formerly rennet, which is employed to coagulate milk, was thought an acid; but, from late observations, it appears, that, if it be an acid it is very different from other acids, and that its coagulum is stronger than that produced by acids. It has been imagined, than a rennet is to be found in the stomachs of all animals, which causes coagulation of milk; but to Dr Cullen the coagulation of milk seems to be owing to a weak acid in the stomach, the relicts of our vegetable food, inducing, in healthy persons, a weak and soluble coagulum: but in different stomachs this may be very different, in these becoming heavy and less soluble food, and sometimes even evacuated in a coagulated undissolved state both by stomach and stool.

As milk is acescent, it may be rendered sometimes purgative by mixing with the bile; and some examples of

Milk. of this have been remarked. More commonly, however, it is reckoned among those foods which occasion costiveness.

Hoffman, in his experiments on milk, found that all kinds of it contained much water; and when this was dissipated, found the residuum very different in their solubility. But we must not thence conclude, that the same insolubility takes place in the stomach; for extracts made from vegetables with water are often very insoluble substances, and hardly diffusible through water itself: therefore, in Hoffman's extracts, if we may so call them, of milk, somewhat of the same kind might have appeared; and these substances, which in their natural state were not so, might appear very insoluble. However, we may allow that milk is always somehow insoluble in the intestines, as it is of a drying nature, and as cheese, &c. is very costive. And this effect shows that milk is always coagulated in the stomach: for if it remained fluid, no fæces would be produced, whereas sometimes very hard ones are observed. In the blood-vessels, from its animal nature, it may be considered as nutritious; but when we consider its vegetable contents, and acescency in the primæ viæ, we find that, like animal-food, it does not excite that degree of fever in the time of digestion, and that from its acescency it will resist putrefaction. Hence its use in hectic fevers, which, whatever be their cause, appear only to be exacerbations of natural feverish paroxysms, which occur twice every day, commonly after meals, and at night. To obviate these, therefore, we give such an aliment as produces the least exacerbation of these fevers: and of this nature is milk, on account of its acescent vegetable nature.

There appears also somewhat peculiar to milk, which requires only a small exertion of the animal-powers in order to its assimilation; and besides, in hectic complaints there is wanted an oily, bland food, approaching to the animal-nature; so that on all these accounts milk is a diet peculiarly adopted to them, and, in general, to most convalescents, and to those of inflammatory temperaments. So far of milk in general. We shall now speak of the particular kinds which are in common use.

The milk of women, mares, and asses, agree very much in their qualities, being very dilute, having little solid contents, and, when evaporated to dryness, having these very soluble, containing much saccharine matter, of a very ready acescency, and, when coagulated, their coagulum being tender and easily broke down. From this view they have less oil, and seem to have less coagulable matter than the rest.

The milk of cows, sheep, and goats, agree in opposite qualities to the three just mentioned; but here there is somewhat more of gradation. Cows milk comes nearest to the former milk: goats milk is less fluid, less sweet, less flatulent, has the largest proportion of insoluble part after coagulation, and indeed the largest proportion of coagulable part; its oily and coagulable parts are not spontaneously separable, never throwing out a cream, or allowng butter to be readily extracted from it. Hence the virtues of these milks are obvious, being more nourishing, though at the same time less easily soluble in weak stomachs, than the three first, less acescent than these, and so more rarely laxative, and peculiarly fitted for the diet of convalescents without fever. The three first again are less nourishing, more soluble, more laxative, as more acescent, and adapted to the convalescents with fever. Milk.

These qualities, in particular milks, are considerably diversified by different circumstances. First, different animals, living on the same diet, give a considerably different milk; for there seems to be something in the constitution, abstracting from the aliment, which constitutes a considerable diversity of milk, not only in the same species of animals, but also in the same animal, at different ages, and at different distances after delivery: this applies to the choice of nurses. Secondly, Milk follows the nature of the aliment more than any other juice in the human body, being more or less fluid and dilute, more or less solid and nourishing, in proportion as these qualities are more or less in the aliment. The nature of the aliment differs according to its time of growth, *e. g.* old grass being always found more nourishing than young. Aliment, too, is always varied according to the season, as that is warm or dry, moist or cloudy.

The milk of each particular kind of animal is fitter for particular purposes, when fed on proper food.—Thus the cow delights in the succulent herbage of the vale: if the sheep be fed there he certainly rots, but on the higher and more dry side of the mountain he feeds pleasantly and healthy; while the goat never stops near the bottom, but ascends to the craggy summit: and certainly the milks of these animals are always best on their proper soil, and that of goats is best on a mountainous country. From a dissertation of Linnæus, we have many observations concerning the diversity of plants on which each animal chooses to feed. All the Swedish plants which could be collected together, were presented alternately to domestic animals, and then it appeared that the goat lived on the greatest variety, and even on many which were poisonous to the rest; that the cow chose the first succulent shoots of the plant, and neglected the fructification; which last was preferred by the goat. Hence may be deduced rules, concerning the pasturage of different animals; *e. g.* Farmers find, that, in a pasture which was only fit to feed a certain number of sheep, an equal number of goats may be introduced, while the sheep are no less nourished than before.

It is not easy to assign the difference between milk fresh-drawn and that detained in the open air for some time: but certainly there is some material one, otherwise nature universally would not have directed infants to sucking; and indeed it seems, better than the other, fitted for digestion and nourishment. Physicians have supposed that this depended on the evaporation of some *spt. rector:* but our author cannot conceive any such, except common water here; and besides, these volatile parts can hardly be nutritious. A more plausible account seems deducible from mixture: milk new-drawn has been but lately mixed, and is exposed to spontaneous separation, a circumstance hurtful to digestion; none of the parts being, by themselves, so easily assimilated as when they are all taken together. Hence, then, milk new drawn is more intimately blended, and therefore then is most proper to the weakly and infants.

Another difference in the use of milk exposed for some time to the air, is taking it boiled or unboiled.

Physicians

Milk. Phyſicians have generally recommended the former; but the reaſon is not eaſily aſſigned. Perhaps it is this: Milk kept for ſome time expoſed to the air has gone ſo far to a ſpontaneous ſeparation; whereas the heat thoroughly blends the whole, and hence its reſolution is not ſo eaſy in the ſtomach; and thus boiled milk is more coſtive than raw, and gives more fæces. Again, when milk is boiled, a conſiderable quantity of air is detached, as appears from the froth on the ſurface; and air is the chief inſtrument of fermentation in bodies; ſo that after this proceſs it is not liable to aceſcency: for theſe reaſons it is proper for the robuſt and vigorous.

Another difference of milk is, according as it is fluid or coagulated. The coagulated is of two kinds, as induced by rennet, or the natural aceſcency of the milk. The former preparation makes the firmer and leſs eaſily ſoluble coagulum; though, when taken with the whey unſeparated, it is leſs difficult of ſolution, though more ſo than any other coagulum in the ſame caſe. Many nations uſe the latter form, which is eaſier ſoluble, but very much aceſcent, and therefore, in point of ſolution, ſhould be confined to the vigorous, in point of aceſcency, to thoſe who live on alkaleſcent food; and in the laſt caſe, the Laplanders uſe it as their chief aceſcent condiment. From the ſame conſiderations it is more cooling, and in its other effects like all other aceſcent vegetables.

Milk by evaporation yields a ſweet ſaline matter, of which Dr Lewis gives the following proportions:

Twelve ounces of	Left of dry matter	From which water extracted a ſweet ſaline ſubſtance amounting to
Cows milk	13 drams.	$1\frac{1}{2}$ drams.
Goats milk	$12\frac{1}{2}$	$1\frac{1}{2}$
Human milk	8	6
Aſſes milk	8	6

The ſaline ſubſtance extracted from aſſes milk was white, and ſweet as ſugar; thoſe of the others brown or yellow, and conſiderably leſs ſweet; that from cows milk had the leaſt ſweetneſs of any.

On diſtilling 12 quarts of milk *in balneo mariæ*, at leaſt nine quarts of pure phlegm were obtained: the liquor which afterwards aroſe was acidulous, and by degrees grew ſenſibly more and more acid as the diſtillation was continued. After this came over a little ſpirit, and at laſt an empyreumatic oil. The remaining ſolid matter adhered to the bottom of the retort, in the form of elegant ſhining black flowers, which being calcined and elixated yielded a portion of fixed alkaline ſalt.

Milk, ſet in a warm place, throws up to the ſurface an unctuous cream, from which, by agitation, the butter is eaſily ſeparated. The addition of alkaline ſalts prevents this ſeparation, not (as ſome have ſuppoſed) by abſorbing an acid from the milk, but by virtue of their property of intimately uniting oily bodies with watery liquors. Sugar, another grand intermedium betwixt oils and water, has this effect in a greater degree, though that concrete is by no means alkaline, or an abſorbent of acids.

The ſweet ſaccharine part of the milk remains diſſolved in the whey after the ſeparation of the curd or cheeſy matter, and may be collected from it in a white cryſtalline form, by boiling the whey till all remains of the curdled ſubſtance have fallen to the bottom; then filtering, evaporating it to a due conſiſtence, ſetting it to ſhoot, and purifying the cryſtals by ſolution in water and a ſecond cryſtallization. Much has been ſaid of the medicinal virtues of this ſugar of milk, but it does not ſeem to have any conſiderable ones: It is from cows milk that it has been generally prepared: and the cryſtals obtained from this kind of milk have but little ſweetneſs.

When milk is ſuffered to coagulate ſpontaneouſly, the whey proves acid, and on ſtanding grows more and more ſo until the putrefactive ſtate commences. Sour whey is uſed as an acid, preferably to the directly vegetable or the mineral acids, in ſome of the chemical arts; as for diſſolving iron in order to the ſtaining of linen and leather. This acid was commonly made uſe of in the bleaching of linen, for diſſolving and extracting the earthy particles left in the cloth by the alkaline ſalts and lime employed for cleanſing and whitening it. Butter-milk is preferred to plain ſour-milk or ſour whey: this laſt is ſuppoſed to give the cloth a yellow colour. Dr Home, in his ingenious treatiſe on this ſubject, recommends water acidulated with ſpirit of vitriol (in the proportion of about half an ounce, or at moſt three quarters of an ounce, to a gallon), as preferable in many reſpects to the acid of milk, or of the more directly vegetable ſubſtances. He obſerves, that the latter are often difficultly procurable, abound with oleaginous particles, and haſten to corruption; whilſt the vitriolic acid is cheap, and pure, and indiſpoſed to putrefy: That milk takes five days to perform its office, whilſt the vitriolic acid does it in as many hours, perhaps in as many minutes: That this acid contributes alſo to whiten the cloth, and does not make it weaker though the cloth be kept in it for months. He finds, that acids as well as alkalies, extract an oily matter from the cloth, and loſe their acidity and alkalicity. Since this treatiſe appeared, the uſe of ſour-milk is very generally ſuperſeded by oil of vitriol.

It is obſervable, that aſſes milk is greatly diſpoſed, on ſtanding for a little time, to become thick and ropy. In the Breſlau collection for the year 1720, there is a remarkable account of milk (which probably was that of the aſs) grown ſo thick and tenacious as to be drawn out into long ſtrings, which, when dried, were quite brittle.

New cows milk, ſuffered to ſtand for ſome days on the leaves of butterwort or ſun-dew, becomes uniformly thick, ſlippery, and coherent, and of an agreeable ſweet taſte, without any ſeparation of its parts. Freſh milk, added to this, is thickened in the ſame manner, and this ſucceſſively. In ſome parts of Sweden, as we are informed in the Swediſh Memoirs, milk is thus prepared for food.

New milk has a degree of glutinous quality, ſo as to be uſed for joining broken ſtone ware. There is a far greater tenacity in cheeſe properly prepared.

Milk, when examined by a microſcope, appears compoſed of numerous globules ſwimming in a tranſparent fluid. It boils in nearly the ſame degree of heat with common water; ſome ſorts rather ſooner, and ſome a little later: after boiling, it is leſs diſ-

 poſed

posed to grow sour than in its natural state. It is coagulated by acids both mineral and vegetable, and by alkalies both fixed and volatile. The coagulum made by acids falls to the bottom of the serum; that made by alkalies swims on the surface, commonly forming (especially with volatile alkalies) a thick coriaceous skin. The serum, with alkalies, proves green or sanious; with acids, it differs little in appearance from the whey that separates spontaneosly. The coagulum formed by acids is dissolved by alkalies, and that formed by alkalies is redissolved by acids; but the milk does not in either case resume its original properties. It is coagulated by most of the middle salts, whose basis is an earth or a metallic body; as solution of alum, fixed sal ammoniac, sugar of lead, green and blue vitriol; but not by the chalybeate or purging mineral waters, nor by the bitter salt extracted from the purging waters. Among the neutral salts that have been tried, there is not one that produces any coagulation. They all dilute the milk, and make it less disposed to coagulate with acids or alkalies: Nitre seems to have this effect in a greater degree than the other neutral salts. It is instantly coagulated by highly-rectified spirit of wine, but scarcely by a phlegmatic spirit. It does not mingle with expressed oils. All the coagula are dissolved by gall.

It has generally been supposed by medical authors, that the milk of animals is of the same nature with chyle, and that the human milk always coagulates on the stomach of infants; but in a late dissertation upon the subject by Mr Clarke, member of the royal Irish academy, we find both these positions controverted. According to him, woman's milk, in an healthy state, contains no coagulable, mucilaginous, or cheesy principle, in its composition; or it contains so little, that it cannot admit of any sensible proof. Dr Rutter states, that it does not afford even a sixth part of the curd which is yielded by cows milk; and Dr Young denies that it is at all coagulable either by rennets or acids. This is confirmed by Dr Ferris, who in 1782 gained the Harveian prize-medal at Edinburgh by a dissertation upon milk. Mr Clarke informs us, that he has made a vast number of experiments upon woman's milk with a view to determine this point. He made use of ardent spirits, all the different acids, infusions of infants stomachs, and procured the milk of a great many different women; but in no instance, excepting one or two, did he perceive any thing like curd. This took place in consequence of a spontaneous acescency; and only a small quantity of soft flaky matter was formed, which floated in the serum. This he looked upon to be a morbid appearance.

Irish Transf. for 1788.

The general opinion that woman's milk is coagulable, has arisen from a single circumstance, *viz.* that infants frequently vomit the milk they suck in a state of apparent coagulation, This greatly perplexed Dr Young; who, after having tried in vain to coagulate human milk artificially, concluded, that the process took place spontaneously in the stomach; and that it would always do so if the milk were allowed to remain in a degree of heat equal to about 96 degrees of Fahrenheit. Mr Clarke took equal quantities of three different kinds of milk, and put them into bottles slightly corked, and these bottles into water, the temperature of which was kept up by a spirit-of-wine lamp as near as possible to 96° of Fahrenheit: but after frequently examining each bottle during the course of the experiment, at the expiration of several hours there was not the smallest tendency towards coagulation to be perceived in any of them; the cream was only thrown to the surface in a thick and adhesive form, and entirely separated from the fluid below, which had something of a grey and wheyish appearance. As the matter vomited by infants is sometimes more adhesive than we can suppose cream to be, Mr Clarke supposed that the curd might be so entangled with the cream, as to be with difficulty separated from it; but having collected a quantity of rich cream from the milk of different women, he repeated the experiment with precisely the same event, not being able in any one instance to produce the smallest quantity of curd. To determine, however, what effects might be produced upon milk by the stomach of an infant, Mr Clarke made the following experiment: Having taken out the stomach of a fœtus which had been deprived of life by the use of instruments, he infused it in a small quantity of hot water, so as to make a strong infusion. He added a tea-spoonful of this infusion to equal quantities of cows and human milk; the consequence of which was, that the cow's milk was firmly coagulated in a short time, but the human milk was not altered in the least; neither was the least coagulation produced by adding a second and third spoonful to the human milk. "Upon the whole, then, (says Mr Clarke), I am persuaded it will be found, that human milk, in an healthy state, contains little or no curd, and that the general opinion of its nature and properties is founded upon fallacious analogy and superficial observations made on the matter vomited by infants. We may presume, that the cream of woman's milk, by its inferior specific gravity, will swim on the surface of the contents of the stomach; and being of an oily nature, that it will be of more difficult digestion than any other constituent part of milk. When an infant then sucks very plentifully, so as to over-distend the stomach, or labours under any weakness in the powers of digestion, it cannot appear unreasonable to suppose, that the cream shall be first rejected by vomiting. Analogous to this, we know that adults affected with dyspepsia often bring up greasy fluids from the stomach by eructation, and this especially after eating fat meat. We have, in some instances, known this to blaze when thrown into the fire like spirit of wine or oil." Our author derives a confirmation of his opinion from the following observation, *viz.* that curds vomited by infants of a few days old are yellow, while they become white in a fortnight or three weeks. This he accounts for from the yellow colour of the cream thrown up by the milk of women during the first four or five days after delivery.

Mr Clarke likewise controverts that common opinion of the human milk being so prone to acidity; that a great number of the diseases of children are to be accounted for from that principle. "Whoever (says he) takes the trouble of attentively comparing human milk with that of ruminant animals, will soon find it to be much less prone to run into the acescent or acid process. I have very often exposed equal quantities of human and cows milk in degrees of temperature, varying from the common summer heat, or 65° to 100°;

and

Milk.

and I have conftantly found that cows milk acquires a greater degree of acidity in 36 hours than the human did in many days: cows milk becomes offenfively putrid in four or five days; a change which healthy human milk, expofed in the fame manner, will not undergo in many weeks, nay fometimes in many months. I once kept a few ounces of a nurfe's milk, delivered about fix or feven days, for more than two years in a bottle moderately corked. It ftood on the chimney-piece, and was frequently opened to be examined. At the end of this period it fhowed evident marks of moderate acidity, whether examined by the tafte, fmell, or paper ftained by vegetable blues or purples; the latter it changed to a florid red colour, whereas cows milk kept a few days changed the colour of the fame paper to a green, thereby clearly fhowing its putrefcent tendency."

Our author next goes on to confider of the probability there is of milk becoming fo frequently and ftrongly acid as to occafion moft of the difeafes of infants. He begins with an attempt to fhow, that the phenomena commonly looked upon to be indications of acrimony are by no means certain. Curdled milk has already been fhown to be no fign of acidity; and the other appearance, which has commonly been thought to be fo certain, *viz.* green fæces, is, in the opinion of Mr Clarke, equally fallacious. In fupport of this he quotes a letter from Dr Sydenham to Dr Cole; in which he fays that the green matter vomited by hyfterical women is not any proof of acrid humours being the caufe of that difeafe, for fea-fick people do the fame. The opinion of green fæces being an effect of acidity, proceeds on the fuppofition that a mixture of bile with an acid produces a green colour; but it is found, that the vegetable acid, which only can exift in the human body, is unable to produce this change of colour, though it can be effected by the ftrong mineral acids. As nothing equivalent to any of thefe acids can be fuppofed to exift in the bowels of infants, we muft therefore take fome other method of accounting for the green fæces frequently evacuated by them. "Why fhould four milk, granting its exiftence, give rife to them in infants and not in adults? Have butter milk, fummer-fruits of the moft acefcent kind, lemon or orange juice, always this effect in adults by their admixture with bile? This is a queftion which, I believe, cannot be anfwered in the affirmative."

On the whole, Dr Clarke confiders the difeafe of acidity in the bowels, though fo frequently mentioned, to be by no means common. He owns, indeed, that it may fometimes occur in infancy as well as in adults, from weaknefs of the ftomach, coftivenefs, or improper food; and an indubitable evidence is afforded by fæces which ftain the blue or purple colour of vegetables to a red, though nothing can be inferred with certainty from the colour or fmell.

The Doctor next proceeds to ftate feveral reafons for his opinion, that the greater number of infantile difeafes are not owing to acidity: 1. Woman's milk in an healthy ftate contains little or no coagulable matter or curd. 2. It fhows lefs tendency out of the body to become acefcent than many other kinds of milk. 3. The appearances which have been generally fuppofed to characterife its acidity do not afford fatisfactory evidence of fuch a morbid caufe. 4. Granting this to be the cafe, we have plenty of mild abforbents, capable of deftroying all the acid which can be fuppofed to be generated in the bowels of an infant; yet many children are obferved to die in confequence of thefe difeafes fuppofed to arife from acidity. 5. Tho' the milk of all ruminant animals is of a much more acefcent nature than that of the human fpecies, yet the young of thefe animals never fuffer any thing like the difeafes attributed to acidity in infants. 6. Hiftory informs us, that whole nations ufe four curdled milk as a confiderable part of their food without feeling any inconvenience; which, however, muft have been the cafe, if acidity in the ftomach were productive of fuch deleterious effects as has been fuppofed.

The reafoning of Dr Clarke feems here to be very plaufible, and nothing has as yet been offered to contradict it. The reviewers in taking notice of the treatife only obferve, that the Doctor's pofitions are fupported by great probability; yet "they have feen them, or think they have feen them, contradicted by the appearance of difeafes and the effects of medicines;" fo that they muft leave the fubject to farther examination.

In a memoir by Meffrs Parmentier and Deyeux, members of the royal college of pharmacy, &c. in Paris, we have a great number of experiments on the milk of affes, cows, goats, fheep, and mares, as well as women. The experiments on cows milk were made with a view to determine whether any change was made in the milk by the different kinds of food eaten by the animal. For this purpofe fome were fed with the leaves of *mais* or Turkey wheat; fome with cabbage; others with fmall potatoes; and others with common grafs. The milk of thofe fed with the *mais* or Turkey wheat was extremely fweet; that from the potatoes and common grafs much more ferous and infipid; and that from the cabbages the moft difagreeable of all. By diftillation only eight ounces of a colourlefs fluid were obtained from as many pounds of each of thefe milks; which from thofe who fed upon grafs had an aromatic flavour; a difagreeable one from cabbage; and none at all from the potatoes and Turkey wheat. This liquid became fetid in the fpace of a month whatever fubftance the animal had been fed with, acquiring at the fame time a vifcidity and becoming turbid; that from cabbage generally, but not always, becoming firft putrid. All of them feparated a filamentous matter, and became clear on being expofed to the heat of 25° of Reamur's thermometer. In the refiduums of the diftillations no difference whatever could be perceived. As the only difference therefore exifting in cow's milk lies in the volatile part, our authors conclude, that it is improper to boil milk either for common or medicinal purpofes. They obferved alfo, that any fudden change of food, even from a worfe to a better kind, was attended by a very remarkable diminution in the quantity of milk. All the refiduums of the diftillations yielded, in a ftrong fire, a yellow oil, an acid, a thick and black empyreumatic oil, a volatile alkali, and towards the end a quantity of inflammable air, and at laft a coal remained containing fome fixed alkali with muriatic acid.

On agitating, in long bottles, the creams from the milk of cows fed with different fubftances, all of them were

were formed into a kind of half-made butter; of which that formed from the milk from mais was white, firm, and insipid; that from potatoes was softer and more pinguedinous; but that from common grass was the best of all. Cabbage, as in other cases, gave a strong taste.

In the course of their experiments, it was endeavoured to determine whether butter is actually contained in the cream, or whether it be a chemical production of the operation of churning. They could not find any reason absolutely satisfactory on either side, but incline to the latter opinion; because when cream is allowed to remain among the milk, and the whole curdled promiscuously, only fat cheese, without any butter, is produced. The oily parts cannot be separated into butter either by acids or any other means than churning: even the artificial mixture of oil with the cream is insufficient for the purpose.

The serum of milk was reduced by filtration to a clear and pellucid liquor; and, by mixture with fixed alkali, deposited a portion of cheesy matter which had been dissolved in the whey. The sugar of milk was also found in this liquor.

In their experiments upon the milk of various animals, it was found that the milk of asses yielded by distillation an insipid liquor, and deposited a liquor similar to the lymph of cows milk. It is coagulated by all the acids, but not into an uniform mass, exhibiting only the appearance of distinct flocculi. It affords but little cream, which is converted with difficulty into a soft butter that soon becomes rancid. It has but a small quantity of saccharine particles, and these are often mixed with muriatic selenite and common salt. Goats milk has a thick cream, and agreeable to the taste; and the milk itself may be preserved longer in a sound state than any other species, the scum on its surface being naturally convertible into palatable cheese. It is easily made into firm butter, which does not soon become rancid, and has a good flavour. The butter-milk contains a large quantity of cheesy matter which readily coagulates; but has still less saccharine matter than that of asses. Sheeps milk can scarce be distinguished from that of a cow, and easily parts with its cream by standing. It is of a yellow colour, an agreeable flavour, and yields a great proportion of butter; but this is not solid, and soon becomes rancid. Mare's milk is the most insipid and least nutritious of any; notwithstanding which it has been much recommended for weak and consumptive patients: in which cases it is probable that it proves efficacious by being more consonant than any other to the debilitated powers of digestion. It boils with a smaller fire than any other kind of milk, is easily coagulated, and the distilled water does not soon change its nature. It has but a small quantity of cheesy matter, and very few oily particles: the cream cannot be made into butter; and the whey contains about as much sugar as cows or goats milk.

In this memoir our authors remark, that in order to augment the quantity, as well as to improve the quality, of the milk of animals, they should be well fed, their stalls kept clean, and their litter frequently renewed: they should be milked at stated hours, but not drained: great attention should also be paid to the breed; because inferior cattle are maintained at as great expence as the most valuable kinds. No change ought to be made in the food; though if the milk be employed for medicinal purposes, it may be improved by a proper mixture of herbs, &c.

In their experiments on woman's milk, Messrs Parmentier and Deyeux differ somewhat from Dr Clarke. They first tried the milk of a woman who had been delivered four months; and observed, that after the cream had been separated the other part appeared of a more perfect white, and that it could not be coagulated either by vinegar or mineral acids; which they attributed to a superabundance of serum. But they found that in proportion to the age of the milk it was found to be more easily coagulable; and this was confirmed by experiments made upon the milk of 20 nurses. Its coagulability was not increased by heat. The cream, by agitation, formed a viscid unctuous matter, but could not be changed into perfect butter: but they found that it was extremely difficult to determine the proportions of the various component parts in human milk, as it differs remarkably, not only in different subjects, but in the same subject at different times. In a nurse aged about 32 years, who was extremely subject to nervous affections, the milk was one day found almost quite colourless and transparent. In two hours after, a second quantity drawn from the breast was viscid like the white of an egg. It became whiter in a short time, but did not recover its natural colour before the evening. It was afterwards found that these changes were occasioned by her having some violent hysteric fits in the mean time.

Sugar of Milk. Under the article Chemistry an account has been given of the sugar of milk, with some of the different methods of making it: but of late we have an account of a method used by some of the Tartar nations of preserving their milk by means of frost; in which operation great quantities of the sugar of milk are accidentally formed. The account was given by Mr Fahrig of Petersburgh, who undertook a journey, by order of the academy of Petersburgh, among the Mogul tribes who inhabit the country beyond the lake Baikal, on the Banks of the river Salenga. These people allow their milk to freeze in large quantity in iron kettles; and, when it is perfectly congealed, they place them over a gentle fire to soften the edges of the cake, after which it may be taken out with a wooden spatula. They commence these operations at the beginning of the cold, when they have milk in the greatest abundance; after which it may be preserved with great ease throughout the whole winter. Mr Fahrig having frequent opportunities of seeing these cakes, soon observed, that the surface of them was covered to a considerable depth with a farinaceous powder; and having established a dairy upon the same plan with those of the Moguls, he found the same thing take place with himself. This powder was extremely sweet, and he received platefuls of it from the natives, who used it in their food, and sweetened their other victuals with it Having caused a number of cakes of frozen milk to be conveyed to the top of his house, where they were directly exposed to the violent cold, he found that the separation of the saccharine powder was greatly promoted by this means. He scraped the cakes every week to the depth

depth of two inches, and afterwards ſpread out the powder upon an earthen plate in order to deſtroy the remains of moiſture which might have prevented it from keeping for any length of time. When expoſed in this manner it had a very agreeable and ſtrong ſaccharine taſte; diſſolved in warm water; and when ſtrongly ſtirred by means of a chocolate-ſtick, would at all times produce an excellent and well-taſted milk. Raw milk affords a much larger quantity of this ſaccharine matter than ſuch as has been boiled, or which has had the cream taken off it. Neither muſt the milk be ſuddenly expoſed to the cold before it has loſt its natural heat; for the ſudden contact of the cold drives all the cheeſy and fat part towards the middle, while the external parts conſiſt of little elſe than water. In order to allow the parts of the milk to be all properly mixed together, Mr Fahrig allowed the milk when newly taken from the cows to cool, and then poured it out into ſhallow kettles.

Our author is of opinion that this method of making milk would be of great ſervice to navigators to ſupply themſelves with milk during long ſea voyages: and he aſſures us, from his own experience, that it will always ſucceed, if proper attention be paid to it. He is of opinion, however that all countries are not equally proper for the preparation of this ſaccharine matter: and indeed this ſeems very evidently to be the caſe, as the proceſs appears to be a cryſtallization of the ſaccharine parts of the milk, and the ſeparation of them from the aqueous ones by means of extreme cold. The country in which he made the experiments is one of the moſt elevated in all Aſia; and ſo cold, that, though it lies only in the 50th degree of north latitude, its rivers are frozen up for ſix months of the year. A very dry cold wind alſo prevails throughout almoſt the whole year; and the dry winds generally come from the north, being almoſt always preceded by a warm wind from the ſouth, which blows for ſome time. The dry rarefied air increaſes the evaporation from the ice-cakes, and leaves nothing but the ſaccharine or pure conſtituent parts of the milk, which with the addition of water can always recompoſe the fluid.

Milk, in the wine-trade. The coopers know very well the uſe of ſkimmed milk, which makes an innocent and efficacious forcing for the fining down of all white wines, arracks, and ſmall ſpirits; but is by no means to be uſed for red wines, becauſe it diſcharges their colour. Thus, if a few quarts of well ſkimmed milk be put to a hogſhead of red-wine, it will ſoon precipitate the greater part of the colour, and leave the whole nearly white; and this is of known uſe in the turning red wines, when pricked, into white; in which a ſmall degree of acidity is not ſo much perceived.

Milk is, from this quality of diſcharging colour from wines, of uſe alſo to the wine-coopers, for the whitening of wines that have acquired a brown colour from the caſk, or from having been haſtily boiled before fermenting; for the addition of a little ſkimmed milk, in theſe caſes, precipitates the brown colour, and leaves the wines almoſt limpid, or of what they call a *water whiteneſs*, which is much coveted abroad in wines as well as in brandies.

Milk of Lime; Milk of Sulphur. The name of *milk* is given to ſubſtances very different from *milk* properly ſo called, and which reſemble milk only in colour. Such is water in which quicklime has been ſlaked, which acquires a whiteneſs from the ſmall particles of the lime being ſuſpended in it, and has hence been called the milk of *lime*. Such alſo is the ſolution of liver of *ſulphur*, when an acid is mixed with it, by which white particles of ſulphur are made to float in the liquor.

Milk of Vegetables. For the ſame reaſon that milk of animals may be conſidered as a true animal emulſion, the emulſive liquors of vegetables may be called *vegetable milks*. Accordingly emulſions made with almonds are commonly called *milk of almonds*. But beſides this vegetable milk, which is in ſome meaſure artificial, many plants and trees contain naturally a large quantity of emulſive or milky juices. Such are lettuce, ſpurge, fig-tree, and the tree which furniſhes the elaſtic American reſin. The milky juices obtained from all theſe vegetables derive their whiteneſs from an oily matter, mixed and undiſſolved in a watery or mucilaginous liquor. Moſt reſinous gums were originally ſuch milky juices, which afterwards become ſolid by the evaporation of their moſt fluid and volatile parts.

Theſe natural milky juices have not been examined by any chemiſt. Such an examination would, however, procure much eſſential knowledge concerning vegetable œconomy. We ſhould probably find examples of all kinds of oils reduced into milky juices; and this knowledge cannot fail of throwing much light on the nature of reſins and gum-reſins.

Milk-Fever. See Midwifery, p. 806.

Milky-Hedge, the Engliſh name of a ſhrub growing on the coaſt of Coromandel, where it is uſed for hedging. The whole ſhrub grows very buſhy with numerous erect branches, which are compoſed of cylindrical joints as thick as a tobacco-pipe, of a green colour, and from three to ſix inches long: the joints are thicker than the other parts, but always give way firſt on any accidental violence offered to the plant. When broken it yields a milk of an exceſſively cauſtic quality, which bliſters any part of the ſkin it touches. When the joints are broken off at each end, the tube then contains but very little milk. In this ſtate Mr Ives ventured to touch it with his tongue, and found it a little ſweet. In the hedges it is ſeldom very woody; but when it is, the wood is pretty ſolid, and the bark grey and cracked. This plant, he informs us, has acquired a great reputation in curing the venereal diſeaſe, on the following account. A poor Portugueſe woman, the oldeſt female of her family, had wrought ſurpriſing cures in the moſt inveterate venereal diſorders, even ſuch as the European phyſicians had pronounced incurable. Theſe facts became ſo notorious, that the ſervants of the company, and eſpecially their ſurgeons, were induced to offer her a very conſiderable premium for a diſcovery of the medicine; but ſhe always refuſed to comply, giving for a reaſon, that while it remained a ſecret, it was certain proviſion for the maintenance of the family in the preſent as well as in future generations. On account of this denial the Engliſh ſurgeons were ſometimes at the pains to have her motions without doors carefully watched; and as they were not able to diſcover that ſhe ever gathered of any other plant or tree but this, they conjec-

Milky-way Mill.

tured that the milk of this tree was the ſpecific employed. Mr Ives inquired at the black doctors concerning the virtues of this plant; who all agreed, that it will cure the lues venera, but differed as to the manner of adminiſtering it; ſome ſaying that a joint of it ſhould be eaten every morning; others that the milk only ſhould be dropped upon ſugar; and then put into milk, oil, &c. and given daily to the patient.

Milky-Way. See Astronomy-*Index*.

MILL, a machine for grinding corn, &c. of which there are various kinds, according to the different methods of applying the moving power; as water-mills, wind-mills, mills worked by horſes, &c. See Mechanics, Sect. V.

The firſt obvious method of reducing corn into flour for bread would be, by the ſimple expedient of pounding. And that was for ages the only one which was practiſed by the various deſcendants of Adam, and actually continued in uſe among the Romans below the reign of Vaſpaſian. But the proceſs was very early improved by the application of a grinding power, and the introduction of mill-ſtones. This, like moſt of the common refinements in domeſtic life, was probably the invention of the antediluvian world, and certainly practiſed in ſome of the earlieſt ages after it. And, like moſt of them, it was equally known in the eaſt and weſt. Hence the Gauls and Britons appear familiarly acquainted with the uſe of hand-mills before the time of their ſubmiſſion to the Romans; the Britons particularly diſtinguiſhing them, as the Highlanders and we diſtinguiſh them at preſent, by the ſimple appellations of *querns*, *carnes*, or *ſtones*. And to theſe the Romans added the very uſeful invention of water-mills. For this diſcovery the world is pretty certainly indebted to the genius of Italy; and the machine was not uncommon in the country at the conqueſt of Lancaſhire. This, therefore, the Romans would neceſſarily introduce with their many other refinements among us. And that they actually did, the Britiſh appellation of a *water-mill* fully ſuggeſts of itſelf; the *melin* of the Welſh and Corniſh, the *mull*, *meill*, and *melin* of the Armoricans, and the Iriſh *muilean* and *muilind*, being all evidently derived from the Roman *mola* and *molendinum*. The ſubject Britons univerſally adopted the Roman name, but applied it, as we their ſucceſſors do, only to the Roman *mill*; and one of theſe was probably erected at every ſtationary city in the kingdom. One plainly was at Mancheſter, ſerving equally the purpoſes of the town and the accommodation of the garriſon. And one alone would be ſufficient, as the uſe of handmills remained very common in both, many having been found about the ſite of the ſtation particularly; and the general practice having deſcended among us nearly to the preſent period. Such it would be peculiarly neceſſary to have in the camp, that the garriſon might be provided againſt a ſiege. And the water-mill at Mancheſter was fixed immediately below the Caſtlefield and the town, and on the channel of the Medlock. There, a little above the ancient ford, the ſluice of it was accidentally diſcovered about 30 years ago. On the margin of Dyer's-croft, and oppoſite to ſome new conſtructions, the current of the river, accidentally ſwelled with the rains, and, obſtructed by a dam, broke down the northern bank, ſwept away a large oak upon the edge of it, and diſcloſed a long tunnel in the rock below. This has been ſince laid open in part with a ſpade. It appeared entirely uncovered at the top, was about a yard in width, and another in depth, but gradually narrowed to the bottom. The ſides ſhowed every where the marks of the tool on the rock, and the courſe of it was parallel with the channel. It was bared by the flood about 25 yards only in length, but was evidently continued for ſeveral further; having originally begun, as the nature of the ground evinces, juſt above the large curve in the channel of the Medlock.

Whitaker's Hiſtory of Mancheſter.

For the firſt five or ſix centuries of the Roman ſtate, there were no public bread-bakers in the city of Rome. They were firſt introduced into it from the eaſt, at the concluſion of the war with Perſeus, and about the year 167 before Chriſt. And, towards the cloſe of the firſt century, the Roman families were ſupplied by them every morning with freſh loaves for breakfaſt. But the ſame cuſtom, which prevailed originally among the Romans and many other nations, has continued nearly to the preſent time among the Mancunians. The providing of bread for every family was left entirely to the attention of the women in it. And it was baked upon ſtones, which the Welſh denominate *greidiols* and we *gredles*. It appears, however, from the kiln-burnt pottery which has been diſcovered in the Britiſh ſepulchres, and from the Britiſh appellation of an *odyn* or *oven* remaining among us at preſent, that furnaces for baking were generally known among the original Britons. An odyn would, therefore, be erected at the manſion of each Britiſh baron, for the uſe of himſelf and his retainers. And, when he and they removed into the vicinity of a Roman ſtation, the oven would be rebuilt with the manſion, and the public bakehouſes of our towns commence at the firſt foundation of them. One bakehouſe would be conſtructed, as we have previouſly ſhown one mill to have been ſet up, for the public ſervice of all the Mancunian families. One oven and one mill appear to have been equally eſtabliſhed in the town. And the inhabitants of it appear immemorially accuſtomed to bake at the one and grind at the other. Both, therefore, were in all probability conſtructed at the firſt introduction of water-mills and ovens into the country. The great ſimilarity of the appointments refers the conſideration directly to one and the ſame origin for them. And the general nature of all ſuch inſtitutions points immediately to the firſt and actual introduction of both. And, as the ſame eſtabliſhments prevailed equally in other parts of the north, and pretty certainly obtained over all the extent of Roman Britain, the ſame erections were as certainly made at every ſtationary town in the kingdom.

MILL (John), a very learned divine, was born at Shap in Weſtmoreland, about the year 1645; and became a ſervitor of Queen's college Oxford. On his entering into orders he became an eminent preacher, and was made prebendary of Exeter. In 1681, he was created doctor of divinity; about the ſame time he was made chaplain in ordinary to King Charles II. and in 1685 he was elected principal of St Edmund's hall in Oxford. His edition of the Greek Teſtament, which will ever render his name memorable, was publiſhed about a fortnight before his death, which happened

pened in June 1707. Dr Mills was employed 30 years in preparing this edition.

MILL-STONE, the ſtone by which corn is ground.—The mill-ſtones which we find preſerved from ancient times are all ſmall, and very different from thoſe in uſe at preſent. Thoreſby mentions two or three ſuch found in England, among other Roman antiquities, which were but 20 inches broad; and there is great reaſon to believe that the Romans as well as the Egyptians of old, and the ancient Jews, did not employ horſes, or wind, or water, as we do, to turn their mills, but made their ſlaves and captives of war do this laborious work: they were in this ſervice placed behind theſe mill-ſtones, and puſhed them on with all their force. Sampſon, when a priſoner to the Philiſtines, was treated no better, but was condemned to the mill-ſtone in his priſon. The runner or looſe mill-ſtone, in this ſort of grinding, was uſually very heavy for its ſize, being as thick as broad. This is the mill-ſtone which is expreſsly prohibited in ſcripture to take in pledge, as lying looſe it was more eaſily removed. The Talmudiſts have a ſtory, that the Chaldeans made the young men of the captivity carry mill-ſtones with them to Babylon, where there ſeems to have been a ſcarcity at that time; and hence, probably, their paraphraſe renders the text "have borne the mills, or mill-ſtones;" which might thus be true in a literal ſenſe. They have alſo a proverbial expreſſion of a man with a mill-ſtone about his neck; which they uſe to expreſs a man under the ſevereſt weight of affliction. This alſo plainly refers to this ſmall ſort of ſtones.

Rheniſh Mill-Stone, is claſſed by Cronſtedt among the volcanic products, on account of its appearance, which is a blackiſh grey, porous, and perfectly reſembling a lava of Mount Veſuvius.

MILLENARIANS, or CHILIASTS, a name given to thoſe, in the primitive ages, who believed that the ſaints will reign on earth with Chriſt 1000 years. See MILLENIUM.

MILLENER, or MILLINER, one who ſells ribbands and dreſſes, particularly head-dreſſes, for women; and who makes up thoſe dreſſes.

Of this word different etymologies have been given. It is not derived from the French; for, through ſome ſtrange fatality, the French cannot expreſs the notion of *millener*, otherwiſe than by the circumlocution *marchand* or *marchande des modes*.

Neither is it derived from the Low-Dutch language, the great, but neglected, magazine of the Anglo-Saxon. For Sewell, in his Dictionary Engliſh and Dutch, 1708, deſcribes *milliner* to be "en kraamer van lint en andere optoniſelon, Franſche kraamer;" that is "a pedlar who ſells ribbons and other trimmings or ornaments; a French pedlar."

Littleton, in his Engliſh and Latin dictionary, publiſhed 1677, defines millener, "a jack of all trades;" q. d. *millenarius*, or *mille mercium venditor;* that is, "one who ſells a thouſand different ſorts of things," This etymology ſeems fanciful: But, if he rightly underſtood the vulgar meaning of the word *millener* in his time, we muſt hold that it then implied what is now termed "a haberdaſher of ſmall wares," one who dealt in various articles of petty merchandiſe, and who did not *make up* the goods which he ſold.

Before Littleton's time, however, a ſomewhat nicer characteriſtic than ſeems compatible with his notion, appears to have belonged to them; for Shakeſpeare, in his Henry IV. makes Hotſpur, when complaining of the daintineſs of a courtier, ſay,

"He was *perfumed* like a millener."

The fact ſeems to be, that there were milleners of ſeveral kinds: as *horſe-milleners*, (for ſo thoſe perſons were called who made ornaments of coloured worſted for horſes); haberdaſhers of ſmall wares, the *milleners* of Littleton; and *milleners* ſuch as thoſe now peculiarly known by that name, whether male or female, and to whom Shakeſpear's alluſion ſeems moſt appropriate.

Laſtly, Dr Johnſon, in his Dictionary, derives the word from *milaner*, an inhabitant of *Milan*, from whence people of this profeſſion firſt came, as a *Lombard* is a banker.

MILLE PASSUS, or *Millia Paſſuum;* a very common expreſſion among the ancient Romans for a meaſure of diſtance, commonly called a *mile*. *Milliarium*, rarely uſed. Which Heſychius made to conſiſt of ſeven ſtadia; Plutarch, little ſhort of eight; but many others, as Strabo and Polybius, make it juſt eight ſtadia. The reaſon of this difference ſeems to be, that the former had a regard to the Grecian foot, which is greater than the Roman or Italic. This diſtance is oftentimes called *lapis*, which ſee. Each paſſus conſiſted of five feet, (Collumella).

MILLENIUM, "a thouſand years;" generally employed to denote the thouſand years, during which, according to an ancient tradition in the church, grounded on ſome texts in the Apocalypſe and other ſcriptures, our bleſſed Saviour ſhall reign with the faithful upon earth after the firſt reſurrection, before the final completion of beatitude.

Though there has been no age of the church in which the millenium was not admitted by individual divines of the firſt eminence, it is yet evident from the writings of Euſebius, Irenæus, Origen, and others among the ancients, as well as from the hiſtories of Dupin, Moſheim, and all the moderns, that it was never adopted by the whole church, or made an article of the eſtabliſhed creed in any nation.

About the middle of the fourth century the millenians held the following tenets:

1ſt, That the city of Jeruſalem ſhould be rebuilt, and that the land of Judea ſhould be the habitation of thoſe who were to reign on earth 1000 years.

2dly, That the firſt reſurrection was not to be confined to the martyrs; but that after the fall of Antichriſt all the juſt were to riſe, and all that were on the earth were to continue for that ſpace of time.

3dly, That Chriſt ſhall then come down from heaven, and be ſeen on earth, and reign there with his ſervants.

4thly, That the ſaints during this period ſhall enjoy all the delights of a terreſtrial paradiſe.

Theſe opinions were founded upon ſeveral paſſages of ſcripture, which the millenarians among the fathers underſtood in no other than a literal ſenſe, but which the moderns, who hold that opinion, conſider as partly literal and partly metaphorical. Of theſe paſſages, that upon which the greateſt ſtreſs has been laid, we believe to be the following:—"And I ſaw an angel come down from heaven, having the key

Millenium. key of the bottomless pit, and a great chain in his hand. And he laid hold on the dragon, that old serpent, which is the devil and Satan, and bound him a *thousand years*, and cast him into the bottomless pit, and shut him up, and set a seal upon him, that he should deceive the nations no more till *the thousand years* should be fulfilled: and after that he must be loosed a little season. And I saw thrones, and they sat upon them, and judgment was given unto them: and I saw the souls of them that were beheaded for the witness of Jesus, and for the word of God, and which had not worshipped the beast, neither his image, neither had received his mark upon their foreheads, or in their hands; and they lived and reigned with Christ a *thousand years*. But the rest of the dead lived not again till *the thousand years were finished*. This is the first resurrection *." This passage all the ancient millenarians took in a sense grossly literal; and taught, that during the millenium the saints on earth were to enjoy every bodily delight. The moderns, on the other hand, consider the power and pleasure of this kingdom as wholly spiritual; and they represent them as not to commence till after the conflagration of the present earth. But that this last supposition is a mistake, the very next verse except one assures us: for we are there told, that "when the thousand years are expired, Satan shall be loosed out of his prison, and shall go out to deceive the nations which are in the four quarters of *the earth*;" and we have no reason to believe that he will have such power or such liberty in "the new heavens and the *new earth*, wherein dwelleth righteousness."

* Rev. xx. 1--6.

For this and other reasons, which our limits will not permit us to enumerate, many judicious critics contend, that the prophecies of the millenium point, not to a resurrection of martyrs and other just men to reign with Christ a thousand years in a visible kingdom upon earth, but to that state of the Christian church, which, for a thousand years before the general judgment, will be so pure and so widely extended, that when compared with the state of the world in the ages preceding, it may, in the language of scripture be called a resurrection from the dead. In support of this interpretation they quote two passages from St Paul, in which a conversion from Paganism to Christianity, and a reformation of life, is called a resurrection from the dead:—"Neither yield ye your members as instruments of unrighteousness unto sin; but yield yourselves unto God as those that are *alive from the dead* §:" And again "Wherefore he saith, Awake thou that sleepest, and *arise from the dead*, and Christ shall give thee light ‡." It is likewise to be observed, that in all the descriptions of the resurrection and future judgment which are given us at such length in the gospels and epistles, there is no mention made of a *first* and *second* resurrection at the distance of a thousand years from each other. There is indeed an order in the resurrection: for we are told †, that "every man shall rise in his own order; Christ the first fruits, afterwards they that are Christ's at his coming, &c." But were the millenarian hypothesis well founded, say its opposers, the words should rather have run thus: "Christ the first fruits, then the martyrs at his coming, and a thousand years afterwards the residue of mankind. Then cometh the end, &c."

§ Rom. vi. 13.

‡ Eph. v. 14.

† 1 Cor. xv. 23.

These arguments incline many to believe, that by the reign of Christ and the saints for a thousand years upon earth, nothing more is meant, than that before the general judgment the Jews shall be converted, genuine Christianity be diffused through all nations, and mankind enjoy that peace and happiness which the faith and precepts of the gospel are calculated to confer on all by whom they are sincerely embraced.

Our Saviour's own account of his religion is, that from a small beginning it will increase to the full harvest. The millenium therefore is to be considered as the full effect of the Christian principles in the hearts of men, and over the whole world; and the divines who have treated of this subject endeavour to prove, that this is to be expected from the facts which have already existed, and from the importance of the Christian doctrine.

1. The gradual progress of Christianity is no objection to this fact. This is similar to the progress and advancement from less to greater perfection in every thing which possesses vegetable or animal life. The same thing is observed in the arts, in civilization, in societies, and in individuals—and why should it not be admitted to have place in religion? There is indeed a general principle on which a gradual progression, both in the natural and moral world, is founded. The Almighty never employs supernatural means where the thing can be accomplished by those which are natural. This idea is of the most general extent through the whole of the present system of nature. The possibility of another plan could easily be admitted; but in this case there would be a total alteration of every part of the works of God or of man that we are acquainted with. In the same manner, if the religion of Christ had been irresistible, it would have totally altered its natural consequences. It was necessary, therefore, from the present condition of man as an active, intelligent, and accountable being, that means should be employed; and wherever means are employed, the effects produced must be gradual, and not instantaneous.

2. Though the progress of a divine revelation be gradual yet it is to be expected, from the wisdom and compassion of God, that it still will be advancing in the hearts of men, and over the world. In the first age of the church, the word of God, supported by miracles, and by the animated zeal of men, who spake what they saw and heard, grew and prevailed. In this case supernatural means were necessary, because the prejudices of the world could not be subdued without them. It was the first watering of a plant which you afterwards leave to the dew of heaven. Miracles at the same time were employed only as the means of conviction; and they were not continued, because in this case they would have become a constant and irresistible principle, incompatible with the condition of man as a reasonable agent. After this power was withdrawn, there were many ages of ignorance and superstition in the Christian church. But what is necessary to be established on this subject is, not that the progress of Christianity has never been interrupted, but that on the whole it has been advancing. The effects of this religion on mankind, in proportion as it was received, were immediate and visible:

Millenium. fible; It deftroyed the grofs fuperftition of idol-worfhip: it abolifhed the practice, which was general in the heathen world, of reducing to the loweft ftate of fervitude the greateft part of our brethren: it foftened the horrors of war even when the vices of mankind made defence neceffary: it entered into focial and private life; and taught men benevolence, humanity, and mercy. It is in thefe bleffed effects that we can obferve the progrefs of Chriftianity even to this day. Superftition and idolatry were foon engrafted on the ftem which our Saviour planted in the world; but the fimplicity of the gofpel has been gradually undermining the fabric of fuperftition; and the men who are moft nearly interefted in the deceit are now almoft afhamed to fhow their faces in the caufe. The practice of flavery has, generally fpeaking, been extinguifhed in the Chriftian world: yet the remains of it have been a difgrace to the Chriftian name, and the profeffors of that religion have now begun to fee the inconfiftency. War is not only carried on with lefs animofity, and lefs havoc of the human fpecies; but men begin to cultivate more generally, and to delight in, the arts of peace. The increafing fpirit of charity and benevolence, of which it were eafy to give unexampled inftances in the prefent age, is a decided proof of the increafing influence of Chriftianity. At the fame time, if, inftead of thefe general principles, we were to defcend to private examples of infidelity or of wickednefs, it would be eafy to bring proofs in fupport of an oppofite opinion: but the reafoning would by no means be equally conclufive; for if the general principles by which fociety is regulated be more liberal and merciful, it is evident that there is more goodnefs in a greater number of the human race. Society is nothing more than a collection of individuals; and the general tone, efpecially when it is on the fide of virtue, which almoft in every inftance oppofes the defigns of leading and interefted men, is a certain evidence of the private fpirit. To fhow that this reformation is connected with Chriftianity, it is unneceffary to ftate any comparifon between the influence of heathen and the influence of Chriftian principles; between civilization as depending on the powers of the human underftanding, and on the efficacy of the word of God. The whole of this controverfy may be appealed to an obvious fact, viz. that as any nation has come nearer to the fimplicity of the gofpel in the ftandard of its worfhip, it has been more poffeffed of thofe national virtues which we have afcribed to the influence of Chriftianity. This fact is worth a thoufand volumes of fpeculation on this fubject.

3. A revelation fanctioned by God, for a benevolent purpofe, will be expected to produce effects correfponding to the wifdom which gave it, and to the purpofe for which it is employed. It may be gradual: but it will be increafing, and it muft increafe, to the full harveft. He that has begun the good work will alfo finifh it. It is reafonable to expect this illuftrious fuccefs of the gofpel, both from the nature of the thing, and from the prophecies contained in the facred fcriptures. The precepts of the gofpel, in their genuine fenfe, are admirably calculated for the peace and welfare both of individuals and fociety. The greateft liberality of mind, the greateft generofity of temper, the moft unbounded love, and the greateft indifference to the accumulation of this world's property, if they glowed from breaft to breaft, and operated with equal force on all men, would be productive of equal good and happinefs to all. We are fcarcely able to perceive the force of this at firft view, becaufe the deceit and impofition which yet exift in the world, prevent the operation of the beft principles even in the beft hearts. But in proportion to the improvement of mankind, what is their real intereft, and what are the real objects of happinefs, will gradually unfold. The contempt of vice will be greater in proportion to the fcarcity of it: for one villain gives countenance and fupport to another, juft as iron fharpeneth iron. This opens to our view another fact connected with the practice of Chriftianity, namely, that the nearer it arrives to its perfect ftate, it will be the more rapid in its progrefs. The beauty of holinefs will be more vifible; and, in the ftrong language of the prophet, "the earth fhall bring forth in one day, and a nation fhall be born at once *." This future perfection of the gofpel is confiftent with its nature and importance.— We can fcarcely believe that means fo admirably adapted to the reformation of mankind fhould be without their effect; and if the moft difficult part be already accomplifhed, we have no reafon to apprehend that the fcheme will not be completed. This fact is alfo clearly the fubject of ancient prophecy. For "thus faith the Lord †, I will extend peace to her like a river, and the glory of the Gentiles like a flowing ftream. And it fhall come to pafs, from one fabbath to another, and from one new moon to another, fhall all flefh come to worfhip before me, faith the Lord."— "Violence fhall be no more heard in thy land, wafting nor deftruction within thy border; but thou fhalt call thy walls falvation, and thy gates praife." (If. lx. 18.)

* If. lxvi. 8.

† Ver. 12, 23.

Without entering more minutely on the prophecy already quoted from chap. xx. of the book of the Revelation, it is fufficient to obferve, that Dr Whitby, in his treatife on the millenium at the end of his commentary endeavours to prove, from the fpirit of the paffage and the fimilarity of the expreffions with thofe of other prophets, that it refers to a ftate of the church for a thoufand years, which fhall be like life from the dead. The commencement of this period is connected with two events; the fall of antichrift, and the converfion of the Jews. The latter of thefe events he confiders as a key to all the prophecies concerning the millenium. As the Jews were the ancient people of God, and as their converfion is to be the previous ftep to the general knowledge of Chriftianity, the prophecies of the millenium have a chief relation to this important event. We have already obferved, that God never interpofes with miraculous power to produce what can be effected by natural means; and from what we know of human nature, we cannot but perceive that the converfion of the Jews will powerfully operate to the general converfion of mankind. Freed from thofe prejudices which now make them the objects of hatred in all nations, and fired with that zeal by which new converts are always actuated, they will preach the gofpel with a fervour of which we, who have long been bleffed with its rays, can hardly form a conception; and, by their prefent difperfion over the whole earth, they will be enabled to adapt their inftructions to every individual of the human race in the language of his fathers. Indeed, if they are not at some future period to be employed by Providence for this purpose, it is difficult, if not impossible, to give any reason for their dispersed state and political existence. Just now it must be confessed that they are the most implacable enemies of the Christian name; but their conversion is not on that account more unlikely or improbable than were events which have taken place of nearly equal importance a very few years ago. On the whole, the perfection of Christianity is a doctrine of reasonable expectation to the church; and it is impossible for the advocates for natural religion to deny, that unlimited obedience to its precepts is consistent with the purest state of liberty and of happiness. This is the only millenium which the prophets and apostles, as we understand them, promise to the saints; but as men figuring in the very first ranks of learning have thought otherwise, we would not be too confident that our interpretation is just.—Such of our readers as wish for further information, will find it in the works of Mr Mede, bishop Newton, Dr Whitby, and Dr Gill; and to those masterly writers we refer them for that satisfaction which in such an article as this cannot be given.

MILLEPES, or WOOD-LOUSE, in zoology; a species of ONISCUS. These insects are found in cellars, under stones, and in cold moist places; in the warmer countries they are rarely met with. Millepedes have a faint disagreeable smell, and a somewhat pungent, sweetish, nauseous taste. They have been highly celebrated in suppressions of urine, in all kinds of obstructions of the bowels, in the jaundice, weakness of sight, and variety of other disorders. Whether they have any just title to these virtues is greatly to be doubted; thus much is certain, that their real effects come far short of the character usually give them.

MILLEPORA, in natural history, a name by which Linnæus distinguishes that genus of lithophytes, of a hard structure and full of holes, which are not stellate or radiated, and whose animal is the hydra, in which it differs from the madrepora, and comprehending 14 different species.

In the millepora, the animal which forms and inhabits it occupies the substance; and it is observed that the milleporæ grow upon one another; their little animals produce their spawn; which attaching itself either to the extremity of the body already formed, or underneath it, gives a different form to this production. Hence the various shapes of the millepora, which is composed of an infinite number of the cells of those little insects, which all together exhibit different figures, though every particular cellula has its essential form, and the same dimensions, according to its own species.

MILLET, in botany. See MILIUM.

MILLIARE, or MILLIARIUM, a Roman mile, which consisted of 1000 paces, *mille passus*, whence the name.

MILLIARIUM AUREUM, was a gilded pillar in the forum of Rome, at which all the highways of Italy met, as one common centre. From this pillar the miles were counted, and at the end of every mile a stone was put down. The milliary column was erected by Augustus Cæsar, and, as we are informed by travellers, is still to be seen.

MILLING of CLOTH. See FULLING.

MILLION, in arithmetic, the sum of ten hundred thousand, or a thousand times a thousand. See ARITHMETIC.

MILLO, a part of mount Zion at its extremity; and therefore called *Millo* of the city of David (2 Chron. xxxii.), taken in with the wall that encompassed mount Zion. Uncertain whether *Beth-Millo*, (Judges ix. 20.) denotes a place; if it did, it lay near Sechem.

MILLOT (Claude Francis Xavier), of the French academy, was born at Besançon March 1726, and was for some time Jesuit. He was consecrated for the pulpit, and continued to preach after he left the society: But the weakness of his voice, his timidity, and the awkwardness of his manner, not permitting him to continue in this profession, he relinquished it, although he had preached Advent sermons at Versailles, and Lent sermons at Luneville. The Marquis de Felino, minister of Parma, instituted an historical class for the benefit of the young nobility; and, at the desire of M. le Duc de Nivernois, he gave the charge of it to the Abbé Millot. The minister having occasioned a kind of rebellion among the people by some innovations which he had made in the state, the Abbé continued attached to the interests of his patron, and would not desert him till the storm was blown over. When he was told that he would lose his place by this conduct, he replied, "My place is with a virtuous persecuted man who has been my benefactor; and that I shall never lose." At length, having filled the historical chair with great approbation, he returned to France, and was appointed preceptor to M. le Duc d'Enghien. In this situation he died, A. D. 1785, aged 59. The Abbé Millot did not shine in company; he was cold and reserved in his manner; but every thing he said was judicious, and exactly in point.—D'Alembert said, that of all his acquaintance the Abbé Millot had the fewest prejudices and the least pretension. He composed several works, which are digested with great care, and written in a pure, simple, and natural style. The principal are, 1. *Elemens de l' Histoire de France, depuis Clovis jusque a Louis XIV.* 3 vols in 12mo. The author, selecting the most curious and important facts, has suppressed every thing foreign to the subject; and has not only arranged the materials in their proper order, but chosen them with the greatest judgment. Querlon thought this the best abridgment which we have of the history of France, and preferred it to that of the President Henault. 2. *Elemens de l'Histoire d'Angleterre, depuis son origine sous les Romains, jusqu' à George II.* 3 vols. 12mo. In this valuable abridgment, the author satisfies, without tiring, his readers. It is all that is necessary for those who wish to gain a general knowledge of the English history, without entering minutely into its particular parts.—3. *Elemens de l'Histoire Universelle*, 9 vols. 12mo. A certain critic maintains, that this work is merely a counterfeit of Voltaire's general history. But this censure is altogether unjust. The ancient history in this work is wholly composed by the Abbé Millot; and, no less than the modern part, discovers his abilities in the choice of facts, in divesting them of useless circumstances, in relating them without prejudice, and in adorning them with judicious reflections. 4. *L'Histoire*

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ſtoire des Troubadours, 3 vols. 12mo. compiled from the manuſcripts of M. de Sainte-Palaie. This work appears rather tedious, becauſe it treats of men almoſt unknown, and moſt of them deſerving to be ſo. What is there quoted from the Provencal poets is not at all intereſting; and, according to the obſervation of a man of wit, "it ſerves no purpoſe to ſearch curiouſly into a heap of old ruins while we have modern palaces to engage our attention." 5. *Memoires politiques et Militaires, pour ſervir à l'Hiſtoire de Louis XIV. et de Louis XV.* compoſed from original papers collected by Adrian Maurice duc de Noailles, marſhal of France, in 6 vols 12mo. 6. The Abbé Millot publiſhed alſo ſeveral Diſcourſes, in which he diſcuſſes a variety of philoſophical queſtions, with more ingenuity of argument than fire of expreſſion; and a tranſlation of the moſt ſelect harangues in the Latin hiſtorians; of which it has been remarked, as well as of the orations of the Abbé d'Olivet, that they are coldly correct, and elegantly inſipid. The character of the author, more prudent and circumſpect than lively and animated, ſeldom elevated his imagination above a noble ſimplicity without warmth, and a pure ſtyle without oſtentation. Some of the critics, however, have accuſed him of declamation in ſome parts of his hiſtories, particularly in thoſe parts which concern the clergy. But, in our opinion, the word declamation is totally inapplicable to the writings of the Abbé Millot. He flatters, it is true, neither prieſts nor ſtateſmen; and he relates more inſtances of vicious than of virtuous actions, becauſe the one are infinitely more common than the other: But he relates them coldly; and he appears to be guided more by ſincerity and a love of truth, than by that partial philoſophy which blames the Chriſtian religion for thoſe evils which it condemns.

MILO, a celebrated athlete of Crotona in Italy. His father's name was Diotimus. He early accuſtomed himſelf to carry the greateſt burdens, and by degrees became a prodigy of ſtrength. It is ſaid that he carried on his ſhoulders a young bullock, four years old, for above forty yards; and afterwards killed it with one blow of his fiſt, and eat it up in one day. He was ſeven times crowned at the Pythian games, and ſix at the Olympian. He preſented himſelf a ſeventh time; but no one had the courage or boldneſs to enter the liſts againſt him. He was one of the diſciples of Pythagoras; and to his uncommon ſtrength, it is ſaid, the learned preceptor and his pupils owed their lives. The pillar which ſupported the roof of the ſchool ſuddenly gave way; but Milo ſupported the whole weight of the building, and gave the philoſopher and his auditors time to eſcape. In his old age, Milo attempted to pull up a tree by the roots, and break it. He partly effected it; but his ſtrength being gradually exhauſted, the tree when half cleft re-united, and his hands remained pinched in the body of the tree. He was then alone; and, being unable to diſentangle himſelf, he was devoured by the wild beaſts of the place, about 500 years before the Chriſtian æra.

MILO (T. Annius), a native of Lanuvium, who attempted to obtain the conſulſhip at Rome by intrigue and ſeditious tumults. Clodius the tribune oppoſed his views; yet Milo would have ſucceeded but for the following event: As he was going into the country, attended by his wife and a numerous retinue of gladiators and ſervants, he met on the Appian road his enemy Clodius, who was returning to Rome with three of his friends and ſome domeſtics completely armed.— A quarrel aroſe between the ſervants. Milo ſupported his attendants, and the diſpute became general.— Clodius received many ſevere wounds, and was obliged to retire to a neighbouring cottage. Milo purſued his enemy in his retreat, and ordered his ſervants to diſpatch him. The body of the murdered tribune was carried to Rome, and expoſed to public view. The enemies of Milo inveighed bitterly againſt the violence and barbarity with which the ſacred perſon of a tribune had been treated. Cicero undertook the defence of Milo; but the continual clamours of the friends of Clodius, and the ſight of an armed ſoldiery, which ſurrounded the ſeat of judgment, ſo terrified the orator, that he forgot the greateſt part of his arguments, and the defence he made was weak and injudicious.— Milo was condemned, and baniſhed to Maſſilia. Cicero ſoon after ſent his exiled friend a copy of the oration which he had prepared for his defence, in the form in which we have it now; and Milo, after he had read it, exclaimed, *O Cicero, hadſt thou ſpoken before my accuſers in theſe terms, Milo would not be now eating figs at Marſeilles.* The friendſhip and cordiality of Cicero and Milo were the fruits of long intimacy and familiar intercourſe, It was to the ſucceſsful labours of Milo that the orator was recalled from baniſhment, and reſtored to his friends.

Milo.

MILO, (anciently *Melos)*, an iſland in the Archipelago, about 50 miles in circumference, with a harbour, which is one of the largeſt in the Mediterranean. The principal town is of the ſame name as the iſland, and was prettily built, but abominably naſty: the houſes are two ſtories high, with flat roofs; and are built with a ſort of pumic-ſtone, which is hard, blackiſh, and yet very light.

This iſland was formerly rich and populous. From the earlieſt times of antiquity it enjoyed pure liberty. The Athenians, not being able to perſuade the Melians to declare in their favour in the Peloponneſian war, made a deſcent upon the iſland, and attacked them vigorouſly. In two different expeditions they failed of their purpoſe: but returning with more numerous forces, they laid ſiege to Melos; and, obliging the beſiged to ſurrender at diſcretion, put to the ſword all the men who were able to bear arms. They ſpared only the women and children, and theſe they carried into captivity. This act of cruelty put humanity to the bluſh, and diſgraces the Athenian name. But war was then carried on with a degree of wild rage, unexampled in the preſent times. That republic knew not how to pardon, and always carried its vengeance to an extravagant height. When Lyſander, the Lacedemonian general, came to give law to the Athenians, he expelled the colony which they had ſent to Melos, and re-eſtabliſhed the unfortunate remains of its original inhabitants.

This iſland loſt its liberty when Rome, aſpiring to the empire of the world, conquered all the iſſes of the Archipelago. In the partition of the empire, it fell to the ſhare of the eaſtern emperors, was governed by particular dukes, and was at laſt conquered by Soliman II. Since that period, it has groaned under the

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yoke of Turkiſh deſpotiſm, and has loſt its opulence and ſplendor. At the commencement of the preſent century, it boaſted of 17 churches, and 11 chapels, and contained more than 20,000 inhabitants. It was very fertile in corn, wine and fruits; and the whole ſpace from the town to the harbour, which is nearly two miles, was laid out in beautiful gardens. M. Tournefort, who viſited it in the year 1700, gives a fine deſcription of it. "The earth, being conſtantly warmed by ſubterraneous fires, produced almoſt without interruption plenteous crops of corn, barley, cotton, exquiſite wines, and delicious melons. St Elias, the fineſt monaſtery in the iſland, and ſituated on the moſt elevated ſpot, is encircled with orange, citron, cedar, and fig trees. Its gardens are watered by a copious ſpring. Olive trees, of which there are but few in the other parts of the iſland, grow in great numbers around this monaſtery. The adjacent vineyards afford excellent wine. In a word, all the productions of the iſland are the very beſt of their kinds; its patridges, quails, kids, and lambs, are highly valued, and yet may be bought at a very cheap price."

* Letters on Greece, let. 42.

Were M. Tournefort to return to Milo, M. Savary * aſſures us, he would no longer ſee the fine iſland which he has deſcribed. "He might ſtill ſee alum, in the form of feathers, and fringed with ſilver thread, hanging from the arches of the caverns; pieces of pure ſulphur filling the cliffs of the rocks; a variety of mineral ſprings; hot baths, (though theſe are now only a ſet of ſmall dirty caves); the ſame ſubterraneous fires which in his days warmed the boſom of the earth, and were the cauſe of its extraordinary fertility: but inſtead of 5000 Greeks, all paying the capitation tax (A), he would now find no more than about 700 inhabitants on an iſland 18 leagues in circumference. He would ſigh to behold the fineſt lands lying uncultivated, and the moſt fertile valleys converted into moraſſes; of the gardens ſcarcely a veſtige left; three-fourths of the town in ruins, and the inhabitants daily decreaſing. In ſhort, during the laſt 50 years, Milos has aſſumed a quite different appearance. The plague, which the Turks propagate every where, has cut off one part of its inhabitants; the injudicious adminiſtration of the Porte, and the oppreſſive extortions of the Captain Pacha, have deſtroyed the reſt. At preſent, for want of hands, they cannot cut out a free channel for their waters, which ſtagnate in the valleys, corrupt, and infect the air with their putrid exhalations. The ſalt marſhes, of which there are numbers in the iſland, being equally neglected, produce the ſame effect. Add to theſe inconveniences, thoſe ſulphureous exhalations which ariſe all over the iſland, and by which the inhabitants of Milos are afflicted with dangerous fevers during three-fourths of the year. Perhaps they may be obliged to forſake their country. Every countenance is yellow, pale, and livid; and none bears any mark of good health. The prudent traveller will be careful to ſpend but a very ſhort time in this unwholeſome country, unleſs he chooſes to expoſe himſelf to the danger of catching a fever. To ſleep over-night, or to ſpend but one day in the iſland, is often enough to occaſion his being attacked with that diſtemper.

"Yet (continues our author) a judicious and enlightened government might expel thoſe evils which ravage Milos. Its firſt care would be to eſtabliſh a lazaretto, and to prohibit veſſels whoſe crews or cargoes are infected with the plague from landing. Canals might next be cut, to drain the marſhes, whoſe exhalations are ſo pernicious. The iſland would then be re-peopled. The ſulphureous vapours are not the moſt noxious. Theſe prevailed equally in ancient times, yet the iſland was then very populous. M. Tournefort, who travelled through it at a time leſs diſtant from the period when it was conquered by the Turks, and when they had not yet had time to lay it waſte, reckons the number of its inhabitants (as we have ſaid) at about 20,000. The depopulation of Milos is therefore to be aſcribed to the deſpotiſm of the Porte, and its deteſtable police."

Sutherland's Tour up the Straits, p. 146.

The women of Milo once ſo celebrated for their beauty, are now ſallow, unhealthy, and diſguſtingly ugly; and render themſelves ſtill more hideous by their dreſs, which is a kind of looſe jacket, with a white coat and petticoat, that ſcarcely covers two-thirds of their thighs, barely meeting the ſtocking above the knee. Their hind hair hangs down the back in a number of plaits; that on the fore part of the head is combed down each ſide of the face, and terminated by a ſmall ſtiff curl, which is even with the lower part of the cheek. All the inhabitants are Greeks, for the Turks are not fond of truſting themſelves in the ſmall iſlands; but every ſummer the captain baſhaw goes round with a ſquadron to keep them in ſubjection, and to collect the revenue. When the Ruſſians made themſelves maſters of the Archipelago during the late war, many of the iſlands declared in their favour; but being abandoned by the peace, they were ſo ſeverely mulcted by the Grand Signior, that they have profeſſed a determination to remain perfectly quiet in future. As the Turks, however do not think them worth a garriſon, and will not truſt them with arms and ammunition, all thoſe which the Ruſſians may chooſe to invade will be obliged to ſubmit. The two points which form the entrance of the harbour, croſſing each other, render it imperceptible until you are cloſe to it. Thus, while you are perfectly ſecure within it, you find great difficulty in getting out, particularly in a northerly wind; and as no trade is carried on except a little in corn and ſalt, Milo would ſcarcely ever be viſited, were it not that, being the firſt iſland which one makes in the Archipelago, the pilots have choſen it for their reſidence. They live in a little town on the top of a high rock, which, from its ſituation and appearance, is called the *caſtle*.—Patridges ſtill abound in this iſland; and are ſo cheap, that you may buy one for a charge of powder only. The peaſants get them by ſtanding behind a portable ſcreen, with a ſmall aperture in the centre, in which they place the muzzle of their piece, and then draw the

(A) Grown up men are the only perſons who pay the capitation tax. Therefore, by adding to the number of 5000 who paid the tax, the women, boys, and girls, we find that Milos, in the days of Tournefort, contained at leaſt 20,000 ſouls.

the partridges by a call. When a sufficient number are collected, they fire among them, and generally kill from four to seven at a shot: but even this method of getting them is so expensive, from the scarcity of ammunition, that the people can never afford to shoot them, except when there are gentlemen in the island, from whom they can beg a little powder and shot.

Milo is 60 miles north of Candia; and the town is situated in E. Long. 25. 15. N. Lat. 36. 27.

MILSTONE. See Mill-stone.

MILT, in anatomy, a popular name for the Spleen.

Milt, or *Melt*, in natural history, the soft roe in fishes; thus called from its yielding, by expression, a whitish juice resembling milk. See Roe.

The milt is properly the seed or spermatic part of the male fish. The milt of a carp is reckoned a choice bit. It consists of two long whitish irregular bodies, each included in a very thin fine membrane. M. Petit considers them as the testicles of the fish wherein the seed is preserved; the lower part, next the anus, he takes for the *vesiculæ seminales*.

MILTHORP, a port-town of Westmoreland, at the mouth of the Can, five miles from Kendal. It is the only sea-port in the county; and goods are brought hither in small vessels from Grange in Lancashire. Here are two paper-mills. It has a market on Friday, and a fair on Old May-day; and there is a good stone-bridge over the river Betha, which runs through the town.

MILTIADES, an Athenian captain, son of Cypselus. He obtained a victory in a chariot race at the Olympic games. He led a colony of Athenians to the Chersonesus. The causes of this appointment are striking and singular. The Thracian Dolonci, harassed by a long war with the Absynthians, were directed by the oracle of Delphi to take for their king the first man they met in their return home, who invited them to come under his roof and partake his entertainments. This was Miltiades, whom the appearance of the Dolonci, with their strange arms and garments, had struck. He invited them to his house, and was made acquainted with the commands of the oracle. He obeyed; and when the oracle of Delphi had approved a second time the choice of the Dolonci, he departed for the Chersonesus, and was invested by the inhabitants with sovereign power. The first measures he took was to stop the further incursions of the Absynthians, by building a strong wall across the Isthmus. When he had established himself at home, and fortified his dominions against foreign invasion, he turned his arms against Lampsacus. His expedition was unsuccessful; he was taken in an ambuscade, and made prisoner. His friend Crœsus king of Lydia was informed of his captivity, and procured his release. He lived few years after he had recovered his liberty. As he had no issue, he left his kingdom and possessions to Stesagoras the son of Cimon, who was his brother by the same mother. The memory of Miltiades was greatly honoured by the Dolonci, and they regularly celebrated festivals and exhibited shows in commemoration of a man to whom they owed their greatness and preservation.

Miltiades, the son of Cimon, and brother of Stesagoras mentioned in the preceding article, was some time after the death of the latter, who died without issue, sent by the Athenians with one ship to take possession of the Chersonesus. At his arrival Miltiades appeared mournful, as if lamenting the recent death of his brother. The principal inhabitants of the country visited the new governor to condole with him; but their confidence in his sincerity proved fatal to them. Miltiades seized their persons, and made himself absolute in Chersonesus. To strengthen himself, he married Hegesipyla, the daughter of Olorus the king of the Thracians. His triumph was short. In the third year of his government, his dominions were threatened by an invasion of the Scythian Nomades, whom Darius had some time before irritated by entering their country. He fled before them; but as their hostilities were of short duration, he was soon restored to his kingdom. Three years after, he left Chersonesus; and set sail for Athens, where he was received with great applause. He was present at the celebrated battle of Marathon; in which all the chief officers ceded their power to him, and left the event of the battle to depend upon his superior abilities. He obtained an important victory over the more numerous forces of his adversaries. Some time after, Militades was intrusted with a fleet of 70 ships, and ordered to punish those islands which had revolted to the Persians. He was successful at first; but a sudden report that the Persian fleet was coming to attack him, changed his operations as he was besieging Paros. He raised the siege, and returned to Athens. He was accused of treason, and particularly of holding correspondence with the enemy. The falsity of these accusations might have appeared, if Miltiades had been able to come into the assembly. But a wound which he had received before Paros detained him at home, and his enemies, taking advantage of his absence, became more eager in their accusations, and louder in their clamours. He was condemned to death; but the rigour of his sentence was retracted on the recollection of his great services to the Athenians, and he was put into prison till he had paid a fine of 50 talents to the state. His inability to discharge so great a sum detained him in confinement; and his wounds becoming incurable, he died a prisoner about 489 years before the Christian æra. His body was ransomed by his son Cimon; who was obliged to borrow and pay the 50 talents, to give his father a decent burial.—The accusations against Miltiades were probably the more readily believed by his countrymen, when they remembered how he made himself absolute in Chersonesus; and in condemning the barbarity of the Athenians towards a general, who was the source of their military prosperity, we must remember the jealousy which ever reigns among a free and independent people, and how watchful they are in defence of the natural rights which they see wrested from others by violence. Cornelius Nepos has written the life of Miltiades the son of Cimon; but his history is incongruous and unintelligible, from his confounding the actions of the son of Cimon with those of the son of Cypselus. Greater reliance is to be placed on the narration of Herodotus, whose veracity is confirmed, and who was indisputably better informed and more capable of giving an account of the

Milton. the life and exploits of men who flouriſhed in his age, and of which he could ſee the living monuments. Herodotus was born about ſix years after the famous battle of Marathon; and C. Nepos, as a writer of the Auguſtan age, flouriſhed about 450 years after the age of the father of hiſtory.

MILTON (John,) the moſt illuſtrious of the Engliſh poets, was deſcended of a genteel family, ſeated at a place of their own name, viz. *Milton*, in Oxfordſhire. He was born December 9, 1608, and received his firſt rudiments of education under the care of his parents, aſſiſted by a private tutor. He afterwards paſſed ſome time at St Paul's ſchool, London; in which city his father had ſettled, being engaged in the buſineſs of a ſcrivener. At the age of 17, he was ſent to Chriſt's college, Cambridge; where he made a great progreſs in all parts of academical learning; but his chief delight was in poetry. In 1628, he proceeded bachelor of arts, having performed his exerciſe for it with great applauſe. His father deſigned him for the church; but the young gentleman's attachment to the muſes was ſo ſtrong, that it became impoſſible to engage him in any other purſuits. In 1632, he took the degree of maſter of arts; and having now ſpent as much time in the univerſity as became a perſon who determined not to engage in any of the three profeſſions, he left the college, greatly regretted by his acquaintance, but highly diſpleaſed with the uſual method of training up youth there for the ſtudy of divinity; and being much out of humour with the public adminiſtration of eccleſiaſtical affairs, he grew diſſatisfied with the eſtabliſhed form of church-government, and diſliked the whole plan of education practiſed in the univerſity. His parents, who now dwelt at Horton, near Colnbrook, in Buckinghamſhire, received him with unabated affection, notwithſtanding he had thwarted their views of providing for him in the church, and they amply indulged him in his love of retirement; wherein he enriched his mind with the choiceſt ſtores of Grecian and Roman literature: and his poems of *Comus*, *L'Allegro*, *Il Penſeroſo*, and *Lycidas*, all wrote at this time, would have been ſufficient, had he never produced any thing more conſiderable, to have tranſmitted his fame to lateſt poſterity. However, he was not ſo abſorbed in his ſtudies as not to make frequent excurſions to London; neither did ſo much excellence paſs unnoticed among his neighbours in the country, with the moſt diſtinguiſhed of whom he ſometimes choſe to relax his mind, and improve his acquaintance with the world as well as with books. —After five years ſpent in this manner, he obtained his father's permiſſion to travel for farther improvement.—At Paris he became acquainted with the celebrated Hugo Grotius; and from thence travelling into Italy, he was every where careſſed by perſons of the moſt eminent quality and learning.

Upon his return home, he ſet up a genteel academy in Alderſgate-ſtreet.—In 1641, he began to draw his pen in defence of the Preſbyterian party; and the next year he married the daughter of Richard Powell, Eſq; of Foreſt-Hill in Oxfordſhire. This lady, however, whether from a difference on account of party, her father being a zealous royaliſt, or ſome other cauſe, ſoon thought proper to return to her relations; which ſo incenſed her huſband, that he reſolved never to take her again, and wrote and publiſhed ſeveral tracts in defence of the doctrine and diſcipline of divorce. He even made his addreſſes to another lady; but this incident proved the means of a reconciliation with Mrs Milton. Milton.

In 1644, he wrote his Tract upon Education; and the reſtraint on the liberty of the preſs being continued by act of parliament, he wrote boldly and nobly againſt that reſtraint. In 1645, he publiſhed his juvenile poems; and about two years after, on the death of his father, he took a ſmaller houſe in High Holborn, the back of which opened into Lincoln's-Inn Fields.—Here he quietly proſecuted his ſtudies, till the fatal cataſtrophe and death of Charles I.; on which occaſion he publiſhed his Tenure of Kings and Magiſtrates, in juſtification of the fact. He was now taken into the ſervice of the commonwealth, and made Latin ſecretary to the council of ſtate, who reſolved neither to write to others abroad, nor to receive any anſwers, except in the Latin tongue, which was common to them all. The famous Εικων βασιλικη coming out about the ſame time, our author, by command, wrote and publiſhed his *Iconoclaſtes* the ſame year. It was alſo by order of his maſters, backed by the reward of 1000 l. that, in 1651, he publiſhed his celebrated piece, entitled *Pro Populo Anglicano Defenſio.* "A Defence of the People of England, in anſwer to Salmaſius's Defence of the King;" which performance ſpread his fame over all Europe.—He now dwelt in a pleaſant houſe, with a garden, in Petty France, Weſtminſter, opening into St James's Park. In 1652, he buried his wife, who died not long after the delivery of her fourth child; and about the ſame time he alſo loſt his eye-ſight, by a *gutta ſerena*, which had been growing upon him many years.

Cromwell took the reigns of government into his own hands in the year 1653; but Milton ſtill held his office. His leiſure-hours he employed in proſecuting his ſtudies; wherein he was ſo far from being diſcouraged by the loſs of his ſight, that he even conceived hopes this misfortune would add new vigour to his genius; which, in fact, ſeems to have been the caſe.—Thus animated, he again ventured upon matrimony: his ſecond lady was the daughter of Captain Woodſtock of Hackney: ſhe died in childbed about a year after. On the depoſition of the protector, Richard Cromwell, and on the return of the long parliament, Milton being ſtill continued ſecretary, he appeared again in print; pleading for a farther reformation of the laws relating to religion; and, during the anarchy that enſued, he drew up ſeveral ſchemes for re-eſtabliſhing the commonwealth, exerting all his faculties to prevent the return of Charles II. England's deſtiny, however, and Charles's good fortune, prevailing, our author choſe to conſult his ſafety, and retired to a friend's houſe in Bartholomew-Cloſe. A particular proſecution was intended againſt him; but the juſt eſteem to which his admirable genius and extraordinary accompliſhments entitled him, had raiſed him ſo many friends, even among thoſe of the oppoſite party, that he was included in the general amneſty.

This ſtorm over, he married a third wife, Elizabeth, daughter of Mr Minſhall a Cheſhire gentleman; and

Milton. not long after he took a house in the Artillery Walk, leading to Bunhill-Fields. This was his last stage: here he sat down for a longer continuance than he had been able to do any where; and though he had lost his fortune (for every thing belonging to him went to wreck at the Restoration), he did not lose his taste for literature, but continued his studies with almost as much ardour as ever; and applied himself particularly to the finishing his grand work, the *Paradise Lost;* one of the noblest poems that ever was produced by human genius.—It was published in 1667, and his *Paradise Regained* came out in 1670.—This latter work fell short of the excellence of the former production; although were it not for the transcendent merit of Paradise Lost, the second composition would doubtless have stood foremost in the rank of English epic poems. After this he published many pieces in prose; for which we refer our readers to the edition of his Historical, Poetical, and Miscellaneous Works, printed by Millar, in 2 vols. 4to, in 1753.

In 1674, this great man paid the last debt to nature at his house in Bunhill-Fields, in the 66th year of his age; and was interred on the 12th of November, in the chancel of St Giles's, Cripplegate.—A decent monument was erected to his memory, in 1737, in Westminster abbey, by Mr Benson, one of the auditors of the imprest.—As to his person, it was remarkably handsome; but his constitution was tender, and by no means equal to his incessant application to his studies.—Though greatly reduced in his circumstances, yet he died worth 1500 l. in money, beside his household goods.—He had no son; but left behind him three daughters, whom he had by his first wife.

MILTON, the name of several places in England; particularly,

Milton, or *Middleton,* in Dorsetshire, south-west of Blandford, near the road to Dorchester, 114 miles from London. It is chiefly noted for its abbey, built by king Athelstan. The church stands near the south side of the abbey. It is a large and magnificent pile of Gothic architecture, and contains several ancient monuments. Here is an alms-house for six people, who have 12 s. a week, and three yards of cloth for a gown, one pair of shoes and stockings, and 10 s. each on St Thomas's day yearly. Here is a free-school, and a market on Tuesdays.

Milton, in Kent, near Sittinbourn and the Isle of Sheppey, 6 miles north-west of Feversham, and 40 from London. It is also called *Middleton* from its situation near the middle of the county, *i. e.* from Deptford to the Downs. The kings of Kent had a palace here, which was castellated, and stood below the church; but was burnt down in Edward the Confessor's time by Earl Godwin, &c. Its church stands near a mile off. On approaching the town up the Thames, by the East-Swale, it seems hid among the creeks: yet it is a large town; and has a considerable market on Saturdays, and a fair on July 24. The oysters taken hereabouts are the most famous of any in Kent. This town is governed by a portreeve, chosen yearly on St James's-day, who supervises the weights and measures all over the hundred of Milton.

Milton, in Kent, a mile on the east side of Gravesend, was incorporated with it in the reign of Queen Elizabeth, by the name of the portreeve, jurats, and inhabitants of the towns of Gravesend and Milton. King Henry VIII. raised a platform or block-house here, for the defence both of this town and Gravesend, and the command of the river. It has a fair Jan. 25.

Milvius ‖ Mimnermus.

MILVIUS Molvius, or Mulvius, *Pons;* a bridge on the Tiber, built by Æmilius Scaurus the censor, in the time of Sylla, at two miles distance from the city, on the Via Flaminia, and repaired by Augustus. From this bridge the ambassadors of the Allobroges were brought back to Rome, by Cicero's management, and made a discovery of Cataline's conspiracy (Sallust). Near it Maxentius was defeated by Constantine (Eutropius). Now called *Ponte Molle.*

Milvius, in ornithology, a species of Falco.

MIMI, Mimes, in the ancient comedy, were buffoons or mimics, who entertained the people by taking off certain characters, using such gestures as suited the persons or subjects they represented. There were on the Roman stage female performers of this kind called *mimæ.* The word is derived from μιμεομαι, *I imitate.* Some of the *mimi* acted their parts to the sound of the *tibia;* these they called *mimauli.*

Mimi were also a kind of farces or ludicrous comedies, generally performed by one person. They had no acts, nor any *exordium.*—The *mimi* were introduced upon the Roman stage long after comedy and tragedy had arrived at their full perfection. The actor wore no mask, but smeared his face with soot, was dressed in lambskin, wore garlands of ivy, and carried a basket of flowers and herbs, in honour of Bacchus, and diverted the audience with apish tricks and ridiculous dances. This was the state of the *mimi* soon after their first introduction; but they underwent many alterations, which it would take up too much room to relate, and which are not of sufficient importance to justify a detailed account. See Pantomimes.

MIMESIS, in rhetoric, the imitating the voice and gestures of another person.

MIMNERMUS, an ancient poet and musician, flourished about the beginning of the 6th century B. C. He was of Smyrna, and cotemporary with Solon. Athenæus gives him the invention of pentameter verse. His elegies, of which only a few fragments are preserved, were so much admired in antiquity, that Horace preferred them to those of Callimachus. He composed a poem of this kind, as we learn from Pausanias, upon the battle fought between the people of Smyrna, and the Lydians, under Gyges. He likewise was author of a poem in elegiac verse, quoted by Strabo, which he entitled *Nanno,* and in which we may suppose he chiefly celebrated a young and beautiful girl of that name, who, according to Athenæus, was a player on the flute, with whom he was enamoured in his old age. With respect to love matters, according to Propertius, his verses were more valuable than all the writings of Homer.

Plus in amore valet Mimnermi versus Homero.

Lib. I. Eleg. 9. v. 11.

And Horace bears testimony to his abilities, in describing that seducing passion:

Si Mimnermus uti censet, sine amore jocisque
Nil est jucundum, vivas in amore jocisque.

Epist. VI. Lib. i. v. 65.

> If, as wiſe Mimnermus ſaid,
> Life unbleſt with love and joy
> Ranks us with the ſenſeleſs dead,
> Let theſe gifts each hour employ.

Alluding to ſome much admired lines of this Greek poet, which have been preſerved by Stobæus.

> Τις δε βιος, τι δε τερπνον ατερ χρυσης 'Αφροδιτης, &c.
>
> What is life and all its pride,
> If love and pleaſure be denied?
> Snatch, ſnatch me hence, ye fates whene'er
> The am'rous bliſs I ceaſe to ſhare.
> Oh let us crop each fragrant flow'r
> While youth and vigour give us pow'r:
> For frozen age will ſoon deſtroy
> The force to give or take a joy;
> And then, a prey to pain and care,
> Deteſted by the young and fair,
> The ſun's bleſt beams will hateful grow,
> And only ſhine on ſcenes of wo.

MIMOSA, the SENSITIVE PLANT: A genus of the polygamia order, belonging to the monœcia claſs of plants; and in the natural method ranking under the 33d order, *Lomentaceæ*. The hermaphrodite calyx is quinquedentate; the corolla quinquefid; there are five or more ſtamina, one piſtil, and a legumen: The male calyx is quinquedentate; the corolla quinquefid; with five, ten, or more ſtamina.

The name *mimoſa* ſignifies "mimic;" and is given to this genus on account of the ſenſibility of the leaves, which, by their motion, mimic or imitate, as it were, the motion of animals. See *SENSITIVE Plant*.

To this genus Linnæus joins many of the *acacias;* and it compriſes near 60 different ſpecies, all natives of warm climates. Of the ſorts cultivated here in our ſtoves, &c. ſome are of the ſhrub and tree kind, and two or three are herbaceous perennials and annuals. The ſenſitive kinds are exceedingly curious plants in the very ſingular circumſtance of their leaves receding rapidly from the touch, and running up cloſe together; and in ſome ſorts the footſtalks and all are affected, ſo as inſtantly to fall downward as if faſtened by hinges, which laſt are called *humble* ſenſitives. They have all winged leaves, each wing conſiſting of many ſmall pinnæ.

In the *Syſtema Vegetabilium*, this genus, including the *mimoſas* properly ſo called, and the *acacias*, is divided into ſeveral ſections, diſtinguiſhed by the figure, ſituation, and arrangement, of the leaves; as ſimple, ſimply pinnated, bigeminous and tergeminous, conjugate and pinnated, doubly pinnated. The following are the moſt remarkable

Species, with their properties. 1. The *Senſitiva*, or common ſenſitive humble plant, riſes with an underſhrubby prickly ſtem, branching ſix or eight feet high, armed with crooked ſpines; conjugated, pinnated leaves, with bijugated patial lobes or wings, having the inner ones the leaſt, each leaf on a long footſtalk; and at the ſides and ends of the branches many purple flowers in roundiſh heads; ſucceeded by broad, flat, jointed pods, in radiated cluſters.—This is ſomewhat of the humble ſenſitive kind; the leaves, footſtalks, and all, receding from the touch, though not with ſuch facility as in ſome of the following ſorts.

2. The *Pudica*, or baſhful humble plant, riſes with an underſhrubby, declinated, prickly ſtem, branching two or three feet around, armed with hairy ſpines; pinnated, digitated leaves, each leaf being of five or more long folioles, attached by their baſe to a long footſtalk, and ſpread out above like the fingers of a hand; and at the ſides and ends of the branches roundiſh heads of greeniſh white flowers, ſucceeded by ſmall jointed prickly pods.—This is truly of the humble ſenſitive kind; for by the leaſt touch the leaves inſtantly recede, contract, cloſe, and together with the footſtalk quickly decline downward, as if aſhamed at the approach of the hand.

3. The *Pernambucana*, or Pernambuca ſlothful mimoſa, has unſhrubby, procumbent, unarmed ſtems, branching two or three feet around; bipinnated leaves, of three or four pair of ſhort, winged foliola; and at the axillas drooping ſpikes of pentandrous flowers, the lower ones caſtrated.—This ſpecies recedes very ſlowly from the touch, only contracting its pinnæ a little when ſmartly touched; hence the name *ſlothful mimoſa*.

4. The *Aſperata*, or Panama ſenſitive plant. Of this curious ſpecies, which has been well deſcribed by Dr Browne (but not figured), there is a good figure in the *Reliquiæ Houſtonianæ* publiſhed by Sir Joſeph Banks. It grows in moiſt places, and by the ſides of rivulets, in the pariſhes of St James and Hanover, Jamaica. It ſeldom riſes above three feet in height; but its ſlender branches extend conſiderably on the neighbouring buſhes. It is armed with crooked, ſharp, ſpines; ſo thickly ſet on the trunk, branches, and leaves, that there is no touching it with ſafety. But the plant has a beautiful appearance; the flowers are yellow and globular, growing at the extremity of the branches. The pods are hairy, brown, and jointed; each containing a ſmall, flat, and brown ſeed. The leaves are numerous, ſmall, and winged: next to thoſe of the mimoſa pudica, they are the moſt irritable; contracting with the leaſt touch, and remaining ſo for ſeveral minutes after. This ſpecies would form a good hedge or fence round a garden; and by being trimmed now and then by a cutlaſs or gardener's ſciſſars, may be eaſily kept from ſpreading.

5. The *Punctata*, or punctated ſenſitive mimoſa, riſes with a ſhrubby, upright, taper, ſpotted, unarmed ſtem, branching erectly five or ſix feet high; bipinnated leaves, of four or five pair of long winged folioles, having each about 20 pair of pinnæ; and at the axillas and termination of the branches oblong ſpikes of yellowiſh decandrous flowers, the inferior ones caſtrated; ſucceeded above by oblong ſeed-pods. This ſort, though naturally ſhrubby and perennial in its native ſoil, yet in this country it ſometimes decays in winter. It is only ſenſitive in the foliola, but quick in the motion.

6. The *Viva*, lively mimoſa, or ſmalleſt ſenſitive weed, has many creeping roots, and ſpreads itſelf ſo as to cover large ſpots of ground. It riſes at moſt to two inches, has winged leaves, with numerous ſmall pinnæ. The flower is globular, of a bluiſh colour, and grows in cluſters from the axillæ: theſe are followed by little ſhort, hairy, pods, containing ſmooth ſhining ſeeds. This is the moſt ſenſible of all the mimoſas, the pudica not excepted. By running a ſtick over the plant, a perſon may write his name, and it will remain viſible for ten minutes.

7. The *Quadrivalvis*, perennial, or quadrivalve humble mi-

Mimosa. mimosa, has herbaceous, slender, quadrangular, prickly stems, branching and spreading all around, armed with recurved spines; bipinnated leaves of two or three pair of winged lobes, having each many pinnæ; and at the axillas globular heads of purple flowers, succeeded by quadrivalvular pods. This is of the humble sensitive kind, both leaves and footstalks receding from the touch.

8. The *Plena*, annual, or double-flowered sensitive mimosa, rises with an herbaceous, erect, round, unarmed stem, closely branching and spreading every way, three or four feet high; bipinnated leaves of four or five pair of winged lobes, of many pairs of pinnæ; and at the axillas and termination of the branches spikes of yellow pentandrous flowers, the lower ones double; succeeded by short broad pods. This annual is only sensative in the foliola, but extremely sensible of the touch or air.

9. The *Cornigera*, or horned Mexican mimosa, commonly called *great horned acacia*, has a shrubby upright, deformed stem, branching irregularly, armed with very large, horn-like white spines, by pairs, connated at the base; bipinnated leaves thinly placed; and flowers growing in spikes. This species is esteemed a curiosity for the oddity of its large spines, resembling the horns of animals, and which are often variously wreathed, twisted, and contorted.

10. The *Farnesiana*, or fragrant acacia, grows in woodlands and waste lands in most parts of Jamaica; rising to 25 or 30 feet, with suitable thickness. The bark of the trunk is brown and scaly, the branches are alternate. It is adorned with bipinnated leaves of a bright green colour; and yellow globular flowers from the axillæ, of a fragrant smell. The pods are about three inches long, and half an inch broad; they are of a light brown colour, smooth, compressed, and contain five or six smooth flat seeds. Formerly the flowers of this tree were used as an ingredient in the *theriaca andromachi* of the old dispensatories. The tree is sometimes planted for a hedge or fence round inclosures: and the timber, though small, is useful in rural economy.

11. The *Arborea*, or wild tamarind tree, is common in all the woodlands, and especially near where settlements have been made, in Jamaica. It rises to a considerable height, and is proportionally thick. The timber is excellent, and serves many purposes in rural economy: it is of the colour of cedar, pretty hard and takes a good polish. The leaves are numerous; the flowers globular and white. The pods are about a foot in length, of a fine scarlet colour: when they are ripe they open and become twisted. The seeds then appear; they are oblong, smooth, of a shining black, and quite soft. On the whole, from the leaves, flowers, and pods, this tree exhibits a singular and beautiful contrast. With us this plant is raised in hot-houses; but it appears, that with a little pains it may be made to grow in the open air. A good sizeable tree of this sort grew in the garden of the late Dr William Pitcairn, at Islington, near London.

12. The *Latifolia*, shag-bark, or white wild tamarind. This excellent timber tree is very common in Jamaica, and rises to a moderate height and good thickness. The trunk is rough and scaly: The leaves are numerous, of a rhomboidal figure, and yellowish cast. The flower-spikes are from the axillæ; their colour is yellow. The seed-vessels are flat, jointed, and twisted. The seeds are of the bigness of a vetch, white, and finely streaked with blue.

Of this tree there is a variety which some botanists call *M. serpentina*. The chief difference is in the leaves, which are smaller, and of a shining dark green.

13. The *Lebeck*, or ebony tree. This is a native of the East Indies but raised from seeds in Jamaica and St Vincent's. It is figured, though not accurately, by Plukenet, Tab. 331. fig. 1. To what height this tree grows, we cannot yet say: but it must be of a considerable thickness if it be the ebony we have in use here. Time will soon determine this, as the few plants in the islands are reared with great care by Dr Dancer in Jamaica and Mr Alexander Anderson in St Vincent's.

14. 15. The *Cinerea* α;— β *Pinnata?* Cashaw bushes. Plate CCCXI. fig. 4. These species are common about Kingston and Spanish town Jamaica, and rise by slender trunks to about 20 feet.

Dr Roxburgh of Madrass, amongst a number of useful discoveries, has found the lac insect on this species of mimosa *. We have seen the native gum-lac on one of the small twigs, and a specimen of the plant in the collection of a gentleman here. The plant is a variety of the cinerea, and appears rather to be the *M. pinnata*, Lin. It is to be hoped, that in a short time the useful insect just mentioned may be transported from Asia to the West Indies, where this gum, or rather wax, may be also produced.

* See Asiatic Researches Vol. I.

16. The *Scandens*, cacoons, or mafootoo wyth (*Gigalobium scandens*, Browne's Jam. p. 362. *Phaseolus maximus perennis*, Sloane's Cat. 68. *Perein Kaku-valli*, H. M. viii. T. 32, 3, 4.) This species of mimosa is frequent in all the upland valleys and woodlands on the north side of Jamaica. It climbs up the tallest trees, and spreads itself in every direction by means of its *cirrhi* or claspers, so as to form a complete arbour, and to cover the space of an English acre from one root. This circumstance has a bad effect on the trees or bushes so shaded. Light, air, and rain (so necessary for all plants), being shut out, the leaves drop off, the tree gradually rots, and the limbs fall down by the weight of this parasite.

Several authors have mentioned the cacoon; but their descriptions of the plant, and particularly the figures, are erroneous. On that account we have given a figure from the herbarium of a gentleman long resident in Jamaica: and the following are the characters, Fig 3. transcribed from his field notes.

Folio conjugata, *Petioli* communis longi oppositi *cirrho* terminali. *Pinnæ* quadrijugæ vel duodecim jugæ, oblongæ apice obtusæ nitidæ utrinquæ glabræ. *Cirrhus* longus contortus apice bifidus. *Spicæ* axillares erectæ, longissimæ, multifloræ floribus parvis, colore viride flavo. *Calyx* quinquedentatus minimus. *Corolla* pentapetala, erecta, parva. *Filamenta* numerosa, è basi corollæ, et eodem longitudine. Antheræ globosæ erectæ. *Stylus* filiformis, tortus, longitudine staminum. *Stigma* simplex. Legumen maximum, lignosum durum, 5 vel 8-pedale longum et 4-5 unciarum latitudine, varie contortum, compressum, bivalve.

Mimosa.

Semina plura, circiter decem vel quindecim numero, orbiculata, subcompressa, cortice duro, nitido-fusco, *Hilo* nigro breve.

The roots of this plant run superficially under the ground or herbage. The trunk is seldom thicker than a man's thigh, and sends off many branches, with numerous shining green leaves, each of which terminates in a tendril or clasper, that serves to fasten it to trees or bushes. The flower-spikes are from the axillæ: they are slender, and the florets on them small and numerous. The pod is perhaps the largest and longest of any other in the world; being sometimes eight or nine feet in length, five inches broad, jointed, and containing 10 or 15 seeds. These seeds are brown, shining, flattened, and very hard, and called *cacoons*. They are the same mentioned in the Philosophical Transactions, n° 222. page 298. by Sir Hans Sloane, as being thrown ashore on the Hebrides and Orkneys. This happens in the following manner: The seeds or beans fall into the rivers, and are conveyed to the sea. The trade-winds carries them westward till they fall into the gulf stream, which forces them northward along the coast of America and the Bahama islands. As the winds blow frequent and strong from America, these seeds are driven to the eastward, till at length they are thrown ashore and left with the tide as aforesaid.

This bean, after being long soaked in water, is boiled and eaten by some negroes; but, in general, there seems to be no other use made of it than as a sort of snuff-box.

† Med. Ob. and Inquir. Vol. V. p. 151. &c.

17. The *Catechu*, according to Mr Ker†, grows only to 12 feet in height, and to one foot in diameter; it is covered with a thick rough brown bark, and towards the top divides into many close branches: the leaves are bipinnated, or doubly winged, and are placed alternately upon the younger branches: the partial pinnæ are nearly two inches long, and are commonly from 15 to 30 pair, having small glands inserted between the pinnæ: each wing is usually furnished with about 40 pair of pinnulæ or linear lobes, beset with short hairs: the spines are short, recurved, and placed in pairs at the bases of each leaf: the flowers are hermaphrodite and male, and stand in close spikes, which arise from the axillæ of the leaves, and are four or five inches long: the calyx is tubular, hairy, and divides at the limb into five oval pointed segments: the corolla is monopetalous, whitish, and of the same form as the calyx, but twice its length: the filaments are numerous, capillary, double the length of the corolla, adhering at the base of the germen, and crowned with roundish antheræ: the germen is oval, and supports a slender style, which is of the length of the filaments, and terminated by a simple stigma: the fruit, or pod, is lance-shaped, brown, smooth, compressed, with an undulated thin margin; it contains six or eight roundish flattened seeds which produce a nauseous odour when chewed. From this tree, which grows plentifully on the mountainous parts of Indostan, where it flowers in June, is produced the officinal drug long known in Europe by the name of *terra japonica*; for the history and preparation of which, see the article *Terra Japonica*.

Plate CCCXI. fig. 2.

18. The *Nilotica*, or true Egyptian acacia, rises to a greater height than the preceding: the bark of the trunk is smooth, and of a grey colour; that of the branches has commonly a purplish tinge: the leaves are bipinnated, and placed alternately: the partial pinnæ are opposite, furnished with a small gland between the outermost pair, and beset with numerous pairs of narrow elliptical pinnulæ, or leafits: the spines are long, white, spreading, and proceed from each side of the base of the leaves: the flowers are hermaphrodite and male; they assume a globular shape, and stand four or five together upon slender peduncles, which arise from the axillæ of the leaves: the calyx is small, bell-shaped, and divided at the mouth into five minute teeth: the corolla consists of five narrow yellowish segments: the filaments are numerous, capillary, and furnished with roundish yellow antheræ: the germen is conical, and supports a slender style, crowned with a simple stigma: the fruit is a long pod, resembling that of the lupin, and contains many flattish brown seeds. It is a native of Arabia and Egypt, and flowers in July.

Plate CCCXI. fig. 1.

Although the mimosa nilotica grows in great abundance over the vast extent of Africa, yet gum arabic is produced chiefly by those trees, which are situated near the equatorial regions; and we are told, that in Lower Egypt the solar heat is never sufficiently intense for this purpose. The gum exsudes in a liquid state from the bark of the trunk and branches of the tree, in a similar manner to the gum which is often produced upon the cherry-trees &c. in this country; and by exposure to the air it soon acquires solidity and hardness. In Senegal the gum begins to flow when the tree first opens its flowers; and continues during the rainy season till the month of December, when it is collected for the first time. Another collection of the gum is made in the month of March, from incisions in the bark, which the extreme dryness of the air at that time is said to render necessary. Gum arabic is now usually imported into England from Barbary; not packed up in skins, which was the practice in Egypt and Arabia, but in large casks or hogsheads. The common appearance of this gum is well known; and the various figures which it assumes seem to depend upon a variety of accidental circumstances attending its transudation and concretion. Gum Arabic of a pale yellowish colour is most esteemed; on the contrary, those pieces which are large, rough, of a roundish figure, and of a brownish or reddish hue, are found to be less pure, and are said to be produced from a different species of mimosa *(M. Senegal)*; but the Arabian and Egyptian gum is commonly intermixed with pieces of this kind, similar to that which comes from the coast of Africa near the river Senegal.

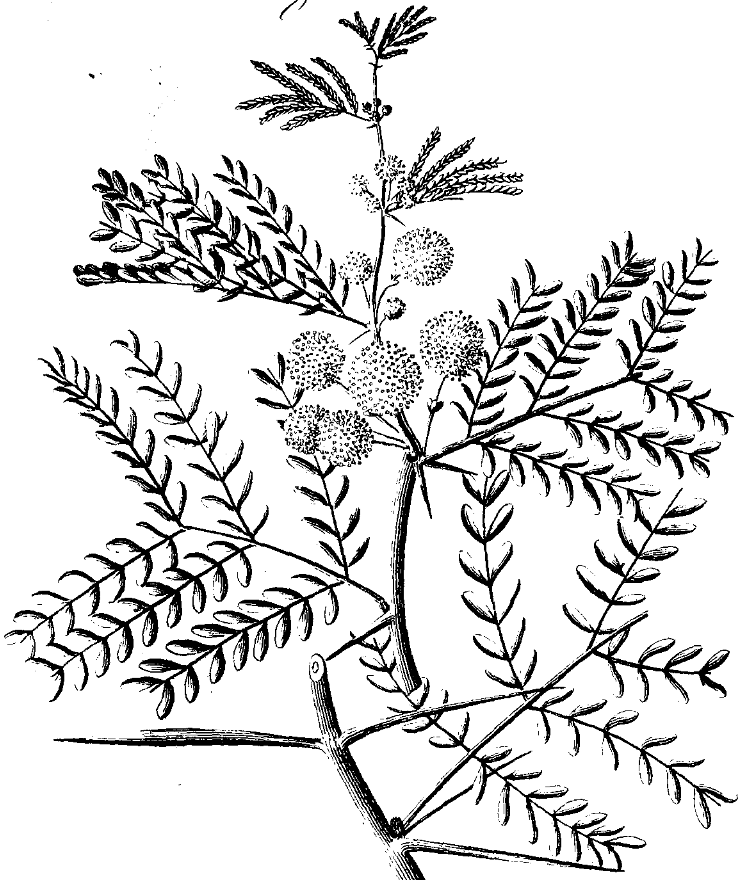
Gum-arabic does not admit of solution by spirit or oil, but in twice its quantity of water it dissolves into a mucilaginous fluid, of the consistence of a thick syrup; and in this state answers many useful pharmaceutical purposes, by rendering oily, resinous, and pinguious substances, miscible with water. The glutinous quality of gum-arabic is preferred to most other gums and mucilaginous substances, as a demulcent in coughs, hoarsenesses, and other catarrhal affections, in order to obtund irritating acrimonious humours, and to supply the loss of abraded mucus. It has been very generally employed in cases of ardor urinæ and strangu-

ary;

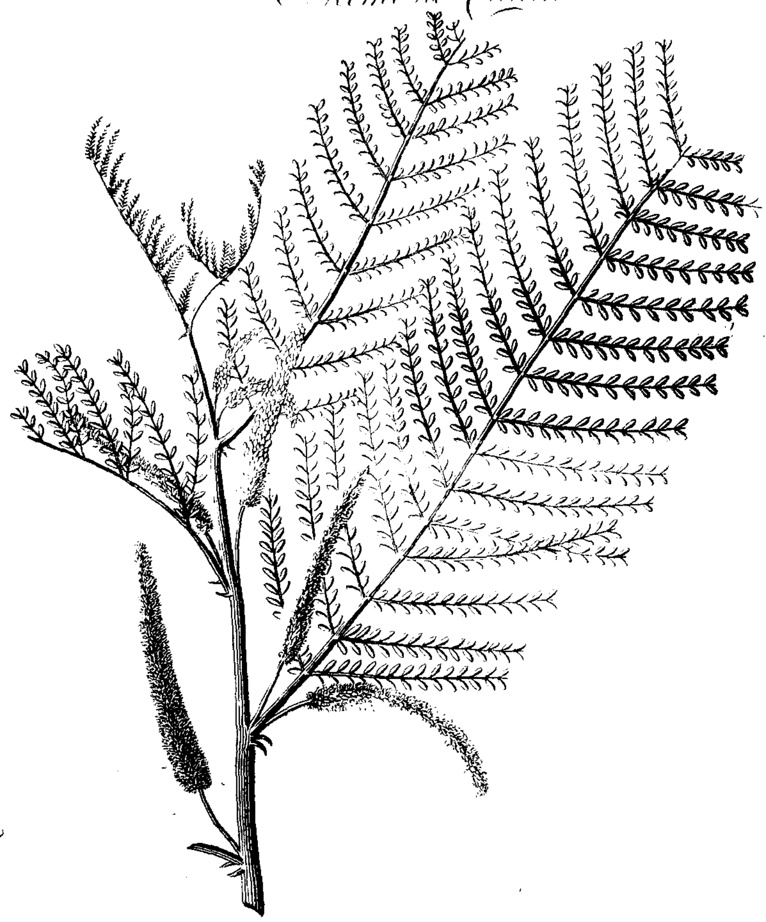
Mimosa

Plate CCCXL.

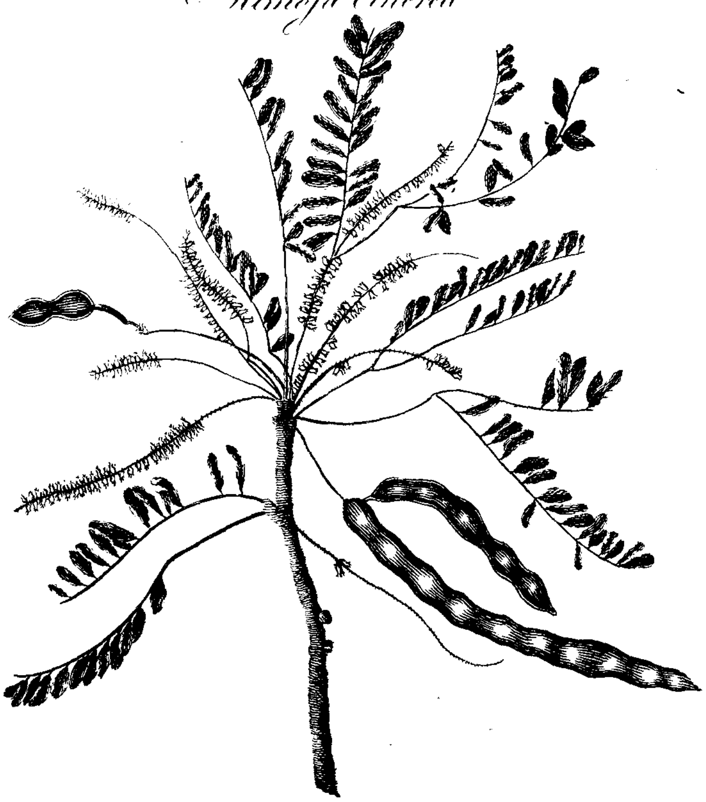
Mimosa nilotica



Mimosa Catechu



Mimosa Cinerea

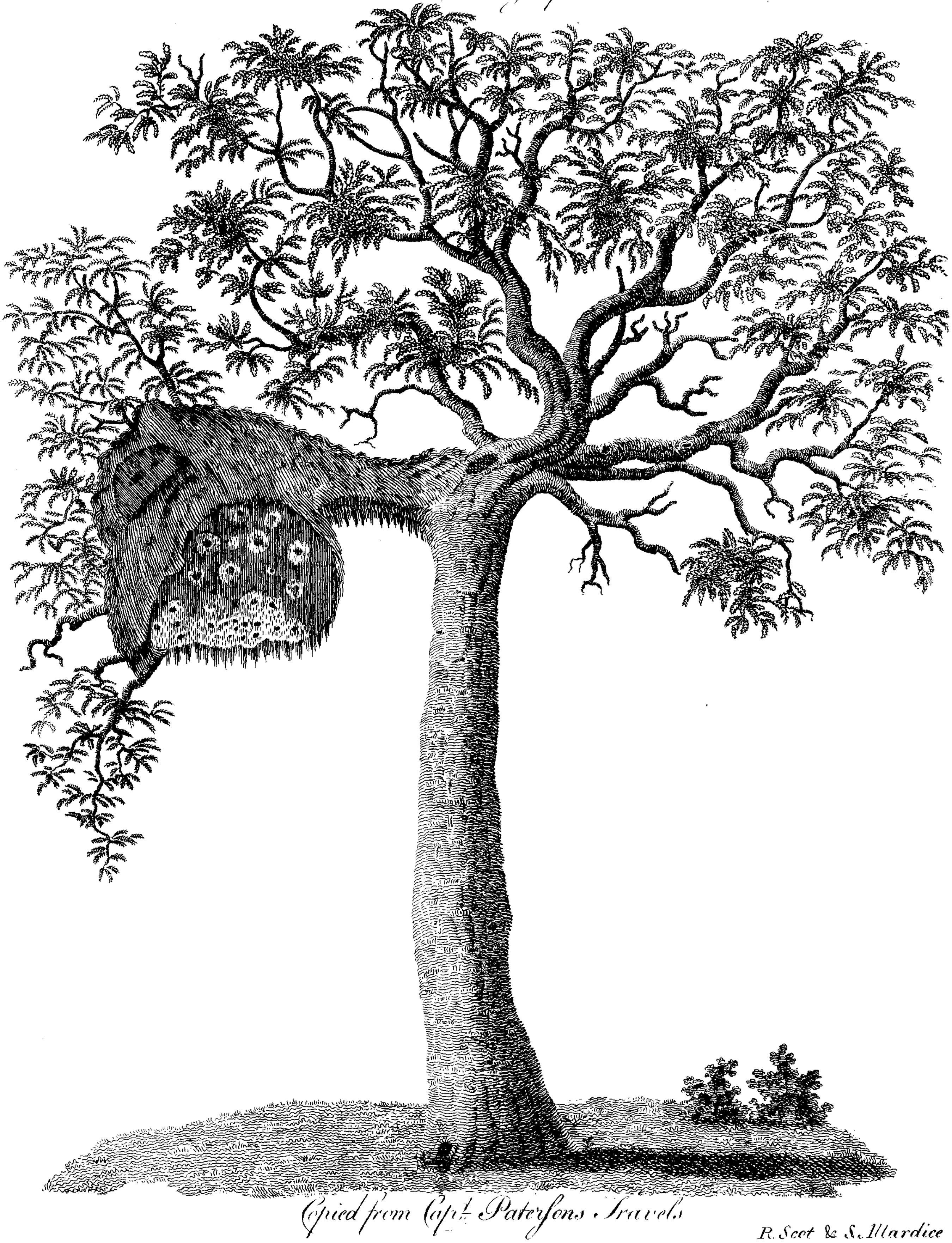


Mimosa Scandens

R. Scot & S. Mardie

Mimosa (non-descript)

Plate CCCXII



Copied from Capt. Paterson's Travels

R. Scot & S. Mardice

ary: but it is the opiuion of Dr Cullen, "that even this mucilage, as an internal demulcent, can be of no service beyond the alimentary canal." See farther the article *Gum Arabic*.

19. The *Senegal* is a native of guinea, and was some time ago introduced into Jamaica. Dr Wright tells us, he saw both this and the mimosa nilotica, of the size of a cherry tree, growing at Dr Paterson's in the parish of Hanover, Jamaica. The flowers are globular, yellow, and fragrant, The pods are brown, and of the size of a goose-quill. The tree, on being wounded, exsudes gum arabic, though in less quantity and less transparent, than that of the shops, which is obtained from the *nilotica* above described.

There are above 40 other species characterised in the *Systema Vegetabilium*.

On Plate CCCXII. is figured a new species, of an uncommon size, mentioned by Mr Paterson in his Travels among the Hottentots, but not particularly described. Like several of the other mimosas, it produces gum, which is considered by the natives as a peculiarly delicate species of food; the leaves and lower points of the branches seem to constitute the principal aliment of the camelopardalis; and, from the extent of its boughs, and the smoothness of the trunk, it affords a sufficient defence to a species of gregarious bird against the tribe of serpents and other reptiles which would otherwise destroy its eggs. See the article Loxia.

Mr Bruce † describes two plants which seem referable to this genus; the one named *ergett el dimmo*, the other *ergett el krone*.

† Travels, Vol. V. p. 34, 35.

The former, in our author's opinion, should be named *mimosa sanguinea*; its name in the Abyssinian language signifying *the bloody ergett*, and derived, as he supposes, from its being partly composed of beautiful pink filaments. When the blossoms are fully spread, the upper part of them consists of yellow curled filaments, and the under part of pink filaments of a similar shape. In its unripe state, that part which afterwards becomes pink is of a green colour, and composed of tubercles of a larger size, and more detached than these which afterwards produce the yellow filaments; the latter being smaller, and closer set together: the leaves are of the double-pinnated kind.

The name of the other species, in the Abyssinian language, signifies *the horned ergett*; which our author supposes to be given it on account of the figure of the pods. The flower very much resembles that of the acacia vera in size and shape, excepting that it is attached to the branch by a strong woody stalk of considerable length, which grows out at the bottom of the branch bearing the leaves, and is sheltered as in a case by the lower part of it. The branches are all covered with short, strong, and sharp-pointed thorns, having their points inclined backwards towards the root. The pods are covered with a prickly kind of hair, which easily rubs off with the fingers, sticks to them, and gives a very uneasy sensation. They have thirteen divisions: in each of which are three hard, round, and shining seeds, of a dusky brown colour.

Both of these shrubs shut their leaves on the coming on of the violent rains in the wet season, and never fully expand them till the dry season returns.

MINA, or Maneh, a species of money, which properly signifies *one part* or *ounce*. It is observed that this word occurs only in the books of Kings, Chronicles, Ezra, and Ezekiel. This prophet (xlv. 12.) tells us, that the minah or maneh was valued at 60 shekels, which in gold make of our English money about $54\frac{3}{4}$ pounds, and in silver almost seven pounds. Thus for the Hebrew maneh. But the Greek or Attic mina, which is probably that mentioned in the books of the Maccabees and in the New Testament, is valued at 100 drachmæ, or about 2l. 17s. sterling. There was also a lesser mina, which was valued at 75 drachmæ.

MINAGNGHINIM, a pulsatile instrument of music, among the Hebrews, which was a square table of wood, fitted with a handle; over this table was stretched an iron chain, or hempen, cord, passing thro' balls of wood or brass, which struck against the table when the instrument was shook, and occasioned a clear sound, which might be heard at a great distance. See Kircher's figure of it in Plate CCCXIV.

MINCHA, in the Jewish customs, offerings of meal, cakes, or biscuits, made in the temple of the Lord. The Seventy have sometimes preserved this word in their translation; but instead of *mincha* they read *manaa*, which doubtless was the received pronunciation in their time. We find *manaa* in the same sense, in Baruch i. 10. Levit. ii. 3. &c. See the Greek of Jerem. xvii. 26. Dan. ii. 46. 2 Kings viii. 5, 9, xvii. 7. xx. 12. 2 Chron. vii. 7. Nehem. xiii. 5, 9, &c.

MINCHING-hampton, a town of Gloucestershire, 20 miles from Bath and Bristol, and near 90 from London, with a market on Tuesdays, and two fairs. The parish is pretty large, being bounded on the north by the Stroud, and on the south by the brook Avening: and has 12 hamlets belonging to it, with a common called Amberley. Here is a good large rectory church, built in form of a cross, and worth 200l. a-year, Near it are very large camps, with deep trenches; and near Dunkirk in this parish are fulling mills.

MINCIUS, a river of the Transpadana: running from, or rather transmitted through, the Lacus Benacus, from north to south, into the Padus; but originally rising in the Rhetian Alps. Now Mincio or Menzo, running through the duchy of Mantua into the Po.

MIND, a thinking intelligent being, otherwise called *spirit*, in opposition to matter or body. See Metaphysics, Part III.

MINDANOA, or Magindanao, a large island of Asia in the East Indies, and one of the Philippines; 160 miles in length, and 120 in breadth. The interior parts contain several chains of lofty mountains, between which are extensive plains, where vast herds of cattle roam at large in the most delicious pastures. Several deep valleys also intersect, as it were, certain parts of the country, through which, during the rainy seasons, vast torrents pour from the mountains, and force their impetuous way to the sea. The rains and vapours which lodge in the plains diffuse themselves into meandering rivulets, and, collecting a variety of small streams in their course, approach the sea in the form of considerable rivers.—The sovereign of Magindanao is a powerful prince, and has several inferior chiefs, who

Meares's Voyages.

acknow-

acknowledge him as their head. Neverthelefs, there are others of them who refufe fubmiffion to him, and are confequently in a continual ftate of war: fo that peace, at leaft, does not appear to be one of the bleffings of this ifland. The Spaniards, indeed affert their right to the entire dominion of Magindanao: but it is mere affertion for though they have forts, &c. on the ifland, it is by no means in a ftate of fubjection to their nation.

The air is efteemed falubrious, particularly in the vicinity of the fea. The heat there is not, in any degree, fo intenfe as might be expected in a country which is fituated on the very verge of the torrid zone. The prevalence of the eafterly winds, in that part of the coafts which is wafhed by the Pacific Ocean, renders the air cool and pleafant, the trade-wind blowing inceffantly on its fhores. It acts, indeed, with fo much power as to fweep the whole breadth of the ifland: and though in its paffage it lofes much of its ftrength, it retains a fufficient degree of force to afford refrefhing breezes to the inhabitants of the weftern fhore. The inferior parts are much colder, from a very cloudy atmofphere, which frequently hangs over the fummits of the mountains in thick and humid vapours. The foil, which is very exuberant, is fuited to the cultivation of the whole vegetable tribes. Rice is produced in the greateft abundance; a pecul, or 133 pounds, may be purchafed for a Spanifh dollar. Every part of the ifland abounds with buffaloes, cows, hogs, goats, &c. It affords alfo great variety of fowls, and a fpecies of duck, whofe head is of a fine fcarlet colour. Here are alfo a fmall breed of horfes, remarkable for their fpirit. The natives however principally employ buffaloes in the various branches of hufbandry and agriculture.

The city of Magindanao is fituated on the fouth-eaft fide of the ifland, has a river capable of admitting fmall veffels, and carries on a confiderable trade with Manilla, Sooloo, Borneo, and the Moluccas. Their exports are rice, tobacco, bees-wax, and fpices; in return for which they receive coarfe cloths of Coromandel, China ware, and opium. The village or town of Samboingan is fituated on the banks of a fmall rivulet, which empties itfelf immediately into the fea, and is agreeably fhaded by groves of cocoa-trees. The number of its inhabitants are about 1000, among which are included the officers, foldiers, and their refpective families. In its envirous there are feveral fmall look-out houfes, erected on pofts of twelve feet high, in all of which a conftant guard is kept; fo that it appears as if the Spaniards were in a continnal ftate of enmity with the natives. The houfes are built of thofe fimple materials which are of very general ufe in the eaftern feas. They are erected on pofts, and built of bamboo, covered with matts; the lower apartments ferve for their hogs, cattle, and poultry, and the upper ones are occupied by the family."

MINDELHEIM, a town of Germany, in the circle of Suabia, and in Algow, with a caftle. It is capital of a fmall territory between the rivers Iller and Lech, fubject to the houfe of Bavaria. It was taken by the Imperialifts after the battle of Hockftet, who erected it into a principality in favour of the duke of Marlborough; but it returned back to the houfe of Bavaria by the treaty of Raftat. It is 33 miles fouth eaft of Ulm. E. Long. 10. 40. N. Lat. 48. 5.

MINDELHEIM, a diftrict of Germany, in Suabia, lying between the bifhopric of Augfburgh and the abbacy of Kempten, which is 20 miles in length and 16 in breadth.

MINDEN, a confiderable town of Germany in the circle of Weftphalia; and capital of a territory of the fame name; feated on the river Wefer, which renders it a trading-place. It belongs to the king of Pruffia, who has fecularized the bifhopric. It is 27 miles eaft-by-fouth of Ofnaburg, and 37 weft of Hanover. E Long. 9. 5. N. Lat. 52. 21.

MINDEN (the principality of), in Germany, lies in the circle of Weftphalia, to the north of the country of Ravenfberg, and along each fide of the river Wefer. It is about 22 miles fquare, and Minden and Peterfhagen are the principal places. It was formerly a bifhopric, but is now fecularifed; and was ceded to the elector of Brandenburg by the treaty of Weftphalia.

MINDORA, an ifland of Afia, in the Eaft Indies, and one of the Philippines, 50 miles in circumference, and feparated from Luconia by a narrow channel. It is full of mountains, which abound in palm-trees and all forts of fruits. The inhabitants are idolaters, and pay tribute to the Spaniards to whom this ifland belongs.

MINE, in natural hiftory, a deep pit under ground, from whence various kinds of minerals are dug out; but the term is more particularly applied to thofe which yield metals. Where ftones only are procured, the appellation of *quarries* is univerfally beftowed upon the places from which they are dug out, however deep they may be.

The internal parts of the earth, as far as they have been yet inveftigated, do not confift of one uniform fubftance, but of various *ftrata* or beds of fubftances, extremely different in their appearances, fpecific gravities, and chemical qualities, from one another. Neither are thefe ftrata fimilar to one another either in their nature or appearance in different countries; fo that even in the fhort extent of half a mile, the ftrata will be found quite different from what they are in another place. As little are they the fame either in depth or folidity. Innumerable cracks and fiffures, by the miners called *lodes*, are found in every one of them; but thefe are fo entirely different in fize and fhape, that it is impoffible to form any inference from their fize in one place to that in another. In thefe, lodes or fiffures the metallic ore is met with; and confidering the great uncertainty of the dimenfions of the lodes, it is evident that the bufinefs of mining which depends on that fize, muft in like manner be quite uncertain and precarious. Mr Price, in his treatife on the Cornifh mines, obferves, that "the comparative fmallnefs of the largeft fiffures to the bulk of the whole earth is really wonderful. In the fineft pottery we can make, by a microfcopic view, we may difcover nnmerous cracks and fiffures, fo fmall as to be impenetrable by any fluid, and impervious to the naked eye;" as, by the laws of nature originally impofed by the Creator, it happens that matter cannot contract itfelf into folid large maffes, without leaving fiffures between them, and yet the very fiffures are as

neceffary

Mine. necessary and useful as the strata through which they pass. They are the drains that carry off the redundant moisture from the earth; which, but for them, would be too full of fens and bogs for animals to live or plants to thrive on. In these fissures, the several ingredients which form *lodes*, by the continual passing of waters, and the menstrua of metals, are brought out of the adjacent strata, collected and conveniently lodged in a narrow channel, much to the advantage of those who search for and pursue them; for if metals and minerals were more dispersed, and scattered thinly in the body of the strata, the trouble of finding and getting at them would be endless, and the expence of procuring them exceed the value of the acquisition.

The insides of the fissures are commonly coated over with a hard, crystalline, earthy substance or rind, which very often, in the breaking of hard ore, comes off along with it, and is commonly called the *capels* or *walls* of the lode: but Mr Price is of opinion, that the proper walls of the lode are the sides of the fissure itself, and not the coat just mentioned, which is the natural plaster upon those walls, furnished perhaps by the contents of the fissures, or from oozings of the surrounding strata.

The breadth of a lode is easily known by the distance betwixt the two incrusted sides of the stones of ore; and if a lode yields any kind of ore, it is a better sign that the walls be regular and smooth, or at least that one of them be so, than otherwise; but there are not many of these fissures which have regular walls until they have been sunk down some fathoms.

Thus the inner part of the fissure in which the ore lies, is all the way bounded by two walls of stone, which are generally parallel to one another, and include the breadth of the vein or lode. Whatever angle of inclination some fissures make in the solid strata at their beginning, they generally continue to do the same all along. Some are very uncertain in their breadth, as they may be small at their upper part and wide underneath, and *vice versa*. Their regular breadth, as well as their depth, is subject to great variation; for though a fissure may be many fathoms wide in one particular place, yet a little further east or west it may not perhaps be one inch wide. This excessive variation happens generally in very compact strata, when the vein or fissure is squeezed, as it were, through hard rocks which seem to compress and straiten it. A true vein or fissure, however, is never entirely obliterated, but always shows a string of metallic ore or of a veiny substance; which often serves as a leader for the miners to follow until it sometimes leads them to a large and richly impregnated part. Their length is in a great measure unlimited, though not the space best fitted for yielding metal. The richest state for copper, according to Mr Price, is from 40 to 80 fathoms deep; for tin, from 20 to 60; and though a great quantity of either may be raised at 80 or 100 fathoms, yet "the quality (says our author) is often too much decayed and dry for metal."

Mr Price informs us, that the fissures or veins of the Cornish mines extend from east to west; or, more properly, one end of the fissure points west and by south, or west and by north; while the other tends east and by south, or east and by north. Thus they frequently pass through a considerable tract of country with very few variations in their directions, unless they be interrupted by some intervening cause.— But, besides this east and west direction, we are to consider what the miners call the *underlying* or *hade* of the vein or lode; viz. the deflection or deviation of the fissure from its perpendicular line, as it is followed in depth like the slope of the roof of a house, or the descent of the steep side of a hill. This slope is generally to the north or south; but varies much in different veins, or sometimes even in the same vein: for it will frequently slope or underlie a small space in different ways, as it may appear to be forced by hard strata on either side.—Some of the fissures do not vary much from a perpendicular, while some deviate more than a fathom; that is, for every fathom they descend in perpendicular height, they deviate likewise as much to the south or north. Others differ so much from the perpendicular, that they assume a position almost horizontal; whence they are also called *horizontal* or *flat lodes*, and sometimes *lode plots*. Another kind of these has an irregular position with regard to the rest; widening horizontally for a little way, and then descending perpendicularly almost like stairs, with only a small string or leader to follow after; and thus they alternately vary and yield ore in several flat or horizontal fissures. This, by the Cornish tinners, is called (but in Mr Price's opinion erroneously) a *floor* or *squat*; which, properly speaking, is a hole or chasm impregnated with metal, making no continued line of direction or regular walls. Neither does a floor of ore descend to any considerable depth; for underneath it there appears no sign of a vein or fissure, either leading directly down or any other way. This kind of vein is very rare in Britain. The fissures most common in Britain are the perpendicular and inclined, whether their direction be north or south, east or west.

The perpendicular and horizontal fissures (according to our author) probably remain little altered from their first position, when they were formed at the induration of the strata immediately after the waters left the land. The perpendicular fissures are found more commonly situated in level ground, at a distance from hills, and from the sea-shore; but with regard to the latter, we find that the upper and under masses of strata differ in their solidity and other properties. "Hence, (says our author) it is very plain, that inclined fissures owe their deflection or underlie to some secondary cause, violence, or subsidence, of the earth: for though perpendicular fissures are seldom to be seen, yet such as are inclined at very considerable depths, become more and more perpendicular as the more central strata, by reason of the vast superincumbent weight, do not seem so likely to be driven out of their position as those which lie nearer the surface."

The fissures are often met with fractured as well as inclined; the reason of which, in Mr Price's opinion, has been a subsidence of the earth from some extraordinary cause. "The original position (says he) must have been horizontal, or parallel to the surface of the earth: but we often find these strata very sensibly declined from that first position; nay, sometimes

times quite reverſed, and changed into perpendicular. When we ſee a wall lean, we immediately conclude that the foundation has given way, according to the angles which the wall makes with the horizon; and when we find the like declination in ſtrata, we may conclude, by parity of reaſon, that there has been a like failure of what ſupported them, in proportion to that declination; or that whatever made the ſtrata to fall ſo much awry, muſt alſo cauſe every thing included in thoſe ſtrata to fall proportionably. Wherever the greateſt ſubſidence is to the north, the top of the lode or fiſſure will point to the north, and of conſequence underlie to the ſouth, and *vice verſa:* the ſlide or heave of the lode manifeſts the greater ſubſidence of the ſtrata; but the ſame lode is frequently fractured and heaved in ſeveral places: all of which, by due obſervation, will ſhow us they were occaſioned by ſo many ſeveral ſhocks or ſubſidencies, and that the ſtrata were not unfooted, ſhaken, or brought to fall once only or twice, but ſeveral times."

Mr Price, in the courſe of his work, obſerves, that though the metallic veins generally run from eaſt to weſt, they are frequently interſected by veins or *lodes*, as he calls them, of other matters, which run from north to ſouth. Some of theſe croſs veins contain lead or antimony, but never tin or copper. Sometimes one of theſe unmetallic veins interſects the true one at right angles, ſometimes obliquely; and ſometimes the mixture of both is ſo intimate, that the moſt expert miners are at a loſs to diſcover the ſeparated part of the true vein. When this laſt is intercepted at right angles, it is moved, either north or ſouth, a very little way, perhaps not more than one fathom; in which caſe, the miners having worked to a ſmall diſtance in one of theſe directions, if they find themſelves diſappointed, turn to the other hand, and ſeldom fail of meeting with what they expected. Sometimes they are directed in their ſearch by the pointing of a rib or ſtring of the true vein; but when the interruption happens in an oblique direction, the difficulty of finding the vein again is much greater.

When two metallic veins in the neighbourhood of each other run in an oblique direction, and of conſequence meet together, they commonly produce a body of ore at the place where they interſect; and if both are rich, the quantity will be conſiderable; but if one be poor and the other rich, then both are either enriched or impoveriſhed by the meeting. After ſome time they ſeparate again, and each will continue its former direction near to the other; but ſometimes, though rarely, they continue united.

It is a ſign of a poor vein when it ſeparates or diverges into ſtrings; but, on the contrary, when ſeveral of them are found running into one, it is accounted a promiſing ſign. Sometimes there are branches without the walls of the vein in the adjacent ſtrata, which often come either obliquely or tranſverſely into it. If theſe branches are impregnated with ore, or if they underlie faſter than the true vein, that is, if they dip deeper into the ground, then they are ſaid to overtake or come into the lode, and to enrich it; or if they do not, then they are ſaid to go off from it, and to impoveriſh it. But neither theſe nor any other marks either of the richneſs or poverty of a mine are to be entirely depended upon: for many mines, which have a very bad appearance at firſt, do neverthelеſs turn out extremely well afterwards; while others, which in the beginning ſeemed very rich, turn gradually worſe and worſe: but in general, where a vein has a bad appearance at firſt, it will be imprudent to be at much expence with it.

Veins of metal, as has been already obſerved, are frequently, as it were, ſo compreſſed betwixt hard ſtrata, that they are not an inch wide; nevertheleſs, if they have a ſtring of good ore, it will generally be worth while to purſue them; and they frequently turn out well at laſt, after they have come into ſofter ground. In like manner, it is an encouragement to go on if the branches or leaders of ore enlarge either in width or depth as they are worked; but it is a bad ſign if they continue horizontal without inclining downwards; though it is not proper always to diſcontinue the working of a vein which has an unfavourable aſpect at firſt. Veins of tin are worth working when only three inches wide, provided the ore be good; and copper ores when ſix inches wide will pay very well for the working. Some of the great mines, however, have very large veins, with a number of other ſmall ones very near each other. There are alſo veins croſſing one another ſometimes met with, which are called *contras*, vulgarly *caunters*. Sometimes two veins run down into the ground in ſuch a manner that they meet in the direction of their depth; in which caſe, the ſame obſervations apply to them which are applicable to thoſe that meet in an horizontal direction. Sometimes a vein will ſuddenly diſappear without giving any warning, by becoming narrower, or of worſe quality; which by the miners is called a *ſtart* or *leap*, and is very common in the mines of Cornwall. In one day's time they may thus be diſappointed in the working of a rich vein of tin, and have no further ſign of any thing to work upon: at the fractured extremity of their vein they perceive a body of clay or other matter; and the method of recovering their vein is to drive on their work in the direction of the former part, ſo that their new work ſhall make the ſame angle with the clay that the other part of the vein does. Sometimes they ſink a ſhaft down from the ſurface; but it is generally a matter of difficulty to recover a vein when thus loſt.

The method of diſcovering mines is a matter of ſo much difficulty, that it ſeems ſurpriſing how thoſe who were totally unacquainted with the nature of metals firſt came to think of digging them out of the earth. According to Lucretius, the diſcovery was made by the conflagration of certain woods, which melted the veins of metal in the earth beneath them; but this ſeems to be rather improbable. Ariſtotle, however, is of the ſame opinion with Lucretius, and tells us, that ſome ſhepherds in Spain having ſet fire to the woods, the earth was thus heated to ſuch a degree, that the ſilver near the ſurface of it melted and flowed into a maſs; and that in a ſhort time the metallic maſs was diſcovered by the rending of the earth in the time of an earthquake: and the ſame ſtory is told by Strabo, who aſcribes the diſcovery of the mines of Andaluſia to this accident. Cadmus is ſaid by ſome to have been the firſt who diſcovered gold: while others aſcribe this to Thoas the Thracian, to Mercury the ſon of Jupiter, or to Piſus king of of Italy; who having left his own country, went into Egypt, where he was elected king after the death of Mizraim the son of Ham; and, on account of his discovery, was called the *Golden God*. Others say, that *Eaclis* or Cæacus the son of Jupiter, or Sol the son of Oceanus, was the first discoverer; but Æschylus attributes the discovery not only of gold, but of all other metals, to Prometheus. The brass and copper mines in Cyprus were first discovered by Cinyra the son of Agryopa; and Hesiod ascribes the discovery of the iron mines of Crete to the Cretan Dactyli Idæi. The extraction of lead or tin from its ore in the island of Cassiteris, according to several ancient authors, was discovered by Midacritus.—The scripture, however, ascribes the invention of brass and iron, or at least of the methods of working them, to Tubal Cain before the flood.

In more modern times, we know that mines have been frequently discovered by accident; as in sea-cliffs, among broken craggy rocks, by the washing of the tides or floods, also by irruptions and torrents of water issuing out of hills and mountains, and sometimes by the wearing of high roads. Mr Price mentions another way by which mines have been discovered, *viz.* by fiery coruscations; which, he says, he has heard from persons whose veracity he is unwilling to question. "The tinners (says he) generally compare these effluvia to blazing stars or other whimsical likenesses, as their fears or hopes suggest; and search with uncommon eagerness the ground over which these jack-a-lanterns have appeared and pointed out. We have heard but little of these phenomena for many years; whether it be, that the present age is less credulous than the foregoing, or that the ground being more perforated by innumerable new pits sunk every year, some of which, by the stannary laws, are prevented from being filled up, has given these vapours a more gradual vent, it is not necessary to enquire as the fact itself is not generally believed."

Mines, however, are now most commonly discovered by investigating the nature of such veins, ores, and stones, as may seem most likely to turn to account; but there is a particular sagacity, or habit of judging from particular signs, which can be acquired only by long practice. Mines, especially those of copper, may also be discovered by the harsh and disagreeable taste of the waters which issue from them; though it is probable that this only happens when the ore lies above the level of the water which breaks out; for it does not seem likely that the taste of the ore could *ascend*, unless we were to suppose a pond or lake of water standing above it. The presence of copper in any water is easily discovered by immerging in it a bit of polished iron, which will thus instantly be turned of a copper colour, by reason of the precipitation of the metal upon it. A candle, or piece of tallow put into water of this kind, will in a short time be tinged of a green colour.

Another and still more remarkable method of discovering mines is said to be by the *virgula divinatoria*, or "divining rod;" which, however incredible the stories related concerning it may be, is still relied on by some, and among others by Mr Price. It is not known who was the inventor of this method; but Agricola supposes that it took its rise from the magicians, who pretended to discover mines by inchantment. No mention is made of it, however, before the 11th century, since which time it has been in frequent use; and the Corpuscular Philosophy has even been called in to account for it. But before we pretend to account for phenomena so very extraordinary as those reported of the *virgula divinatoria*, it is necessary, in the first place, to determine whether or not they exist. Mr Price as has been already hinted, believes in it, though he owns that by reason of his constitution of mind and body he is almost incapable of co-operating with its influence. The following account, however, he gives from Mr William Cookworthy of Plymouth, a gentleman of known veracity and great chemical abilities.

He had the first information concerning this rod from one Captain Ribeira, who deserted from the Spanish service in Queen Anne's reign, and became captain-commandant in the garrison of Plymouth; in which town he satisfied several intelligent persons of the virtues of the rod, by many experiments on pieces of metal hid in the earth, and by an actual discovery of a copper mine near Oakhampton, which was wrought for some years. This captain very readily showed the method of using the rod in general, but would not by any means discover the secret of distinguishing the different metals by it; though, by a constant attention to his practise, Mr Cookworthy discovered it. Captain Ribeira was of opinion, that the only proper rods for this purpose were those cut from the nut or fruit-trees; and that the virtue was confined to certain persons, and those comparatively speaking but few: but Mr Price says that the virtue resides in all persons and in all rods under certain circumstances. "The rod (says he) is attracted by all the metals, by coals, limestone, and springs of water, in the following order: 1. Gold; 2. Copper; 3. Iron; 4. Silver; 5. Tin; 6. Lead; 7. Coals; 8. Limestone and springs of water. One method of determining the different attractions of the rod is this; Stand, holding the rod with one foot advanced; put a guinea under that foot, and an halfpenny under the other, and the rod will be drawn down; shift the pieces of money, and the rod will be drawn towards the face, or backwards to the gold, which proves the gold to have the stronger attraction.

"The rods formerly used were shoots of one year's growth that grew forked; but it is found, that two separate shoots tied together with packthread or other vegetable substance answer rather better than such as are naturally forked, as the shoots of the latter are seldom of an equal size. They are to be tied together by the greater ends, the small ones being held in the hands. Hazle rods cut in the winter, such as are used for fishing rods, and kept till they are dry, do best: though, where these are not at hand, apple-tree suckers, rods from peach trees, currants, or the oak, though green, will answer tolerably well."

Our author next proceeds to describe the manner of holding the rod; of which he gives a figure, as he says it is difficult to be described. The small ends being crooked, are to be held in the hands in a position flat or parallel to the horizon, and the upper part in an elevation not perpendicular to it, but at an angle of about 70 degrees. "The rod (says he) being proper-

Mine.

perly held by those with whom it will answer, when the toe of the right foot is within the semidiameter of the piece of metal or other subject of the rod, it will be repelled towards the face, and continue to be so while the foot is kept from touching or being directly over the subject; in which case it will be sensibly and strongly attracted, and be drawn quite down. The rod should be firmly and steadily grasped; for if, when it has begun to be attracted, there be the least imaginable jerk or opposition to its attraction, it will not move any more till the hands are opened, and a fresh grasp taken. The stronger the grasp the livelier the rod moves, provided the grasp be steady and of an equal strength. This observation is very necessary; as the operation of the rod in many hands is defeated purely by a jerk or counteraction: and it is from thence concluded, that there is no real efficacy in the rod, or that the person who holds it wants the virtue: whereas, by a proper attention to this circumstance in using it, five persons in six have the virtue, as it is called; that is, the nut or fruit-bearing rod will answer in their hands. If a rod, or the least piece of one of the nut-bearing or fruit kind, be put under the arm, it will totally destroy the operation of the *virgula divinatoria*, in regard to all the subjects of it, except water, in those hands in which the rod naturally operates. If the least animal thread, as silk, or worsted, or hair, be tied round or fixed on the top of the rod, it will in like manner hinder its operation; but the same rod placed under the arm, or the same animal substances tied round or fixed on the top of the rod, will make it work in those hands, in which without these additions it is not attracted."

Such are the accounts of this extraordinary rod, to which it is probable that few will assent; and we believe the instances of mines having been discovered by it are but very rare. Another and very ancient mode of discovering mines, less uncertain than the divining rod, but extremely difficult and precarious, is that called *shoding*; that is, tracing them by loose stones, fragments, or *shodes*, which may have been separated and carried off to a considerable distance from the vein, and are found by chance in running waters, on the superfices of the ground, or a little under. "When the tinners (says Mr Price) meet with a loose single stone of tin ore, either in a valley or in ploughing or hedging, though at 100 fathoms distance from the vein it came from, those who are accustomed to this work will not fail to find it out. They consider, that a metallic stone must originally have appertained to some vein, from which it was severed and cast at a distance by some violent means. The deluge, they suppose, moved most of the loose earthy coat of the globe, and in many places washed it off from the upper towards the lower grounds, with such a force, that most of the backs or lodes of veins which protruded themselves above the fast were hurried downwards with the common mass: whence the skill in this part of their business lies much in directing their measures according to the situation of the surface." Afterwards, however, our author complains, that this art of *shoding*, as he calls it, is in a great measure lost.

The following account of a method of finding silver mines by Alonzo Barba seems to be similar to that of shoding just now mentioned. "The veins of metal (says he) are sometimes found by great stones above ground; and if the veins be covered, they hunt them out after this manner; *viz.* taking in their hands a sort of mattock, which has a steel point at one end to dig with, and a blunt head at the other wherewith to break stones, they go to the hollows of the mountains, where the current of rain-water descends, or to some other part of the skirts of the mountains, and there observe what stones they meet with, breaking in pieces those that seem to have any metal in them; whereof they find many times both middling sort of stones and small ones also of metal. Then they consider the situation of that place, and whence these stones can tumble, which of necessity must be from higher ground, and follow the tract of them up the hill as long as they can find any of them," &c.

"Another way (says Mr Price) of discovering lodes is by working drifts across the *country*, as we call it, that is, from north to south, and *vice versa*. I tried the experiment in an adventure under my management, where I drove all open at grass about two feet in the shelf, very much like a level to convey water upon a mill wheel: by so doing I was sure of cutting all lodes in my way; and did accordingly discover five courses, one of which has produced above 180 tons of copper ore, but the others were never wrought upon. This method of discovering lodes is equally cheap and certain; for 100 fathoms in shallow ground may be driven at 50 s. expence.

In that kind of ground called by our author *feasible*, and which he explains by the phrase *tender-standing*, he tells us, that "a very effectual, proving, and consequential way is, by driving an adit from the lowest ground, either north or south; whereby there is a certainty to cut all lodes at 20, 30, or 40 fathoms deep, if the level admits of it. In driving adits or levels across, north or south, to unwater mines already found, there are many fresh veins discovered, which frequently prove better than those they were driving to."

After the mine is found, the next thing to be considered is, whether it may be dug to advantage. In order to determine this, we are duly to weigh the nature of the place, and its situation, as to wood, water, carriage, healthiness, and the like; and compare the result with the richness of the ore, the charge of digging, stamping, washing, and smelting.

Particularly the form and situation of the spot should be well considered. A mine must either happen, 1. In a mountain; 2. In a hill; 3. In a valley; or, 4. In a flat. But mountains and hills are dug with much greater ease and convenience, chiefly because the drains and burrows, that is, the adits or avenues, may be here readily cut, both to drain the water and to form gang-ways for bringing out the lead, &c. In all the four cases, we are to look out for the veins which the rains or other accidental thing may have laid bare; and if such a vein be found, it may often be proper to open the mine at that place, especially if the vein prove tolerably large and rich: otherwise the most commodious place for situation is to be chosen for the purpose, *viz.* neither on a flat, nor on the tops of mountains, but on the sides. The best situation for a mine, is a mountainous, woody, wholesome spot; of a safe easy ascent, and bordering on a navigable river.

The

Mine. The places abounding with mines are generally healthy, as ſtanding high, and every where expoſed to the air; yet ſome places where mines are found prove poiſonous, and can upon no account be dug, though ever ſo rich: the way of examining a ſuſpected place of this kind, is to make experiments upon brutes, by expoſing them to the effluvia or exhalations to find the effects.

Devonſhire and Cornwall, where there are a great many mines of copper and tin, is a very mountainous country, which gives an opportunity in many places to make adits or ſubterraneous drains to ſome valley at a diſtance, by which to carry off the water from the mine, which otherwiſe would drown them out from getting the ore. Theſe adits are ſometimes carried a mile or two, and dug at a vaſt expence, as from 2000 l. to 4000 l. eſpecially where the ground is rocky; and yet they find this cheaper than to draw up the water out of the mine quite to the top, when the water runs in plenty and the mine is deep. Sometimes, indeed, they cannot find a level near enough to which an adit may be carried from the very bottom of the mine; yet they find it worth while to make an adit at half the height to which the water is to be raiſed, thereby ſaving half the expence.

The late Mr Coſtar, conſidering that ſometimes from ſmall ſtreams, and ſometimes from little ſprings or collections of rain-water, one might have a good deal of water above ground, though not a ſufficient quantity to turn an overſhot-wheel, thought, that if a ſufficient fall might be had, this collection of water might be made uſeful in raiſing the water in a mine to the adit, where it may be carried off.

But now the moſt general method of draining mines is by the ſteam-engine. See *Steam-Engine*.

Mine, in the military art, denotes a ſubterraneous canal or paſſage, dug under the wall or rampart of a fortification, intended to be blown up by gunpowder.

The alley or paſſage of a mine is commonly about four feet ſquare; at the end of this is the chamber of the mine, which is a cavity of about five feet in width and in length, and about ſix feet in height; and here the gunpowder is ſtowed. The ſauciſſe of the mine is the train, for which there is always a little aperture left.

Two ounces of powder have been found, by experiment, capable of raiſing two cubic feet of earth; conſequently 200 ounces, that is, 12 pound 8 ounces, will raiſe 200 cubic feet, which is only 16 feet ſhort of a cubic toiſe, becauſe 200 ounces joined together have proportionably a greater force than 2 ounces, as being an united force.

All the turnings a miner uſes to carry on his mines, and through which he conducts the ſauciſſe, ſhould be well filled with earth and dung; and the maſonry in proportion to the earth to be blown up, as 3 to 2. The entrance of the chamber of the mine ought to be firmly ſhut with thick planks, in the form of a St Andrew's croſs, ſo that the incloſure be ſecure, and the void ſpaces ſhut up with dung or tempered earth. If a gallery be made below or on the ſide of the chamber, it muſt abſolutely be filled up with the ſtrongeſt maſonry, half as long again as the height of the earth; for this gallery will not only burſt, but likewiſe obſtruct the effect of the mine. The powder ſhould always be kept in ſacks, which are opened when the mine is charged, and ſome of the powder ſtrewed about: the greater the quantity of earth to be raiſed is, the greater is the effect of the mine, ſuppoſing it to have the due proportion of powder. Powder has the ſame effect upon maſonry as upon earth, that is, it will proportionably raiſe either with the ſame velocity. Mine.

The branches which are carried into the ſolidity of walls do not exceed three feet in depth, and two feet ſix inches in width nearly: this ſort of mine is moſt excellent to blow up the ſtrongeſt walls.

The weight of a cubic foot of powder ſhould be 80 lb. 1 foot 1 inch cube will weigh 100 lb. and 1 foot 2 inches and $\frac{1}{12}$, 150 lb. and 200 lb. of powder will be 1 foot 5 inches cube; however, there is a diverſity in this, according to the quantity of ſaltpetre in the gunpowder.

If, when the mines are made, water be found at the bottom of the chamber, planks are laid there, on which the powder is placed either in ſacks or barrels of 100 lb. each. The ſauciſſe muſt have a clear paſſage to the powder, and be laid in an auget or wooden trough, through all the branches. When the powder is placed in the chamber, the planks are laid to cover it, and others again acroſs theſe; then one is placed over the top of the chamber, which is ſhaped for that purpoſe: between that and thoſe which cover the powder, props are placed, which ſhore it up; ſome inclining towards the outſide, others to the inſide of the wall; all the void ſpaces being filled with earth, dung, brick, and rough ſtones. Afterwards planks are placed at the entrance of the chamber, with one acroſs the top, whereon they buttreſs three ſtrong props, whoſe other ends are likewiſe propped againſt another plank ſituated on the ſide of the earth in the branch; which props being well fixed between the planks with wedges, the branch ſhould then be filled up to its entrance with the forementioned materials. The ſauciſſes which paſs through the ſide branches muſt be exactly the ſame length with that in the middle, to which they join: the part which reaches beyond the entrance of the mine is that which conveys the fire to the other three; the ſauciſſes being of equal length, will ſpring together.

From a great number of experiments, it appears, 1. That the force of a mine is always towards the weakeſt ſide; ſo that the diſpoſition of the chamber of a mine does not at all contribute to determine this effect. 2. That the quantity of powder muſt be greater or leſs, in proportion to the greater or leſs weight of the bodies to be raiſed, and to their greater or leſs coheſion; ſo that you are to allow for each cubic fathom

Of looſe earth, - -	9 or 10 lb.
Firm earth and ſtrong ſand,	11 or 12
Flat clayey earth, -	15 or 16
New maſonry, not ſtrongly bound,	15 or 20
Old maſonry, well bound,	25 or 30

3. That the aperture, or entonnoir of a mine, if rightly changed, is a cone, the diameter of whoſe baſe is double the height taken from the centre of the mine. 4. That when the mine has been overcharged, its entonnoir is nearly cylindrical, the diameter of the upper

Mineral.

extreme not much exceeding that of the chamber. 5. That besides the shock of the powder against the bodies it takes up, it likewise crushes all the earth that borders upon it, both underneath and sidewise.

To charge a mine so as to have the most advantageous effect, the weight of the matter to be carried must be known; that is, the solidity of a right cone, whose base is double the height of the earth over the centre of the mine: thus, having found the solidity of the cone in cubic fathoms, multiply the number of fathoms by the number of pounds of powder necessary for raising the matter it contains; and if the cone contains matters of different weights, take a mean weight between them all, always having a regard to their degree of cohesion.

As to the disposition of mines, there is but one general rule, which is, that the side towards which one would determine the effect be the weakest; but this varies according to occasions and circumstances.

The calculation of mines is generally built upon this hypothesis, that the entonnoir of a mine is the frustrum of an inverted cone, whose altitude is equal to the radius of the excavation of the mine, and the diameter of the whole lesser base is equal to the line of least resistance; and though these suppositions are not quite exact, yet the calculations of mines deduced from them have proved successful in practice; for which reason this calculation should be followed till a better and more simple be found out.

M. de Valliere found that the entonnoir of a mine was a paraboloid, which is a solid generated by the rotation of a semiparabola about its axis; but as the difference between these two is very insignificant in practice, that of the frustum of a cone may be used.

MINERAL, in natural history, is used in general for all fossile bodies, whether simple or compound, dug out of a mine; from whence it takes its denomination.

Mineral Waters. All waters naturally impregnated with any heterogeneous matter which they have dissolved within the earth may be called *mineral-waters*, in the most general and extensive meaning of that name; in which are therefore comprehended almost all those that flow within or upon the surface of the earth, for almost all these contain some earth or selenites. But waters containing only earth or selenites are not generally called *mineral*, but *hard* or *crude waters*.

Hard waters which are simply selenetic, when tried by the chemical proofs, show no marks of an acid or of an alkali, nor of any volatile, sulphureous, or metallic matters. Waters which contain a disengaged calcareous earth, change the colour of syrup of violets to a green; and those that contain selenites, being mixed with a solution of mercury in nitrous acid, form a turbith mineral; and when a fixed alkali is added, they are rendered turbid, and a white sediment is precipitated. These waters also do not dissolve soap well. From these circumstances we may know, that any water which produces these effects is a hard, earthy, or selenetic water. The waters impregnated with gas are also hard.

Although the waters of the sea and saline springs be not generally enumerated amongst mineral waters, they might nevertheless be justly considered as such: for besides earthy and selenetic matters, they also contain a large quantity of mineral salts. We shall therefore consider them as such in this article.

Mineral waters, properly so called, are those in which gas, or sulphureous, saline, or metallic substances, are discovered by chemical trials. As many of these waters are employed successfully in medicine, they are also called *medicinal waters*.

Mineral waters receive their peculiar principles by passing through earths containing salts, or pyritous substances that are in a state of decomposition. Some of these waters are valuable from the quantity of useful salts which they contain, particularly of common salt, great quantities of which are obtained from these waters; and others are chiefly valued for their medicinal qualities. The former kind of mineral waters is an object of manufacture, and from them is chiefly extracted that salt only which is most valuable in commerce. See Salt.

Many of those waters have been accurately analysed by able chemists and physicians. But notwithstanding these attempts, we are far from having all the certainty and knowledge that might be desired on this important subject; for this kind of analysis is perhaps the most difficult of any in chemistry.—Almost all mineral waters contain several different substances, which being united with water may form with each other numberless compounds. Frequently some of the principles of mineral waters are in so small quantity, that they can scarcely be perceived; although they may have some influence on the virtues of the water, and also on the other principles contained in the water.—The chemical operations used in the analysis of mineral waters, may sometimes occasion essential changes in the substances that are to be discovered. And also, these waters are capable of suffering very considerable changes by motion, by rest, and by exposure to air.

Probably also the variations of the atmosphere, subterranean changes, some secret junction of a new spring of mineral or of pure water, lastly the exhaustion of the minerals whence waters receive their peculiar principles, are causes which may occasionally change the quality of mineral waters.

We need not therefore wonder that the results of analyses of the same mineral waters made by different chemists, whose skill and accuracy are not questioned, should be very different.

The consequences of what we have said on this subject are, That the examination of mineral waters is a very difficult task; that it ought not to be attempted but by profound and experienced chemists; that it requires frequent repetitions, and at different times; and lastly, that no fixed general rules can be given concerning these analyses.

As this matter cannot be thoroughly explained without entering into details connected with all the parts of chemistry, we shall here mention only the principal results, and the most essential rules, that have been indicated by the attempts hitherto made on this subject.

We may admit the division or arrangement of mineral waters into certain classes, proposed by some of the best chemists and naturalists.

Some of these waters are called *cold*, because they are not naturally hotter than the atmosphere. Some of them are even colder, especially in summer.

Those are called *hot* mineral waters, which in all seasons are hotter than the air. These are of various degrees of heat, and some of them are almost as hot

as

as boiling water. In ſome mineral waters certain volatile, ſpirituous, and elaſtic principles may be perceived, by a very ſenſible piquant taſte: this principle is called the *gas* or *ſpirit* of the waters.

The waters which contain this principle are generally lighter than pure water. They ſparkle and emit bubbles, at their ſpring, but eſpecially when they are ſhaken, and poured from one veſſel into another. They ſometimes break the bottles containing them, when theſe are well corked, as fermenting wines ſometimes do. When mixed with ordinary wine, they give to it the piquancy and ſparkling quality of Champaigne wine.

This volatile principle, and all the properties of the water dependent upon it, are loſt merely by expoſure to air, or by agitation. The waters containing this principle are diſtinguiſhed by the name of *ſpirituous mineral waters*, or *acidulous waters*.

Other diviſions of mineral waters may be made relatively to ſome of their predominant principles. Hence ſome waters are called *acidulous*, *alkaline*, *martial*, *neutral*, &c.

When a mineral water is to be examined, we may obſerve the following rules:

Experiments ought to be made near the ſpring, if poſſible.

The ſituation of the ſpring, the nature of the ſoil, and the neighbouring riſing grounds, ought to be examined.

Its ſenſible qualities, as its ſmell, taſte, colour, are to be obſerved.

Its ſpecific gravity and heat are to be aſcertained by the hydroſtatical balance and the thermometer.

From the properties abovementioned of ſpirituous mineral waters, we may diſcover whether it be one of this claſs. For greater certainty we may make the following trial. Let the neck of a wet bladder be tied to the neck of a bottle containing ſome of this water. By ſhaking the water, any gas that it may contain will be diſengaged, and will ſwell the bladder. If the neck of the bladder be then tied with a ſtring above the bottle, and be cut below this ſtring, ſo as to ſeparate the bladder from the bottle, the quantity and nature of the contained gas may be further examined.

Laſtly, we muſt obſerve the changes that are ſpontaneouſly produced upon the water in cloſe and in open veſſels, and with different degrees of heat. If by theſe means any matter be cryſtallized or depoſited, it muſt be ſet apart for further examination.

Theſe preliminary experiments and obſervations will almoſt certainly indicate, more or leſs ſenſibly, ſomething concerning the nature of the water, and will point out the method to be followed in our further inquiry.

We muſt then proceed to the decompoſition of the water, either without addition, and merely by evaporation and diſtillation, or with the addition of other ſubſtances, by means of which the matters contained in the water may be precipitated and diſcovered. It is not material which of theſe two methods be firſt practiſed, but it is quite neceſſary that the one ſhould ſucceed the other. If we begin by evaporating and diſtilling, theſe operations muſt be ſometimes interrupted, that the ſeveral principles which riſe at different times of the diſtillation may be obtained and examined ſeparately, and alſo to allow the ſeveral ſalts that may be contained to cryſtallize by the evaporation and by cold.

The ſubſtances which have hitherto been met with in mineral waters are,

1. *Vitriolic acid.* This acid is ſometimes found pure and unmixed with any other ſubſtance, though more frequently joined with iron or copper. In its pure ſtate, it is moſt frequently found in the neighbourhood of volcanoes, where, in the opinion of Dr Donald Monro, it is moſt probably "diſtilled from mines of vitriol or of pyrites-ſtone, decompoſed by ſubterraneous fire." It ſeems, however, more probably to proceed from the decompoſition of ſulphur; for neither vitriol nor pyrites will at all give a pure acid. This only can be obtained from the fumes of ſulphur, which we know abound in all ſuch places. Dr Vandellius, in a book intitled *De Thermis Agri Patavini*, publiſhed in 1761, mentions a cave near to the town of Latera, about 30 miles from Viterbo, in Italy, where a clear acid water drops from the crevices of the rocks, and is collected by the country people in glazed earthen veſſels. This has a mild agreeable taſte, and is found to be a pure vitriolic acid much diluted. The cavern, however, is ſo filled with noxious vapours, that it cannot be entered without danger of ſuffocation, except in winter, or when it blows a north wind. A ſimilar native vitriolic water is mentioned by Theophilus Griſſonius, near the town of Salvena. Varenius alſo mentions a ſpring in the province of Nota in Sicily, the waters of which are ſo ſour, that the neighbouring people uſe it inſtead of vinegar. In ſome waſte coal pits, the water taſtes ſour, and effervesces with alkalies; but in all theſe the acid is mixed with much vitriol, or other matter. Dr Monro mentions acid dews collected in the Eaſt Indies: this acid he ſuppoſes to be the vitriolic, and that it probably imparts ſome acidity to waters upon which the dews fall.

2. *Nitrous* and *marine* acids are never found in waters pure, though the former is frequently found combined with calcareous earth, and the latter with foſſile alkali, calcareous earth, or magneſia.

3. *Fixed air* enters into the compoſition of all waters; but abounds particularly in thoſe of the mineral kind, at leaſt ſuch as are cold. It imparts an agreeable acidulous taſte to ſuch water as it is mixed with, and is found by undoubted experiments to be that which gives the power and efficacy to the cold kind. It is known to be a ſolvent of iron, and that by its means this metal is very often ſuſpended in waters; and Dr Dejean of Leyden, in a letter to Dr Monro in the year 1777, ſuppoſes it to be the medium by which ſulphur alſo is diſſolved. "Having been lately at Aix-La-Chapelle (ſays he), I mixed a ſolution of arſenic in the marine acid with ſome of the water of the emperor's bath, and immediately a true and genuine ſulphur was precipitated to the bottom of the veſſel in which the water was contained: which convinced me that the ſulphur was diſſolved by means of fixed air, though Sir Torbern Bergman thinks otherwiſe, and that the ſulphur is ſuſpended by means of phlogiſton, and the matter of heat united in the waters; and he ſays, that if the concentrated nitrous acid be added to theſe waters, it ſeizes the phlogiſton, precipitates the ſulphur, and takes away the hepatic ſmell." If ſulphur is by this medium ſuſpended in water,

water, however, it muſt be by a natural proceſs, with which we are entirely unacquainted; for we cannot unite ſulphur and fixed air artificially. We are not informed whether there is any native mineral water impregnated only with fixed air; probably, indeed, there is not, for water thus impregnated becomes a very active ſolvent of calcareous and other earths, and muſt undoubtedly meet with ſomething or other of this kind in paſſing through the ground. Many waters in Germany, particularly in the neighbourhood of the Rhine, are very much impregnated with this acid, and are eſteemed otherwiſe pretty pure; but they have never been examined chemically to diſcover whether they are not impregnated alſo with ſome proportion of metallic or earthy ſubſtances.

4. *Vegetable alkali* was long ſuppoſed to be a production entirely artificial; but ſome late authors ſeem to think that it is a native ſalt as well as the vegetable alkali. M. Margraaf mentions his having got a true nitre, the baſis of which is the vegetable alkali, from ſome waters at Berlin. M. Monnet ſays, that from the Pohoun ſpaw water he obtained eight grains of a grey-coloured alkaline ſalt from a reſiduum of twelve Paris pints of the water, which he ſaturated with the vitriolic acid; and on diluting, evaporating, and cryſtallizing, he obtained a tartarus vitriolatus, and not a Glauber's ſalt as he expected. Dr Hoffman affirms, that he obtained a vitriolated tartar from the Seltzer water by mere evaporation: but as this ſalt has neither been found in Seltzer nor any other water by other chemiſts, it is probable that he has been miſtaken.

5. The *foſſil alkali* is found in many waters in Hungary, Tripoli, Egypt, and other countries where that ſalt is found native. It is combined in Seltzer water, and other acidulous waters, with fixed air, and may be obtained from them pretty pure by ſimple evaporation. M. Monnet informs us, that he has obtained it in tolerable purity from the waters of Auvergne: but in moſt of the alkaline waters this ſalt was in an imperfect ſtate, and may be called rather an embryo than a perfect ſalt; for it would not cryſtallize, and made a very imperfect neutral ſalt with acids. It was incapable alſo of decompoſing the ſelenites, which was frequently found along with it in the ſame water.—Bergman makes mention of an imperfect alkaline ſalt; but obſerves, that all of that kind which he had an opportunity of examining, appeared to him to be no other than a genuine mineral alkali mixed with deliqueſcent ſalts.

In ſome of the mineral waters near volcanoes, this kind of alkali has been found ſo intimately united with phlogiſton as to be capable of producing a true Pruſſian blue, on adding a ſolution of ſilver or of green vitriol to the water; of which an example is given by Dr Nichola Andrea, in the thermal waters of a ſpring in the iſland of Iſchia.

6. *Volatile alkali* has formerly been accounted an ingredient in mineral waters; but Dr Hoffman, and moſt of the later chemiſts, have denied this, as the volatile alkali is not a mineral ſubſtance. It is poſſible, indeed, that ſome waters in the neighbourhood of great quantities of putrid matter may give ſome tokens of volatile alkali, as was the caſe with Rathbone-place water, analyſed by the Hon. Henry Cavendiſh.

7. *Glauber's ſalt.* Many mineral waters contain a portion of this ſalt, though the quantity is commonly very ſmall. However, M. Boulduc, in the memoirs of the academy of ſciences at Paris for 1724, makes mention of the waters of a ſpring in the neighbourhood of a village about three leagues from Madrid, which, by evaporation, yields a true Glauber's ſalt.—This ſalt, he ſays, is found in a concreted ſtate about the ſides of the ſpring, reſembling the icicles which in winter hang from the roofs of houſes. From this circumſtance, it would ſeem that the water of the ſpring was very richly impregnated with the ſalt; and Dr Nichola Andrea ſpeaks of a water at Sællia, in Calabria, which is ſo ſtrongly impregnated with this kind of ſalt, that he thinks it would be worth while to prepare it from thence in the way of trade. It is very probable that ſuch waters are frequently to be met with in countries where the ſoil is impregnated with mineral alkali.

8. *Common nitre.* In ſome of the barren provinces of Bengal, the earth is ſo ſtrongly impregnated with this ſalt, that the ſurface is covered with a nitrous cruſt reſembling hoar-froſt; and in ſuch places the waters are ſtrongly impregnated with it, as may naturally be ſuppoſed. In colder countries, however, this impregnation is more rare, though inſtances of perfect nitre being found in ſprings are not wanting in Europe; but no natural combination of nitrous acid with foſſil alkali, or cubic nitre, has yet been met with in any part of the world.

9. *Sea ſalt.* This abound not only in the waters of the ocean, but in great numbers of ſalt ſprings; and there are but few waters ſo pure as not to contain ſome portion of it.

10. *Aerated foſſile alkali.* This is found in Seltzer, and other waters of that kind, but combined with ſuch a quantity of fixed air, that the acrid taſte of the alkali is entirely covered, and the water has a briſk acidulous one. By evaporating the water, however, this ſuperfluous quantity of air is diſſipated, and the alkali then appears in its more acrid ſtate.

11. *Gypſum*, or *ſelenites.* This compoſition of the vitriolic acid and lime is extremely common in mineral waters. For a long time it was ſuppoſed to be a ſimple earth or ſtone, on account of its difficult ſolubility in water, requiring 700 or 800 times its own weight of water to diſſolve it artificially, though Dr Rutty informs us, that the water in which it is originally diſſolved will contain four or five times that proportion. There are to appearance ſeveral kinds of this ſubſtance; but whether they ariſe from foreign mixture, or from any difference in the calcareous earths among themſelves, we know not. It is not, however, conſidered as a medicinal ingredient, nor indeed is the internal uſe of it thought to be very ſafe.

12. *Epſom ſalt.* Bergman and ſome other chemiſts have reduced all the calcareous purging ſalts in which the vitriolic acid is concerned; but Dr Monro obſerves, that theſe ſalts not only cryſtallize in various modes, but have different degrees of ſolubility in water.—Thus the Epſom ſalt, properly ſo called, diſſolves in an equal quantity of water; while the calcareous nitres, or purging ſalts from mineral waters, require from 10 to 80 times their weight to diſſolve them.—This matter would require the analyſis of a great number

ber of falts, obtained from mineral waters in large quantity, and has not yet been thoroughly explained. Thefe falts, however, are feldom met with by themfelves in mineral waters, but ufually mixed with fea-falt, iron, earth, fulphureous matter, &c. Dr Rutty tells us, that a mineral water begins to be laxative when it contains ten grains of this falt to a pint, or 80 to a gallon.

13. *Alum*. This was formerly fuppofed to be a very common ingredient in mineral waters: but more accurate obfervations have fhown it to be very rare, infomuch that Dr Hoffman thinks it is not to be met with in any. Dr Layard, however, in the 56th volume of the Philofophical Tranfactions, gives an account of a chalybeate water at Somerfham, from which he got five grains of alum out of two pounds of the water. Dr Rutty fuppofes that the mineral water at Ballycaftle, in Ireland, contains alfo a portion of this falt.

14. *Calcareous nitre*. This is rarely found in mineral waters, though common enough in fuch as are fimply called *hard* waters. Dr Monro fays, that the only one containing this ingredient which he ever heard of is one mentioned by Dr Home, in his treatife on bleaching.

15. 16. *Muriated calcareous earth, and muriated magnefia*. Muriated calcareous earth is likewife a rare ingredient in mineral waters, though frequently mentioned by writers on this fubject. Bergman informs us, that he obtained a fmall quantity from a fpring in Oftro-Gothland: and Dr Monro got fome from the water of a falt fpring at Pitkeathly, near Perth, in Scotland. It is found, as well as muriated magnefia, in fea water, though the latter is much more abundant, and probably to be met with in all falt waters whatever, but is very difficult to be obtained in a cryftalline form; though its prefence and nature may always be afcertained, by dropping vitriolic acid into the concentrated liquor fuppofed to contain it, which will both precipitate the calcareous earth, and raife the marine acid in vapours. Muriated magnefia is likewife found in falt waters, and abounds in thofe of the ocean. It is the principal ingredient in the bitter ley remaining after the falt is extracted from fea-water, and is much more capable of being cryftallized than the former.

17. *Aerated calcareous earth*, and *aerated magnefia*. Both thefe earths may be diffolved by means of fixed air, and frequently are fo in mineral waters, as well as iron. They are likewife often found in great quantity in hard waters; nor is there probably any kind of water, unlefs that which is diftilled, entirely void of them.— When fuch waters are boiled, the air evaporates, and the earth falls to the bottom, which will alfo be the cafe upon long expofure to the air. Hence originates the cruft upon tea-kettles, the petrefactions upon different fubftances immerfed in fome kinds of water, &c. Hence alfo hard waters become foft, by running in channels for a confiderable way: and to this caufe we may with probability afcribe the growth of ftones in rivulets.

18. *Vitriolated copper*. This falt is feldom found, except in waters which flow from copper mines. The water impregnated with it is emetic and purgative, and may juftly be accounted poifonous rather than medicinal. On dipping clean iron into fuch water, the copper is inftantly precipitated in its metallic ftate, and the iron diffolved in its ftead. Sometimes the quantity of copper is fo great, that it is found advantageous to extract it in this way, as is the cafe in a certain ftream in Ireland.

16. *Vitriolated iron* is found in confiderable quantity in feveral waters both of England, Scotland and Ireland, as well as in many countries on the continent. Some authors have imagined, that there is a kind of volatile vitriol with which waters are fometimes impregnated. An anonymous author, in a work intitled *delle Terme Portenne*, publifhed at Rome in 1768, informs us, that having fixed a glafs receiver to a hole through which the vapour of the water rifes from the aqueduct below, he found in it a month afterwards, as well as in the mouth of the hole, a concrete and incruftated fubftance, like ftalactite, which by experiment proved to be a true falt of iron, with a fuperabundant quantity of acid. Hence he concludes that this water, as it rifes from the fpring, is impregnated with a fine volatile martial vitriol, in fuch fmall proportion that it cannot be difcovered in any quantity that may be analyfed in retorts or ftills, though it may be difcovered by confining for a long time the vapour, which is naturally and conftantly fublimed from the whole body of the thermal water difcharged from the fpring, as it paffes through the aqueducts. The water of this fpring is ftrongly fulphureous, and its heat 92 degrees of Fahrenheit.

Another kind of fuppofed volatile vitriol is that compofed of iron, diffolved by fixed air. The notion of this being a volatile fubftance arofe from obferving that there are fome waters which tafte ftrongly chalybeate at the fountain, but, after running for a little way, lofes it entirely. This, however, is founded on a miftake: for it is only one of the ingredients, viz. the fixed air, which flies off when it is combined with earth: after which the iron precipitates in a fimilar manner.

20. *Vitriolated zinc*. This has been found native in the bowels of the earth; and thence has been fuppofed, not without reafon, to be an ingredient in mineral waters: but none have yet brought any decifive experiments on this fubject, except Dr Rutty and Dr Gmelin, who both fay that they have obtained a white vitriol from mineral waters which were at the fame time impregnated with iron and fome other ingredients.

21. *Muriated magnefia*. Waters impregnated with this falt are mentioned both by Bergman and Scheele; but the particular properties of them are not known.

22. *Arfenic* has been fuppofed fometimes to be an ingredient in mineral waters, though no certain proofs of its exiftence have been brought. Poifonous fprings, fuppofed to be impregnated with it, are mentioned by Varenius: and Dr Baldaffari tells us of a fmall fpring (near to the Aqua Sancta, in the country of Siena), the waters of which kill any animal that drinks them. He fufpects this to be owing to arfenic, but was afraid to analyfe the water.

23. *Foffil oils*. Almoft all waters, even thofe which are accounted the moft pure, contain fome portion of an oily matter though generally fo fmall that it cannot be perceived without evaporating a large quantity of the liquid. Some contain it in great quantity; infomuch that, befides impregnating the water as ftrongly as poffible, a great quantity falls to the bottom,

tom, or swims on the top. The other ingredients of these bituminous waters have not been examined; but in whatever manner the oil is united with the water, a portion of it adheres very obstinately, so that it cannot be fully separated even by filtration through paper. A fine bituminous vapour rises from the bottom of some wells, and prevades the water, taking fire on the application of any flaming substance, though no oil is observed in the water itself. Of this kind are the burning wells at Brosely and Wigan in Lancashire in England, and others in different countries.—The cause of the inflammation of these waters was first discovered in 1759 by Mr Thomas Shirley, who caused the waters of the well at Wigan to be drained away; and found that the inflammable vapour rose from the ground at the bottom, where it would take fire, as it did at the surface of the water. On applying his hand to the place whence the vapour issued, he found the impulse of it like a strong breath; or wind; and the same sensation was felt on applying his hand to the surface of the water. See *Phil. Transf.* vol. 26.

24. *Sulphur*. This is a common ingredient in mineral waters; and its presence is known by the strong hepatic smell they emit, as well as by their blackening silver. &c. Sulphureous waters are frequently very clear and transparent when taken up at the fountain; but when kept in open vessels, or bottles not well stopped, they soon deposit the sulphur they contain in the form of a dirty white powder, and lose their sulphureous smell. The bottom of the wells containing such waters, or of the channels in which they run, assume a black colour, and a raggy kind of matter is deposited on such substances as they run over for some time; and when these are taken up and dried, they appear covered with a true sulphur. Some waters contain this ingredient in very considerable quantity. From that of Harrowgate it may be separated by filtration; and Father de Tertre, in the second volume of his *Histoire Naturelle des Antilles*, tells us, that when he was in the islandof Guadaloupe, and amusing himself one day with evaporating in a tin plate some sulphureous water which he found near the burning mountain, there remained on the plate a layer of sulphur about the thickness of a leaf of paper. Dr Monro mentions his having obtained a true sulphur, by evaporation, from a mineral water at Castle-Leod, in the county of Ross, in Scotland. Dr Brown, in his Travels, informs us, that having caused some of the pipes which carry off the water from the duke's bath at Baden, in Austria, to be opened, he took from thence a quantity of fine sulphur in powder, something like flower of brimstone, which had been sublimed from the waters. A similar kind of sulphur is obtained from the upper part of the pipes and conduits which convey the waters of Aix-la-Chapelle from their sources.

From these and other facts of a similar nature, Dr Monro concludes, that sulphur is dissolved by some means or other in the water. Great differences however have taken place among chemists concerning the mode in which sulphur is thus dissolved. Sulphur, we know, may be dissolved by means of an alkali, as well as by calcareous earth; and there are some instances of alkaline waters containing sulphur, though we are not absolutely certain that the alkaline salt is the bond of union betwixt the sulphur and them. Dr Vandellius, in his treatise *de Thermis agri Palivini*, already quoted, mentions a substance found in the conduits of the waters of the baths at Aponum, which he calls crystallized sulphur, and says that it dissolves in the waters by boiling, recovering afterwards its solid form. This substance has not been examined; but we know of no other mineral with which sulphur readily assumes a crystalline form than terra ponderosa.—This compound is easily dissolved in water, and communicates to it a most powerful taste and smell of hepar sulphuris. Great part of the terra ponderosa, though not the whole, may be separated by fixed air, so that it is probably this permanent compound which Vandellius observed. Dr Lucas supposed that the sulphureous waters contain both an acid and phlogiston; and Sir Torbern Bergman, that they are impregnated only with the hepatic gas: and that this gas consists of sulphur united with phlogiston, from which the sulphur may be precipitated by the nitrous acid.

For an account of the cause of heat in mineral waters, see the article SPRINGS.

Having now mentioned the principal substances that form almost all these waters, we shall next show the proofs by means of which they may be discovered in water, without decomposing the water by evaporation or by distillation.

If any portion of disengaged acid or alkali be contained in water, it may be known by the taste, by changing the colour of violets or of turnsol, and by adding the precise quantity of acid or of alkali that is necessary for the separation of the contained disengaged saline matter.

Sulphur, and liver of sulphur, may be discovered in waters by their singular smell, and by the black colour which these substances give to white metals or to their precipitates, but especially to silver.

Vitriolic salts with earthy basis may be discovered in water by two proofs; 1. By adding some fixed alkali, which decomposes all these salts, and precipitates their earthy basis; and, 2. By adding a solution of mercury in nitrous acid, which also decomposes these salts, and forms a *turbith mineral* with their acid. But for this purpose the solution of mercury ought to have a superabundant quantity of acid; for this solution when perfectly saturated, forms a precipitate with any kind of water, as M. Rouelle has very justly remarked: and indeed, all metallic solutions in any acids are strictly capable of decomposition by water alone, and so much more easily as the acid is more perfectly saturated with the metal.

Martial vitriol or iron combined with any acid, or even with gas, shows itself in waters by blackening an infusion of galls, or by forming a Prussian blue with the phlogisticated alkaline lixivium.

The vitriol of copper, or copper dissolved by any acid, may be discovered by adding some of the volatile spirit of sal ammoniac, which produces a fine blue colour; or by the addition of clean iron, upon the surface of which the copper is precipitated in its natural or metalic state.

Glauber's salt is discovered by adding a solution of mercury in nitrous acid, and forming with it a turbith mineral: or by crystallization.

Common salt contained in waters forms with a solution

Mineral.

lution of silver in nitrous acid a white precipitate, or luna cornea. It may also be known by its crystallization. Marine salt with earthy basis produces the same effect upon solution of silver. It also forms a precipitate when fixed alkali is added. The acrimony, bitterness, and deliquescency of this salt, serve to distinguish it.

The proofs related for the examination of mineral waters, are only those which are most essential. Many others may be made to confirm the former proofs: but the details of these are too extensive to be inserted here. We shall add only two of them, because they are very general, and may be very useful.

The first is the production of artificial sulphur, or of the volatile sulphureous acid; by which means the vitriolic acid may be discovered in any combination whatever. For this purpose, the matter to be examined must be mixed with any inflammable substance, and exposed to a red heat. If this matter contained but a particle of volatile acid, it would be rendered sensible by the sulphur, or by the vitriolic sulphureous acid thence produced.

The second general proof for mineral waters which we shall mention here, serves to discover any metallic substance whatever, dissolved in water by any acid. This proof consists in adding some of the liquor saturated by the colouring matter of Prussian blue. This liquor produces no effects upon any neutral salts with earthy or alkaline bases, but decomposes all metallic salts: so that if no precipitate be formed upon adding some of this liquor, we may be certain that the water does not contain any metallic salt; and on the contrary, if a precipitate be formed, we may certainly infer that the water does contain some metallic salt.

Two kinds only of gas, or the spirituous volatile part of some waters, are hitherto known; of which one is the volatile sulphureous acid, and the other is fixed air. See Aerology, Fixed *Air*, and Gas, *passim*. Air united superabundantly with spirituous waters is the chief cause of their lightness, piquancy, and sparkling.

When the nature and quantities of the principles contained in a mineral water are ascertained by suitable experiments, we may imitate artificially this water, by adding to pure water the same proportions of the same substances, as Mr Venel has done in examining several waters, especially that of Selters.

We may easily perceive the necessity of using no vessels in these experiments, but such as are perfectly clean and rinsed with distilled water; of weighing the products of the experiments very exactly; of making the experiments upon as large quantities of water as is possible, especially the evaporations, crystallizations, and distillations; and of repeating all experiments several times. We may further observe, that the mixtures from which any precipitates might be expected ought to be kept two or three days, because many of these precipitates require that time, or more, to appear, or to be entirely deposited.

An Alphabetical Table of the most noted Mineral Waters in Europe, exhibiting their Medicinal Properties and Contents.

Names of Springs.	*Countries in which they are found.*	*Contents and quality of the water.*	*Medicinal Virtues.*
Abcourt,	Near St Germain's in France.	A cold chalybeate water, containing besides the iron a small quantity of fossil alkali saturated with fixed air.	Diuretic and purgative. Internally used in dropsies, jaundice, and obstructions of the viscera; externally in scorbutic eruptions, ulcers, &c.
Aberbrothick,	County of Forfar in Scotland.	A cold chalybeate. Contains iron dissolved in fixed air.	Diuretic and corroborative. Used in indigestions, nervous disorders, &c.
Acton,	Middlesex county, England.	Contains Epsom and sea salt. Cold.	Strongly purgative, and causes a soreness in the fundament.
Aghaloo,	Tyrone, Ireland.	Sulphur, fossile alkali, and some purging salt. Cold.	Alterative and corroborant. Useful in scrofulous disorders, worms and cutaneous diseases.
Aix-la-Chapelle,	Juliers in Germany.	Sulphureous and hot. Contain aerated calcareous earth, sea-salt, fossile alkali and sulphur.	Diaphoretic, purgative, and diuretic. Used as baths as well as taken internally. Useful in rheumatisms, and all diseases proceeding from a debility of the system.
Alford or Awford,	Somersetshire, England.	A purging salt along with sea-salt. Cold.	Strongly purgative.
Askeron,	Yorkshire, in England.	Contains Epsom salt, aerated calcareous earth, and sulphur. Cold.	Diuretic. Useful when drank in leprosy, scabs, and other cutaneous diseases.
Antrim,	Ireland.		Similar to Barrowdale water, but weaker.
Baden,	Swabia in Germany.	Hot and sulphureous springs and baths, resembling those of Aix-la-Chapelle.	See Aix-la-Chapelle and Baden, in the order of the alphabet.

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Bagnigge.	Middlesex, near London.	Epsom salt and muriated magnesia. Cold. Another spring contains iron and fixed air.	Strongly purgative, three half pints being a dose. The chalybeate spring also proves purgative when the bowels contain any vitiated matter.
Balemore,	Worcestershire in England.	A fine cold chalybeate, containing iron rendered soluble by fixed air, along with some other salt supposed to be fossile alkali.	Corroborative, and good in obstructions of the viscera. Drank from two to three pints in a morning.
Ball, or Baudwell,	Lincolnshire in England.	A cold petrifying water; contains aerated calcareous earth or magnesia.	Corroborative and astringent. Drunk to the quantity of two pints, or two and an half.
Balaruc,	Languedoc in France.	Hot, and contain some purging salts.	Drank as purgatives, and used as hot-baths. Useful in scrofulous and cutaneous disorders.
Ballycastle,	Antrim in Ireland.	Chalybeate and sulphureous. Cold.	Resembles that of Balemore in virtue.
Ballynahinch,	Down in Ireland.	Iron, fixed air, and sulphur. Cold.	Useful in scorbutic disorders and diseases of indigestion.
Ballyspellan,	Near Kilkenny in Ireland.	Iron, fixed air, and probably fossile alkali.	Similar in virtue to that of Balemore.
Bagniers,	Biggore in France.	Earth and sulphur. Hot.	The waters used in baths, like those of Aix-la-Chapelle. Some of the springs purgative, others diuretic.
Bareges,	Biggore in France.	Sea-salt, fossile alkali, calcareous earth, selenites, sulphur, and a fine bituminous oil. Hot.	Diuretic and diaphoretic. Useful in nervous as well as cutaneous disorders, in old wounds, and some venereal complaints. Used as baths, as well as taken internally to the quantity of a quart or three pints.
Barnet, and North-hall,	Hertfordshire in England.	Epsom salt, and aerated calcareous earth.	Purgative.
Barrowdale,	Cumberland in England.	A great quantity of sea-salt, aerated calcareous earth, and some bittern. Cold.	Strongly emetic and cathartic. Sometimes useful in the jaundice and dropsy, scorbutic disorders, chronic obstructions. Used likewise as a bath in cutaneous diseases. Taken in the dose of a pint, containing only about seven drams and an half of sea-salt; so that a great part of the virtue must reside in the aerated calcareous earth.
Bath,	Somersetshire in England.	Iron, aerated calcareous earth, selenite, Glauber's salt, and sea-salt. Hot.	Powerfully corroborative, and very useful in all kinds of weaknesses. Used as a bath, and taken internally.
Bandola,	Italy.	Iron, fixed air, fossile alkali, and a little sulphur.—Cold.	Gently laxative, diuretic, and diaphoretic.
Brentwood,	Essex in England.	Epsom salt, and aerated calcareous earth.	Purgative.
Bristol,	Somersetshire in England.	Calcareous earth, sea-salt, Epsom-salt Glauber's salt, and selenites. Hot.	Used as a bath; and drank from four to eight ounces at a time, to two quarts per day. Useful in consumptions, diabetes, fluor albus, &c.
Bromley,	Kent in England.	Iron and fixed air. Cold.	Diuretic and corroborative.
Broughton,	Yorkshire in England.	Sulphur, sea-salt, Epsom-salt, and aerated earth. Cold.	Similar to Harrowgate.
Buxton,	Derbyshire in England.	A small quantity of sea-salt, fossile alkali, Epsom-salt, and aerated calcareous earth. Hot. Here is also a fine cold chalybeate spring.	Useful in gout, rheumatism, and other disorders in which tepid baths are serviceable. Used as baths, and drank to the quantity of five or six pints per day.

Caroline

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Carolinebaths,	Bohemia.	Iron, fixed air, aerated earth, fea-falt, foffile-alkali, Epfom falt, and Glauber's falt. Hot.	Purgative, and ufed as baths. Of fervice in diforders of the ftomach and bowels, fcrofula, &c.
Carlton,	Nottinghamfhire in England.	Iron diffolved in fixed air, along with a bituminous oil, which gives it the fmell of horfe-dung.—Cold.	Diuretic and corroborative.
Carrickfergus,	Antrim in Ireland.	Seems from its bluifh colour to contain a very fmall quantity of copper. Cold.	Weakly purgative.
Carrickmore,	Cavan in Ireland.	Foffile alkali, fixed air, and fome purging falt. Cold.	Purgative and diuretic.
Cafhmore,	Waterford in Ireland.	Green vitriol.	Purgative, diuretic, and fometimes emetic.
Caftle-Connel,	Limerick in Ireland.	Iron diffolved in fixed air, &c. Cold.	Refembles the German Spaw, and is in confiderable repute.
Caftle-Leod,	Rofs-fhire in Scotland.	Aerated earth, felenites, Glauber's falt, and fulphur. Cold.	Diuretic, diaphoretic, and corroborant; ufeful in cutaneous difeafes.
Caftlemain,	Kerry in Ireland.	Iron, fulphur, and fixed air. Cold.	Corroborant and diuretic.
Cawley,	Derbyfhire in England.	Epfom falt, aerated calcareous earth, and fulphur. Cold.	Gently purgative.
Cawthorp,	Lincolnfhire in England.	Iron, fixed air, and probably foffile alkali. Cold.	Purgative, and corrects acidities.
Chadlington,	Oxfordfhire in England.	Foffile alkali, fea-falt, and fulphur. Cold.	Purgative.
Chaude Fontaine,	Liege in Germany.	Aerated earth, foffile alkali, and fixed air. Hot.	Refembles thofe of Aix la Chapelle and Buxton.
Cheltenham,	Gloucefterfhire in England.	Calcareous earth, iron, Epfom falt, and common falt. Cold.	Purgative and corroborant; taken in the quantity of from one to three or four pints. Is ufeful in cafes of indigeftion and fcorbutic diforders; alfo in the gravel.
Chippenham,	Wiltfhire in England.	Iron diffolved in fixed air.	Diuretic and corroborative.
Cleves,	Germany.	Iron, fixed air, and other ingredients of Pyrmont water.	Diuretic and corroborant.
Clifton,	Oxfordfhire in England.	Foffile alkali, and aerated calcareous earth or felenite. Cold.	Gently laxative, and ufed as a bath for cutaneous diforders.
Cobham,	Surry in England.	Iron, and fome purging falt.	Purgative, diuretic, and corroborant.
Codfalwood,	Staffordfhire in Enland.	Sulphur, fixed air, and aerated earth.	Refembles the Afkeron water.
Colchefter,	Effex in England.	Epfom falt, and aerated calcareous earth.	Strongly purgative.
Colurian,	Cornwall in England.	Iron, fixed air, and aerated earth.	Corroborative and diuretic.
Comner, or Cumner,	Berkfhire in England.	Some purging falt, and probably aerated earth; the water is of a whitifh colour.	Purgative, in the quantity of one, two, or three quarts.
Coolauran,	Fermanagh in Ireland.	Iron, fixed air, and aerated earth.	Diuretic.
Corftorphin,	Mid-Lothian in Scotland.	Sulphur, fea-falt, clay, and Epfom falt. Cold.	Diuretic and laxative.
Coventry,	Warwickfhire in England.	Iron, fixed air, and fome purging falt.	Purgative, diuretic, and corroborant.

Names of Springs.	Countries in which they are found.	Contents and Quality of the Water.	Medicinal Virtues.
Crickle-Spaw.	Lancashire in England.	Sulphur, sea-salt, and aerated earth.	Purgative, and resembling Harrowgate water.
Croft,	Yorkshire in England.	Aerated earth, vitriolated magnesia, and sea-salt.	Purgative, and resembling Askeron water.
Cross-town,	Waterford in Ireland.	Martial vitriol.	Diuretic, purgative, and sometimes emetic.
Cunley-house,	Lancashire in England.	Sulphur, aerated earth, and fixed air.	Purgative, and resembling the Askeron water.
Das-WildBad,	Nuremberg in Germany.	Iron, fixed air, and some saline matter.	Corroborant. Useful in obstructions of the viscera, and female complaints.
D'Ax en Foix,	15 leagues from Tholouse in France.	Similar to Aix-la-Chapelle. Hot.	Used as a bath, and also drank, like the Aix-la-Chapelle waters.
Deddington,	Oxford in England.	Iron, sulphur, aerated earth, sea-salt, or fossile alkali.	Alterative, purgative in large quantity, and useful in scorbutic and cutaneous disorders.
Derby,	Near the capital of Derbyshire in England.	Iron dissolved by fixed air.	Corroborant.
Derryinch,	Fermanagh in Ireland.	Sulphur and fossile alkali.	Diuretic and diaphoretic.
Derrindaff,	Cavan in Ireland.	Sulphur and purging salt.	Similar to the *Askeron* water.
Derrylester,	Cavan in Ireland.	Similar to *Swadlingbar* water.	
Dog and Duck,	St George's-fields, London.	Aerated magnesia, Epsom salt, and sea-salt.	Cooling and purgative, but apt to bring on or increase the fluor albus in women.
Dortshill,	Staffordshire in England.	Iron dissolved in fixed air.	Corroborant.
Drig-well,	Cumberland in England.	Similar to Deddington.	
Dropping-well,	Yorkshire in England.	Aerated earth.	Astringent and corroborant.
Drumas-nave,	Leitrim in Ireland.	Sulphur, fossile alkali, with some purging salt.	Powerfully diuretic and anthelmintic, and of use in cutaneous and scrofulous disorders.
Drumgoon,	Fermanagh in Ireland.	Similar to the former.	
Dublin salt springs,	Ireland.	Sea-salt and Epsom salt.	Purgative.
Dulwich,	Kent in England.	Sea-salt and Epsom salt.	Purgative and diuretic. Useful in nervous cases and diseases proceeding from debility.
Dunnard,	18 miles from Dublin.	Iron dissolved in fixed air.	Diuretic and corroborant.
Dunse,	Scotland.	Iron dissolved in fixed air, with a little sea-salt and bittern.	Similar to the former.
Durham,	England.	Sulphur, sea-salt, and a little aerated earth. In the middle of the river is a salt spring.	Similar to the Harrowgate water.—That of the salt spring used as a purgative.
Egra,	Bohemia.	Similar to Cheltenham water.	
Epsom,	Surry in England.	Vitriolated and muriated magnesia, with a small quantity of aerated calcareous earth.	Purgative, and of use in washing old sores.
Fairburn,	Ross-shire in Scotland.	Sulphur, aerated earth, and Glauber's salt.	Alterative, and useful in cutaneous diseases.
Felstead,	Essex in England.	Similar to Islington.	
Filah,	Yorkshire in England.	Sea-salt and aerated earth.	Powerfully diuretic and purgative.
Frankfort,	Germany.	Sulphur and sea-salt.	Similar to Harrowgate.

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Gainſborough	Lincolnſhire in England.	Sulphur, iron, aerated earth, and Epſom ſalt.	Diuretic and laxative.
Galway,	Ireland.	Similar to Tunbridge water.	
Glanmile,	Ireland.	Similar to Peterhead water.	
Glaſtonbury,	Somerſetſhire in England.	Similar to Clifton water.	
Glendy,	Merns county in Scotland.	Similar to Peterhead water.	
Granſhaw,	Down in Ireland.	Iron; ſimilar to the German Spaw.	
Haigh,	Lancaſhire in England.	Green vitriol, iron diſſolved by fixed air, with ſome aerated earth.	Emetic and cathartic.
Hampſtead,	England.	Green vitriol, iron diſſolved by fixed air, and a ſmall quantity of aerated earth.	Alterative and corroborant. The water is taken from half a pint to ſeveral pints; is better in the morning than in the middle of the day, and in cold than hot weather.
Hanbridge,	Lancaſhire in England.	Similar to Scarborough water.	Leſs purgative than the Scarborough water.
Hanlys,	Shropſhire in England.	Epſom, or other purging ſalt.	Purgative.
Harrowgate,	Yorkſhire in England.	Sulphur, ſea-ſalt, and ſome purging ſalt. Some chalybeate ſprings here alſo.	Alterative, purgative, and anthelmintic; uſeful in ſcurvy, ſcrofula, and cutaneous diſeaſes. Uſed externally for ſtrains and paralytic weakneſſes.
Hartfell,	Annandale in Scotland.	Green vitriol.	Aſtringent and corroborant. Uſeful in all kinds of inward diſcharges of blood.
Hartlepool,	Durham in England.	Sulphur, iron diſſolved by fixed air, with ſome purging ſalt.	Diuretic and laxative.
Holt,	Wiltſhire in England.	Purging ſalt, with a large quantity of aerated earth.	Mildly purgative. Uſeful in old ulcers and cutaneous diſorders.
Joſeph's well,	Stock Common near Cobham in Surry.	A very large proportion of Epſom ſalt, and poſſibly a little ſea-ſalt.	Alterative, purgative, and diuretic. Drank to about a quart, it paſſes briſkly without griping: taken in leſs doſes as an alterative, it is a good antiſcorbutic.
Ilmington,	Warwickſhire in England.	Aerated foſſile alkali, with ſome iron diſſolved by fixed air.	Diuretic and laxative.
Inglewhite,	Lancaſhire in England.	Sulphur, and iron diſſolved by fixed air.	Alterative. Uſeful in ſcorbutic and cutaneous diſeaſes.
Iſlington,	Near London.	Iron diſſolved by fixed air.	Corroborant. Uſeful in lowneſs of ſpirits and nervous diſeaſes. Operates by urine, and may be drank in large quantity.
Kanturk,	Cork in Ireland.	Similar to the water at Peterhead.	
Kedleſtone,	Derbyſhire in England.	Sulphur, ſea-ſalt, and aerated earth.	Similar to Harrowgate; but intolerably fetid.
Kenſington,	Near London.	Similar to Acton water.	
Kilbrew,	Meath in Ireland.	A large quantity of green vitriol.	Emetic and cathartic, in the doſe of half a pint.
Killburn,	Near London.	Fixed air, hepatic air, Epſom ſalt, Glauber's ſalt: muriated magneſia, ſea-ſalt, aerated earth, and iron.	
Killaſher,	Fermanagh in Ireland.	Sulphur and foſſile alkali.	Similar to Swadlingbar water.
Killingſhanvally,	Fermanagh, Ireland	Smilar to Hanly's chalybeate water.	

Kilroot

Names of Springs.	Countries in which they are found.	Contents and Quality of the Water.	Medicinal Virtues.
Kilroot,	Antrim in Ireland.	Nature of Barrowdale water, but weaker.	
Kinalton,	Nottinghamſhire in England.	A purging ſalt.	Purgative.
Kincardine,	Merns in Scotland.	Similar to the water of Peterhead.	
Kingſcliff,	Northamptonſhire in England.	Similar to Cheltenham waters.	
Kirby,	Weſtmoreland in England.	Iron, fixed air, and probably ſome foſſile alkali.	Laxative, and uſeful in correcting acidities.
Knareſborough,	See *Dropping-well.*		
Knowſley,	Lancaſhire in England.	Similar to Scarborough water.	
Kuka,	Bohemia.	Aerated fixed alkali.	Operates by inſenſible perſpiration ſometimes by ſpitting, ſweat, or urine.
Lancaſter,	England,	Similar to Tunbridge water.	
Latham,	Lancaſhire in England.	Similar to the former.	
Llandrindod,	Radnor in South Wales.	Three ſprings; a purgative, a ſulphureous, and chalybeate.	Uſeful in the ſcurvy, leproſy, cutaneous diſorders, &c.
Llangybi,	Caernarvonſhire in North Wales.		Uſeful in diſorders of the eyes, ſcrofula, &c.
Leamington,	Warwickſhire in England.	Sea-ſalt and aerated calcareous earth.	Emetic and cathartic. Uſeful in old ſores, and cures mangy dogs.
Leez,	Eſſex in England.	Similar to Iſlington water.	
Lincomb,	Somerſetſhire in England.	Aerated iron, foſſile alkali, and a Little Epſom ſalt.	
Liſbeak,	Fermanagh in Ireland.	Sulphur, &c.	Similar to Swadlingbar water.
Lis-done-Vurna,	Clare in Ireland.	Foſſile alkali, with much iron.	Emetic, cathartic, and diuretic.
Loanſbury,	Yorkſhire in England.	Sulphur, and ſome purging ſalt.	Uſed only for waſhing mangy dogs and ſcabby horſes.
Maccroomp,	Cork in Ireland.	Similar to Ilmington water.	
Mahereberg,	Kerry in Ireland.	Similar to Barrowdale water.	
Mallow,	Cork in Ireland.	A hot water, ſimilar to that of Briſtol.	
Malton,	Yorkſhire in England.	Iron and fixed air in conſiderable quantity.	Similar to Scarborough water, but is ſometimes apt to vomit.
Malvern,	Glouceſterſhire in England.	Iron. Two ſprings.	Diuretic and cathartic; uſed alſo externally. Recommended as excellent in diſeaſes of the ſkin; in leproſies, ſcorbutic complaints, ſcrofula, old ſores, &c. Alſo ſerviceable in inflammations and other diſeaſes of the eyes; in the gout and ſtone, in bilious and paralytic caſes, and in female obſtructions. The external uſe is by waſhing the part at the ſpout ſeveral times a-day, and afterwards covering it with cloths dipt in the water and kept conſtantly moiſt; alſo by general bathing.
Markſhall,	Eſſex in England.	Similar to Iſlington.	
Matlock,	Derbyſhire in England.	Warm ſprings, of the nature of the Briſtol water, except that they are very ſlightly impregnated with iron, but contain a great quantity of aerated earth. They are colder than the Buxton; but their virtues ſimilar to thoſe of the two places mentioned.	

Names of Springs.	Countries in which they are found.	Contents and Quality of the Water.	Medicinal Virtues.
Maudfley,	Lancafhire in England.	Sulphur and fea-falt.	Similar to Harrowgate.
Mechan	Fermanagh in Ireland.	Sulphur and foffile alkali.	Similar to the waters of Drumgoon.
Miller's Spaw,	Lancafhire in England.	Similar to Tunbridge.	
Moffat,	Annandale in Scotland.	Sulphur, fea-falt, and earth.	Alterant, diuretic, and fometimes purgative. Is ufed as a bath, and the fteam of the hot water has been found ferviceable in relaxing hard tumors and ftiff joints.
Mofs-houfe.	Lancafhire in England.	Similar to Iflington water.	Purges ftrongly.
Moreton,	Shropfhire in England.	Similar to Holt water.	
Mount D'Or,	France.	Warm, and fimilar to the waters of Aix-la-Chapelle.	Diuretic, purgative, and diaphoretic.
Nevil-Holt,	Leicefterfhire in England.	Selenite or aerated earth, and Epfom falt.	Purgative, diuretic, and diaphoretic.—Powerfully antifeptic in putrid difeafes, and excellent in diarrhœa, dyfenteries, &c.
New Cartmall,	Lancafhire in England.	Sea-falt and aerated earth.	Purgative.
Newham Regis,	Warwickfhire in England.	Similar to Scarborough water.	
Newtondale,	Yorkfhire in England.	Aerated calcareous earth or magnefia.	Aftringent or tonic.
Newton-Stewart,	Tyrone in Ireland.	Similar to Tunbridge.	
Nezdenice,	Germany.	Fixed air, foffile alkali, iron, and earth.	Diuretic, diaphoretic, and tonic.
Nobber,	Meath in Ireland.	Martial vitriol.	Similar to Hartfell.
Normanby,	Yorkfhire in England.	Sulphur, much fixed air, fome fea-falt, and Epfom falt.	Similar to Afkeron water.
Nottington,	Dorfetfhire, England.	Sulphur, foffile alkali, and earth.	Ufeful in cutaneous difeafes.
Orfton,	Nottingham, England.	Much fixed air, Epfom falt, and a little fea-falt, with fome iron.	Purgative.—It intoxicates by reafon of the great quantity of air contained in it.
Oulton,	Norfolk, England.	Similar to Iflington.	
Owen Breun,	Cavan, Ireland.	Sulphur, Epfom falt, and foffile alkali.	Similar to Afkeron water.
Pancras,	Near London.	Epfom falt, and aerated earth.	Diuretic and purgative.
Paffy,	Near Paris.	Similar to Pyrmont water.	
Peterhead,	Aberdeen county, Scotland.	A ftrong chalybeate but of which no analyfis has been publifhed.	Similar to Iflington, but more powerful.
Pettigoe,	Donnegal, Ireland.	Sulphur and purging falt.	Similar to Afkeron water.
Pitkeathly,	Perthfhire, Scotland.	Sea-falt, a fmall quantity of muriated and likewife of aerated earth.	Gently purgative. Very ufeful in fcrofulous and fcorbutic habits.
Plombiers,	Lorraine, France.	Saline matter, probably foffile alkali, with a fmall portion of oil.— Warm.	Ufed as a bath, and for wafhing ulcers. Inwardly taken it cures complaints from acidity, hemorrhagies, &c.
Pontgibault,	Auvergne, France.	Foffile alkali and calcareous earth.	Diuretic and laxative.
Pougues,	Nivernois, France.	Calcareous earth, magnefia, foffile alkali, fea-falt, earth, of alum, and filiceous earth.	Diuretic and laxative.

Pyrmont,

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Pyrmont,	Weſtphalia, Germany.	Aerated iron, calcareous earth, magneſia, Epſom, ſalt, and common ſalt.	Diuretic, diaphoretic, and laxative. Recommended in caſes where the conſtitution is relaxed; in female complaints, in cutaneous diſeaſes, in nervous diſorders, in the gravel and urinary obſtructions; and conſidered as among the beſt reſtoratives in decayed and broken conſtitutions.
Queen Camel,	Somerſetſhire, England.	Sulphur, ſea-ſalt, foſſile alkali, calcareous earth, and bituminous oil.	Uſed in ſcrofulous and cutaneous diſorders.
Richmond,	Surry in England,	Similar to Acton water.	
Rippon,	Yorkſhire, England,	Sulphur, ſea-ſalt, and aerated earth.	Diaphoretic and alterant.
Road,	Wiltſhire, England.	Sulphur, iron, foſſile alkali, and fixed air.	Uſeful in ſcrofula, ſcurvy, and cutaneous diſorders.—Acts as a laxative.
St Bartholomew's well,	Cork in Ireland.	Foſſile alkali, iron, and fixed air.	Similar to Tilbury water.
St Bernard's well,	Near Edinburgh.	Sulphureous volatile acid and phlogiſton.	Somewhat congenial with Moffat and Harrowgate. In nervous and ſtomachic caſes, analeptic and reſtorative; in ſcorbutic, ſcrofulous, and moſt dropſical caſes, reckoned a ſpecific.
St Eraſmus's well,	Staffordſhire, England.		Similar to Barrowdale water.
Scarborough,	Yorkſhire, England.	Aerated calcareous earth, Epſom ſalt, ſea-ſalt, and iron.	Diuretic and purgative.
Scollienſis,	Switzerland.	Iron, foſſile alkali, and a great quantity of fixed air.	Excellent in cholic pains, both as a cure and preventative.
Sedlitz,	Bohemia.	Epſom ſalt.	Strongly purgative.
Seltzer,	Germany.	Calcareous earth, magneſia, foſſile alkali, and fixed air.	Diuretic. Uſeful in the gravel, rheumatiſm, ſcurvy, ſcrophula, &c.
Sene, or Send,	Wiltſhire, England.	Similar to Iſlington.	
Seydſchutz,	Germany.	Similar to Sedlitz.	
Shadwell,	Near London.	Green vitriol.	Emetic and cathartic.
Shapmoor,	Weſtmoreland, England.	Sulphur and purging ſalt.	Similar to Aſkeron water.
Shettlewood,	Derbyſhire, England.		Similar to Harrowgate water.
Shipton,	Yorkſhire, England.	Sulphur, ſea-ſalt, and purging ſalt.	Similar to Harrowgate.
Somerſham,	Huntingdonſhire, England.	Green vitriol, alum and fixed air.	Corroborant and alterative. Uſeful for waſhing foul ulcers and cancers.
Spaw,	Liege in Germany.	Foſſile alkali, iron, aerated earth, Epſom ſalt, and ſea-ſalt.	Diuretic and purgative. Serviceable in many diſorders. See the article SPAW.
Stanger,	Cumberland, England.	Green vitriol.	Emetic and cathartic.
Stenfield,	Lincolnſhire, England.	Similar to Orſton.	
Streatham,	Surry, England.	Aerated earth, Epſom ſalt, ſea-ſalt, and muriated magneſia.	Purgative.
Suchaloza,	Hungary.		Similar to Nezdenice.
Sutton-bog,	Oxfordſhire, England.	Sulpur, foſſile alkali, and ſea-ſalt.	Alterative and laxative.
Swadlingbar,	Cavan in Ireland.	Sulphur, earth, ſea-ſalt, and foſſile alkali.	Alterative and diaphoretic.
Swanſey,	Glamorganſhire in North Wales.	Green vitriol.	Similar to Shadwell.
Sydenham,	Kent in England.	Similar to Epſom, but weaker	

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Tarleton,	Lancashire in England.	Similar to Scarborough water.	
Tewksbury,	Gloucestershire in England.	Similar to Acton.	
Thetford,	Norfolk in England.	Fossile alkali, fixed air, and iron.	Purgative and diuretic.
Thornton,	Nottinghamshire in England.	Similar to Orston.	
Thursk,	Yorkshire in England.	Similar to Scarborough.	
Tibshelf,	Derbyshire in England.	Iron dissolved in fixed air.	Similar to Spaw water.
Tilbury,	Essex in England.	Fossile alkali.	Diuretic and diaphoretic.
Tober Bony,	Near Dublin in Ireland.	Fossile alkali, earth, and bituminous oil.	Similar to Tilbury.
Tonstein,	Cologne in Germany	Fossile alkali.	Similar to Seltzer, but more purgative
Tralee,	Kerry in Ireland.	Similar to Castle Connel.	
Tunbridge,	Kent in England.	Iron, some sea-salt, with a little selenites and calcareous earth.	An excellent chalybeate, useful in all diseases for which the Spaw is recommended.
Upminster,	Essex in England	Sulphur, fossile alkali, and purging salt.	Purgative and diuretic.
Vahls,	Dauphiny in France.	Fossile alkali.	Diuretic and laxative.
Wardrew,	Northumberland.	Sulphur, earth, and sea-salt.	Similar to Harrowgate water.
Weatherstack,	Westmoreland in England.	Iron, sea-salt, and a small quantity of hepatic gas.	Purgative.
Wallenfrow,	Northamptonshire in England.	Similar to Islington water.	
West Ashton,	Wiltshire in England.	Similar to Islington.	
Westwood,	Derbyshire in England.	Green vitriol.	Similar to Shadwell. Used for washing ulcers of the legs.
Wexford,	Ireland.	Similar to Islington.	
Whiteacre,	Lancashire in England.	Aerated iron and probably calcareous earth.	Somewhat astringent
Wigglesworth	Yorkshire in England.	Sulphur, earth, and common salt.	Emetic in the quantity of two quarts, and said to be cathartic in the quantity of three; a singular circumstance if true.
Wildungan,	Waldech in Germany.	Similar to the waters of Bath.	Useful in scorbutic and gouty diseases.
Witham,	Essex in England.	Aerated iron, and common salt.	Diuretic, alterative, and corroborant.
Wirksworth,	Derbyshire in England.	Sulphur, purging salt, and aerated iron.	Useful in scrofulous and cutaneous diseases.
Zahorovice,	Germany.	Similar to Nezdenice water.	Much esteemed in scrofulous cases.

MINEHEAD, a town of Somersetshire, 166 miles from London. It is an ancient borough, with a harbour in the Bristol channel, near Dunster castle, much frequented by passengers to and from Ireland. It was incorporated by Queen Elisabeth, with great privileges, on condition the corporation should keep the quay in repair; but its trade falling off, the quay was neglected, and they lost their privileges. A statute was obtained in the reign of King William, for recovering the port, and keeping it in repair, by which they were to have the profits of the quay and pier for 36 years, which have been computed at about 200 l. a year; and they were at the expence of new-building the quay. In pursuance of another act, confirming the former, a new head has been built to the quay, the beach cleared, &c. so that the biggest ship may enter, and ride safe in the harbour. The town contains about 500 houses, and 2000 souls. It was formerly governed by a portreve, and now by two constables chosen yearly at a court-leet held by the lord of the manor. Its chief trade is with Ireland, from whence about 40 vessels used to come hither in a year with wool; and about 4000 chaldrons of coals are yearly imported at this place. Watchet and Poriock, from South Wales, which lies directly opposite to it, about seven leagues over, the common breadth of this channel all the way from Holmes to the Land's End. Here are several rich merchants, who have some trade also to Virginia and the West Indies; and they correspond much with the merchants of Barnestaple and Bristol in their foreign commerce. Three or four thousand barrels of herrings, which come up the Severn in great shoals about Michaelmas, are caught, cured, and shipped off here every year, for the Mediterranean, &c. The market here is on Wednesday, and fair on Whitsun-Wednesday.

MINERALOGY.

IS that ſcience which teaches us the properties of mineral bodies, and by which we learn how to characteriſe, diſtinguiſh, and claſs them into a proper order.

INTRODUCTION.

Mineralogy ſeems to have been in a manner coeval with the world. Precious ſtones of various kinds appear to have been well known among the Jews and Egyptians in the time of Moſes; and even the moſt rude and barbarous nations appear to have had ſome knowledge of the ores of different metals. As the ſcience is nearly allied to chemiſtry, it is probable that the improvements both in chemiſtry and mineralogy have nearly kept pace with each other; and indeed it is but of late, ſince the principles of chemiſtry were well underſtood, that mineralogy has been advanced to any degree of perfection. The beſt way of ſtudying mineralogy, therefore, is by applying chemiſtry to it; and not contenting ourſelves merely with inſpecting the outſides of bodies, but decompounding them according to the rules of chemiſtry. This method has been brought to the greateſt perfection by Mr Pott of Berlin, and after him by Mr Cronſtedt of Sweden. To obtain this end, chemical experiments in the large way are without doubt neceſſary: but as a great deal of the mineral kingdom has already been examined in this manner, we do not need to repeat all thoſe experiments in their whole extent, unleſs ſome new and particular phenomena ſhould diſcover themſelves in thoſe things we are examining; elſe the tediouſneſs of thoſe proceſſes might diſcourage ſome from going farther, and take up much of the time of others that might be better employed. An eaſier way may therefore be adopted, which even for the moſt part is ſufficient, and which, though made in miniature, is as ſcientifical as the common manner of proceeding in the laboratories, ſince it imitates that, and is founded upon the ſame principles. This conſiſts in making the experiments upon a piece of charcoal with the concentrated flame of a candle directed through a blow-pipe. The heat occaſioned by this is very intenſe; and the mineral bodies may here be burnt, calcined, melted and ſcorified, &c. as well as in any great works.

For a deſcription of the blow-pipe, the method of uſing it, the proper fluxes to be employed, and the different ſubjects of examination to which that inſtrument is adapted, ſee the article *Blow-pipe*, where all thoſe particulars are conciſely detailed. It may not be improper here, however, to reſume thoſe details at greater length; avoiding, at the ſame time, all unneceſſary repetitions. After which we ſhall exhibit a ſcientific arrangement of the mineral kingdom according to the moſt approved ſyſtem.

Part I. EXPERIMENTAL MINERALOGY; with a Description of the Necessary Apparatus (a).

Sect. I. *Of experiments upon Earths amd Stones.*

When any of theſe ſubſtances are to be tried, we muſt not begin immediately with the blow-pipe; but ſome preliminary experiments ought to go before, by which thoſe in the fire may afterwards be directed. For inſtance, a ſtone is not always homogenous, or of the ſame kind throughout, although it may appear to the eye to be ſo. A magnifying glaſs is therefore neceſſary to diſcover the heterogeneous particles, if there be any; and theſe ought to be ſeparated, and every part tried by itſelf, that the effects of two different things, examined together, may not be attributed to one alone. This might happen with ſome of the finer micæ, which are now and then found mixed with ſmall particles of quartz, ſcarcely to be perceived by the eye The trapp (in German *ſchwartzſtein*) is alſo ſometimes mixed with very fine particles of feltſpar (*ſpatam ſcintillans*) or of calcareous ſpar, &c. After this experiment, the hardneſs of the ſtone in queſtion muſt be tried with ſteel. The flint and garnets are commonly known to ſtrike fire with ſteel; but there are alſo other ſtones, which, though very ſeldom, are found ſo hard as likewiſe to ſtrike fire. There is a kind of trapp of that hardneſs, in which no particles of feltſpar are to be ſeen. Coloured glaſſes reſemble true gems; but as they are very ſoft in proportion to theſe, they are eaſily diſcovered by means of the file. The common quartz-cryſtals are harder than coloured glaſſes, but ſofter than the gems. The loadſtone diſcovers the preſence of iron, when it is not mixed in too ſmall a quantity in the ſtone, and often before the ſtone is roaſted. Some kinds of hæmatites, and particularly the cœruleſcens, greatly reſemble ſome other iron ores; but this diſtinguiſhes itſelf from them by a red colour when pounded, the others giving a blackiſh powder, and ſo forth.

The management of the *Blow-pipe* has been deſcribed under that article; but a few particulars may be here recapitulated, or added.

The candle ought to be ſnuffed often, but ſo that the top of the wick may retain ſome fat in it, becauſe the flame is not hot enough when the wick is almoſt burnt to aſhes; but only the top muſt be ſnuffed off, becauſe a low wick gives too ſmall a flame. The blue flame is the hotteſt; this ought, therefore, to be forced

(a) From Engeſtrom's *Treatiſe on the Blow-Pipe*, and Magellan's *Deſcription of Pocket-Laboratories*, &c. ſubjoined to the Engliſh Tranſlation of *Cronſtedt's Mineralogy*, 2d edit. in 2 vols. Dilly.

forced out when a great heat is required, and only the point of the flame muſt be directed upon the ſubject which is to be eſſayed. M. Magellan recommends, as being moſt cleanly and convenient, that the candle be made of wax, and the wick ſhould be thicker than ordinary. Its upper end muſt be bended towards the matter intended to be heated, and the ſtream of air muſt be directed along the ſurface of the bended part, ſo as not abſolutely to touch it.

The piece of charcoal made uſe of in theſe experiments muſt not be of a diſpoſition to crack. If this ſhould happen, it muſt gradually be heated until it does not crack any more, before any aſſay is made upon it. If this be not attended to, but the aſſay made immediately with a ſtrong flame, ſmall pieces of it will ſplit off in the face and eyes of the aſſayer, and often throw along with them the matter that was to be aſſayed. Charcoal which is too much burnt conſumes too quick during the experiment, leaving ſmall holes in it, wherein the matter to be tried may be loſt; and charcoal that is burnt too little, catches flame from the candle, burning by itſelf like a piece of wood, which likewiſe hinders the proceſs.

Of thoſe things that are to be aſſayed, only a ſmall piece muſt be broken off for that purpoſe, not bigger than that the flame of the candle may be able to act upon it at once, if required; which is ſometimes neceſſary, as, when the matter requires to be made red hot throughout, the piece ought to be broken as thin as poſſible, at leaſt the edges; the advantage of which is obvious, the fire having then more influence upon the ſubject, and the experiment being more quickly made.

Some of the mineral bodies are very difficult to be kept ſteady upon the charcoal during the experiment, before they are made red hot; becauſe, as ſoon as the flame begins to act upon them, they ſplit aſunder with violence, and are diſperſed. Such often are thoſe which are of a ſoft conſiſtence or a particular figure, and which preſerve the ſame figure in however minute particles they are broken; for inſtance, the calcareous ſpar, the ſparry gypſum, ſparry fluor, white ſparry lead-ore, the potters ore, the teſſellated mock-lead or blende, &c. even all the common fluors which have no determinate figure. Theſe not being ſo compact as common hard ſtones, when the flame is immediately urged upon them, the heat forces itſelf through and into their clefts or pores, and cauſes this violent expanſion and diſperſion. Many of the clays are likewiſe apt to crack in the fire, which may be for the moſt part aſcribed to the humidity, of which they always retain a portion.

The only way of preventing this inconvenience is to heat the body as ſlowly as poſſible. It is beſt, firſt of all, to heat that place of the charcoal where the piece is intended to be put on; and afterwards lay it thereon; a little crackling will then enſue, but commonly of no great conſequence. After that the flame is to be blown very ſlowly towards it, in the beginning not directly upon, but ſomewhat above it, and ſo approaching nearer and nearer with the flame until it become red hot. This will do for the moſt part; but there are nevertheleſs ſome, which, notwithſtanding all the precautions, it is almoſt impoſſible to keep on the charcoal. Thus the fluors are generally the moſt difficult; and as one of their principal characters is diſcovered by their effects in the fire *per ſe*, they ought neceſſarily to be tried that way. To this purpoſe, it is beſt to make a little hole in the charcoal to put the fluor in, and then to put another piece of charcoal as a covering upon this, leaving only a ſmall opening for the flame to enter. As this ſtone will nevertheleſs ſplit and fly about, a larger piece thereof than is before-mentioned muſt be taken, in order to have at leaſt ſomething of it left.

But if the experiment is to be made upon a ſtone whoſe effects one does not want to ſee in the fire *per ſe*, but rather with fluxes, then a piece of it ought to be forced down into melted borax, when always ſome part of it will remain in the borax, notwithſtanding the greateſt part may ſometimes fly away by cracking.

1. *Of ſubſtances to be tried in the fire* per ſe. As the ſtones undergo great alterations when expoſed to the fire by themſelves, whereby ſome of their characteriſticks, and often the moſt principal, are diſcovered, they ought firſt to be tried that way, obſerving what has been ſaid before concerning the quantity of matter, direction of the fire, &c. The following are generally the reſults of this experiment.

Calcareous earth or *ſtone*, when it is pure, does not melt by itſelf, but becomes white and friable, ſo as to break freely between the fingers; and, if ſuffered to cool, and then mixed with water, it becomes hot, juſt like common quick-lime. As in theſe experiments only very ſmall pieces are uſed, this laſt effect is beſt diſcovered by putting the proof on the outſide of the hand, with a drop of water to it, when inſtantly a very quick heat is felt on the ſkin. When the calcareous ſubſtance is mixed with the vitriolic acid, as in gypſum, or with a clay, as in marle, it commonly melts by itſelf, yet, more or leſs difficultly in proportion to the differences of the mixtures. Gypſum produces generally a white, and marle a grey, glaſs or ſlag. When there is any iron in it, as a white iron ore, it becomes dark, and ſometimes quite black, &c.

The *ſiliciæ* never melt alone, but become generally more brittle after being burnt. Such of them as are coloured become colourleſs, and the ſooner when it does not ariſe from any contained metal; for inſtance, the topazes, amethiſts, &c. ſome of the precious ſtones, however, excepted: And ſuch as are mixed with a quantity of iron grow dark in the fire, as ſome of the jaſpers, &c.

Garnets melt always into a black ſlag, and ſometimes ſo eaſily that they may be brought into a round globule upon the charcoal.

The *argillaceæ*, when pure, never melt, but become white and hard. The ſame effects follow when they are mixed with phlogiſton. Thus the ſoap-rock is eaſily cut with the knife; but being burnt it cuts glaſs, and would ſtrike fire with the ſteel, if as large a piece as is neceſſary for that purpoſe could be tried in this way. The ſoap-rocks are ſometimes found of a dark brown and nearly black colour, but nevertheleſs become quite white in the fire like a piece of China ware. However, care muſt be taken not to urge the flame from the top of the wick, there being for the moſt part a ſooty ſmoke, which commonly will darken all that it touches; and if this is not obſerved, a miſtake in the experiment might eaſily happen. But if it

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it is mixed with iron, as it is sometimes found, it does not so easily part with its dark colour. The argillaceæ when mixed with lime melt by themselves, as above-mentioned. When mixed with iron, as in the boles, they grow dark or black; and if the iron is not in too great a quantity, they melt alone into a dark slag; the same happens when they are mixed with iron and a little of the vitriolic acid, as in the common clay, &c.

Mica and *asbestos* become somewhat hard and brittle in the fire, and are more or less refractory, though they give some marks of fusibility.

The *fluors* discover one of their chief characteristics by giving a light like phosphorus in the dark, when they are slowly heated; but lose this property, as well as their colour, as soon as they are made red hot.—They commonly melt in the fire into a white opaque slag, though some of them not very easily.

Some sorts of the *zeolites* melt easily, and foam in the fire, sometimes nearly as much as borax, and become a frothy slag, &c.

A great many of those mineral bodies which are impregnated with iron, as the *boles*, and some of the white iron ores, &c. as well as some of the other iron ores, viz. the bloodstone, are not attracted by the loadstone before they have been thoroughly roasted, &c.

2. *Of substances heated with fluxes.* After the mineral bodies have been tried in the fire by themselves, they ought to be heated with fluxes to discover if they can be melted or not, and some other phenomena attending this operation. For this purpose, three different kinds of salts are used as fluxes, viz. sal sodæ, borax, and sal fusible microsmicum; (see the article *Blow-Pipe*).

The *sal sodæ* is, however, not much used in these small experiments, its effects upon the charcoal rendering it for the most part unfit for it; because, as soon as the flame begins to act upon it, it melts instantly, and is almost wholly absorbed by the charcoal. When this salt is employed to make any experiment, a very little quantity is wanted at once, viz. about the cubical contents of an eighth part of an inch, more or less. This is laid upon the charcoal, and the flame blown on it with the blow-pipe; but as this salt commonly is in form of a powder, it is necessary to go on very gently, that the force of the flame may not disperse the minute particles of the salt. As soon as it begins to melt, it runs along on the charcoal, almost like melted tallow; and when cold, it is a glassy matter of an opaque dull colour spread on the coal. The moment it is melted, the matter which is to be tried ought to be put into it, because otherwise the greatest part of the salt will be soaked into the charcoal, and too little of it left for the intended purpose. The flame ought then to be directed on the matter itself; and if the salt spreads too much about, leaving the proof almost alone, it may be brought to it again by blowing the flame on its extremities, and directing it towards the subject of the experiment. In the assays made with this salt, it is true, we may find whether the mineral bodies which are melted with it have been dissolved by it or not: but we cannot tell with any certitude whether this is done hastily and with force, or gently and slow; nor whether a less or a greater part of the matter has been dissolved: neither can it be well distinguished if the matter has imparted any weak tincture to the slag; because this salt always bubbles upon the charcoal during the experiment, nor is it clear when cool; so that scarcely any colour, except it be a very deep one, can be discovered, although it may sometimes be coloured by the matter that has been tried.

The following earths are entirely *soluble* in this flux with effervescence: Agate; chalcedony; carnelian; Turkey stone †, *(cos Turcica)*; fluor mineralis †; onyx; opal; quartz; common flint; ponderous spar. The following are *divisible* in it with or without effervescence, but not entirely soluble: Amianthus; asbestus; basaltes; chrysolite ‡; granate ‡; hornblende; jasper; marlstone; mica; the mineral of alum from Tolfa; petrosilex; aluminous slate and roof slate from Helsingia; emeralds; steatites; common flint; schoerl; talc; trapp; tripoli; tourmalin. And the following are neither fusible nor divisible in it: Diamond; hyacinth; ruby; sapphire; topaz.

The other two salts, viz. *borax* and the *sal microcosmicum*, are very well adapted to these experiments, because they may by the flame be brought to a clear uncoloured and transparent glass; and as they have no attraction to the charcoal, they keep themselves always upon it in a round globular form. The sal fusible microcosmicum § is very scarce, and perhaps not to be met with in the shops; it is made of urine.

§ See Chemistry, n° 905, 906.

The following earths are soluble in borax, with more or less *effervescence*: Fluor mineralis †; marle; mica †; the mineral of alum from Tolfa; aluminous slate, and roof-slate from Helsingia †; ponderous spar; schoerl; talc †; tourmalin. And the following *without* effervescence; Agate; diamond; amianthus; asbestus; basaltes; chalcedony; carnelian; chrysolite; cos turcica; granate; hyacinth *; jasper; lapis ponderosus; onyx; opal; petro-silex; quartz *; ruby; sapphire; common flint *; steatite; trapp; trippel, or tripoli; topaz; zeolite; hydrophanes.

In the microcosmic salt, the following are soluble with more or less effervescence: Basaltes †; turkey stone ‡; fluor mineralis †; marle; mica; the mineral of alum from Tolfa; schistus aluminaris, schistus tegulalis from Helsingia †; schoerl; spathum ponderosum; tourmalin †; lapis ponderosus. And the following without visible effervescence: Agate; diamond; amianthus; asbestus; chalcedony; carnelian; chrysolite; granate; hyacinth; jasper; onyx ||; opal; petrosilex; quartz ||; ruby; sapphire; common flint ||; emerald; talc; topaz; trapp; trippel; zeolite; hornblend; hydrophanes; lithomarga; steatites.

Calcareous earth; ponderous spar, gypsum, and other additaments, often assist the solution, as well in the microcosmic salt as in borax. To which it is necessary to add, that in order to observe the effervescence properly, the matter added to the flux should be in the form of a small particle rather than in fine powder; because in this last there is always air between the particles, which being afterwards driven off by the heat afford the appearance of a kind of effervescence (A).

The

(A) In the above lists, the articles marked † effervesce very little; those marked ‡ not at all; those marked * require a larger quantity of the flux and a longer continuance of heat than the rest; those marked || are more difficultly dissolved than the others.

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The quantity of thoſe two ſalts required for an experiment is almoſt the ſame as the *ſal ſodæ*; but as the former are cryſtalliſed, and conſequently include a great deal of water, particularly the borax, their bulk is conſiderably reduced when melted, and therefore a little more of them may be taken than the before mentioned quantity.

Both thoſe ſalts, eſpecially the borax, when expoſed to the flame of the blow-pipe, bubble very much and foam before they melt to a clear glaſs, which for the moſt part depends on the water they contain. And as this would hinder the aſſayer from making due obſervations on the phenomena of the experiment, the ſalt which is to be uſed muſt firſt be brought to a clear glaſs before it can ſerve as a flux; it muſt therefore be kept in the fire until it become ſo tranſparent that the cracks in the charcoal may be ſeen through it. This done, whatſoever is to be tried is put to it, and the fire continued.

Here it is to be obſerved, that for the aſſays made with any of theſe two fluxes on mineral bodies may larger pieces muſt be taken that altogether they, no keep a globular form upon the charcoal; becauſe it may then be better diſtinguiſhed in what manner the flux acts upon the matter during the experiment. If this be not obſerved, the flux, communicating itſelf with every point of the ſurface of the mineral body, ſpreads all over it, and keeps the form of this laſt, which commonly is flat, and by that means hinders the operator obſerving all the phenomena which may happen. Beſides, the flux being in too ſmall a quantity in proportion to the body to be tried, will be too weak to act with all its force upon it. The beſt proportion therefore is about a third part of the mineral body to the flux; and as the quantity of the flux abovementioned makes a globe of a due ſize in regard to the greateſt heat that is poſſible to procure in theſe experiments, ſo the ſize of the mineral body muſt be a third part leſs here than when it is to be tried in the fire by itſelf.

The *ſal ſodæ*, as has been already obſerved, is not of much uſe in theſe experiments; nor has it any particular qualities in preference to the two laſt mentioned ſalts, except that it diſſolves the zeolites eaſier than they do.

The microcoſmic ſalt ſhows almoſt the ſame effects in the fire as the borax, only differing from it in a very few circumſtances; of which one of the principal is, that, when melted with mangancſe, it becomes of a crimſon hue inſtead of a jacinth colour, which borax takes. This ſalt is, however, for its ſcarcity ſtill very little in uſe, borax alone being that which is commonly employed. Whenever a mineral body is melted with any of theſe two laſt mentioned ſalts, in the manner already deſcribed, it is eaſily ſeen, Whether it quickly diſſolves; in which caſe an effervescence ariſes, that laſts till the whole be diſſolved: Whether the ſolution be ſlowly performed; in which caſe few and ſmall bubbles only riſe from the matter: or, Whether it can be diſſolved at all; becauſe if not, it is obſerved only to turn round in the flux, without the leaſt bubble, and the edges look as ſharp as they were before.

In order farther to illuſtrate what has been ſaid about theſe experiments, we ſhall give a few examples of the effects of borax upon the mineral bodies.—The *calcareous* ſubſtances, and all thoſe ſtones which contain any thing of lime in their compoſition, diſſolve readily and with effervescence in the borax. The effervescence is the more violent the greater the portion of lime contained in the ſtone. This cauſe, however, is not the only one in the gypſum, becauſe both the conſtituents of this do readily mix with the borax, and therefore a greater effervescence ariſes in melting gypſum with the borax than lime alone.—The *ſiliceæ* do not diſſolve; ſome few excepted which contain a quantity of iron.—The *argillaceæ*, when pure, are not acted upon by the borax: but when they are mixed with ſome heterogeneous bodies, they are diſſolved, though very ſlowly; ſuch are, for inſtance, the ſtone-marrow, the common clay, &c.

The *granates*, *zeolites*, and *trapp*, diſſolve but ſlowly. The *fluors*, *aſbeſtinæ*, and *micaceæ*, diſſolve for the moſt part very eaſily; and ſo forth.—Some of theſe bodies melt to a colourleſs tranſparent glaſs with the borax; for inſtance, the calcareous ſubſtances when pure, the fluors, ſome of the zeolites, &c. Others tinge the borax with a green tranſparent colour, *viz.* the granates, trapp, ſome of the argillaceæ, and ſome of the micaceæ and aſbeſtinæ. This green has its origin partly from a ſmall portion of iron which the granates particularly contain, and partly from phlogiſton.

Borax can only diſſolve a certain quantity of the mineral body proportional to its own. Of the calcareous kind it diſſolves a vaſt quantity; but turns at laſt, when too much has been added, from a clear tranſparent to a white opaque ſlag. When the quantity of the calcareous matter exceeds but little in proportion, the glaſs looks very clear as long as it remains hot: but as ſoon as it begins to cool, a white half opaque cloud is ſeen to ariſe from the bottom, which ſpreads over the third, half, or more of the glaſs globe, in proportion to the quantity of calcareous matter; but the glaſs or ſlag is nevertheleſs ſhining, and of a glaſſy texture when broken. If more of this matter be added, the cloud riſes quicker and is more opaque, and ſo by degrees till the ſlag becomes quite milk white. It is then no more of a ſhining, but rather dry appearance, on the ſurface; is very brittle, and of a grained texture when broken.

Sect. II. *Of Experiments upon Metals and Ores.*

What has been hitherto ſaid relates only to the *ſtones* and *earths*: We ſhall now proceed to deſcribe the manner of examining *metals* and *ores*. An exact knowledge and nicety of procedure are ſo much the more neceſſary here, as the metals are often ſo diſguiſed in their ores, as to be very difficultly known by their external appearance, and liable ſometimes to be miſtaken one for the other: Some of the cobalt ores, for inſtance, reſemble much the *pyrites arſenicalis*; there are alſo ſome iron and lead ores, which are nearly like one another, &c.

As the ores generally conſiſt of metals mineraliſed with ſulphur or arſenic, or ſometimes both together, they ought firſt to be expoſed to the fire by themſelves, in order not only to determine with which of theſe they are mineraliſed, but alſo to ſet them free from thoſe volatile mineraliſing bodies: This ſerves inſtead of calcination, by which they are prepared for further aſſays.

Here

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Here it muſt be repeated, that whenever any metal or fuſible ore is to be tried, a little concavity muſt be made in that place of the charcoal where the matter is to be put; becauſe, as ſoon as it is melted, it forms itſelf into a globular figure, and might then roll from the charcoal, if its ſurface was plain; but when borax is put to it, this inconvenience is not ſo much to be feared.

Whenever an ore is to be tried, a ſmall bit being broke off for the purpoſe, it is laid upon the charcoal, and the flame blown on it ſlowly. Then the ſulphur or arſenic begins to part from it in form of ſmoke: theſe are eaſily diſtinguiſhed from one another by their ſmell; that of ſulphur being ſufficiently known, and the arſenic ſmelling like garlick. The flame ought to be blown very gently as long as any ſmoke is ſeen to part from the ore; but after that, the heat muſt be augmented by degrees, in order to make the calcination as perfect as poſſible. If the heat be applied very ſtrongly from the beginning upon an ore that contains much ſulphur or arſenic, the ore will preſently melt, and yet loſe very little of its mineraliſing bodies, by that means rendering the calcination very imperfect. It is, however, impoſſible to calcine the ores in this manner to the utmoſt perfection, which is eaſily ſeen in the following inſtance, *viz.* in melting down a calcined potter's ore with borax, it will be found to bubble upon the coal, which depends on the ſulphur which is ſtill left, the vitriolic acid of this uniting with the borax, and cauſing this motion. However, lead in its metallic form, melted in this manner, bubbles upon the charcoal, if any ſulphur remains in it. But as the lead as well as ſome of the other metals, may raiſe bubbles upon the charcoal, although they are quite free from the ſulphur, only by the flames being forced too violently on it, theſe phenomena ought not to be confounded with each other.

The ores being thus calcined, the metals contained in them may be diſcovered, either by being melted alone or with fluxes; when they ſhow themſelves either in their pure metallic ſtate, or by tinging the ſlag with a colour peculiar to each of them. In theſe experiments it is not to be expected that the quantity of metal contained in the ore ſhould be exactly determined; this muſt be done in larger laboratories. This cannot, however, be looked upon as any defect, ſince it is ſufficient for a mineralogiſt only to find out what ſort of metal is contained in the ore. There is another circumſtance, which is a more real defect in the miniature laboratories, which is, that ſome ores are not at all capable of being tried by ſo ſmall an apparatus; for inſtance, the gold ore called *pyrites aureus*, which conſiſts of gold, iron, and ſulphur. The greateſt quantity of gold which this ore contains is about one ounce, or one ounce and an half, out of 100 pounds of the ore, the reſt being iron and ſulphur: and as only a very ſmall bit is allowed for theſe experiments, the gold contained therein can hardly be diſcerned by the eye, even if it could be extracted; but it goes along with the iron in the ſlag, this laſt metal being in ſo large a quantity in proportion to the other, and both of them having an attraction for each other.

The blendes and black-jacks, which are mineral zinc ores, containing zinc, ſulphur, and iron, cannot be tried this way, becauſe they cannot be perfectly calcined, and beſides the zinc flies off when the iron ſcorifies. Neither can thoſe blendes, which contain ſilver or gold mineraliſed with them, be tried in this manner, which is particularly owing to the imperfect calcination. Nor are the quickſilver ores fit for theſe experiments: the volatility of that ſemimetal making it impoſſible to bring it out of the poorer ſort of ores: and the rich ores, which ſweat out the quickſilver when kept cloſe in the hand, not wanting any of theſe aſſays, &c. Theſe ores ought to be aſſayed in larger quantities, and even with ſuch other methods as cannot be applied upon a piece of charcoal.

Some of the rich ſilver ores are eaſily tried: for inſtance, *minera argenti vitrea*, commonly called *ſilver-glaſs*, which conſiſts only of ſilver and ſulphur. When this ore is expoſed to the flame, it melts inſtantly, and the ſulphur goes away in fume, leaving the ſilver pure upon the charcoal in a globular form. If this ſilver ſhould happen to be of a dirty appearance, which often is the caſe, then it muſt be melted anew with a very little borax; and after it has been kept in fuſion for a minute or two, ſo as to be perfectly melted and red-hot, the proof is ſuffered to cool: it may then be taken off the coal; and being laid upon the ſteel-plate †, the ſilver is ſeparated from the ſlag by one or two ſtrokes of the hammer †. Here the uſe of the braſs ring† is manifeſt; for this ought firſt to be placed upon the plate, to hinder the proof from flying off by the violence of the ſtroke, which otherwiſe would happen. The ſilver is then found incloſed in the ſlag of a globular form, and quite ſhining, as if it was poliſhed. When a large quantity of ſilver is contained in a lead ore, *viz.* in a potter's ore, it can likewiſe be diſcovered through the uſe of the blow-pipe, of which more will be mentioned hereafter.

† See the article Blow-Pipe and Plate XCIX.

Tin may be melted out of the pure tin ores in its metallic ſtate. Some of theſe ores melt very eaſily, and yield their metal in quantity, if only expoſed to the fire by themſelves: but others are more refractory; and as theſe melt very ſlowly, the tin, which ſweats out in form of very ſmall globules, is inſtantly burnt to aſhes before theſe globules have time to unite in order to compoſe a larger globe, which, might be ſeen by the eye, and not ſo ſoon deſtroyed by the fire; it is therefore neceſſary to add a little borax to theſe from the beginning, and then to blow the flame violently at the proof. The borax does here preſerve the metal from being too ſoon calcined, and even contributes to the readier collecting of the ſmall metalic particles, which ſoon are ſeen to form themſelves into a globule of metallic tin at the bottom of the whole maſs, neareſt to the charcoal. As ſoon as ſo much of the metallic tin is produced as is ſufficient to convince the operator of its preſence, the fire ought to be diſcontinued, though the whole of the ore be not yet melted; becauſe the whole of this kind of ore can be ſeldom or never reduced into metal by means of theſe experiments, a great proportion being always calcined: and if the fire is continued too long, perhaps even the metal already reduced may likewiſe be burnt to aſhes; for the tin is very ſoon deprived of its metallic ſtate by the fire.

Moſt part of the lead ores may be reduced to a metallic ſtate upon the charcoal. The *mineræ plumbi calciformes*, which are pure, are eaſily melted into lead; but

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but such of them as are mixed with an *ochra ferri*, or any kind of earth, as clay, lime, &c. yield very little of lead, and even nothing at all, if the heterogenea are combined in any large quantity: this happens even with the *minera plumbi calciformis arsenico mixta*. These therefore are not to be tried but in larger laboratories. However, every mineral body suspected to contain any metallic substance may be tried by the blow-pipe, so as to give sufficient proofs whether it contain any or not, by its effects being different from those of the stones or earths, &c.

The *mineræ plumbi mineralisatæ* leave the lead in a metallic form, if not too large a quantity of iron is mixed with it. For example, when a tessellated or steel-grained lead ore is exposed to the flame, its sulphur, and even the arsenic if there be any, begins to fume, and the ore itself immediately to melt into a globular form; the rest of the sulphur continues then to fly off, if the flame be blown slowly upon the mass; but, on the contrary, very little of the sulphur will go off, if the flame be forced violently on it: in this case, it rather happens that the lead itself crackles and dissipates, throwing about very minute metallic particles. The sulphur being driven out as much as possible, which is known by finding no sulphureous vapour in smelling at the proof, the whole is suffered to cool, and then a globule of metallic lead will be left upon the coal. If any iron is contained in the lead-ore, the lead, which is melted out of it, is not of a metallic shining, but rather of a black and uneven, surface: a little borax must in this case be melted with it, and as soon as no bubble is seen to rise any longer from the metal into the borax, the fire must be discontinued: when the mass is grown cold, the iron will be found scorified with the borax, and the lead left pure and of a shining colour.

Borax does not scorify the lead in these small experiments when it is pure: if the flame is forced with a violence on it, a bubbling will ensue, resembling that which is observed when borax dissolves a body melted with it; but when the fire ceases, the slag will be perfectly clear and transparent, and a quantity of very minute particles of lead will be seen spread about the borax, which have been torn off from the mass during the bubbling.

If such a lead ore is rich in silver, this last metal may likewise be discovered by this experiment; because as the lead is volatile, it may be forced off, and the silver remain. To effect this, the lead, which is melted out of the ore, must be kept in constant fusion with a slow heat, that it may be consumed. This end will be sooner obtained, and the lead part quicker, if during the fusion the wind through the blow-pipe be directed immediately, though not forcibly, upon the melted mass itself, until it begin to cool; at which time the fire must be directed on it again. The lead, which is already in a volatilising state, will by this artifice be driven out in form of a subtil smoke; and by thus continuing by turns to melt the mass, and then to blow off the lead, as has been said, until no smoke is any longer perceived, the silver will at last be obtained pure. The same observation holds good here also, which was made about the gold, that, as none but very little bits of ores can be employed in these experiments, it will be difficult to extract the silver out of a poor ore: for some part of it will fly off with the lead, and what might be left is too small to be discerned by the eye. The silver, which by this means is obtained, is easily distinguished from lead by the following external marks, *viz.* that it must be red-hot before it can be melted: it cools sooner than lead: it has a silver colour; that is to say, brighter and whiter than lead: and is harder under the hammer.

The *mineræ cupri calciformes* (at least some of them), when not mixed with too much stone or earth, are easily reduced to copper with any flux; if the copper is found not to have its natural bright colour, it must be melted with a little borax, which purifies it. Some of these ores do not all discover their metal if not immediately melted with borax; the heterogenea contained in them hindering the fusion before these are scorified by the flux.

The grey copper ores, which only consist of copper and sulphur, are tried almost in the same manner as abovementioned. Being exposed to the flame by themselves, they will be found instantly to melt, and part of their sulphur to go off. The copper may afterwards be obtained in two ways: the one, by keeping the proof in fusion for about a minute, and afterwards suffering it to cool; when it will be found to have a dark and uneven appearance externally, but which after being broken discovers the metallic copper of a globular form in its centre, surrounded with a regulus, which still contains some sulphur and a portion of the metal: the other, by being melted with borax, which last way sometimes makes the metal appear sooner.

The *mineræ cupri pyritaceæ*, containing copper, sulphur, and iron, may be tried with the blow-pipe if they are not too poor. In these experiments the ore ought to be calcined, and after that the iron scorified. For this purpose a bit of the ore must be exposed to a slow flame, that as much of the sulphur as possible may part from it before it is melted, because the ore commonly melts very soon, and then the sulphur is more difficultly driven off. After being melted, it must be kept in fusion with a strong fire for about a minute, that a great part of the iron may be calcined; and after that, some borax must be added, which scorifies the iron, and turns with it to a black slag. If the ore is very rich, metallic copper will be had in the slag after the scorification. If the ore be of a moderate richness, the copper will still retain a little sulphur, and sometimes iron: the product will therefore be brittle, and must with great caution be separated from the slag, that it may not break into pieces; and if this product is afterwards treated in the same manner as before said, in speaking of the grey copper-ores, the metal will soon be produced. But if the ore is poor, the product after the first scorification must be brought into fusion, and afterwards melted with some fresh borax, in order to calcine and scorify the remaining portion of iron; after which it may be treated as mentioned in the preceding paragraph. The copper will in this last case be found in a very small globule.

The copper is not very easily scorified with this apparatus, when it is melted together with borax, unless it has first been exposed to the fire by itself for a while in order to be calcined. When only a little of this metal is dissolved, it instantly tinges the slag of a reddish

dish brown colour, and mostly opaque; but as soon as this slag is kept in fusion for a little while, it becomes quite green and transparent: and thus the presence of the copper may be discovered by the colour, when it is concealed in heterogeneous bodies, so as not to be discovered by any other experiment.

If metallic copper is melted with borax by a slow fire, and only for a very little time, the glass or slag becomes of a fine transparent blue or violet colour, inclining more or less to the green: but this colour is not properly owing to the copper, but it may rather be to its phlogiston; because the same colour is to be had in the same manner from iron; and these glasses, which are coloured with either of those two metals, soon lose their colour if exposed to a strong fire, in which they become quite clear and colourless. Besides, if this glass, tinged blue with the copper, is again melted with more of this metal, it becomes of a good green colour, which for a long time keeps unchanged in the fire.

The iron ores, when pure, can never be melted *per se*, by the means of the blow-pipe alone; nor do they yield their metal when melted with fluxes; because they require too strong a heat to be brought into fusion; and as both the ore and the metal itself very soon lose their phlogiston in the fire, and cannot be supplied with a sufficient quantity from the charcoal, so likewise they are very soon calcined in the fire. This easy calcination is also the reason why the fluxes, for instance borax, readily scorify this ore, and even the metal itself. The iron loses its phlogiston in the fire sooner than the copper, and is therefore more easily scorified.

The iron is, however, discovered without much difficulty, although it were mixed but in a very small quantity with heterogeneous bodies. The ore, or those bodies which contain any large quantity of the metal, are all attracted by the loadstone, some without any previous calcination, and others without having being roasted. When a clay is mixed with a little iron, it commonly melts by itself in the fire; but if this metal is contained in a limestone; it does not promote the fusion, but gives the stone a dark and sometimes a deep black colour, which always is the character of iron. A *minera ferri calciformis pura crystallisata*, is commonly of a red colour: This being exposed to the flame, becomes quite black; and is then readily attracted by the loadstone, which it was not before. Besides these signs, the iron discovers itself, by tinging the slag of a green transparent colour, inclining to brown, when only a little of the metal is scorified; but as soon as any larger quantity thereof is dissolved in the slag, this becomes first a blackish brown, and afterwards quite black and opaque.

Bismuth is known by its communicating a yellowish brown colour to borax; and arsenic by its volatility and garlick smell. Antimony, both in form of regulus and ore, is wholly volatile in the fire when it is not mixed with any other metal except arsenic; and is known by its particular smell, easier to be distinguished when once known than described. When the ore of antimony is melted upon the charcoal, it bubbles constantly during its volatilising.

Zinc ores are not easily tried upon the coal; but the regulus of zinc exposed to the fire upon the charcoal burns with a beautiful blue flame, and forms itself almost instantly into white flowers, which are the common flowers of zinc.

Cobalt is particularly remarkable for giving to the glass a blue colour, which is the zaffre or smalt. To produce this, a piece of cobalt ore must be calcined in the fire, and afterwards melted with borax. As soon as the glass, during the fusion, from being clear, seems to grow opaque, it is a sign that it is already tinged a little; the fire is then to be discontinued, and the operator must take hold, with the nippers, of a little of the glass, whilst yet hot, and draw it out slowly in the beginning, but afterwards very quick, before it cools, whereby a thread of the coloured glass is procured, more or less thick, wherein the colour may easier be seen than in a globular form. This thread melts easily, if only put in the flame of the candle without the help of the blow-pipe.—If this glass be melted again with more of the cobalt, and kept in fusion for a while, the colour becomes very deep; and thus the colour may be altered at pleasure.

When the cobalt ore is pure, or at least contains but little iron, a cobalt regulus is almost instantly produced in the borax during the fusion; but when it is mixed with a quantity of iron, this last metal ought first to be separated, which is easily performed since it scorifies sooner than the cobalt; therefore, as long as the slag retains any brown or black colour, it must be separated, and melted again with fresh borax, until it shows the blue colour.

Nickel is very seldom to be had; and as its ores are seldom free from mixtures of other metals, it is very difficultly tried with the blow-pipe. However, when this semimetal is mixed with iron and cobalt, it is easily freed from these heterogeneous metals, and reduced to a pure nickel regulus by means of scorification with borax, because both the iron and cobalt sooner scorify than the nickel. The regulus of nickel itself is of a green colour when calcined: it requires a pretty strong fire before it melts, and tinges the borax with a hyacinth colour. Manganese gives the same colour to borax; but its other qualities are quite different, so as not to be confounded with the nickel.

By means of the foregoing explanations, and those given under the article *Blow-Pipe*, any gentleman, who is a lover of this science, will be able, in an easy manner, to amuse himself in discovering the properties of those works of nature, with which the mineral kingdom furnishes us; or more usefully to employ himself by finding out what sorts of stones, earths, ores, &c. there are on his estate, and to what economical purposes they may be employed. The scientific mineralist may, by examining into the properties and effects of the mineral bodies, discover the natural relation these bodies stand in to each other, and thereby furnish himself with materials for establishing a mineral system, founded on such principles as Nature herself has laid down in them; and this in his own study, without being forced to have recourse to great laboratories, crucibles, furnaces, &c. which is attended with much trouble, and is the reason why so few can have an opportunity of gratifying their desire of knowledge in this

Portable Apparatus.

this part of natural hiſtory. Farther improvements of this apparatus may ſtill be made by thoſe who chooſe to beſtow their attention upon it.

A great number of fluxes might, perhaps, be found out, whoſe effects might be different from thoſe already in uſe, whereby more diſtinct characters of thoſe mineral bodies might be diſcovered, which now either ſhow ambiguous ones, or which it is almoſt impoſſible to try exactly with the blow-pipe. Inſtead of the *ſal ſodæ*, ſome other ſalt might be diſcovered better adapted to theſe experiments. But it is very neceſſary not to make uſe of any other fluxes on the charcoal than ſuch as have no attraction to it: if they, at the ſame time, be clear and tranſparent, when melted, as the borax and the *ſal fuſibile microcoſmicum*, it is ſtill better: however, the tranſparency and opacity are of no great conſequence, if a ſubſtance be aſſayed only in order to diſcover its fuſibility, without any attention to its colour; in which caſe, ſome metallic ſlag, perhaps, might be uſeful.

When ſuch ores are to be reduced whoſe metals are very eaſily calcined, as tin, zinc, &c. it might perhaps be of ſervice to add ſome phlogiſtic body, ſuch as hard reſin, ſince the charcoal cannot afford enough of it in the open fire of theſe aſſays. The manner of melting the volatile metals out of their ores *per deſcenſum* might alſo, perhaps, be imitated: for inſtance, a hole might be made in the charcoal, wide above and very narrow at the bottom; a little piece of the ore being then laid at the upper end of the hole, and covered with ſome very ſmall pieces of the charcoal, the flame muſt be directed on the top: the metal might, perhaps, by this method, run into the hole below, concealed from the violence of the fire, particularly if the ore is very fuſible, &c.

The uſe of the apparatus above referred to, and which may be called a *pocket laboratory* (as the whole admits of being eaſily packed into a ſmall caſe), is chiefly calculated for a travelling mineraliſt. But a perſon who always reſides at one and the ſame place, may by ſome alteration make it more commodious to himſelf, and avoid the trouble of blowing with the mouth. For this purpoſe he may have the blow-pipe go through a hole in a table, and fixed underneath to a ſmall pair of bellows with double bottoms, ſuch as ſome of the glaſs-blowers uſe, and then nothing more is required than to move the bellows with the feet during the experiment; but in this caſe a lamp may be uſed inſtead of a candle. This method would be attended with a ſtill greater advantage, if there were many ſuch parts as *c*, fig. 13. the openings of which were of different dimenſions: thoſe parts might by means of a ſcrew be faſtened to the main body of the blow-pipe, and taken away at pleaſure. The advantage of having theſe nozzles of different capacities at their ends, would be that of exciting a ſtronger or weaker heat as occaſion might require. It would only be neceſſary to obſerve, that in proportion as the opening or nozzle of the pipe is enlarged, the quantity of the flame muſt be augmented by a thicker wick in the lamp, and the force of blowing encreaſed by means of weights laid on the bellows; a much intenſer heat would thus be produced by a pipe of a conſiderable opening at the end, by which the experiments muſt undoubtedly be carried farther than the common blow-pipe.

Plate CCCXIII.

A traveller, who has ſeldom an opportunity of carrying many things along with him, may very well be contented with this laboratory and its apparatus, which are ſufficient for moſt part of ſuch experiments as can be made on a journey. There are, however, other things very uſeful to have at hand on a journey, which ought to make a ſeparate part of a portable laboratory, if the manner of travelling does not oppoſe it: this conſiſts of a little box including the different acids, and one or two matraſſes, in order to try the mineral bodies in liquid menſtrua if required.

Theſe acids are, the acid of nitre, of vitriol, and of common ſalt. Moſt of the ſtones and earths are attacked, at leaſt in ſome degree, by the acids; but the calcareous are the eaſieſt of all to be diſſolved by them, which is accounted for by their calcareous properties. The acid of nitre is that which is moſt uſed in theſe experiments; it diſſolves the limeſtone, when pure, perfectly, with a violent efferveſcence, and the ſolution becomes clear: when the limeſtone enters into ſome other body, it is nevertheleſs diſcovered by this acid, through a greater or leſs efferveſcence in proportion to the quantity of the calcareous particles, unleſs there are ſo few as to be almoſt concealed from the acid by the heterogeneous ones. In this manner a calcareous body, which ſometimes nearly reſembles a ſiliceous or argillaceous one, may be known from theſe latter, without the help of the blow-pipe, only by pouring one or two drops of this acid upon the ſubject; which is very convenient when there is no opportunity nor time of uſing this inſtrument.

The gypſa, which conſiſt of lime and the vitriolic acid, are not in the leaſt attacked by the acid of nitre, if they contain a ſufficient quantity of their own acid; becauſe the vitriolic acid has a ſtronger attraction to the lime than the acid of nitre: but if the calcareous ſubſtance is not perfectly ſaturated with the acid of vitriol, then an efferveſcence ariſes with the acid of nitre, more or leſs in proportion to the want of the vitriolic acid. Theſe circumſtances are often very eſſential in diſtinguiſhing the *calcarea* and *gypſa* from one another.

The acid of nitre is likewiſe neceſſary in trying the zeolites, of which ſome ſpecies have the ſingular effect to diſſolve with efferveſcence in the abovementioned acid; and within a quarter of an hour, or even ſometimes not until ſeveral hours after, to change the whole ſolution into a clear jelly, of ſo firm a conſiſtence, that the glaſs wherein it is contained may be reverſed without its falling out.

If any mineral body is tried in this menſtruum, and only a ſmall quantity is ſuſpected to be diſſolved, though it was impoſſible to diſtinguiſh it with the eye during the ſolution, it can be eaſily diſcovered by adding to it *ad ſaturitatem* a clear ſolution of the alkali, when the diſſolved part will be precipitated, and fall to the bottom. For this purpoſe the *ſal ſodæ* may be very uſeful.

The acid of nitre will ſuffice for making experiments upon ſtones and earths; but if the experiments are to be extended to the metals, the other two acids are alſo neceſſary.

Another inſtrument is likewiſe neceſſary to a complete

Portable Apparatus.

complete Pocket Laboratory, viz. a washing-trough (fig. 21.), in which the mineral bodies, and particularly the ores, may be separated from each other, and from the adherent rock, by means of water. This trough is very common in laboratories, and is used of different sizes; but here only one is required of a moderate size, such as 12 inches and a half long, three inches broad at the one end and one inch and a half at the other end, sloping down from the sides and the broad end to the bottom, where it is three quarters of an inch deep. It may, however, be made of much smaller dimensions. It is commonly made of wood, which ought to be chosen smooth, hard, and compact, wherein are no pores in which the minute grains of the pounded matter may conceal themselves. It is to be observed, that if any such matter is to be washed as is suspected to contain some native metal, such as silver or gold, a trough should be procured for this purpose of a very shallow slope; because the minute particles of the native metal have then more power to assemble together at the broad end, and separate from the other matter.

The management of this trough, or the manner of washing, consists in this: That when the matter is mixed with about three or four times its quantity of water in the trough, this is kept very loose between two fingers of the left hand, and some light strokes given on its broad end with the right, that it may move backwards and forwards; by which means the heaviest particles assemble at the broad and lower end, from which the lighter ones are to be separated by inclining the trough and pouring a little water on them. By repeating this process, all such particles as are of the same gravity may be collected together, and separated from those of different gravity, provided they were before equally pounded: though such as are of a clayey nature, are often very difficult to separate from the rest, which, however, is of no great consequence to a skilful and experienced washer. The washing process is very necessary, as there are often rich ores, and even native metals, found concealed in earths and sand in such minute particles as not to be discovered by any other means.

Sect. III. *Description of an Improved Portable Laboratory for assaying Minerals.*

The chief pieces and implements of the portable laboratories are represented in Plate XCIX. at *Blow-Pipe*, and in Plate CCCXIII. annexed to the present article.

I. The first contains those belonging to the *Dry* Laboratory, so called on account of its containing whatever is required to try all kinds of fossils in the dry way by fire, without any of the humid menstruums. They are made to pack in a box of the size of an octavo book, lined with green velvet, and covered with black fish-skin; the inside divided into different compartments, suited to the size, form, and number of the implements it is to contain. Of these the principal are described under *Blow-Pipe*. We must here, however, add the following remarks and alterations of that instrument by Mr Magellan.

Plate CCCXIII.

D and Q (fig, 13.) are the two pieces that form the blow-pipe, which is here represented entire. This very useful instrument has been considerably improved of late in England. The mouth-piece *aa* is made of ivory, to avoid the disagreeable sensation of having a piece of metal a long time between the teeth and lips, which, if not of silver or gold, may be very noxious to the operator; a circumstance that has been hardly noticed before.

1. If the mouth-piece *aa* be made of a round form, it cannot be held for any length of time between the teeth and lips, to blow through it, without straining the muscles of the mouth, which produces a painful sensation. It must, therefore, have such an external figure, as to adapt itself accurately to the lateral angles of the lips, having a flattish oval form externally, with two opposite corners to fit those internal angles of the mouth, when it is held between the lips, as may be seen in that represented in the figure.

2. The small globe *bb* is hollow, for receiving the moisture of the breath; and must be composed of two hemispheres, exactly screwing into one another in *bb*; the male-screw is to be in the lower part, and soldered on the crooked part Q of the tube QD, at such a distance, that the inside end of the crooked tube be even with the edge of the hemisphere, as represented by the pointed lines in the figure. But the upper hemisphere is to be soldered at the end of the straight tube D. By these means, the moisture arising from the breath falls into the hollow of the lower hemisphere, where it is collected round the upper inside end of the crooked part Q of the blow-pipe, without being apt to fall into it.

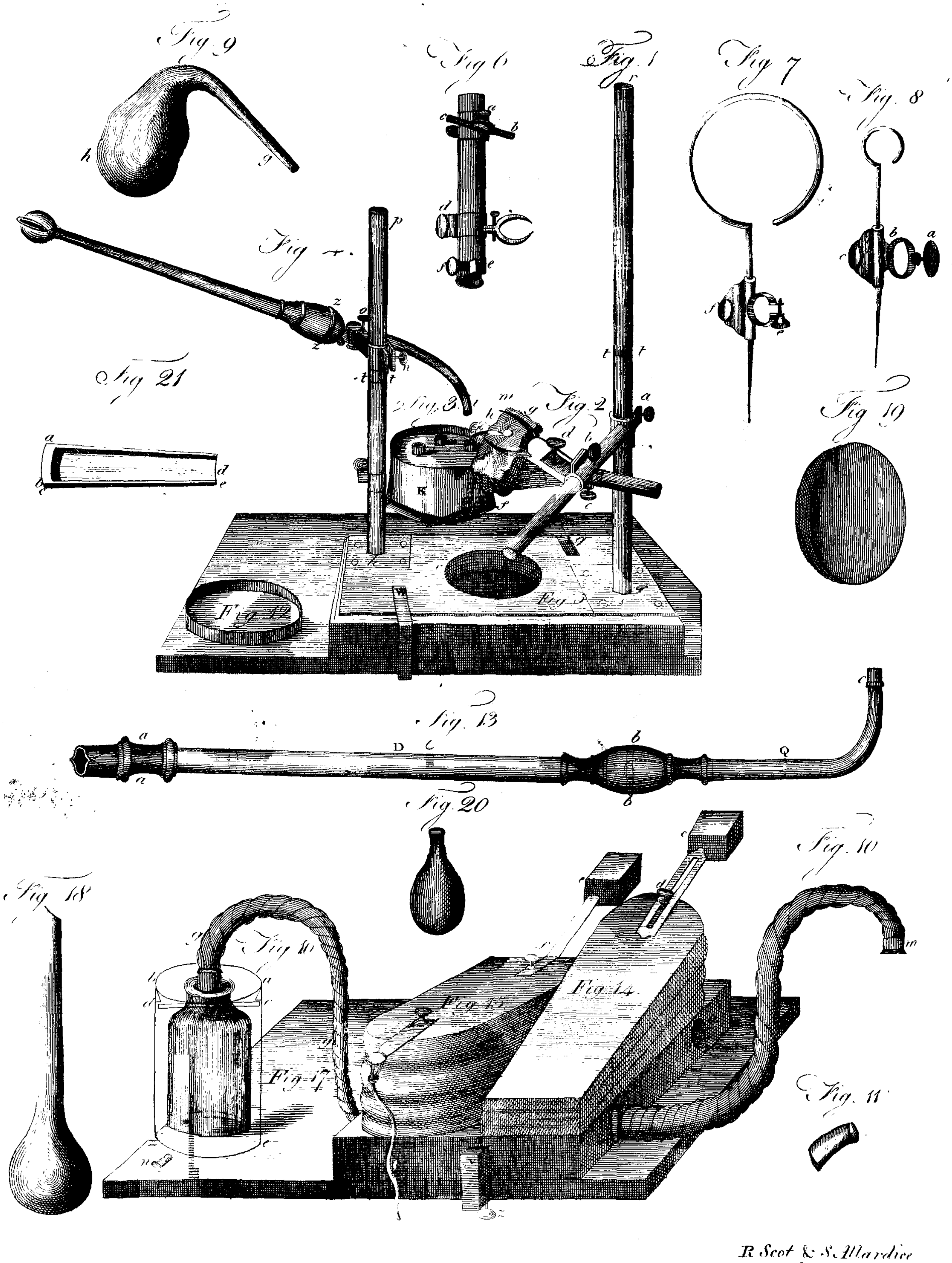
3. The small nozzles, or hollow conical tubes, advised by Messrs Engestrom, Bergman, and others, are wrong in the principle; because the wind that passes from the mouth through such long cones loses its velocity by the lateral friction, as happens in hydraulic spouts; which, when formed in this manner, do never throw the fluid so far as when the fluid passes through a hole of the same diameter, made in a thin plate of a little metallic cap that screws at the end of the large pipe. It is on this account that the little cap *c* is employed, having a small hole in the thin plate, which serves as a cover to it; and there are several of these little caps, with holes of smaller and larger sizes, to be changed and applied whenever a flame is required to be more or less strong.

4. Another convenience of these little caps is, that even in case any moisture should escape falling into the hemisphere *bb*, and pass along with the wind through the crooked pipe Q, it never can arrive at nor obstruct the little hole of the cap *c*, there being room enough under the hole in the inside, where this moisture must be stopped till it is cleaned and wiped out.

The stream of air that is impelled by the blow-pipe (as seen in fig. 3.) upon the flame, must be constant and even, and must last as long as the experiment continues to require it. This labour will fatigue the lungs, unless an equable and uninterrupted inspiration can at the same time be continued. To succeed in this operation without inconvenience, some labour and practice are necessary, as already explained under the detached article.

Every assay ought always to begin by the exterior flame, which must be first directed upon the mass under examination; and, when its efficacy is well known, then the interior blue flame is to be employed.

After



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Portable Apparatus.

After the ore is roaſted, it is to be rounded upon the ſteel plate by the hammer; the particles being prevented from being diſſipated by the ring H (fig. 9, Plate XCIX.), within which the pieces to be broken are to be put.

Among the apparatus, beſide the particulars already mentioned, three phials are neceſſary, containing the required fluxes, viz. the *borax*, the *ſal ſodæ*, and *ſal fuſibile microcoſmicum*. Other uſeful particulars are, A ſmall link of hard ſteel, to try the hardneſs or ſoftneſs of mineral ſubſtances, and alſo to ſtrike fire for lighting the candle when required: A piece of black flint, to ſerve as a touch-ſtone; (for being rubbed with any metal, if it be gold the marks will not be corroded by aqua fortis); and alſo to ſtrike fire, when neceſſary, with the link of ſteel: An artificial load-ſtone, properly armed with iron, for the better preſervation of its attractive power; (it ſerves to diſcover the ferrugineous particles of any ore after it has been roaſted and powdered:) A triple magnifier, which, differently combined, produces ſeven magnifying powers, the better to diſtinguiſh the ſtructure and metallic parts of ores, and the minute particles of native gold, whenever they contain that metal: A file, to try the hardneſs of ſtones and cryſtals, &c.: Some pieces of dry agaric or tinder, and ſmall bits or ſplinters of wood tipped with brimſtone, to ſerve as matches for lighting the candle; and various other little articles of uſe in theſe experiments.

II. For performing experiments in the *Humid Way*, the chief additional articles (and which muſt be kept in a ſeparate caſe) conſiſt of a collection of phials, containing the principal acids, teſts, precipitants, and re-agents, both for examining mineral bodies by the humid way, and for analyſing the various kinds of mineral waters. Thoſe with acids and corroſive ſolutions have not only ground ſtoples, but alſo an external cap to each, ground over the ſtople, and ſecured downward by a bit of wax between both, in order to confine the corroſive and volatile fluids within. But thoſe which contain mild fluid liquors have not ſuch external caps: and thoſe with dry inoffenſive ſubſtances are only ſtopped with cork. Beſides theſe phials, there are two ſmaller cylindrical ones, which ſerve to exhibit the changes of colour produced by ſome of the re-agents in thoſe analytical aſſays. There are alſo two or three ſmall matraſſes, to hold the ſubſtances with their ſolvents over the fire; a ſmall glaſs funnel, for pouring the fluids; a ſmall porcelain mortar, with its peſtle; one or two crucibles of the ſame ſubſtance; a ſmall wooden trough to waſh the ground ores; ſome glaſs ſticks to ſtir up the fluid mixtures; and, finally, pieces of paper tinged red, yellow, and blue, by the tinctures of Fernambuc wood (commonly called Braſil wood), turmeric, and litmus, thickened with a little ſtarch.

The following liſt contains the names of the various fluid teſts and re-agents that are neceſſary for theſe aſſays. But the whole number being too large to be all contained in a portable caſe, every one may give the preference to thoſe he likes beſt.

1. Concentrated vitriolic acid, whoſe ſpecific gravity may be expreſſed in the outſide.
2. Nitrous acid, purified by the nitrous ſolution of ſilver.
3. Concentrated marine acid, with its ſpecific gravity.
4. Marine acid dephlogiſticated.
5. Aqua regia for gold, viz. 2 nit. and 1 marine.
6. Aqua regia for platina viz. half marine and half nitrous acid.
7. Nitrous ſolution of ſilver.
8. Nitrous ſolution of mercury, made in the cold.
9. Muriatic ſolution of barytes.
10. Nitrous ſolution of lime.
11. Muriatic ſolution of lime.
12. Mercury in its metallic ſtate.
13. Corroſive ſublimate of mercury.
14. White arſenic.
15. Nitrous ſolution of ſilver.
16. Nitrous ſolution of copper.
17. Acid of ſugar.
18. Liquor probatorius vini.
19. Hepar ſulphuris.
20. Oil of tartar *per deliquium*.
21. Salt of tartar.
22. Cauſtic vegetable alkali.
23. Pearl-aſhes.
24. Soap-makers ley.
25. Common ſalt.
26. Vitriolated argilla (alum.)
27 Vitriol of iron (copperas)
28. Nitrous ſolution of ſilver.
29. Acetous ſolution of lead.
30. Acetous ſolution of barytes.
31. Phlogiſticated alkali by the Pruſſian blue.
32. Lime-Water.
33. Lime-water phlogiſticated by the Pruſſian blue.
34. Cauſtic volatile alkali.
35. Mild volatile alkali (dry.)
36. Rectified ſpirit (alcohol.
37. Æther.
38. Spirituous tincture of galls.

The following teſts are very fit alſo for theſe aſſays, viz. 39, Spirituous ſolutions of ſoap; 40. Syrup of violets; 41 Tincture of litmus; 42. Tincture of Braſil wood; 43. Tincture of turmeric; 44. Oil of olives; 45. Oil of linſeed: 46. Oil of turpentine; 47. Eſſential ſalt of wild-ſorrel; 48. Hepar ſulphuris: 49. Sugar of lead; 50. Solution of alum.

The method of applying the above teſts of acids and re-agents may be ſeen in Bergman's treatiſes of the Analyſis of Waters, and of Aſſaying by the Humid Way; in Kirwan's Elements of Mineralogy; in the Elements of Chemiſtry of Dijon; in the Memoirs of the ſame Academy; in Fourcroy's Lectures of Chemiſtry, &c.

III. The *Lamp-furnace* Laboratory, for experiments both by the *humid* and the *dry way*, is a very curious and uſeful, though ſmall apparatus. It is an improvement of that which was contrived by M. de Morveau, in conſequence of the information he received from his friend the preſident de Virly, who ſaw at Upſal how advantageouſly the late eminent profeſſor Bergman availed himſelf of this convenience for many analytical proceſſes in miniature, by the uſe of very ſmall glaſs veſſels about one inch diameter, and other implements of proportional ſize, for performing various chemical operations. (See the Dijon Memoirs for 1783. Part 1. p. 171.)

Portable Apparatus.

There can be no doubt but that whenever these processes are properly conducted, though in miniature, the lamp-furnace will prove amply sufficient to perform in a few minutes, and with very little expence, the various solutions, digestions, and distillations, which otherwise would require large vessels, stills, retorts, reverberatory furnaces, &c. to ascertain the component parts of natural bodies; though it is not always sufficient to ascertain their respective quantities. In this last case, operations must be performed in great laboratories, and on a large scale, at a considerable expence. But the substances are sometimes too valuable; as, for instance, when precious stones are examined; and of course the last way never can be attempted in such cases.

These small processes have likewise another advantage before noticed, which cannot be obtained in works at large. It consists in one's being able to observe the gradual progress of each operation; of easily retarding or urging it, as it may require: and of ascertaining at pleasure each step of every experiment, together with the phenomena attending the same.

Plate CCCXIII.

The lamp-furnace is mounted in a small parallelogram of mahogany, about six inches long and four wide, marked fig. 5. This is kept steady over the edge of a common table, by means of the metallic clamp *wvw*, which is fastened by the screw *x*. The pillar *rs* is screwed in a vertical position on the plate *s*, being about ten inches high: the other is screwed to the opposite corner, marked *pk*, and is only 7½ inches long; both are composed of two halves, that screw at *tt*, to be easily packed up with all the implements in a case covered with black fish skin, and lined with green velvet, like the other laboratory already described.

The lamp *k*, fig. 3. is supported on the plate *f*, which has a ring *l* that runs in the column *pk*, and may be fixed by its screw *l* at the required height.— This lamp has three small pipes of different sizes, to receive as many wicks of different thickness, and to be filled with spirit of wine. By a similar method, a piece of charcoal is mounted and supported by the pliers or little forceps screwed to the arm *ac*, fig. 1. which has all the motions requisite for being fixed by means of proper screws, at a proper distance from the flame of the wick *h*. The blow-pipe, fig. 4. is, by a similar mechanism, mounted on the smaller column *pq*, at such a distance as to blow the flame *hi* to the piece of ore *m*, which is upon the charcoal *gf*.

Every thing being disposed in this manner, the operator blows through the mouth-piece of the blow-pipe, fig. 4. and remains with his hands free to make the changes and alterations he may think proper.—

[*N. B.* The large round cavity *e* in the middle of the parallelogram, fig. 5. is to receive the lamp *k*, fig. 3. when all the implements are packed up in their case of black fish skin: and the cover of the lamp is represented by fig. 12.]

But if the operator has the double bellows, fig. 14. and 15. he fixes them, at a due distance, to the same table by the brass clamp *y*. He then unscrews the blow-pipe at *z z*, joins the month *m* of the flexible tube of the hemisphere *z z*, passing each orifice thro' the leather tube fig. 11, and tying both ends with a waxed thin pack-thread. If he works with his foot on the pedal, the string of which is seen hanging from the end of the bellows, fig. 15. (and is always up, on account of the weight *e*), then the air is absorbed by the bellows fig. 15. from whence it is propelled by the motion of the foot on the pedal to the bellows, fig. 14. whose constant weight *r* drives it out through the flexible pipe, fig. 10. it of course enters the curbed part *zzi* of the blow-pipe, and drives the flame on the piece *m* of the ore, that is to be examined upon the charcoal.

Portable Apparatus.

[*N. B.* 1. This double bellows is packed up by itself in a mahogany case, about 9 inches long. 6½ wide, and about 3¼ deep, outside measure. 2. The last blowing bellows, fig. 14, has an inside valve, which opens when the upper surface of it is at its greatest height; in order to let the superfluous air escape out, as it would otherwise issue with great velocity out of the tube, fig, 11. and spoil the operation.]

If the operator chooses to apply the vital or dephlogisticated air in his process, let him fill the glass jar *b*, fig. 17. with this air; and put it within the tube marked by *abze*, filled with water, fastening the neck of the jar within by a cross-board *cd*, which has a hole in it for that purpose: then introducing the two ends of the flexible hollow tube, fig. 16. both to the mouth of the jar and to the hole of the bellows fig. 15. he opens the hole *m* of the jar, that was stopped with the stopple *n*; the column of the water passes in through *m*, and forces up the vital air, which enters the bellows, and of course, by the alternate motion of the pedal, passes through the end of the blow-pipe, to urge the flame upon the piece of ore *m*, fig. 2. on the charcoal *g*. But the dephlogisticated air may be also received at the same time that it is produced, by tying the pipe, fig. 16. to the mouth of an earthen retort, or even of a glass retort well-coated, according to the method of Mr Willis, described in the Transactions of the Society of Arts, Vol. V. p. 96. This last consists in dissolving two ounces of borax in a pint of boiling water, and adding to the solution as much slacked lime as is necessary to form a thin paste. This glass retort is to be covered all over with it, by means of a painter's brush, and then suffered to dry. It must then be covered with a thin paste made of linseed oil and slacked lime, except the neck that enters into the receiver. In two or three days it will dry of itself; and the retort will then bear the greatest fire without cracking. Two ounces of good nitre being urged in the retort, by a good fire on a chafing-dish, will afford about 700 or 800 ounce-measures of dephlogisticated air.

To make any other kind of chemical assays, the forceps of fig. 2. which supports the charcoal, is taken off by unscrewing the screw *b*; the blow-pipe is also taken off, by loosening the screw *n*; the hoop fig. 7. is put in its place, where the metallic basin of fig. 19. is put filled with sand; the piece of fig. 8. is set on the other pillar *rs*, fig. 1. to hold the matrass, fig. 18. upright, or the receiver fig. 20, &c.

In the same manner, the retort, fig. 9. may be put in the sand-bath instead of the matrass, with its receiver fig. 20. which may be supported on a bit of cork or wood, hollowed to its figure, and held by the pliers, instead of the charcoal fig. 2.

But if the operation is to be made in the naked fire, Of Arrangement.

fire, the neck of the retort, fig. 9. being luted to the receiver, or balloon, fig. 20. may be hanged by a little chain with its ring over the flame, being suspended from the piece of fig. 7. or 8. screwed to either of the pillars as may be most convenient. Otherwise the receiver, fig. 20. may be supported by the round hoop of brass, fig. 8. or 7. screwed at a proper height to the pillar, fig. 1. tying round it some packthread to defend the glass from the contact with the metallic support.

The piece of fig. 6. may be screwed by its collar and screw *ef* to any of the pillars; carrying with it the retort and its receiver, at proper distances, higher or nearer to the lamp according as the flame is more or less violent.

It easily may be conceived, that these implements afford all sorts of conveniences for making any kind of small operations and assays in miniature, provided the operator pays a proper attention to the disposition requisite for each process or operation.

Every glass retort, receiver, matrass, bason, small funnels, &c. are made by the lamp-workers, that blow beads, thermometers, and other small glass instruments.

It is directed that the lamp *k*, fig. 3. be filled with spirit of wine, because it gives no disagreeable smell, and does not produce any fuliginous and disagreeable crust on the vessels as oil does: moreover, the spirit gives a dry flame, without smoke, and stronger than oil; besides the spots and disagreeable consequences this last causes, if split, &c. M. de Morveau adds, that the expence of spirit is quite inconsiderable; and that he performed in eight or ten minutes, with this apparatus, various dissolutions, evaporations, and other processes, which otherwise would have taken more than three hours, with the expence only of two or three halfpence for the spirit of wine, whilst the fuel of charcoal would have cost near ten or eleven pence.

But a very important circumstance is, as Morveau observes likewise, that many philosophers do not apply themselves to chemical operations, for want of opportunity of having a laboratory to perform them: it requiring a proper room, and suitable expences of many large furnaces, retorts, crucibles and numerous other implements, &c. whilst these miniature laboratories may in great measure afford the same advantages; at least to that degree of satisfaction sufficient to ascertain the contents and products of any substance that is subjected to trial: for with this simple apparatus a man of some abilities may, without any embarassment, in a very short time, and with little expence, perform such distillations as require a reverberatory furnace; all sorts of processes, digestions, and evaporations, which require a regular sand heat; he may vary his experiments or trials, and multiply them to a great number of various performances, draw up his conclusions, and reason upon them, without loss of time, without the hinderance of long preparations to work at large. And even when such large works are to be performed, he may observe beforehand various phenomena of some substances, which being known in time, would otherwise impede the processes at large, or make them fail absolutely; and all this without the risk of a considerable loss, and without exposing himself to a great fire, &c.

Part II. ARRANGEMENT (A) of MINERAL BODIES (B).

THE bodies belonging to the mineral kingdom are divided into four different classes, viz.

1. *Earths* (c), or those substances which are not ductile, are mostly indissoluble in water or oil, and preserve their constitution in a strong heat.
2. *Salts*: these dissolve in water, and give it a taste; and when the quantity of water required to keep them in dissolution is evaporated, they concrete again into solid and angular bodies.
3. *Inflammables*, which can be dissolved in oils, but not in water, and are inflammable.
4. *Metals*, the heaviest of all bodies: some of which are malleable, and some can be decompounded.

Here, however, it must be observed, that these classes are unavoidably blended one with another; and therefore some exceptions must be allowed in every one of them: for instance, in the first class, the calcareous earth is in some measure dissoluble in water, and pipe-clay with some others diminish somewhat in their bulk when kept for a long time in a calcining heat. In the third class, the calx of arsenic has nearly the same properties as salts; and there is no possible definition of salt that can exclude the arsenic, though at the same time it is impossible to arrange it elsewhere than among the semimetals. In the fourth class it is to be observed, that the metals and semimetals, perfect or imperfect, have not the same qualities common to them all; because some of them may be calcined, or deprived of their phlogiston, in the same degree of fire in which others are not in the least changed, unless particular artifices or processes are made use of: some of them also may be made malleable, while others are by no means to be rendered so. That the convex surface metals take after being melted, is a quality not particularly belonging to them, because every thing that is perfectly fluid in the fire, and has no attraction to the vessel in which it is kept, or to any added matter, takes the same figure; as we find borax, *sal fusibile microcosmicum*, and others do, when melted upon a piece of charcoal: therefore, with regard to all that has.

(A) According to the system of *Cronstedt* †; altered, augmented, and improved from the Observations of other Mineralogists.

(B) Of the different bodies enumerated in the following classification, full explanations are given under their respective names as they occur in the course of this Work. See also METALLURGY, and CHEMISTRY-*Index*.

(C) By *earths*, the author (Mr Cronstedt) does not mean (strictly speaking) only earths, but includes under that title all the kinds of stones or fossils not inflammable, saline, or metallic.

† Cronstedt's Mineralogy, 2d edition, in 2 vols, by Magellan.

Earths.

has been ſaid, it is hardly worth while to invent ſuch definitions as ſhall include ſeveral ſpecies at once; we ought rather to be content with perfectly knowing them ſeparately.

Class I. EARTHS.

Earths, are thoſe mineral bodies, not ductile, for the moſt part not diſſoluble in water or oils, and which preſerve their conſtitution in a ſtrong heat.

Calcareous Earths.

Theſe bodies are here arranged according to their conſtituent parts, ſo far as hitherto diſcovered; and are divided into five orders. See the article Earth.

Order I. Calcareous Earths (d).

The properties of theſe are as follow:

1. Friability and falling into a fine white powder after calcination.

2. Partial ſolution in water, with which they contract

(d) Calcareous earth is moſt commonly found in the form of lime-ſtone; hard, compact, and of various colours; under which general name may be comprehended all the different kinds of marbles. Near Bath in England is found a kind of grey ſtone, rather ſoft than hard. This contains calcareous earth in a mild ſtate, and likewiſe ſome in a ſtate of cauſticity: hence, when newly dug out of the earth, it will diſſolve ſulphur, or make lime-water without any calcination. By attraction of fixed air from the atmoſphere, it ſoon hardens after it has been dug up.

* Nat. Hiſt. of the Mineral Kingdom, 2 vols.

Mr Williams * divides the lime-ſtones of Scotland into the following ſpecies:

1. Grey, whitiſh, and pure white; regularly ſtratified; of a granulated texture; and much uſed in the Highlands for building bridges. Some of it is compoſed of fine glittering ſpangles like the ſcales of fiſhes; and ſome is as pure white as the beſt refined ſugar, which kind he thinks may be called *Parian marble*.

2. Coarſe-looking grey mountain-limeſtone, hard and ſtrong, of a granulated texture, difficult to work, in ſome places rough and unequal, in others ſmooth and even. Sometimes regularly ſtratified, at other times appearing like one vaſt irregular bed or rock, of various thickneſſes.

3. Aſh-coloured mountain-limeſtones, conſiſting of ſmall grains of a fine ſmooth texture; when broken reſembling flint. In the Highlands there are hills of this kind of ſtone, which our author informs us he has ſeen; ſome of which have regular ſtrata, while others appear in one vaſt maſs like a rock of granite.

4. Regularly-ſtratified lime-ſtone, found in the low countries, exhibiting a vaſt variety of colours; as black, blue, grey, brown, purple, red, and aſh-coloured; with various mixtures, of all degrees of hardneſs and purity.

5. Limeſtone accompanying coal, and frequently the immediate roof of the vein. This likewiſe ſhows a great variety of colour, texture, and quality; ſome being ſo much adulterated with clay and other heterogeneous mixtures as to be good for nothing, while others are very pure and fine. Theſe limeſtones are always found in regular ſtrata. "They are found (ſays our author) as regular as the coals they accompany; and the coal-ſtrata are more regular in continuation upon the bearing, as far as the claſs of ſtrata belonging to the coal reaches, than any other that I have inveſtigated; and I look upon it, that this obſervation may be of uſe in practice."

For diſcovering limeſtone at ſome diſtance, Mr Williams gives the following directions:—Let them keep the line of ſtretch, or bearing of the ſtrata; and, in the coal-country, they will be ſure to diſcover it at nearly the ſame parallel diſtance from a ſeam of coal or other given ſtratum, as the place where it was laſt ſeen. But many of the mountain-limeſtones are not much to be depended on. Though you may have a good and plentiful quarry in one place, yet, perhaps, half a mile, or half a quarter of a mile farther forward, you cannot diſcover it: it is dwindled away to nothing, and yet will appear again farther forward; which makes the mountain-limeſtones uncertain to be diſcovered where you do not ſee them; as theſe rocks very frequently grow thicker or thinner, and ſometimes ſqueezes out to nothing: and I comprehend under this denomination all the limeſtones not accompanying the coals and coal-metals.—The limeſtones of the coal fields are often diſtinguiſhable by containing a great variety of ſhells, coral, and other marine bodies, which are found blended in the heart and compoſition of the ſtone."

6. The Scotch marbles are of great variety and beauty; and the parts of the kingdom moſt unfit for cultivation are found to abound moſt in them. Aſſint in Sutherland has a kind of white ſtatuary marble, which Mr Williams ſays is the pureſt and beſt he ever ſaw. "I am perſuaded (ſays he) there is none better, if any ſo good, in all Europe, and there is enough of it to ſerve all Britain; perfectly ſolid and pure, free of any blemiſhes, flaws, or ſtains, and blocks or ſlabs of any ſize may be cut out: but there is bad acceſs to it; nor would it be eaſily quarried, there being a little cover above it, of a ſoft, looſe, whitiſh limeſtone. This marble accompanies a prodigious rock of grey limeſtone, of a granulated texture, appearing in regular ſtrata at Aſſint; but it is one of thoſe which varies in thickneſs as you advance along the bearing of the ſtrata. The good white marble of Aſſint is only to be ſeen in the bed of the river, near a conſiderable houſe a mile or two ſouth of the church; but I cannot remember the name of the particular place."

Near Blairgourie in Perthſhire, not far from the ſide of the high road, is an excellent, granulated, broad-bedded limeſtone, of a ſugar-loaf texture, and as white as the fineſt ſtatuary marble, which Mr Williams ſuppoſes to be a good ſpecies of the true Parian marble, and that it requires only to be known and brought into uſe to become of great value. In the duke of Gordon's lands, in the foreſt of Glenavon, there is alſo a kind of marble compoſed of broad glittering grains like ſpangles, as large as the ſcales of fiſhes; but the ſituation is remote, and difficult of acceſs.

In

Calcareous Earths.

tract great heat, and by sprinkling with water they fall more readily into powder.

3. Infusibility without addition.

4. They attract the fixed air from the vegetable and mineral alkalies, and thus rendering them much more caustic, becoming at the same time mild themselves.

5. Solubility in all acids except the vitriolic, tartarous, and some anamalous vegetable acids.

6. Fusibility with borax and microcosmic salts.—The fusion is attended with effervescence, and the result is a transparent and colourless glass.

7. With metalline calces they melt into a corrosive slag.

8. They imperfectly reduce the calces of lead and bismuth, and have even some effect upon those of copper and iron.

The calcareous earth is found,

I. Pure.

1. In form of powder. *Agaricus mineralis*, or *lac lunæ*.
   - *a.* White, in moors, and at the bottom of lakes.
   - *b.* Red.
   - *c.* Yellow.
2. Friable and compact. Chalk, *creta*.
   - *a.* White, *creta alba*. Chalk is a name also applied to other earths; whence we hear of chalks of various colours: but there are none which are known to be of a calcareous nature, except this kind here described, and of which there are no other varieties, otherwise than in regard to the looseness of the texture, or the fineness of the particles.
3. Indurated, or hard; Limestone; *Lapis calcareus*.
   - *A.* Solid, or not granulated.
     - *a.* White.
     - *b.* Whitish yellow.
     - *c.* Flesh-coloured, found in loose masses.
     - *d.* Reddish brown.
     - *e.* Grey.
     - *f.* Variegated with many colours, and particularly called *marble*.
     - *g.* Black.
   - *B.* Grained or granulated limestone.
     1. Coarse-grained, and of a loose texture, called *salt-stag* in Swedish, from its resemblance to lumps of salt.
        - *a.* Reddish yellow. *b.* White.
     2. Fine grained.
        - *a.* White. *b.* Semi-transparent, from Solfatara in Italy, in which native brimstone is found.
     3. Very fine grained.
        - *a.* White and green. *b.* White and black.
   - *C.* Scaly limestone.
     1. With coarse or large scales.
        - *a.* White. *b.* Reddish yellow.
     2. With small scales.
        - *a.* White.
     3. Fine glittering or sparkling.
        - *a.* White. *b.* Of many colours.
   - *D.* Lime or calcareous spars.
     - (1.) Of a rhomboidal figure.
       - A. Transparent or diaphanous.
         1. Refracting spar; *Spatum islandicum*; Iceland spar, or Iceland crystal.—This represents the objects seen through it double.
         2. Common spar, which shows the object single.
            - *a.* White, or colourless.
            - *b.* Yellowish and phosphorescent.
       - B. Opaque.
         1. White. 2. Black. 3. Brownish yellow.
     - (2.) Foliated or plated spar.
       - *a.* Opaque white.
   - *E.* Crystallized calcareous spars. *Spar. Drusen* (E).
     - (1.) Transparent.
       - *a.* Hexagonal truncated.
       - *b.* Pyramidal.
         1. Dog's teeth; *Pyramidales distinctæ*.
         2. Balls of crystallized spar, *Pyramidales concretæ*.
   - *F.* Stalactitical spar; *Stalactites calcareus*. Stalactites, Stone-icicle, or Drop-stone.
     - (1.) Scaled stalactites of very fine particles.
       - *a.* Of a globular form.
         1. White, the pea-stone.
         2. Grey, *pisolithus*, *oolithus*. Also the hammites, from its resemblance to the roes or spawn of fish. It has been exhibited by authors as petrified roes. The Ketton free-stone, of Rutlandshire, is a remarkable stone of this sort.
       - *b.* Hollow, in the form of a cone.
         1. White.
       - *c.* Of an indeterminate figure.
       - *d.* Of coherent hollow cones.
     - (2.) Solid stalactites of a sparry texture.
       - *a.* Hollow, and in form of a cone.
         1. White, and semitransparent.

II. Sa-

In Lochaber, near the farm houses on the north side of the ferry of Ballachylish, is a limestone or marble rock, of a beautiful ashen-grey colour, and a fine regular uniform grain or texture; capable of being raised in blocks or slabs of any size, and of receiving a fine polish. It is beautifully sprinkled with fine bright grains of mundick or pyrites, and likewise with grains or specks of beautiful lead ore of a fine texture.

About three miles south of Fort-William, in the bed of a river, is a curious kind of marble with a black ground, flowered with white, like fine needle-work, or rather resembling the frost-flowering upon glass windows in winter; and this flowering is not only on the outside, but quite through all parts of the body of the stone.

Scotland has also chalk in abundance; some of which is regularly stratified, and much appears in thick irregular masses like sediment.

(E) The translator of Mr Cronstedt's Treatise has adopted this German term *drusen* into the English language, for a cluster of regular figured bodies, as a groupe conveys the idea of a cluster only, whether regular or of indeterminate figures.

Calcareous Earths.

II. Saturated or combined with the acid of vitriol. Gypsum, Plaster-stone, or Parget.

1. Looser and more friable than a pure calcareous earth.
2. Either crude or burnt, it does not excite any effervescence with acids; or, at most, it effervesces but in a very slight degree, and then only in proportion as it wants some of the vitriolic acid to complete the saturation.
3. It readily falls into a powder in the fire.
4. If burnt, without being red hot, its powder readily concretes with water into a mass, which soon hardens; and then,
5. No heat is perceived in the operation.
6. It is nearly as difficult to be melted by itself as the limestone, and shows mostly the same effects with other bodies as the lime-stone: the acid of vitriol seems, however, to promote its vitrification.
7. When melted in the fire with borax, it puffs and bubbles very much, and for a long while, during the fusion, owing to the nature of both the salts.
8. When a small quantity of any gypsum is melted together with borax, the glass becomes colourless and transparent; but some sorts of alabaster and sparry gypsa, when melted in some quantity with borax, yield a fine transparent yellow coloured glass, resembling that of the best topazes. This phenomenon might probably happen with every one of the gypseous kind. But it is to be observed, that if too much of such gypsum is used in proportion to the borax, the glass becomes opaque, just as it happens with the pure limestone.
9. Burnt with any inflammable matter, it emits a sulphureous smell; and may as well by that means, as by both the alkaline salts, be decompounded; but for this purpose there ought to be five or six times as much weight of salt as of gypsum.
10. Being thus decompounded, the calx or earth which is left shows commonly some marks of iron.

The gypseous earth is found,

(1.) Loose and friable. Gypseous earth, properly so called; *Guhr*.
 A. White.

(2.) Indurated.
 A. Solid, or of no visible particles, Alabaster.
  a. White, alabaster.
   1. Clear and transparent.
   2. Opaque,
  b. Yellow.
   1. Transparent, from the Eastern countries.
   2. Opaque.
 B. Gypsum of a scalded or granulated structure. This is the common plaster-stone.
  1. With coarse scales. *a*. White.
  2. With small scales. *a*. Yellowish. *b*. Greyish.
 C. Fibrous gypsum, or plaster-stone, improperly (though commonly) called *English talc* by the druggists.
  1. With the fibres coarse. *a*. White, from Livonia.
  2. With fine fibres. *a*. White.
 D. Spar-like gypsum. Selenites, by some also called *glacies mariæ*; and confounded with the clear and transparent mica.
  1. Pure selenites.
   A. Transparent.
    a. Colourless. *b*. Yellowish.
  2. Liverstone, so called by the Swedes and Germans.
 E. Crystallized gypsum. Gypseous drusen.
  (1). Drusen of chrystals of pure sparry gypsum.
   A. Wedge-formed, composed of a pure spar-like gypsum.
    a. Clear and colourless. *b*. Whitish yellow.
   B. Capillary.
    a. Opaque whitish yellow. *b*. Hexagonal, prismatic. *c*. Globular, consisting of cuneated rays proceeding from the centre.
 F. Stalactitical gypsum. *Gypsum sinter*.
  1. Of no visible particles; in French, *grignard*.
   A. Of an irregular figure.
    a. Yellow. *b*. White.
  2. Of a spar-like texture.
   A. In form of a cone.
    a. White and yellow.
   B. Of an irregular figure.
    a. White.

III. Calcareous earth saturated with the acid of common salt. *Sal ammoniacum fixum naturale*.

This is found, 1. In sea-water. 2. In salt-pits.

IV. Calcareous earth combined or saturated with sparry acid, known by the name of *sparry fluor* and *blue john*.

These are commonly called *fluxing*, *vitrescent*, or *glass-spars*; because most part of them have a sparry form and appearance: they are, however, often met in an indeterminate figure.

They are only known in an indurated state, and distinguish themselves from the other earths by the following characters.

1. They are scarce harder than common calcareous spars, and consequently do not strike fire with steel.
2. They do not ferment with acids neither before nor after calcination.
3. They do not melt by themselves, but crack and split to pieces when exposed to a strong fire. But,
4. In mixtures with all other earths they are (generally) very fusible, and especially with calcareous earth, with which they melt into a corroding glass that dissolves the strongest crucibles, unless some quartz or apyrous clay be added thereto.
5. When heated slowly, and by degrees, they give a phosphorescent light: but as soon as they are made red-hot, they loose this quality. The coloured ones, especially the green, give the strongest light, but none of them any longer than whilst they are well warm.
6. They melt and dissolve very easily by the addition of borax, and, next to that, by the microcosmic salt, without ebullition.

A. Indurated fluor.

Calcareous Earths.

(1.) Solid, of an indeterminate figure; of a dull texture, semitransparent, and full of cracks in the rock.

a. White.

(2.) Sparry fluor. This has nearly the figure of spar; though on close observation it is found not to be so regular, nothing but the glossy surfaces of this stone giving it the resemblance of spar.

a. White. b. Blue. c. Violet. d. Deep green. e. Pale green. f. Yellow.

(3.) Crystallised fluor.

1. Of an irregular figure. a. White. b. Blue. c. Red.
2. Of a cubical figure. a. Yellow. b. Violet.
4. Of a polygonal spherical figure. a. White. b. Blue.
4 Of an octoedral figure. a. Clear, colourless.

V. Calcareous earth saturated with a particular acid, perhaps of the metallic kind, *viz.* the tungstenic acid. The *tung stein* of the Swedes.

This resembles the garnet-stone and the tin-grains; is nearly as heavy as pure tin; very refractory in the air, and excessively difficult to reduce to metal. Iron has, however, been melted out of it to more than 30 *per cent.* It is very difficultly dissolved by borax and alkaline salts, but melts very easily with the microcosmic salt, giving a black slag; and for this reason the last mentioned salt must be employed in the assays of this stone. It is found,

1. Solid and fine-grained.
   a. Reddish or flesh-coloured. b. Yellow.
2. Spathose, and with an unctuous surface.
   a. White. b. Pearl-coloured.

VI. Calcareous earth united with the inflammable substance.

These have a very offensive smell, at least when rubbed. They receive their colour from the phlogiston, being dark or black in proportion as it predominates.

(1.) Calcareous earth mixed with phlogiston alone; *Lapis suillus*, fetid stone and spar, or swine-stone and spar.

A. Solid, or of no visible or distinct particles.
a. Black.

B. Grained.
a. Blackish brown.

C. Scaly, *particulis micaceis.*
1. With coarse scales. a. Black.
2. With fine sparkling scales. a. Brown.

D. Sparry.
a. Black. b. Light brown. c. Whitish yellow.

E. Crystallised.
1. In a globular form.

VII. Calcareous earths blended with an argillaceous earth. Marle, *Marga.*

1. When crude, it makes an effervescence with acids: but,
2. Not after having been burnt; by which operation it is observed to harden, in proportion as the clay exceeds the calcareous substance.
3. It easily melts by itself into a glass, and even when it is mixed with the most refractory clay.
4. It is of great use in promoting the growth of vegetables, since the clay tempers the drying quality of the calcareous earth.
5. When burnt in a calcining heat, it readily attracts water: and, exposed to the air, in time it falls into a powder.

The varieties of this kind worthy to be taken notice of, depend on the different quantities of each of their component parts, and on the quality of the clay. The following are specified as examples.

A. Loose and compact, *Marga friabilis.*
a. Reddish brown.
b. Pale red. This, when burnt, is of a yellowish colour, and used for making earthen ware in some places.

B. Semi-indurated; which is nearly as hard as stone when first dug up, but moulders in the open air.
a. Grey. b. Red.

C. Indurated or stone marle.
A. in loose pieces, *Marga indurata amorpha;* by the Germans called *duckstein* or *tophstein.*
a. White. b. Grey, formed from a sediment which the water carries along with it.
B. In continued strata. Hard slaty marle.

VIII. Calcareous earth united with a metallic calx.

Here, as well as in the others, such a mixture or combination is to be understood, as cannot be discovered by the eye alone without the help of some other means.

The subjects belonging to this division lose the property of raising an effervescence with acids, when they are rich in metal, or contain any vitriolic acid. However, there have been found some that contained 20 or 30 *per cent.* of metal, and yet have shown their calcareous nature by the nitrous acid.

There are no more than three metals hitherto known to be united in this manner with the calcareous earth, *viz.*

(1) With iron. White spar like iron ore, *Minera ferri alba.* The *stahlstein* or *weises eisenerz* of the Germans.

1. This ore, however, is not always white, but commonly gives a white powder when rubbed.
2. It becomes black in the open air, as likewise in a calcining heat.
3. In this last circumstance it loses 30 or 40 *per cent.* of its weight, which by distillation has been found owing to the water that evaporates; and it is possible that some small quantity of vitriolic acid may, at the same time, evaporate with the water.
4. It is of all the iron ores the most easy to melt, and is very corrosive when melted.

This kind is found,

A. Loose; the mouldered part of the indurated sort.
a. Black, like soot.
b. Dark brown, somewhat resembling umbre.

B. Indurated.
1. Solid, of no distinct particles.
   a. Red. Looks like red ochre, or the red hæmatites, but dissolves in the acid of nitre with a great effervescence.
2. Scaly, *particulis micaceis.*
   a. White.
   b. Blackish grey.
3. Spar-like.
   a. Light brown.

Calcareous Earths.

4. Drusen.
   a. Blackish brown.
   b. White.
      1. Porous. This is often called *eisenblute*, or *flos ferri*.
      2. Cellular.

(2) With copper.
   A. Loose and friable. Mountain blue; Germanicè, *Bergblau*. This dissolves in aquafortis with effervescence.
   B. Indurated.
      1. Pure calcareous earth mixed with calx of copper. Armenian stone, *lapis Armenus*.
      2. Gypseous earth united with calx of copper. Is of a green colour; and might perhaps be called *turquoise ore*, or *malachites*; though we do not know if all sorts of turquoise ore are of this nature.
         a. Semi-transparent, is found at Ardal in Norway.

(3.) With the calx of lead.

This is a lead ochre, or a spar-like lead-ore, which, in its formation, has been mixed with a calcareous earth, and for that reason effervesces with acids.
   A. Loose and friable.
      1. White.
   B. Indurated.
      1. Scaly.
         a. Yellowish.

Both these varieties contain a considerable quantity of lead, *viz.* 40 *per cent.* more or less; and the calcareous earth, is as equally and intimately mixed with it, as in the white iron ore.

IX. The following compounds of calcareous earth with different mineral substances are added from Mr Kirwan's Elements of Mineralogy.

1. A compound of calcareous and barotical earths: of this species are some yellowish stones found in Derbyshire, consisting of lumps of limestone interspersed with nodules of baroselenite. Many more may occur as compounds of gypsum and baroselenite, fluor and baroselenite, &c. &c.
2. Compounds of calcareous and magnesian earths; such as,
   a. The white marble, interspersed with spots of steatites of soap-rock, either green or black, called by Crondstedt *kolmord marble*. This marble is of a scaly texture.
   b. The *pietra talchina* of the Italians, which consists of white spar with veins of talc.
   c. The *verde antico* of the Italians, which is a light green marble, with deep green, black, white, and purple spots. According to Mr Bayen, it contains 62 parts of mild calcareous earth, 30 of green talc, 1 of magnesia, and 1 of semiphlogisticated iron.
3. Compounds of calcareous and argillaceous earths; such as,
   a. The green Campan marble from the Pyrenées. It is slaty and somewhat magnetic. According to Mr Bayen, it contains 65 of mild calcareous earth, 32 of the argillaceous, and 3 of semiphlogisticated iron.
   b. The red Campan marble: this is not magnetic; it contains 82 parts of mild calcareous earth, 11 of argillaceous shistus, and 7 of dephlogisticated iron.
   c. Yellow figured marble from Florence: according to Mr Bayen, it contains 75 parts of mild calcareous earth, 13 or 14 of shistus, and 4 or 5 of dephlogisticated iron.
   d. Griotte marble from Autun of Burgundy in France: it contains 67 parts of mild calcareous earth, 26 of reddish schistus, 2 of iron, and 1 of magnesian earth.
   e. The Amandola, which is a green marble, honey-comb like, with white spots. It contains 76 parts of mild calcareous earth, 20 of schistus, and 2 of semiphlogisticated iron. The cellular appearance proceeds from the schistus.
4. Compounds of calcareous earth and mica; such as,
   a. The cipolin from Autun in France: it is of a green colour, and consists of 83 parts of chalk, 12 of green mica, and 1 of iron.
   b. The micaceous limestone, is of a glittering appearance, of various degrees of hardness, and effervesces with acids. Such as the macigno of the Italians; their yellow pietra bigia; and their blue pietra columbina or turkina.
5. Compounds of calcareous and siliceous earths; such as,
   a. The calcareous quartz and pudding-stone: this consists of lumps of quartz, and sometimes of felt-spar in a calcareous cement.
   b. The limestone with veins of quartz; such as the *saxum sahlbergense*, and several marbles of Sweden and Siberia, which strike fire with steel.
6. Calcareous volcanic pudding-stone; such as,
   a. The cierchina, which consists of lumps of spar and lava, in a calcareous cement, mentioned by Mr Ferber.
   b. The marble mixed with veins of black or green lava, mentioned by the same author.
7. Compounds of calcareous earth, mixed with two or more kinds of earth; such as,
   a. The cipolin from Rome, which is a green marble with white zones: it strikes, though difficultly, fire with steel: it contains 67,8 parts of mild chalk, 25 of quartz, 8 of shistus, and 0,2 of iron, besides the iron contained in the argillaceous shistus.
   b. The calcareous porphyry, which consists of quartz, felt-spar, and mica in separate grains united by a calcareous cement.
   c. The limestone interspersed with shoerl and mica.
   d. To these compounds belongs the pyritaceous limestone called by the French *Pierre de St Ambroix*. It is of an iron grey colour, interspersed with shining particles. Its texture is compact, and scarcely gives fire with steel. Its specific gravity is 2,7034. It is soluble in acids, and mostly with effervescence; calcines in a strong fire; makes nitre slightly detonate; and if distilled affords a small portion of vitriolic acid, and some sulphur sublimes. Its component

Ponderous Earth.

porent parts are 75 of mild calcareous earth and 25 of pyrites; in which are contained 14 of argil, 7 of quartz and fulphur, and 4 of iron.

Order II. Ponderous Earth.

Ponderous earth, (*Terra Ponderosa*): Cauk, or calk. See Earth, Art. I. This is a particular kind of earth (like chalk in appearance, but with fome very different properties), difcovered in Sweden about 1774, which by its refults with other bodies has fome fimilarity to the known alkalis. It has not yet been found pure, but mixed with other fubftances: however, its great fpecific weight eafily diftinguifhes it from the others, it being the heavieft of all earths.

1. Its fpecific gravity when confiderably purified by art is 3,773.
2. This earth combines with aerial acid: and in this cafe effervefces with ftronger acids.
3. With vitriolic acid it forms the ponderous fpar, which is infoluble in water.
4. Its cryftallization, after being combined with the nitrous, or with the muriatic acids, is hardly foluble;
5. But with acetous acid, it becomes deliquefcent.
6. When pure; viz. without any mixture of acid or alkali, it does not vitrify in the fire.
7. If deprived of the aerial acid (fixed air) by calcination, is then foluble in 900 times its weight of boiling water. This folution expofed to air, forms a cremor, like that of lime-water in the fame circumftances, and like it changes alfo the vegetable colours.
8. Whilft combined with aerial acid, it is only foluble in about 1550 times its weight of water, chiefly if the water has been impregnated alfo with the fame aerial acid.
9. It expels the cauftic volatile alkali from ammoniacal falt.
10. Mixed with brimftone it produces a hepar fulphuris, whofe folution in water is but incompletely decompofed either by the nitrous or the muriatic acid, on account of the great attraction between this earth and the acid of fulphur, which is fo ftrong that it
11. Separates this acid (the vitriolic) from the vegetable alkali.

I. Combined with aerial acid; *Terra Ponderofa aërata*. See Chemistry-*Index*.
  It refembles alum, but is hard and ftriated, as if compofed of radiating fibres coming from a centre. It is found in Alfton-moor in England.
  A. Spar-like gypfum.
    1. Semitranfparent, *fpatum Bononienfe*. The Bononian ftone, or native phofphorus.
    2. Opaque. *a.* White. *b.* Reddifh.
  B. Ponderous Drufen fpar.
    1. Jagged, *criftatum*. Thefe refemble cock's combs, and are found in clefts and fiffures accreted on the furfaces of balls of the fame fubftance.
    2. White.
    3. Reddifh.

II. United with phlogifton and the vitriolic acid. *Leberftein* of the Germans and Swedes. *Lapis hepaticus*.
  This ftone in fome fpecimens conftantly, but in others only when rubbed, fmells like the *hepar fulphuris*, or gun-powder.
  It is found.
  A. Scaly.
    1. With coarfe fcales. *a.* Whitifh yellow.
    2. With fine fparkling fcales. *a.* Black.

Magnefian Earths.

Order III. Magnesian, Micaceous, and Asbestine Earths.

§ 1. *Magnefian Earths.*

Magnesia is a white, loofe, and light earth, only known fince the beginning of this century. It is generally found combined or mixed with other heterogeneous fubftances, as other fimple earths are.

1. When pure its fpecific gravity is 2,330, and then,
2. It neither hardens, contracts, nor melts by the application of heat, even by the folar rays.
3. But it melts afily with borax, or microcofmic falt; though it is fcarcely affected by fixed alkalis or calces of lead.
4. Mixed with other earths, it produces by fire different hard maffes.
5. It gives no caufticity except to the volatile alkali: and,
6. Does not effervefce with any acid.
7. When mixed with water it fhows a very fmall degree of heat, but without any effervefcence. And when the water exceeds the weight of magnefia about 7,692 times, it is totally diffolved.

8 and 9. Being put in water and afterwards dried, it contains $\frac{18}{100}$ parts of its weight; though when faturated with aerial acid, it will abforb and retain after being dried $\frac{66}{100}$ parts of water.

10. This earth combined with aerial acid is more foluble in cold than in hot water.
11. Combined with vitriolic acid it cryftallizes into a bitter falt, known by the name of *Epfom* and *Seydlitz* or *Seidfchulitz* falt, which is foluble in little more than its own weight of water.
12. With nitrous acid it forms a deliquefcent falt.
13. With the muriatic or the acetous acids it does not cryftallize: and the mafs being dried, attracts humidity from the air.
14. It has a ftronger attraction to the fluor acid than to any other (Berg.): and cryftallizes with it into hexangular prifms whofe ends are formed of two low pyramids, of three rhombs (*Romé de l'Ifle*).
15. It is not precipitated from other acids by the vitriolic, as calcareous earth is.
16. According to Lavoifier and Macquer, when magnefia is calcined, it becomes phofphorefcent.

I. Magnefia combined with vitriolic and other acids.
  A. When faturated with the vitriolic acid, it forms a bitter falt, called *Englifh* or *Epfom*, *Seydfhutz* or *Sedlitz* falt. The falts known under thefe dif-

 ferent

Magnesian Earths.

ferent names only differ from one another on account of some heterogeneous substance, which is combined in them, the vitriolated magnesia being the characteristic and principal ingredient in them all.

B. Magnesia is found not only combined with the vitriolic acid in the waters of Epsom, Sedlitz, &c. but also with the marine acid to a considerable quantity in sea-water and other salt springs.

C. It is contained frequently in fresh waters, where it is dissolved by means of a quantity of aerial acid.

II. Combined with other earths.

A. Magnesia, when combined with siliceous earth, is commonly unctuous to the touch, and more or less difficult to be cut or turned in proportion to its different degrees of hardness.

It is not diffusible in water: grows hard, and is very refractory in the fire.

When pounded and mixed with water, it will not easily cohere into a paste: however, if it is managed with care, it may be baked in the fire to a mass, which being broken, shows a dull and porous texture.

It takes for the most part, and without much labour, a fine polish. It is found,

(1.) Compact and soft; *Smectis, Briançon* or French Chalk.

a. White, from the Lands-End, in Cornwall.

b. Yellow.

c. Red and white, from the Lands-End: the soap-earth, from Switzerland: it looks like Castile-soap.

(2.) Solid and compact; of impalpable particles: Steatites or soap-rock.

a. White, or light green. *b.* Deep green.—*c.* Yellow.

(3.) Solid, and of visible particles; serpentine stone.

A. Of fibrous and coherent particles.

This is composed, as it were, of fibres, and might therefore be confounded with the asbestus, if its fibres did not cohere so closely with one another, as not to be seen when the stone is cut and polished. The fibres themselves are large, and seem as if they were twisted.

a. Deep green. It is sold for the *lapis nephriticus*, and is dug at some unknown place in Germany. *b.* Light green, from Skienshyttan, in Westmanland; is used by the plate-smiths instead of French chalk.

B. Of granulated particles; fine grained serpentine stone, the Zoeblitz serpentine.

a. Black. *b.* Deep green. *c.* Light green. *d.* Red. *e.* Bluish grey. *f.* White. These colours are all mixed together in the serpentine stone from Zoeblitz, but the green is the most predominant colour.

B. Porcelain earth mixed with iron; *terra porcellanea*. This is,

A. Diffusible in water.

a. Red, from Montmartre, and China. The water-clinkers which are imported from certain places in Germany seem to be made of this kind.

B. Indurated.

1. Martial soap earth.

a. Red.

2. Martial soap-rock.

a. Black.

b. Red.

C. The telgsten of the Swedes; *lapis ollaris*.

a. Light grey. *b.* Whitish yellow. *c.* Dark grey. *d.* Dark green.

The serpentine stone has many varieties; being found, (1.) Veined or spotted with green steatites. (2.) Red, with veins of asbestos. (3.) Red, green, yellow, or black with veins or spots of white calcareous spar, is called *potzevera*. The black is called *nero di prato*; the green *verde di Suza*; but these names are not restrained to this species. (4.) Veined or spotted with gypsum. (5.) Veined or spotted with baroselenite. (6.) Veined or spotted with shistus.—And, (7.) With veins of quartz, feltspar, or shoerl. (*Kirwan's Mineralogy.*)

What is commonly called *serpentine* is a true *lapis ollaris*; but being variegated with green, yellowish, and brown spots, like the skin of some common serpents, it is called by that name. Great quantities of this stone are found in Italy and Switzerland, where it is often worked into the shape of dishes and other vases. (*Fabroni.*) And the *gabro* of the Italians is nothing else but a kind of serpentine. (*Kirwan.*)

§ 2. *Micaceous Earths.*

These are known by the following characters:

1. Their texture and composition consist of thin flexible particles, divisible into plates or leaves, having a shining surface.
2. These leaves or scales exposed to the fire lose their flexibility and become brittle, and then separate into inner leaves: but in a quick and strong fire, they curl or crumple, which is a step towards fusion; though it is very difficult to reduce them into pure glass by themselves or without addition.
3. They melt pretty easily with borax, the microcosmic salt, and the alkaline salt: and may by means of the blow-pipe be brought to a clear glass with the two former salts. The martial mica is, however, more fusible than the uncoloured ones: its specific gravity is 3,000.

A. Colourless or pure mica; daze, glimmer, or glist.

1. Of large parallel plates; Muscovy glass. This is transparent as glass; found in Siberia and Elfdalen in the province of Wermeland.
2. Of small plates, from Silfverberget, and Runneby, in the province of Blekinge.
3. Of fine particles like chaff; chaffy mica.
4. Of twisted plates; crumpled mica.

B. Coloured and martial glimmer.

1. Brown, semi-transparent.
2. Of fine and minute scales.
   a. Brown. *b.* Deep green. *c.* Light green. *d.* Black.
3. Twisted or crumpled glimmer.
   a. Light green.
4. Chaffy glimmer.
   a. Black.

5. Chry-

Magnesian Earths.

5. Chrystallised glimmer.
   a. Of concentrated and erect scales.
   b. Of hexagonal horizontal plates.

The transparent Muscovy glass is used for windows, and upon all occasions where panes of glass are wanted. Perhaps it might also be advantageously employed to cover houses.

The twisted or crumpled mica, which is found at Hardol in Jemtland, is there manufactured into kettles and other vessels, as also for hearths of chimnies: and the powder which falls in the working may be mixed with the common salt for the distillation of the muriatic acid.

§ 3. *Asbestine Earths.*

These are only yet discovered in an indurated state; and their characters are as follows:

1. When pure, they are very refractory in the fire.
2. In large pieces they are flexible.
3. They have dull or uneven surfaces.
4. In the fire they become more brittle.
5. They do not strike fire with the steel.
6. They are not attacked by acids.
7. They are easily brought into fusion by borax or alkali.

In this section are included both those varieties which by fossilogists have been mentioned under the names of *amiantus* and *asbestus*, and have often been confounded together.

I. Asbestus, which is compounded of soft and thin membranes; *amiantus Wallerii.*
   A. Of parallel membranes: *Corium, sive caro montana*, Mountain-leather.
      1. Pure. *a.* White.
      2. Martial. *a.* Yellowish brown.
   B. Of twisted soft membranes; mountain-cork.
      1. Pure. *a.* White.
      2. Martial. *a.* Yellowish brown.

II. Of fine and flexible fibres; or earth flax: *asbestus Wallerii.*
   A. With parallel fibres: *Byssus.*
      1. Pure and soft. *a.* Light green. *b.* White.
      2. A little martial, and more brittle.
         a. Greenish, from Bastnas Grufva, at Ryddarhyttan in Westmanland. There it forms the greatest part of the vein out of which the copper ore is dug; a great part of it is consequently melted together with the ore, and is then brought to a pure semi-transparent martial slag or glass.
   B. Of broken and recombined fibres.
      1. Martial. *a.* Light green.

Order IV. Siliceous Earths.

Siliceous earth is, of all others, the most difficult to describe and to distinguish perfectly; however, it may be known by the following characters, which are common to all bodies belonging to this order.

1. In its indurated state it is hard, if not in regard to the whole, yet at least in regard to each particle of it, in a degree sufficient to strike fire with steel, and to scratch it, when rubbed against it, though the steel be ever so well tempered.
2. When pure, and free from heterogeneous particles, it does not melt by itself, neither in a reverberatory nor in a blast furnace.
3. After being burnt, it does not fall to a powder, neither in the open air nor in water, as the calcareous earth does, but becomes only a little looser and more cracked by the fire, unless it has been very slowly, and by degrees, heated.
4. It excites no effervescence with acids.
5. In the fire it melts easiest of all to a glass with the fixed alkaline salt; and hence it has got the name of vitrescent, though this name is, properly speaking, less applicable to this order than to a great many other earths.

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To the above we may add the following properties from Bergman.

6. It is not soluble in any of the known acids, the fluor-acid only excepted. But,
7. It may be dissolved by the fixed alkali, both in the dry and wet way.
8. If the fixed alkali is only half the weight of the siliceous earth, it produces a diaphonous and hard glass: but when it is in a double or triple proportion, then the glass deliquesces of itself by attracting the humidity of the atmosphere.
9. It melts easily with borax; but
10. With microcosmic salt it is more difficult, and requires a longer time to melt.
11. This earth has a great analogy to acids, as it is perfectly dissolved in that wonderful natural hot-water spout above ninety feet high at Geyser, in Iceland, where by cooling it forms a siliceous mass.

§ 1. *Gems, or precious stones.*

I. Diamond. *Adamas gemma.* See Diamond.
   1. Of all stones, it is the hardest.
   2. Is commonly clear, or transparent; which quality, however, may, perhaps, only belong to its crystals, but not to the rock itself from which they have their origin.
   3. Its specific gravity is nearest 3,500. When brought to Europe in its rough state, it is in the form either of round pebbles with shining surfaces, or of chrystals of an octoedral form.
   a. Colourless, or diaphonous, or the *diamond* properly so called.
      But it also retains this name when it is tinged somewhat red or yellow. Being rubbed, it discovers some electrical qualities, and attracts the mastic.
   b. Red; Ruby. *Adamas ruber; Rubinus.*—Which, by lapidaries and jewellers, is, in regard to the colour, divided into,
      1. The ruby of a deep red colour inclining a little to purple,
      2. Spinell, of a dark colour.
      3. The balass, pale red, inclining to violet. This is supposed to be the mother of the rubies.
      4. The rubicell, reddish yellow.
      However, all others do not agree in the characters of these stones.

II. Sapphire. *Sapphyrus gemma.*
   It is transparent, of a blue colour; and is said to be in hardness next to the ruby, or diamond.

III. To-

III. Topaz. *Topazius gemma.*

a. The pale yellow topaz; which is nearly uncoloured.

b. The yellow topaz.

c. Deep yellow, or gold coloured topaz, or oriental topaz.

d. Orange-coloured topaz.

e. The yellowish green topaz or *chrysolite.*

f. The yellowish green, and cloudy topaz, the *chrysoprase* (A)

g. Bluish green topaz, or the beryl.

This varies in its colours; and is called, when

1. Of a sea-green colour, the *aqua-marina.*

2. When more green, the *beryl.*

IV. Emerald. *Smaragdus gemma.*

Its chief colour is green and transparent. It is the softest of precious stones and when heated it is phosphorescent like the fluors.

V. To the precious stones belong also the jacinths, or hyacinths; which are chrystals harder than quartz crystals, transparent, of a fine reddish-yellow colour when in their full lustre, and formed in prisms pointed at both ends: these points are always regular, in regard to the number of the facets, being four on each point; but the facets seldom tally; the sides also which form the main body, or column, are very uncertain in regard both to their number and shape; for they are found of four, five, six, seven, and sometimes of eight, sides: further the column or prism is in some also so compressed, as almost to resemble the face of a spherical facetted garnet.

Mr Cronstedt says, he got some jacinths of a quadrangular figure, which did not melt in the fire, but only became colourless.

VI. The amethyst is a gem of a violet colour, with great brilliancy, and as hard as the best kind of rubies or sapphires, from which it only differs by its colour. This is called the *oriental amethyst;* and is very rare: when it inclines to the purple, or rosy colour, it is more esteemed than when it is nearer to the blue.

These amethysts have the same figure, hardness, specific gravity, and other qualities, as the best sapphires or rubies; and come from the same places, particularly from Persia, Arabia, Armenia, and the West Indies.

The amethysts called *occidental,* are of the same nature as rock crystals, and have the same gradations. viz. of a violet inclining to the purple

(A) In the *Annals of Chemistry,* Vol. I. we have the following account of the method of digging for the chrysoprases, and of the earths and stones with which it is accompanied.

This precious stone is found in certain mountains in Silesia, which seem to begin those of Tradas, extending to within half a league of Glatz. These mountains appear, in general, to consist of a number of strata, horizontal or inclined, composed chiefly of substances containing magnesia, but likewise mixed with calcareous, argillaceous, and siliceous earths. The greatest part of these consist of serpentine, mixed with asbestos and amianthus, grey argillaceous earths, boles, and red or green ochres, stone marrow, steatites, or soapstone, and talc. In those mountains also we meet with quartz, petrosilex, opal, and chalcedony, in detached fragments, and sometimes in continued veins. We also discover in them veins of sand, of the nature of granite. Sometimes the serpentine is met with at the surface; sometimes at the depth of 20 or 30 feet. The stone marrow seems here to be produced by the decomposition of a very milky species of opal agate named *cacholong;* for at the depth of 50 feet and upwards the veins of this soapy earth assume a degree of solidity, and we find nothing but hard and semitransparent chacholongs.

The abovementioned strata are crossed by a great number of cracks filled with green-coloured earths and stones; but these frequently do not contain a single true chrysoprasus. They are sometimes found immediately under the vegetable mould, or at the depth of some feet, in shapeless masses, covered with a heavy clay, and sometimes enveloped by an unctuous earth of a beautiful green colour, which it derives from the calx of nickel. In other places, the chrysoprasus has been found in uneven laminæ of several yards in length and breadth, either immediately under the mould, or in the upper strata of serpentine, which have little solidity; and very beautiful ones have been found at the depth of seven or eight fathoms; and some have been met with in grey clay at the depth of four fathoms. In some places also they are met with in a kind of red ochre, which is attracted by the magnet; in others they are found in the clefts of rocks. The beautiful green chrysoprasus is found most plentifully in the mountain of Glassendorf. In another mountain named Kosemutz, where it is also found, the pieces are so porous, and so much spotted with white, &c. that sometimes upwards of 1000 of them have not afforded one large enough for the use of the jewellers. The defects are frequently only discoverable on polishing, as the green opal, while rough, perfectly resembles the chrysoprasus; but, on polishing the stones in which it is contained, it is detected by its want of lustre.

The quantity in which these stones are found is not sufficient to afford the expences of regular mining; the most profitable way, therefore, of obtaining them is by making trenches in the earth from four to six feet deep. Almost all the mountain of Kosemutz, however, has already been examined in this manner; so that they now dig for the chrysoprasus in quarries by uncovering a bank of earth or stone, and descending to other banks by steps in the open air, so as to throw the rubbish back from bank to bank. This method, however, cannot be continued farther than 24 or 30 feet, otherwise the produce would not defray the expence. The only tools employed in digging for the chrysoprasus are a spade and pick-ax; the former to remove the earth, the latter to detach the chrysoprasus itself from the stones which surround it.

Various accounts have been given of the component parts of this precious stone. Lehmann thinks, that the purple or rosy colour, or inclining to the blue; very often they are semi-transparent, without any colour in one end, and violet towards the other. The best are found in the Vic mountains of Catalonia in Spain, and at Wiesenthal in Saxony, as well as in Bohemia in Germany, in Italy, and in the province of Auvergne in France.

Crystals within the geodes, or hollow agatheballs, are very often found of an amethyst colour, and some are very fine.

What we call *amethyst root*, or *mother of amethyst*, is but a sparry fluor, of which there are plenty in Derbyshire: many fine ornamental pieces are made of this substance in different forms and shapes. These spars are found in insulated masses, sometimes pretty large; but never in the form of large rocks.

VII. The garnet, *(Granatus.)* This stone, when transparent and of a fine colour, is reckoned among the gems: but it varies more than any, both in the form of its crystals and in its colour, some being of a deep and dark red, some yellowish and purplish, and some brown, blackish, and quite opaque. In general, their lustre is less than that of other gems, as well as their hardness, which yields to the file, although they may strike fire with steel. But as to their form, these crystals take almost all sorts of figures, as the rhomboidal, tetradecaedral, &c. and some are of an irregular form.

Their colour proceeds from the iron which enters into their composition; and, according to M. de Saussure, even the finest oriental garnets attract the magnetic needle at a small distance.

The Syrian garnet is the finest and best esteemed. It is of a fine red, inclining to the purple colour, very diaphanous, but less brilliant than the oriental amethyst. It seems to be the *amethystizontas* of Pliny: the Italians call it *rubino di rocca*,

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the colour of it is owing to some ferruginous particles modified in a particular manner: but the experiments he adduces for this opinion are not satisfactory. Mr Sage attributes the colour to cobalt from the blue colour it imparts to glass. Mr Achard thinks the stone contains calx of copper as well as calx of iron; because a part of the metal separable from it may be dissolved in volatile alkali. The following are the experiments of M. Klaproth upon the subject.

1. On heating several pieces of very pure chrysoprasus red hot, and quenching them in water, the colour was changed from green to bluish grey: and, on repeating the operation, it became a white grey. They were found to have lost in weight one and an half per cent. and were easily pulverable in a glass mortar.

2. Three hundred grains of chrysoprasus were mixed with double its weight of mild mineral alkali, and the mixture heated for some hours red hot, in a porcelain crucible. The mass was then powdered, and digested in distilled water. By filtration, a yellowish grey residuum was obtained, weighing 44 grains; the filtered liquor was limpid and colourless, a copious precipitate being formed with muriatic acid, which being washed and dried was found to be siliceous earth.

3. The 44 grains of yellowish grey residuum were digested in a retort, with 352 grains of aqua regia; a great part of which was evaporated. The acid which came over was returned into the retort, and filtered after a second digestion. The residuum was a very fine white siliceous earth, which, after being washed, dried, and heated red hot, weighed 20 grains.

4. The filtrated solution was of a pale green, but on supersaturation with volatile alkali immediately turned of a bluish colour, precipitating a small quantity of brownish gelatinous matter; which, when collected, twice distilled with nitrous acid, and afterwards strongly heated, yielded a brown calx of iron, weighing no more than a quarter of a grain: whence our author concludes, that iron does not contribute to the colour of the chrysoprasus, as we know many colourless stones which contain as great a quantity of that metal. This small quantity of calx was left after digesting the gelatinous residuum. On precipitating the soluble parts, they appeared to consist of aluminous earth, in an excessively divided state; which being washed and dried, weighed half a grain.

5. To find whether the solution contained calcareous earth or not, he mixed with that, supersaturated with volatile alkali, a saturated solution of mild mineral alkali, which precipitated four grains and an half of white and very pure calcareous earth.

6. Nothing more was precipitated from the solution, either by acids or alkalies, after the separation of the calcareous earth, though it still retained a bluish colour. It was poured into a retort, and evaporated to dryness; the residuum was of a yellowish colour, which became green on being dissolved in distilled water. Mild mineral alkali threw down only a little earth of a greenish white colour; which being re-dissolved in dephlogisticated nitrous acid, and precipitated with Prussian alkali, the liquor yielded 17 grains of a sea-green powder. This precipitate, in our author's opinion, is the colouring principle of the chrysoprasus; and this principle he afterwards found to be calx of nickel.

7. Our author likewise attempted to analyse the chrysoprasus in the moist way by concentrated vitriolic acid; in which process his chief view was to discover whether the stone contained any volatile particles or not. On an ounce of crude chrysoprasus, therefore, when put into a retort, he poured an equal quantity of rectified vitriolic acid, and two parts of distilled water. After the latter had passed over into the receiver, the fire was increased to force over the superabundant acid; a part arose in white vapours, and some fell into the receiver with an hissing noise. Boiling water, which had been distilled, was then poured upon the residuum, and the solution filtered. The powdered chrysoprasus left on the filter had not been perfectly dissolved, and, in

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rocca, and is found in Syria, Calcutta, Cananor, Camboya, and Ethiopia.

The fine garnet of a red inclining to a yellow colour, is the *ſoranus* of the ancients, the *vermeille* of the French, and the *giacinto guarnacino* of the Italians. Its name is taken from *Sorian*, or *Surian*, a capital town of Pegu, from whence theſe gems are brought: when they have a browniſh taint, they are then called *hyacinths*.

The occidental garnet is of a deep and dark red, and its hardneſs is leſſer. However, ſome very fine hard garnets are found in Bohemia.—Garnets are alſo found in Hungary, at Pyrna in Sileſia, at S. Sapho in the canton of Berne, in Spain, and in Norway.

The garnet melts in the focus of a good burning glaſs into a brown maſs, which is attracted by the loadſtone; and this ſhows that iron enters conſiderably into its compoſition.

Some garnets are found, which contain a little gold. Thoſe called *zingraupen* by the Germans contain tin.

VIII. Tourmalin; *Lapis electricus*.

This is a kind of hard ſtone, lately brought into notice by its electrical properties. See TOURMALIN.

1. Its form is a priſm of nine ſides of different breadths, moſtly truncated, and ſeldom terminating in a pyramid at each end, which is either compoſed of three pentagons, or of nine triangles.
2. When heated in the fire, it gives ſigns of contrary electricity on the two oppoſite ends of their priſmatic form. But many of theſe ſtones are not in the leaſt electric. However, on being rubbed, they become electric in their ſides, like other diaphanous gems.
3. It is as hard almoſt as the topaz, and ſtrikes fire with ſteel.
4. It melts by itſelf in a ſtrong fire, though with difficulty.
5. With the microcoſmic ſalt it melts perfectly; but only in part with borax.
6. With mineral alkali it is divided into a kind of powder.
7. The three mineral acids diſſolve it when firſt reduced to a powder.
8. It bears a greater ſimilarity to ſchoerl than to any other ſtone: but its component parts ſhow

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in general, had undergone but little alteration, ſo that he could not by this method determine the component parts. M. Achard, however, was more ſucceſsful, and by a ſimilar method determined the component parts of this gem to be five grains of an earth, which, diſtilled with vitriolic acid, became volatile; eight grains of calcareous earth, ſix grains of magneſia, two grains of calx of iron, three grains of calx of copper, and 456 of ſiliceous earth.

M. Klaproth never met with any volatile earth or magneſia in his experiments on this gem; and therefore concludes, that the chryſopraſus uſed by him had been eſſentially different from that made uſe of by M. Achard; and he ſeems not to give credit to the account of any copper being found in it.

8. One part of crude chryſopraſus, well powdered and waſhed with two parts of mild vegetable alkali, yielded a violet-coloured glaſs, which in the atmoſphere ran into a browniſh-coloured liquor.

9. Five parts of the gem, with four of mild alkali, gave a beautiful violet-coloured glaſs after being two hours in fuſion.

10. Equal parts of crude chryſopraſus and mild mineral alkali, yielded a tranſparent glaſs in thin laminæ, of a brown colour, reſembling that of the tourmalin, the ſurface being marked with fine reticulated veins; which veins aroſe from ſmall grains of very fine reduced nickel placed in lines againſt one another.

11. Equal parts of crude chryſopraſus and calcined borax, gave a clear, tranſparent, and brown glaſs, reſembling the ſmoky topaz.

12. Equal parts of chryſopraſus, extracted by vitriolic acid and calcined borax, yielded a ſimilar glaſs of a clear brown colour; "which proves (ſays our author), that the vitriolic acid was incapable of perfectly analyſing the chryſopraſus, though I had uſed a double portion of the earth."

13. Eighty grains of prepared ſiliceous earth, ſixty grains of mild fixed alkali, with the three grains of calx of nickel procured from the chryſopraſus, yielded a beautiful, clear, and violet-coloured glaſs.

14. On ſubſtituting three grains of calx produced from an ore of nickel, a glaſs was produced exactly like the former.

15. Sixty grains of prepared ſiliceous earth and calcined borax, with three grains of calx of nickel from the chryſopraſus, yielded a tranſparent glaſs of a clear brown colour.

16. Sixty grains of prepared ſiliceous earth and vitrified phoſphoric acid, with three grains of calx of nickel from the chryſopraſus, gave a glaſs of the colour of honey.

17. Thus the attempts of M. Klaproth to recompoſe the chryſopraſus proved abortive. From his experiments, however, he deduces the following concluſions: 1. The blue colour obſervable in the glaſs produced by fuſing the chryſopraſus with vegetable alkali, ariſes entirely from the nickel contained in the gem: and the experiment ſhows that the calx of nickel, when purified as much as poſſible, has the ſurpriſing property of tinging glaſs frits prepared with vegetable alkali of a blue colour. "But (ſays he) why was not this colour alſo obtained with ſoda? and what is the cauſe of a difference ſo little to be expected?" 2. By theſe experiments the ſuppoſition of M. Sage is refuted, that the metallic matter which colours the chryſopraſus is cobalt: "many metallic ſubſtances beſides cobalt, it is well known, give by certain proceſſes a blue glaſs; thus

cobalt,

shew that it may be ranged with propriety in this place, along with other precious stones: as the argillaceous earth is also the most prevalent in its composition.

a. The oriental tourmalines are found in the island of Ceylon. They are transparent, of a dark brown yellow; and their specific gravity is from 3062 to 3295.

b. From Brasil. Transparent. These are green for the most part; but there are also some red, blue, and yellow: their specific gravity is from 3075 to 3180.

c. From Tyrol. Of so dark a green as to appear opaque. Their specific gravity is about 3050. These are found in beds of steatites and lapis-ollaris, among the micaceous veins, talcs, and hornblende of Schneeberg, Jurzagl, and Zillerthal, in the mountains of Tyrol.

d. From the mountains of Old Castile in Spain. These are transparent, and have the same properties as the preceding ones.

IX. The opal, *Opalus;* the *girasole* of the Italians.—This is the most beautiful of all the flint kind, owing to the changeable appearance of its colours by reflection and refraction, and must therefore be described under both these circumstances.

1. The opal of Nonnius, the *Sangenon* of the Indians. This appears olive-coloured by reflection, and seems then to be opaque; but when held against the light, is found transparent and of a fine ruby red colour.

There is, however, another of the same kind in Sweden, which by reflection appears rather brown; but by refraction it is red, with violet veins.

2. The white opal. Its ground is white, of a glass-like complexion, from whence are thrown out green, yellow, purple, and bluish rays; but it is of a reddish or rather flame-colour when held against the light.

a. Of many colours; the oriental opal.

b. Of a milky colour.

c. Bluish, and semi-transparent. This is not so much valued as those which are more opaque, because it is easier to be imitated by art.

§ 2. *Of Quartz.*

This stone is very common in Europe, and easier to be known than described. It is distinguished from the other kinds of the siliceous order by the following qualities:

1. That it is most generally cracked throughout, even in the rock itself; whereby,
2. As well as by its nature, it breaks irregularly, and into sharp fragments.
3. That it cannot easily be made red-hot without cracking still more.
4. It never decays in the air.
5. Melted with pot-ashes, it gives a more solid and fixed glass than any other of the siliceous order.
6. When there has been no interruption in its natural accretion, its substance always crystallises into hexagonal prisms pointed at one or both ends.
7. It occurs in clefts, fissures, and small veins in rocks. It very seldom forms large veins, and still seldomer whole mountains, without being mixed with heterogeneous substances.

According to Mr Kirwan, quartz neither loses its hardness nor its weight by calcination. Its texture is lamellar. These stones are in general the purest of the siliceous kind, though most contain a slight mixture of other earths; the most obvious distinction among them arises from their transparency or opacity.

Quartz is found,

(1.) Pure.

A. Solid, of no visible particles, with a glossy surface. Fat Quartz.

a. Uncoloured and clear. This has no crystallized form, but is nevertheless as clear as quartz crystals of the best water.

b. White, the common fat quartz.

c. Blue

cobalt gives a blue colour to combinations of the mineral alkali with phosphoric acid, to mineral alkali itself, to potash, and to borax. The acid of tungsten (falsely so called) also gives a blue colour to frits made with phosphoric salts, but not to those made with borax; the calx of nickel gives a blue colour only to frits made with potash, brown to those with mineral alkali and borax, and yellow, like honey, to combinations of phosphoric acid with mineral alkali." 3. As the chrysoprasus gives a brown colour with borax, and the solution of this stone in muriatic acid gives no signs of cobalt dissolved in the same acid; this shows that there is no cobalt in the stone. Mr Sage, indeed, pretends, that he has obtained a blue glass from the chrysoprasus and borax; but this is contradicted by experience. 4. The mineralogical character of the chrysoprasus, therefore, is a quartz coloured green by nickel. Three hundred grains of it contain 288½ of siliceous earth calcined to redness, one quarter of a grain of pure aluminous earth, two grains and an half of calcareous earth calcined to redness, three grains of calx of nickel, and one quarter of a grain of calx of iron. All these were extracted in the experiments; and there were besides five grains and an half of waste.

Our author mentions, that in the collections of chrysoprasus which have been brought to him, he has constantly observed green opal, in bits of vein from half an inch to an inch, and fixed in its borders: the reddish, yellow, and white opals, on the contrary, are generally met with on a green or brownish petrosilex. But the white opal, which, as well as the green, is found in pieces of the nature of matrix, differs from the true opal, approaching the chalcedony and the opaque milky quartzes. This kind of transparent opal, radiated with a whitish blue, contains the following ingredients in its composition: Siliceous earth, 237 grains; aluminous earth, a quarter of a grain; calx of iron, a quarter of a grain—in all, 237¼ grains. In 240 grains were two and an half of waste. The colour of this stone, as well as the chrysoprasus, in our author's opinion, is derived from nickel.

c. Blue.
d. Violet.
B. Grained.
a. White. *b*. Pale green.
C. Sparry quartz.
This is the ſcarceſt; and ought not to be confounded with the white felt-ſpar, being of a ſmoother appearance, and breaking into larger and more irregular planes.
a. Whitiſh yellow. *b*. White.
D. Cryſtalliſed quartz. Rock cryſtal. Quartz cryſtal.
1. Opaque, or ſemi-tranſparent.
a. White, or of a milk colour.
b. Red, or of a carnelian colour.
c. Black.
2. clear.
a. Blackiſh brown, ſmokey topaz, or *raunch topaz* of the Germans.
b. Yellow; found in Bohemia, and ſold inſtead of topazes.
c. Violet; the amethyſt from Saxony, Bohemia, and Dammemore in Upland (B.)
d. Uncoloured: rock cryſtal, properly ſo called. When theſe coloured cryſtals are not clear, they are called *fluſs*; for inſtance, *topaz-fluſs*, *amethyſt-fluſs*, &c (c.)
(2. Impure quartz.
A. Mixed with iron, in form of a black calx.—This is of a gloſſy texture, and contains a great quantity of iron.
B. Mixed with copper in form of a red calx.
a. Red.

§ 3. *Of Flints.*

The flint (*Silex pyromachus*, *Lapis corneus*, or the *hornſtein* of the Germans) forms a kind of intermediate ſubſtance between quartz and jaſper; both which, however, it ſo nearly reſembles, that it is not eaſy to point out ſuch characters as ſhall readily diſtinguſh it from them. We can only, therefore, ſpeak of its properties comparatively.
1. It is more uniformly ſolid, and not ſo much cracked in the maſs as the quartz; and,
2. It is more pellucid than the jaſper.
3. It bears being expoſed to the air without decaying better than the jaſper, but not ſo well as the quartz.
4. It is better for making of glaſs than the jaſper, but is not quite ſo good as quartz for that purpoſe.
5. Whenever there has been an opportunity in this matter of its ſhooting into cryſtals, quartz cryſtals are always found in it; juſt as if the quartz made one of its conſtituent parts, and had in certain circumſtances been ſqueezed out of it; this is to be ſeen in every hollow flint and its clefts, which are always filled up with quartz.
6. It often ſhows moſt evident marks of having been originally in a ſoft and ſlimy tough ſtate like glue or jelly.

The ſeveral varieties of this ſpecies have obtained more diſtinct names with reſpect to their colours than from any real difference in their ſubſtance; but theſe are ſtill neceſſary to be retained, as the only names uſed by jewellers and others, who know how to value them accordingly.

I. Jade. *Lapis nephriticus*. *Jaſpachates*.
The true lapis nephriticus ſeems to belong to this ſiliceous order, as it gives fire with ſteel, and is ſemi-pellucid like flint; it does not harden

(B.) The moſt tranſparent are called *falſe diamonds*, *Briſtol*, *Kerry ſtones*, and *Alençon diamonds*, &c. The coloured tranſparent cryſtals derive their tinge generally from metallic calces, though in exceeding ſmall portions: they all loſe their colours when ſtrongly heated. Theſe are what we call falſe gems, viz.
The *red*, from Oran in Barbary, *falſe rubies*.
The *yellow*, from Saxony, *falſe topazes*,
The *green*, from Dauphiny, (very rare) *falſe emeralds*, or *praſes*.
The *violet*, from Vil in Catalonia, *falſe amethyſts*.
The *blue*, from Puy in Valay, France, *falſe ſapphires*.
There are alſo *opal*, or *rainbow cryſtals*, ſome of which make a very fine appearance; the various colours of which are thrown out in zones acroſs the ſurface, though they never ſhine like the oriental opal.

(c) M. Fourcroy makes a remarkable difference between the cryſtals and the quartz, by affirming that the former are unalterable in the fire, in which they never loſe their hardneſs, tranſparency, nor colour; whilſt the quartz loſes the ſame qualities, and is reduced by it to a white and opaque earth. He claſſes the rock cryſtals,

1ſt, According to their *form*, viz. 1. Inſulated-hexagonal-cryſtals, ending in two pyramids of ſix faces, which have a double refraction or ſhow two images of the ſame object when looked through. 2. Hexagonal cryſtals united, having one or two points. 3. Tetrædral, dodecædral, flated cryſtals, and which though hexagonal have nevertheleſs their planes irregular. 4. Cryſtals in large maſſes, from the iſland of Madagaſcar, which have a ſimple refraction

2dly, As to the colour, they are either diaphonous, rediſh, ſmokey, or blackiſh.

3dly, As to accidental changes, ſome are *hollow*; ſome contain *water* within one or more cavities: ſome are caſed, viz. one within the other: ſome are of a round form, as the pebbles of the Rhine; ſome have a cruſt of metallic calces, or of a pyrites: ſome are of a geodical form, viz, cryſtalliſed in the inſide of a cavity: ſome ſeem to contain amianthe, or aſbeſtus, and others contain ſhirls.

The ſame author reckons among cryſtals, the oriental topaz, the hyacinth, the oriental ſapphire, and the amethyſt. Mr Daubenton had always looked on this laſt as a quartzous cryſtal.

den in fire, but melts by the solar heat in the focus of a burning lens into a transparent green glass with some bubbles. That called by the name of *circoncision stone*, which comes from the Amazon river, melts easier, in the same solar fire, into a brown opaque glass, which is far less hard than the stone itself. *(Macquer.)*

This stone is superior in hardness to quartz, though from its unctuosity to the touch, one would suspect it to contain a large portion of argillaceous earth, or rather of magnesian earth, as Mr Kirwan seems to suspect.

Its specific gravity is from 2,970 to 3,389.—It is of a granular texture, of a greasy look, and exceedingly hard: is scarcely soluble in acids, at least without particular management, and is infusible in the fire. M. Saussure seems to have extracted iron from it.

a. It is sometimes of a whitish milky colour, from China: but mostly

b. Of a greenish, or

c. Deep-green colour, from America.

d. Grey, yellowish, and olive colour: these are the vulgar *lapis nephriticus*, they being supposed to cure the nephritic pains by their external application to the loins.

The semi-pellucidity, hardness, and specific gravity, are the characters by which the lapis nephriticus may be distinguished from other stones.

II. Cat's eye; *Pseudopalus*. The sun-stone of the Turks, called *guneche*.

This stone is opaque, and reflects green and yellowish rays from its surface: it is found in Siberia. It is very hard and semi-transparent, and has different points, from which light is reflected with a kind of yellow-brown radiation, somewhat similar to the eyes of cats, from whence it had its name. Jewellers do not fail to cut them round to the greatest advantage. The best of these stones are very scarce. One of these of one inch diameter was in the cabinet of the grand duke of Tuscany.

III. *Hydrophanes*, or *Oculus Mundi*; also called *Lapis mutabilis*.

The principal property which distinguishes this from all other stones, is that it becomes transparent by mere infusion in any aqueous fluid; but it gradually resumes its opacity when dry.

IV. The onyx. *Onyx camehuja*. Memphites. It is found of two sorts.

a. Nail-coloured onyx, having pale flesh-coloured and white lines.

b. With black and white lines. The oriental onyx.

V. The chalcedony, or white agate, is a flint of a white colour, like milk diluted with water, more or less opaque: it has veins, circles, and round spots. It is said to be softer than the onyx, but much harder than those agates which are sometimes found of the same colour.

a. The white opaque Chalcedony, or *caholong*, from the Buckharish Calmucks. This was first made known by one Renez, a Swedish officer, who for several years had been in the country. The inhabitants find this flint on the banks of their rivers and work idols and domestic vessels out of it.

b. Of white and semi-transparent strata; from Ceylon.

c. Bluish grey: from Ceylon and Siberia.

VI. The carnelian. *Carniolus*.

Is of a brownish red colour, and often entirely brown. Its name is originally derived from its resemblance to flesh, or to water mixed with blood.

a. Red.

b. Yellowish brown, looks like yellow amber. It is said not to be so hard as the chalcedony.

VII. The sardonyx.

This is a mixture of the chalcedony and carnelian, sometimes stratumwise, and sometimes confusedly blended and mixed together.

a. Stripped with white and red strata; this serves as well cut in cameo as the onyx.

b. White, with red dendritical figures. This very much resembles that agate which is called the *mocha stone*; but with this difference, that the figures are of a red colour in this, instead of black, as in that agate.

Between the onyx, carnelian, chalcedony, sardonyx, and agate, there seems to be no real difference, except some inexplicable degrees of hardness.

VIII. The agate; *Achates*.

This name is given to flints that are variegated with different colours, promiscuously blended together: and they are esteemed in proportion to their mixture of colours, their beauty, and elegance. Hence also they have obtained variety of names, mostly Greek, as if the business of the lapidary in cutting of them, and admiring their several beauties and figures, had been derived from that nation alone. (D).

a. Brown opaque agate, with black veins, and dendritical figures: the Egyptian pebbles.

b. Of a Chalcedony colour; *achates chalcedonisans*.

c. Semi-transparent, with lines of a blackish brown colour, and dendritical figures; the mocha stone.

d. Semi-transparent, with red dots; *Gemma divi Stephani*. When the points are very minute, so as to give the stone a red appearance, it is by some called *Sardea*.

(D) On the side of a hill near the church of Rothes in Moray, is a quantity of fine agate of elegant red and white colours. It is very hard, heavy, of a smooth uniform texture, and of a considerable brightness; in which the red are remarkably clear, and finely mixed and shaded through the stone. Mr Willams says, that this is the largest and most beautiful agate rock he ever saw; and so fine and hard as to be capable of the highest lustre in polishing.

Siliceous Earths. Gems.

c. Semi transparent, with clouds of an orange colour.
f. Deep red or violet, and semi-transparent.
g. Of many colours, or variegated.
h. Black.

IX. Common Flint; *Pyromachus*.

This in reality, is of the same substance as the agate; but as the colours are not so striking or agreeable, it is commonly considered as a different substance.

a. Blackish grey, from the province of Skone.
b. Yellow semi-transparent, from France.
c. Whitish grey.
d. Yellowish brown.

When the flints are small, they are in England called *pebbles;* and the Swedish sailors, who take them as ballast, call them *singel*.

X. Chert; *Petrosilex, Lapis Corneus*. The *hornstein* of the Germans.

This is of a coarser texture than the preceding, and also less hard, which makes it consequently not so capable of a polish. It is semi-transparent at the edges, or when it is broke into very thin pieces.

a. Chert of a flesh colour, from Carl-Scakt, at the silver-mine of Salberg, in the province of Westmanland.
b. Whitish yellow, from Salberg.
c. White, from Kristiersberg, at Nya Kopparberget in Westmanland.
d. Greenish, from Prestguvsan, at Hellefors in Westmanland.

Chert runs in veins through rocks, from whence its name is derived. Its specific gravity is from 2590 to 2700. In the fire, it whitens and decrepitates like silex, but is generally so fusible as to melt *per se*. It is not totally dissolved in the dry way by the mineral alkali; but borax and microcosmic salt dissolve it without effervescence, Its appearance is duller and less transparent than common flint. The reddish Petro-silex used in the Count de Lauragar's procelain manufacture, and called there *felt spat*. contained 72 *per cent*. of silex, 22 of argill, and 6 of calcareous earth.

There are not yet any certain characters known by which the cherts and jaspers may be distinguished from each other: by sight, however, they can easily be discerned, viz. the former (the cherts) appearing transparent, and of a fine sparkling texture, on being broken; whereas the jasper is grained, dull, and opaque, having the appearance of a dry clay; The chert is also found forming larger or smaller veins, or in nodules like kernels in the rocks; whereas the jasper, on the contrary, sometimes constitutes the chief substance of the highest and most extended chain of mountains. The chert is likewise found plentifully in the neighbourhood of scaly limestone, as flints in the strata of chalk. What connection there may be between these bodies, perhaps time will discover.

But flints and agates being generally found in loose and single irregular nodules, and hardly in rocks, as the chert, it is a circumstance very insufficient to establish a difference between them; for there is the agate-stone, near Constantinople, running vein-like across the rock with its country of the same hardness, and as fine and transparent as those other agates which are found in round nodules at Deux-ponts. We must, therefore, content ourselves with this remark concerning flints, viz. That they seem to be the only kind of stone hitherto known, of which a very large quantity has been formed in the shape of loose or separate nodules, each surrounded with its proper crust; and that the matter which constitutes this crust has been separated from the rest of the substance, in like manner as sandiver or glass-gall separates from, and swims upon, glass, during its vitrification; though sometimes the formation of this crust may be prevented by the too sudden hardening of the matter itself.

Other species of stones, which are found in loose pieces or nodules, except ores and some sorts of stalactites, show evidently by their cracks, angles, and irregular figures, that they have been torn from rocks, rolled about, and rubbed against one another in torrents, or by some other violent motions of water.

That flints had originally been in a soft state, M. Cronstedt observes, is easy to be seen in the Egyptian pebbles, which have impressions of small stones, sand, and sometimes, perhaps, grass; which, however, have not had any ingress into the very flint, but seem only to have forced the above agate gall or crust out of the way.

§ 4. *Of Jaspers*

Jasper, *jaspis*, (the *diaspro* of the Italians), is a name given to all the opaque flints whose texture resembles dry clay and which have no other known quality whereby they may be distinguished from other flints, except that they may be more easily melted in the fire; and this quality perhaps may proceed from the heterogeneous mixture, probably of iron.

I. Pure jasper; which by no means yet known can be decompounded.

a. Green with red specks or dots: the *heliotrope*, or blood-stone. *b*. Green: *c*. Red, *d*. Yellow. *e*. Red with yellow spots and veins. *f* Black.

II. Jasper containing iron: *Jaspis martiales Sinople.*

A coarse-grained.

a. Red and reddish brown; *sinople*.

B. Steel-grained, or fine-grained.

a. Reddish brown; looks like the red ochre or chalk used for drawing; and has partition veins, which are unctuous to the touch, like a fine clay, and other like kinds.

C. Of a solid and shining texture, like a flag.

a. Liver-coloured; and, *b*, Deep red. *c*. Yellow. This last mentioned, when calcined, is attracted by the loadstone: and being assayed, yields from 12 to 15 *per cent*. of iron. (E.)

§ 5

(E) Near Portsoy in Banff-shire is an extensive rock of jasper; some parts of which contain a beautiful mixture of green and red, which appear finely shaded and clouded through the body of the stone when polished. Mr Williams is of opinion that it would be a very valuable quarry if worked.

§ 5. *Felt-spars.*

I. Rhombic quartz; *Spatum ſcintillans.*

This has its name from its figure, but ſeems to be of the ſame ſubſtance as the jaſper. We have not, however, ranked them together, for want of true marks to diſtinguiſh the different ſorts of the flinty tribe from one another.

This kind is found,

1. Sparry.
   a. White. *b.* Reddiſh brown. *c.* Pale yellow. *d.* Greeniſh.
2. Cryſtallized.
   a. In ſeparate or diſtinct rhomboidal cryſtals.

II. Labradore ſtone; *Spatum rutilum verſicolor.*

Its colour is commonly of a light or of a deep grey, and moſtly of a blackiſh grey: but when held in certain poſitions to the light, diſcovers different varieties of beautiful ſhining colours, as lazuly-blue, graſs-green, apple-green, pea-green; and ſeldom a citron-yellow; ſome have an intermediate colour betwixt red-copper and tombac-grey; beſides other colours between grey and violet. Theſe colours are ſeen for moſt part in ſpots; but ſometimes in ſtripes, on the ſame piece.

III. White feltſpar; *Terra Silicea Magneſia & ferro intime mixta.*

This ſtone has been deſcribed by Mr Bayen: and is found at St Marie aux mines in Lorrain.—It is of a white opaque colour, ſpotted with ochre on the outſide.

§ 6. *Of the Garnet Kinds.*

The ſubſtances of this *genus* (which is conſidered by Cronſtedt as an *order*) are analogous to gems; ſince all theſe are compoſed of the ſiliceous, calcareous, and argillaceous earths, with a greater or leſs proportion of iron. The opaque and black garnets contain about 20 hundredths of iron: but the diaphanous ones only two hundredths of their weight, according to Bergman. The garnets, properly ſo called, contain a greater quantity of ſiliceous earth than the ſhirls, and both are now juſtly ranked with the ſiliceous earths.

The ſpecies are,

I. Garnet; *Granatus.*

This is a heavy and hard kind of ſtone, cryſtallizing in form of polygonal balls, and moſtly of a red, or reddiſh brown colour.

A. Garnet mixed with iron; *Granatus martialis.*

1. Coarſe-grained garnet-ſtones, without any particular figure; in Swediſh called *Granatberg;* in German, *Granatſtein.*
   a. Reddiſh-brown garnet. *b.* Whitiſh yellow. *c.* Pale yellow.
2. Cryſtallized garnet.
   a. Black. *b.* Red: ſemi-tranſparent, and cracked; tranſparent. *c.* Reddiſh-yellow; tranſparent; the jacinth, or hyacinth. *d.* Reddiſh brown. *e.* Green. *f.* Yellowiſh-green. *g.* Black.

B. Garnet mixed with iron and tin.

1. Coarſe-grained, without any particular figure.
   a. Blackiſh-brown.
2. Cryſtallized.
   a. Blackiſh-brown.
   b. Light-green or white.

C. Garnet mixed with iron and lead.

1. Cryſtallized.
   a. Reddiſh-brown.

II. Cockle, or ſhirl. *Corneus cryſtallizatus Wallerii; Stannum cryſtallis columnaribus nigris Linnæi.*

This is a heavy and hard kind of ſtone which ſhoots into cryſtals of a priſmatical figure, and whoſe chief colours are black or green. Its ſpecific gravity is the ſame as the garnets, viz. between 3000 and 3400, though always proportionable to their different ſolidity.

A. Cockle, or ſhirl, mixed with iron.

1. Coarſe, without any determined figure.
   a. Green.
2. Sparry.
   a. Deep green, (the mother of the emeralds), from Egypt.
   b. Pale green.
   c. White. This occurs very frequently in the ſcaly limeſtones; and its colour changes from deep green to white, in proportion as it contains more or leſs of iron.
3. Fibrous, ſtriated cockle, or ſhirl: it looks like fibres or threads made of glaſs.
   A. Of parallel fibres. *a.* Black. *b.* Green. *c.* White.
   B. Of concentrated fibres: The ſtarred cockle, or ſhirl, from its fibres being laid ſtellarwiſe.
   a. Blackiſh green. *b.* Light green. *c.* White.
4. Cryſtallized cockle, or ſhirl.
   a. Black. To this variety belong moſt of thoſe ſubſtances called *imperfect aſbeſti;* and as the cockle perfectly reſembles a ſlag from an iron furnace, both in regard to its metallic contents and its glaſſy texture, it is no wonder that it is not ſoft enough to be taken for an aſbeſtus. It has, however, only for the ſake of its ſtructure, been ranked among the aſbeſti. The ſtriated cockle, or ſhirl, compared to the aſbeſti, is of a ſhining and angular ſurface (though this ſometimes requires the aid of the magnifying-glaſs to be diſcovered) always ſomewhat tranſparent, and is pretty eaſily brought to a glaſs with the blow-pipe, without being conſumed as the pure aſbeſti ſeem to be.
   b. Deep green.
   c. Light green.
   d. Reddiſh brown. The *tauffstein* is of this colour, and conſiſts of two hexagonal cryſtals of cockle grown together in form of a croſs; this the Roman Catholics wear as an amulet, and is called in Latin *lapis crucifer,* or the croſs ſtone.

The figure of the cockle cryſtals is uncertain, but always priſmatical: the cockle from Yxſio, at Nya Kopparberg, is quadrangular: the French kind has nine ſides or planes; and the tauffstein is hexagonal.

The name *cockle* for theſe ſubſtances is an old Corniſh mineral name; but is alſo given ſometimes to other very different matters.

We

There is not in England any great quantity of species of cockles; the chief are found in the tin mines of Cornwall, and some fine crystallized kinds have been brought from Scotland.

The English mineral name of *call*, has been used by some authors as synonymous with *cockles*, and they are confounded together at the mines; but the call, definitely speaking, is the substance called *wolfram* by the Germans, &c.

Garnets, though small, are often found in micaceous stones in England; but extreme good garnets are found in great plenty also in like stones in Scotland.

III. Rowley rag, *(Kirwan)*. This stone is of a dusky or dark grey colour, with numerous minute shining crystals. Its texture is granular: by exposure to the air it acquires an ochry crust. Its specific gravity is 2748. Heated in an open fire it becomes magnetic. In strong heat it melts *per se*, but with more difficulty than basaltes. According to Dr Withering's analysis, 100 parts of it contain 47,5 of siliceous earth, 32,5 of argil, and 20 of iron.

IV. Siliceous muriatic spar, *(Id.)* This stone is of a hard, solid, and sparry texture; of a grey, ochry, dull colour, but internally bright. It gives fire with steel: yet it effervesces with acids. In a strong heat it grows brown; but at last it melts *per se*. One hundred parts of this stone contain fifty parts of silex: the remainder is mild magnesia and iron; but in what proportion is not mentioned (See *Journal de Physique*, Supplement, vol. xiii. p. 216.

V. Turky stone; *cos Turcica. (Id.)* This stone is of a dull white colour, and often of an uneven colour, some parts appearing more compact than others, so that it is in some measure shattery. It is used as a whetstone: and those of the finest grain are the best hones for the most delicate cutting tools, and even for razors, lancets, &c. Its specific gravity is 2598. It gives fire with steel; yet effervesces with acids. Mr Kirwan found that 100 parts of it contains 25 of mild calcareous earth, and no iron. There probably are two sorts of stones known by this name, as Mr Wallerius affirms, that which he describes neither to give fire with steel nor effervesce with acids.

VI. Ragg stone. The colour of this stone is grey. Its texture is obscurely laminar, or rather fibrous, but the laminæ or fibres consist of a congeries of grains of a quartzy appearance, coarse and rough. Its specific gravity is 2729. It effervesces with acids; and gives fire with steel. Mr Kirwan found it to contain a portion of mild calcareous earth, and a small proportion of iron. It is used as a whet-stone for coarse cutting tools.

[The siliceous grit, *cos arenarius*, and other compounds of the siliceous earth, &c. will be found in a subsequent division of this article.]

Observations on the œconomical Uses of the Siliceous Order.

The Europeans have no farther trouble with the precious stones than either to cut them from their natural or rough figure, or to alter them when they have been badly cut in the East Indies; in which latter circumstances they are called *labora*: and it may be observed, that for cutting the ruby, spinell, ballas, and chrysolite, the oil of olive is required, instead of any other liquid, to be mixed with the diamond powder, in the same manner as for cutting the diamond itself.

If the petty princes in those parts of the Indies, where precious stones are found, have no other power nor riches proportionable to the value of these gems, the reason of it is as obvious as of the general weakness of those countries where gold and silver abound, *viz.* because the inhabitants, placing a false confidence in the high value of their possessions, neglect useful manufactures and trade, which by degrees produces a general idleness and ignorance through the whole country.

On the other hand, perhaps, some countries might safely improve their revenues by such traffic. In Saxony, for example, there might probably be other gems found besides aqua marines and topazes; or even a greater trade carried on with these than at present, without danger of bad consequences, especially under the direction of a careful and prudent government.

The *half-precious* stones, so called, or gems of less value, as the common opal, the onyx, the chalcedony, the cornelian, and the coloured and colourless rock crystals, have been employed for ornaments and economical utensils, in which the price of the workmanship greatly exceeds the intrinsic value of the stones. The ancients used to engrave concave and convex figures on them, which now-a-days are very highly valued, but often with less reason than modern performances of the same kind. These stones are worked by means of emery on plates and tools of lead, copper, and tin, or with other instruments: but the common work on agates is performed at Oberstein with grind-stones at a very cheap rate. When once such a manufactory is established in a country, it is necessary to keep it up with much industry and prudence, if we would wish it to surmount the caprice of fashions; since, how muchsoever the natural beauties of these stones seem to plead for their pre-eminence, they will at some periods unavoidably sink in the esteem of mankind; but they will likewise often recover, and be restored to their former value.

The grindstones at Oberstein are of a red colour, and of such particular texture, that they neither become smooth, nor are they of too loose a composition.

Most part of the flinty tribe is employed for making glass, as the quartz, the flints, the pebbles, and the quartzose sands. The quartz, however, is the best; and if used in due proportion with respect to the alkali, there is no danger of the glass being easily attacked by the acids, as has sometimes happened with glass made of other substances, of which we had an instance of bottles filled with Rhenish and Moselle wines during the time of a voyage to China.

In the smelting of copper ores, quartz is used, to render the slag glassy, or to vitrify the iron; quartz being more useful than any other stone to prevent the calcination of the metal.

The quartzose sand which constitutes part of many stones, and is also used in making crucibles and such vessels

vessels contributes most of all to their power of resisting fire.

It appears likewise probable that the quartzose matter makes the grind and whetstone fit for their intended purposes. (*Magellan.*)

Order V. *The* Argillaceous Earths.

The principal character whereby those may be distinguished from other earths is, that they harden in the fire, and are compounded of very minute particles, by which they acquire a dead or dull appearance when broken.

I. *Argilla aerata ; lac lunæ.*

This fanciful name was heretofore thought to denote a very fine species of calcareous earth ; but Mr Screber has lately shown, that the earth to which this name is given, is a very uncommon species of argill. It is generally found in small cakes of the hardness of chalk ; and like that, it marks white. Its hardness is nearly as that of steatites, and it does not feel so fat as common clay does. Its specific gravity is 1669 ; its colour snow white. When examined with a microscope, it is found to consist of small transparent crystals ; and by his experiments it appears plainly to be an argill saturated with fixed air. It effervesces with acids, and contains a very small proportion of calcareous earth and sometimes of gypsum, besides some feeble traces of iron. It is found near Halles.

II. Porcelain clay ; *Terra porcellanea*, vulgo *Argylla apyra*, very refractory ; the *kaolin* of the Chinese.

(1.) Pure.

A. Diffusible in water.

1. Coherent and dry.

a. White.

2. Friable and lean.

a. White.

(2.) Mixed with phlogiston.

A. Diffusible in water.

a. White and fat pipe clay. *b.* Of a pearl colour. *c.* Bluish grey. *d.* Grey. *e.* Black. *f.* Violet.

These contain a phlogiston, which is discovered by exposing them to quick and strong fire, in which they become quite black interiorly, assuming the appearance of the common flints, not only in regard to colour, but also in regard to hardness: but if heated by degrees, they are first white, and afterwards of a pearl colour. The fatter they seem to be, which may be judged both by their feeling smooth and unctuous, and by their shining when scraped with the nail, they contain a larger quantity of the inflammable principle. It is difficult to determine, whether this strongly inherent phlogiston be the cause of the abovementioned pearl-colour, or prevents them from being burnt white in a strong fire ; yet no heterogeneous substance can be extracted from them, except sand, which may be separated from some by means of water ; but which sand does not form any of the constituent parts of the clays. If they be boiled in aqua regis in order to extract any iron, they are found to lose their viscosity.

III. Stone-marrow ; *Lithomarga Keffekil* of the Tartars.

1. When dry, it is as fat and slippery as soap ; but,

2. Is not wholly diffusible in water, in which it only falls to pieces, either in large bits, or resembles a curd-like mass.

3. In the fire it easily melts to a white or reddish frothy slag, consequently is of a larger volume than the clay was before being fused.

4. It breaks into irregular scaly pieces.

A. Of coarse particles : Coarse stone-marrow.

a. Grey,

b. Whitish yellow, from the Crim Tartary, where it is called *keffekil*, and is said to be used for washing instead of soap.

B. Of very fine particles ; fine stone-marrow.

a. Yellowish brown ; *Terra Lemnia.*—Is of a shining texture, falls to pieces in the water with a crackling noise ; it is more indurated than the preceding, but has otherwise the same qualities.

IV. Bole, (iron clay.)

This is a fine and dense clay of various colours, containing a great quantity of iron, which makes it impossible to know the natural and specifical qualities of the bone itself, by any easy method hitherto in use. It is not easily softened in water, contrary to what the porcelain and the common clays are, (I. and VI.) ; but either falls to pieces in form of small grains, or repels the water, and cannot be made ductile. In the fire it grows black, and is then attracted by the loadstone.

A. Loose and friable boles, or those which fall to a powder in water.

a. Flesh-coloured bole.

b. Red.

1. Fine ; *Bolus Armenus.*

2. Coarse ; *Bolus communis officinalis.*

3. Hard ; *Terra rubrica.*

c. Green ; *Terre verte.*

1. Fine.

2. Coarse.

d. Bluish grey, is ductile as long as it is in the rock, but even then repels the water ; it contains 40 per cent. of iron ; which metal being melted out of it in a close vessel, the iron crystallizes on its surface.

e. Grey.

1. Crystallized in a spherical polygonal figure.

2. Of an undeterminate figure.

B. Indurated bole.

A. Of no visible particles.

This occurs very often in form of slate, or layers, in the earth ; and then is made use of as an iron ore. However, it has usually been considered more in regard to its texture than to its constituent parts ; and has been called *slate*, in common with several other earths which are found to have the same texture.

a. Reddish-brown ; in most collieries, between the seams of coal.

b. Grey.

B. Of scaly particles.—The *hornblende* of the Swedes.

It

It is distinguished from the martial glimmer, or mica, by the scales being less shining, thicker, and rectangular.

a. Black.—This, when rubbed fine gives a green powder.

b. Greenish.

V. Zeolyte.

This is described in its indurated state in the Transactions of the academy of sciences at Stockholm for the year 1756, and there arranged as a stone *sui generis* in regard to the following qualities.

1. It is a little harder than the fluors and the other calcareous spars; it receives, however, scratches from the steel, but does not strike fire with it.
2. It melts easily by itself in the fire, with a like ebullition as borax does, into a white frothy slag, which cannot without great difficulty be brought to a solidity and transparency.
3. It is more easily dissolved in the fire by the mineral alkali *(sal sodæ)*, than by borax or the microcosmic salt.
4. It does not ferment with this last salt, as lime does; nor with the borax, as those of the gypseous kind,
5. It dissolves very slowly, and without any effervescence, in acids, as in oil of vitriol and spirit of nitre. If concentrated oil of vitriol be poured on pounded zeolites, a heat arises, and the powder unites into a mass.
6. In the very moment of fusion it gives a phosphoric light.

There have lately been discovered some of the zeolites, particularly at Adelfors's gold mines in Smoland, in Sweden; of which some sorts do not melt by themselves in the fire, but dissolve readily in the acid of nitre, and are turned by it into a firm jelly.

The zeolyte is found in an indurated state;

(1.) Solid, or of no visible particles.

A. Pure.

a. White.

B. Mixed with silver and iron.

a. Blue, *Lapis lazuli*.

(2.) Sparry zeolite. This resembles a calcareous spar, though it is of a more irregular figure, and is more brittle.

a. Light red, or orange-coloured.

(3.) Crystallised zeolite. This is more common than the two preceding kinds; and is found,

A. In groupes of crystals, in form of balls, and with concentrical points.

a. Yellow,

b. White.

B. Prismatical and truncated crystals.

a. White.

C. Capillary crystals, which are partly united in groupes, and partly separate. In this latter accretion they resemble the capillary or feathery silver ore: and are perhaps sometimes called *flos ferri*, at places where the nature of that kind of stone is not yet fully known.

a. White.

VI. Tripoli.

This is known by its quality of rubbing or wearing hard bodies, and making their surfaces to shine; the particles of the tripoli being so fine as to leave even no scratches on the surface. This effect, which is called *polishing*, may likewise be effected by other fine clays when they have been burnt a little. The tripoli grows somewhat harder in the fire, and is very refractory: it is with difficulty dissolved by borax, and still with greater difficulty by the microcosmic salt. It becomes white when it is heated: when crude, it imbibes water, but is not diffusible in it: it tastes like common chalk, and is rough and sandy between the teeth, although no sand can by any means be separated from it. It has no quality common with any other kind of earth, by which it might be considered as a variety of any other. That which is here described is of a yellow colour, and is sold by druggists. This kind of tripoli has been lately discovered in Scotland. But the *rotten-stone*, so called, is another sort found in England, viz. in Derbyshire. It is in common use in England among workmen for all sorts of finer grinding and polishing, and is also sometimes used by lapidaries for cutting of stones, &c.

The tripoli is found,

1. Solid: of a rough texture.

a. Brown.

b. Yellowish.

c. Spotted like marble.

2. Friable and compact.

a. Granulated.

b. Brown.

c. Yellowish.

VII. Common clay, or brick clay.

This kind may be distinguished from the other clays by the following qualities:

1. In the fire it acquires a red colour, more or less deep.
2. It melts pretty easily into a greenish glass.
3. It contains a small quantity of iron and of the vitriolic acid, by which the preceding effects are produced.

It is found,

A. Diffusible in water.

1. Pure.

a. Red clay.

b. Flesh-coloured, or pale-red.

c. Grey.

d. Blue.

e. White.

f. Fermenting clay.

2 Mixed with lime. See MARLE, above,

B. Indurated.

1. Pure.

a. Grey slate.

b. Red slaty.

2. Mixed with phlogiston, and a great deal of the vitriolic acid. See *Alum Ores*, above.

3. Mixed with lime. See LIME, above.

VIII. Argillaceous fissile stones.

These and many other different kinds of earth have been comprehended under the denomination of

Argillaceous Earths.

of *ſchiſti*; but to avoid ambiguity we will confine this name to ſtones of the argillaceous kind.

1. The bluiſh purple ſchiſtus, or common roof ſlate; *ſchiſtus tegularis*.
   Its colour varies to the pale, to the ſlightly purple, and to the bluiſh.
   a. The dark-blue ſlate, *ſchiſtus ſcriptorius*.
2. The pyritaceous ſchiſtus.
   This is of a grey colour, brown, blue, or black.
3. The bituminous ſchiſtus.
   This is generally black, of a lamellar texture, and of different degrees of hardneſs.
4. Flag ſtone.
   This is of a grey, yellowiſh, or reddiſh white colour.
5. The argillaceous grit.
   This is called alſo *ſand ſtone* and *free ſtone*, becauſe it may be cut eaſily in all directions.
6. *Killas*.
   This ſtone is of a pale grey or greeniſh colour; either lamellar, or coarſely granular. It is found chiefly in Cornwall.
7. *Toadſtone*.
   Dr Withering, who has given an analyſis of this ſtone, deſcribes it as being of a dark browniſh grey colour, of a granular texture, not giving fire with ſteel, nor effervеſcing with acids. It has cavities filled with cryſtalliſed ſpar, and is fuſible *per ſe* in a ſtrong heat. It is found in Derbyſhire. See Toadstone.

For the œconomical uſes of the argillaceous earths, ſee the article Clay.

[The compounds of this and other earths will fall to be mentioned under a ſubſequent diviſion.]

Class II. SALTS.

By this name thoſe mineral bodies are called which can be diſſolved in water; and give it a taſte; and which have the power, at leaſt when they are mixed with one another, to form new bodies of a ſolid and angular ſhape, when the water in which they are diſſolved is diminiſhed to a leſs quantity than is required to keep them in ſolution; which quality is called *cryſtalliſation*.

In regard to the principal known circumſtances or qualities of the mineral- ſalts, they are divided into

1. Acid ſalts, or mineral acids.
2. Alkaline ſalts, or mineral alkalies.

Acid Salts.

Order I. Acid Salts.

For the characters, properties, and phenomena of theſe, ſee the article Acid, and Chemistry-*Index*.

Till of late no more mineral acids were known than the vitriolic and marine; the boracic or ſedative ſalt being reckoned as produced artificially: but later diſcoveries have proved that we may reckon at leaſt *eleven mineral acids*; out of which only two or three have been found in an uncombined ſtate. Thoſe hitherto known are the following, viz. the *vitriolic*, the *nitrous*, the *marine*, the *ſparry*, the *arſenical*, the *molybdenic*, the *tungſtenic*, the *phoſphoric*, the *boracic*, the *ſuccinous*, and the *aerial*. See the article Acid, and Chemistry-*Index*.

I. The vitriolic acid. See Chemistry-*Index*.

II. Nitrous acid.
   This acid is by ſome excluded from the mineral kingdom, becauſe they ſuppoſe it to be produced from putrefaction of organic bodies. But theſe bodies, when deprived of life, are again received amongſt foſſils, from whence their more fixed parts were originally derived. For the nature of this acid, See Chemistry-*Index*.

III. Acid of common or ſea-ſalt. See Chemistry-*Index*, at *Acid* and *Marine*.

IV. The *fluor* acid, or ſparry fluor acid. See Chemistry-*Index*.
   This acid is obtained by art, as it has never been found diſengaged, but united to calcareous earth, forming a ſparry fluor *, called *Derbyſhire fluor*, *Corniſh fluor*, *blue John*, or *amethyſt root*, when of a purple colour. See p. 72. col. 2. concerning the ſubſtances ariſing from the combination of this acid with calcareous earth.

* See Fluor Spar.

V. The acid of *arſenic*. See Chemistry-*Index*.

VI. The acid of *molybdena*. *Ibid.*

VII. The acid of *tungſten*. *Ibid.*

VIII. The *phoſphoric* acid. *Ibid.*

IX. The *boracic* acid. *Ibid.*

X. The ſuccinous or *amber* acid. *Ibid.*

XI. Aerial acid, or *fixed air*. *Ibid.*

Order II. Alkaline Mineral Salts.

For the characters, properties, and phenomena of theſe, ſee the article Alkali; alſo Chemisrty-*Index*, at *Alkaly Alkalies*.

New acids are daily detected: but no additions have been made to the three ſpecies of alkali long ſince known.

Theſe alkali ſalts are,

I. Vegetable fixed alkali (A.)

vegetable

(A) With regard to the origin of the vegetable fixed alkali, there are ſufficient proofs that it exiſts already formed in plants, and alſo that a portion is formed by combuſtion: but in each caſe, the alkali is obtained in an impure ſtate, through the admixture of other matters, which muſt be ſeparated before it can be uſed for chemical purpoſes.

The *cendres gravelées* are made by burning the huſks of grapes and wine lees. They contain the pureſt alkali met with in common, and are uſed by the dyers.

Pot-aſh is made by burning wood and other vegetables. This alkali is much phlogiſticated, and contains many foreign and ſaline matters, which, however, may be ſeparated.

That which is obtained from the aſhes of wood burned in kitchens is the moſt pure of all. On the contrary, Alkaline Salts.

Vegetable fixed alkali, deprived of every acid, is not found any where by itſelf; but it is ſometimes met with in combination with the vitriolic acid or the muriatic, generally with the nitrous, rarely with the aerial (B.)

The fixed vegetable alkali (or *potaſſe* of Morveau), is of a powdery appearance, and of a dead white colour. When pure, it is much more cauſtic than the neutral ſalt; it forms with the aerial acid, and even corrodes the ſkin (C.)

1. It changes the blue colours of vegetables into a deep green.
2. It has no ſmell when dry; but when wetted, it has a ſlight lixivious odour.
3. Its taſte is ſtrongly acrid, burning, cauſtic, and urinous (D). This laſt ſenſation ariſes from the volatile alkali it diſengages from animal ſubſtances.
4. When expoſed to the air, it attracts humidity, and is reduced into a tranſparent colourleſs liquor. According to Gellert, it attracts three times its own weight of water.
5. It likewiſe attracts ſometimes the aerial acid from the atmoſphere, and is thereby deprived of its property of deliqueſcing.
6. When it is diſſolved in an equal weight of water, it has an oily feel, owing to its action on the fatty parts of the ſkin, whence it is, though improperly, called *oil of tartar*.
7. In a moderate heat it melts; but in a more violent fire, it is diſperſed or volatiliſed.
8. It is a moſt powerful ſolvent by the dry way: in a proper heat, it diſſolves calcareous, argillaceous, ſiliceous, and metallic earths: and when the alkali is nearly equal in quantity to the earth, it forms various kinds of hard, ſolid, and tranſparent glaſs.
9. But if the alkali be in quantity three or four times that of the earth, the glaſs is deliqueſcent.
10. The mild vegetable alkali unites with the vitriolic acid with a violent efferveſcence, and produces vitriolated tartar.
11. With the nitrous acid, it forms the cryſtalliſable ſalt, called *nitre*.
12. With the marine acid it forms a kind of ſalt leſs grateful than common ſalt, which is called the *febrifuge ſalt of Sylvius*.
13. With vinegar it forms a neutral deliqueſcent ſalt of a ſharp taſte, called *terra foliata tartari*.
14. With cream of tartar it forms tartarized tartar.
15. It diſſolves ſulphur, and forms the ſubſtance called *liver of ſulphur*, which is a powerful ſolvent of metallic ſubſtances.
16. It attracts the metals, and diſſolves ſome of them with peculiar management. Silver, mercury, and lead, are more difficultly diſſolved than gold, platina, tin, copper, and eſpecially iron. The laſt gives a fine reddiſh ſaffron colour, firſt obſerved by Stahl, who called it the *martial alkaline tincture*.
17. It diſſolves in the dry way all the dephlogiſticated metallic calces.
18. It unites with oils and other fat ſubſtances, with which it forms ſoap.
19. This alkali becomes opaque when expoſed to the flame of the blow-pipe: it decrepitates a long time, and forms a glaſſy button, which is permanent in the little ſpoon; but is abſorbed with ſome noiſe on the charcoal when blown upon it.

II. Foſſile fixed alkalis.

A. Alkali of the ſea, or of common ſalt (E.)

1. Pure.

This has nearly the ſame qualities with the lixivious ſalt, which is prepared from the aſhes of burnt vegetables. It is the ſame with the *ſal ſodæ*, or kelp: for the kelp is nothing elſe than the aſhes remaining, after the burning of certain herbs that abound in common ſalt; but which common ſalt, during the burning of thoſe vegetables, has loſt its acid (F).

The properties of the foſſile alkali are as follows:

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trary, that which is got from tartar, properly burned, then diſſolved in boiling water, and purified by filtration and cryſtalliſation, is called *ſalt of water*. It is the beſt.

(B) The vegetable alkali is ſeldom found in the earth, except in wells of towns, as at Doway, or in the argillaceous alum-ore of la Tolfa: it is found alſo united to the nitrous acid, near the ſurface of the earth, in Spain, and in the Eaſt-Indies, probably from the putrefaction of vegetables.

(C) Common vegetable alkali, ſalt of tartar, and pot-aſh, were formerly conſidered by chemiſts as ſimple alkalis; but Dr Black has demonſtrated them to be true neutral ſalts, ariſing from the combination of the vegetable alkali with the aerial acid. From hence it follows, that the above common alkalies, even after any other extraneous ſubſtance has been extracted, muſt be freed from this acid, by putting each in a crucible, and expoſing it to a ſtrong fire, which will diſſipate this aerial acid. The alkali ſo purified, is to be put in a glaſs vial before it be entirely cold, and kept cloſe with a proper ſtopple; otherwiſe the aerial acid which floats in large quantities on the atmoſphere will combine again with the pure alkali. (*Mongez.*)

(D) The alkali muſt be largely diluted with water, in order to be taſted; otherwiſe it will act on the tongue, and corrode the parts where it touches. (*Macquer.*)

(E) This ſalt is not met with pure in Europe; but it is ſaid to be found in both the Indies, not only in great quantity, but likewiſe of a tolerable purity: it is there collected in form of an efloreſcence in the extenſive deſerts, a profitable trade being carried on in it for the making of ſoap and glaſs; and, therefore, it is very probable that the ancients meant this ſalt by the *natron* or *baurach*. (*Magellan.*)

(F) The mineral alkali is often combined with the vitriolic and marine acid, alſo with the aerial acid;

1. It effervesces with acids, and unites with them.
2. Turns the syrup of violets to a green colour.
3. Precipitates sublimate mercury in an orange-coloured powder.
4. Unites with fat substances, and forms soap.
5. Dissolves the siliceous earth in the fire, and makes glass with it, &c. It distinguishes itself from the salt of the pot-ashes by the following properties (G).
6. It shoots easily into rhomboidal crystals; which
7. Fall to powder in the air, merely by the loss of their humidity (H).
8. Mixed with the vitriolic acid, it makes the *sal mirabile Glauberi*.
9. It melts more easily, and is fitter for producing the *sal commune regeneratum, nitrum cubicum* &c. Perhaps it is also more conveniently applied in the preparation of several medicines.
10. It is somewhat volatile in the fire.

III. Volatile mineral alkali.

This perfectly resembles that salt which is extracted from animals and vegetables, under the name of *alkali volatile* or *sal urinosum*, and is commonly considered as not belonging to the mineral kingdom; but since it is discovered, not only in most part of the clays, but likewise in the sublimations at Solfatara, near Naples, it cannot possibly be quite excluded from the mineral kingdom (I).

Its principal qualities are,

a. In the fire it rises in *forma sicca*, and volatilises in the air in form of corrosive vapours, which are offensive to the eyes and nose (K).
b. It precipitates the solution of the mercurial sublimate in a white-powder.
c. It also precipitates gold out of aqua-regia, and detonates with it; because,
d. It has a re-action in regard to the acids, tho' not so strongly as other alkalies.

M 2 *e.* It

acid; with which last it retains not only the name but many of the properties of a pure alkali, because this last acid is easily expelled.

It is easily known by its crystallisation and its solubility in two times and an half of its weight of water, at the temperature of 60 degrees.

One hundred parts of this alkali, when pure and recently crystallised, contain 20 of mere alkali, 16 of aerial a cid, and 64 of water. *(Macquer.)*

Mineral alkali is found in Hungary, in marshy grounds, of an argillaceous or marly nature, either mixed with water or crystallised and efflorescing. It is found also in Egypt at the bottom of lakes, and dried up by the summer's heat; and also in the province of Suchena, 28 days journey from Tripoli, where it has the name of *Trona*; in Syria, Persia, as well as in the East-Indies, and China, where it is called *kien*. It sometimes germinates on walls, and is called by many *aphronitron*. In its native state, it is frequently mixed with magnesian earth, common salt, muriatic magnesia, and marine selenite. *(Kirwan.)*

(G) This mineral alkali likewise differs from the vegetable, 1. By its taste, which is less corrosive and burning. 2. By its not deliquescing. 3. By the small degree of heat it produces if calcined, and afterwards added to water. 4. By its property of crystallising, by evaporating the water from its solution, as is practised with neutral salts; whereas the vegetable alkali does not crystallise unless combined with a large portion of aerial acid.

(H) This alkali being a very useful commodity, and essentially necessary in a number of manufactories, many ingenious processes have been contrived and attempted to procure it at a cheap rate, by decomposing the sea-salt; but it is believed, that till lately none of these new manufactures have succeeded, except that of Mr Turner, mentioned by Mr Kirwan in the second part of the Philosophical Transactions for 1782.—The process is said to consist in mixing a quantity of litharge with half its weight of common salt, which, on being triturated with water till it assumes a white colour, is left to stand some hours; after which, a decomposition ensues, the alkali being left alone, whilst the acid unites to the metallic calx; and this last being urged by a proper degree of fire, produces a fine pigment of a greenish yellow colour, whose sale pays for the most part of the expences.

Mr Kirwan says, in the place already quoted, that if common salt perfectly dry be projected on lead heated to incandescence, the common salt will be decomposed, and a horn-lead formed, according to Margraaf. He adds also, that according to Scheele, if a solution of common salt be digested with litharge, the common salt, will be decomposed, and a caustic alkali produced; and finally, that Mr Scheele decomposed common salt by letting its solution slowly pass through a funnel filled with litharge.

(I) It is easily known, by its smell, though in a mild state, by its volatility, and by its action on copper; the solutions of which, in the mineral acids, are turned blue by an addition of this alkali. It is frequently found, though in small quantities, in mould, marle, clay, schistus, and in some mineral waters. It probably derives its origin in the mineral kingdom, from the putrefaction or combustion of animal or vegetable substances. *(Kirwan.)*

The same is caustic when uncombined with any acid, not excepting even the aerial acid. It differs from the other two alkalies in many essential particulars. 1. By its aeriform or gaseous nature. For the volatile alkali, in a state of purity, is nothing more than an alkaline gas diffused in water, as Dr Priestley has demonstrated. 2. By its volatility. 3. By the nature of the salts it forms with acids, which are very different from those whose bases are formed either of the vegetable or mineral alkali. *(Mongez.)*

(K) Pure volatile alkali, in an aerial form, resembles atmospheric air, but is more heavy. Its smell is pene-

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e. It tinges the solution of copper blue, and dissolves this metal afresh if a great quantity is added (L).

f. It deflagrates with nitre, which proves that it contains a phlogiston.

It is never found pure.

Order III. Neutral Salts.

Acids united to alkalies form neutral salts. These dissolved in water are no ways disturbed by the addition of an alkali; and generally, by evaporation, concrete into crystals. If, by proper tests, they show neither acid nor alkaline properties, they are said to be *perfect* neutrals; but *imperfect*, when, from defect in quantity or strength of one ingredient, the peculiar properties of the other more or less prevail.

I. Vitriolated tartar, vitriolated vegetable alkali, or (as Morveau calls it) the *vitriol of pot-ash*.

This is a perfectly neutral salt, which results from the combination of the vitriolic acid with the vegetable fixed alkali. According to Bergman, it seldom occurs spontaneously in nature, unless where tracks of wood have been burnt down: and Mr Bowles, quoted by Mr Kirwan, says it is contained in some earths in Spain. See Chemistry-*Index*.

It is easily obtained, by pouring the vitriolic acid on a solution of fixed vegetable alkali till it is saturated. Crystals of this neutral salt are then formed. This crystallisation succeeds better by evaporation than by cooling, according to Mongez.

The taste of this salt is disagreeable, though somewhat resembling common salt.

II. Common nitre, (*Alkali vegetabile nitratum*).

This is known in commerce by the name of *salt-petre*, and is also called *prismatic nitre*, to distinguish it from the cubic nitre after-mentioned.—It is perfect neutral salt; resulting from the combination of the nitrous acid with the pure vegetable alkali.

According to Bergman, it is formed upon the surface of the earth, where vegetables, especially when mixed with animal-substances, putrify.—See Chemistry-*Index*, at *Nitre*.

III. Digestive salt, salt of Sylvius, (*Alkali vegetabile salitum*).

This neutral salt is sometimes, though rarely, met with on the earth, generated perhaps, as professor Bergman observes, by the destruction of animal and vegetable substances.

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According to Macquer, this salt has been very wrongly called *regenerated marine salt*; and the epithet of *febrifuge* has also been given to it, without any good reason, to evince that it has such a property. But M. de Morveau calls it *muriate de potasse* with great propriety.

This salt is produced by a perfect combination of the vegetable alkali with marine acid. It has been wrongly confounded with common salt.—It is found in some bogs in Picardy, and in some mineral waters at Normandy, according to Monet, quoted by Kirwan. Mongez adds also the sea-water, as containing this salt, and that it is never found in large quantities, although its component parts are abundantly produced by nature. See Chemistry-*Index*, at *Digestive*.

IV. Mild vegetable alkali, (*alkali vegetabile aeratum*.)

This salt was formerly considered as a pure alkali, known by the name of *potash* and *salt of tartar*: but since the discovery of the aerial acid, it is very properly classed among the neutral salts, and ought to be called *aerated potasse*.

It results from a combination of the vegetable alkali with the aerial acid, and is hardly ever found native, unless in the neighbourhood of woods destroyed by fire.

On being exposed on a piece of charcoal, urged by the blow-pipe, it melts, and is absorbed by the coal; but,

In the metallic spoon, it forms a glassy bead, which becomes opaque when cold.

V. Vitriolated acid saturated with mineral alkali; Glauber's salt. *Alkali minerale vitriolatum*.

This is a neutral salt, prepared by nature (as well as by art), containing more or less of iron, or of a calcareous earth; from which arises also some difference in in its effects when internally used. It shoots easily into prismatical crystals, which become larger in proportion to the quantity of water evaporated before the crystallisation. When laid on a piece of burning charcoal, or else burnt with a phlogiston, the vitriolic acid discovers itself by the smell resembling the hepar sulphuris.

It is found in a dissolved state in springs and wells. Some of the lakes in Siberia and Astracan,

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penetrating, and suffocates animals. Its taste is acrid and caustic. It quickly converts blue vegetable colours to green, and produces heat during its combination with water. But if the water be frozen, it melts, producing at the same time an extreme degree of cold. It has a remarkable action on most metals, particularly copper.

This substance is obtained by the putrefactive fermentation from animal and some vegetable matters. It is this salt which causes that strong smell which is perceived in drains and privies on a change of weather. (*Mongez*).

Its volatility arises from a very subtile and volatile (or phlogistic) oil, which enters as a principle into its composition. (*Macquer*).

(L) The solution of copper by this alkali, which is of a fine blue, presents a remarkable phenomenon. For if it be kept in a well closed phial, the colour decays, and at length disappears, giving place to transparency. But on opening the phial, the surface or part in contact with the air becomes blue, and the colour is communicated through the whole mass. This experiment may be many times repeated with the same success.

can, and many ſprings in other places, contain this ſalt, according to Bergman. It is found in the ſea-water; alſo in the earth, at ſeveral parts of Dauphiné in France, and in Lorraine; and ſometimes it germinates on the ſurface of the earth, according to Monet, quoted by Kirwan. It is found, in a dry form, on walls, in ſuch places where aphronitrum has effloreſced through them, and the vitriolic acid has happened to be preſent; for inſtance, where marcaſites are roaſted in the open air. This ſalt is often confounded with the aphronitrum or mild mineral alkali.

VI. Cubic or quadrangular nitre. *Alkali minerale nitratum.*

This is the neutral ſalt which reſults from the combination of mineral alkali with nitrous acid. It has almoſt all the characters of priſmatic or common nitre, from which it only differs on account of its baſe; and takes its denomination from the figure of its cryſtals, which appear cubic.

This ſalt rarely occurs but where marine plants putrify. According to Bowles, quoted by Kirwan, it is found native in Spain. See Chemistry, n° 741, &c.

VII. Common ſalt, or ſea-ſalt; *Alkali minerale ſalitum, ſal commune.*

This ſalt ſhoots into cubical cryſtals during the very evaporation; crackles in the fire, and attracts the humidity of the air. It is a perfectly neutral ſalt, compoſed of marine acid, ſaturated with mineral alkali. It has a ſaline but agreeable flavour. See Chemistry-*Index*, at *Sea-ſalt.*

A. Rock ſalt, foſſile ſalt; *Sal montanum.* Occurs in the form of ſolid ſtrata in the earth.

1. With ſcaly and irregular particles.
   - *a.* Grey, and
   - *b.* White. Theſe are the moſt common, but the following are ſcarcer:
   - *c.* Red;
   - *d.* Blue; and
   - *e.* Yellow, from Cracow in Poland, England, Salzberg, and Tirol.
2. Cryſtallized rock ſalt; *ſal gemmæ.*
   - *a.* Tranſparent, from Cracow in Poland, and from Tranſylvania.

B. Sea-ſalt.

This is produced alſo from ſea-water, or from the water of ſalt lakes by evaporation in the ſun, or by boiling.

The ſeas contain this ſalt, though more or leſs in different parts. In Siberia and Tartary there are lakes that contain great quantities of it.

C. Spring ſea-ſalt.

This is produced by boiling the water of the fountains near Halle in Germany, and other places.

Near the city of Lidkoping, in the province of Weſtergotland, and in the province of Dal, ſalt-ſprings are found, but they contain very little ſalt: and ſuch weak water is called *ſolen* by the Swedes.

VIII. Borax.

This is a peculiar alkaline ſalt, which is ſuppoſed to belong to the mineral kingdom, and cannot be otherwiſe deſcribed, than that it is . . . . . . diſſoluble in water, and vitreſcible; . . . . . . that it is fixed in the fire; and melts to a glaſs; which glaſs is afterwards diſſoluble in water. See the detached article Borax.

IX. Mild mineral alkali; *Alkali minerale aeratum.* Natron, the nitre of the ancients.

This neutral ſalt is a combination of the mineral alkali with the aerial acid or fixed air. It is found plentifully in many places, particularly in Africa and Aſia, either concreted into cryſtallized ſtrata, or fallen to a powder; or efloreſcing on old brick walls; or laſtly, diſſolved in ſprings. It frequently originates from decompoſed common ſalt.

This is an imperfect neutral ſalt, and was formerly conſidered as a pure alkali; but the diſcovery of the aerial acid has ſhown the miſtake.

1. It has nearly all the properties of the *pure* mineral *alkali* N° II. *A.* 1. (p. 90.), but with leſs energy.
2. The vegetable blue colours are turned green by this ſalt; it effloreſces with acids, and has an urinous taſte.
3. It is ſoluble in twice its weight of cold water; but if the water is hot, an equal weight is ſufficient for its ſolution.
4. It effloreſces when expoſed to the action of the atmoſphere.
5. It fuſes eaſily on the fire, but without being decompoſed.
6. Facilitates the fuſion of vitrifiable earths, and produces glaſs more or leſs fine according to their qualities.
7. It is decompoſable by lime and ponderous earth, which attract the aerial acid.
8. And alſo by the mineral acids, but theſe expel the aerial acid of this ſalt, by ſeizing its alkaline baſis, (*Mongez.*)

Wallerius confounds this ſalt with the *aphronitrum* after-mentioned, and calls it *halinitrum*, when it contains ſome phlogiſton. Mr Kulbel, quoted by Wallerius, ſhowed that it exiſts in ſome vegetable earths, and takes it to be the cauſe of their fertility; but this (M. Magellan obſerves) can only be on account of its combination with the oily parts of them, and forming a kind of ſoap, which is miſcible with the watery juices.

X. Vitriolic ammoniac, (*Alkali volatile vitriolatum.*)

This neutral ſalt was called *ſecret ſalt of Glauber*, and is a combination of the volatile alkali with vitriolic acid. According to Bergman, it is ſcarcely found any where but in places where the phlogiſticated fumes of vitriolic acid ariſe from burning ſulphur, and are abſorbed in putrid places by the volatile alkali. Thus at Fahlun the acid vapour from the roaſted minerals produces this ſalt in the neceſſary-houſes. Dr Withering, however, obſerves, that as volatile alkali may be obtained in large quantities from pit-coal, and produced by proceſſes not dependent upon putrefaction, there is reaſon to believe that the vitriolic ammoniac may be formed in ſeveral ways not noticed by the above author.

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It is said to have been found in the neighbourhood of volcanoes, particularly of Mount Vesuvius, where, indeed, it might well be expected; yet its existence seems dubious, since Mr Bergman could scarce find any trace of it among the various specimens of salts from Vesuvius which he examined. The reason (according to M. Magellan) probably is, that the vitriolic acid disengaged by the combustion of sulphur is in a phlogisticated state; and all its combinations in this state are easily decomposed by the marine acid, which plentifully occurs in volcanoes. It is also said to be found in the mineral lakes of Tuscany, which is much more probable, as the vitriolic acid when united to water easily parts with phlogiston, and recovers its superiority over other acids. It is said likewise that this neutral salt is found on the surface of the earth in the neighbourhood of Turin.

1. This salt is of a friable texture, and has an acrid and urinous taste.
2. Attracts the moisture of the atmosphere.
3. Is very soluble in water, it requiring only twice its weight of cold water, or an equal weight of boiling water, to be dissolved.
4. It becomes liquid on a moderate fire; but if urged,
5. It becomes red hot, and volatilizes.
6. The nitrous and muriatic acid decompose this salt by seizing the volatile alkali. But
7. Lime, ponderous earth, and pure fixed alkali, set the volatile alkali free, and combine with the vitriolic acid.
8. According to Kirwan, 100 parts of this salt contain about 42 of real vitriolic acid, 40 of volatile alkali, and 18 of water.

This vitriolic ammoniac is easily known; for if quicklime or fixed alkali be thrown into its solution, the smell of the volatile alkali is perceived; and if this solution be poured into that of chalk or ponderous earth by the nitrous acid, a precipitate will appear.

XI Nitrous ammoniac, (*Alkali volatile nitratum.*)

This is a neutral salt, which results from the combination of the nitrous acid with the volatile alkali. It is frequently found in the mother-liquor of nitre. When mixed with a fixed alkali, the volatile betrays itself by its smell.

1. It is of a friable texture, of a sharp bitter, and of a nitrous or cooling taste.
2. According to Mongez, it attracts the moisture of the atmosphere; but Romé de l'Isle asserts, that its crystals are not deliquescent: the experiment may be easily tried, and the truth ascertained.
3. It is soluble in cold water; but half the quantity of water, if boiling, is sufficient for dissolving it.
4. It liquefies on the fire, and afterwards it becomes dry.
5. It detonates with a yellow flame before it is red hot; and what is peculiar to this salt, it needs not, like common nitre, the contact of any combustible matter for its detonation; from whence it appears that the volatile alkali itself possesses a great share of phlogiston.
6. Its component parts, viz. the nitrous acid and the volatile alkali, are not very intimately united; and of course,
7. It is easily decomposed by all the substances that have any affinity to either of them.
8. Mixed with the muriatic acid it makes aqua regia.
9. One hundred parts of this neutral salt contain 46 of nitrous acid, 40 of volatile alkali, and 14 of water, as Mr Kirwan thinks.

XII. Native sal ammoniac. The muriatic (or marine) acid saturated with a volatile alkali.

This is of a yellowish colour, and is sublimed from the flaming crevices, or fire-springs, at Solfatara, near Naples.

XIII. Aerated or mild volatile alkali.

This neutral salt results from the combination of volatile alkali united to the aerial acid. It was formerly considered as a pure alkali:—But the discovery of the aerial acid (or fixed air) has shown it to be a true neutral salt, though imperfect; as it retains still all the properties of an alkali, though in a weaker degree, on account of its combination with the aerial acid, which is itself the most weak of all acids, and of course other stronger acids easily dislodge it from its base, and from various ammonial salts.

1. This imperfect neutral salt has an urinous taste, and a particular smell, which is very penetrating, though less pungent, than the pure volatile alkali; and in the same manner it turns the blue vegetable juices green. But,
2. It effervesces with other acids stronger than the aerial one, which the pure or caustic volatile alkali does not.
3. It sublimes very easily with a small degree of heat;
4. And dissolves in twice its weight of cold water; but in a lesser quantity, when this last is boiling hot.
5. It acts on metallic substances, chiefly on copper, with which a blue colour is produced.

According to Bergman, this salt was found in a well in London (Phil. Transf. for 1767), at Frankfort on the Main, and at Lauchstadt.—Messrs. Hierne, Henkel, and Brandt, have found also this salt in the vegetable earth, in various kinds of argil, and in some stony substances. Mr Vozel found it also in some of the incrustations at Gottingen; and Mr Malouin in some acidulous waters in France.

M. Magellan observes, that the borax and the three aerated alkalis are called *imperfect* neutrals; whilst the other neutral salts have acquired the name of *perfect*, because these last do not exhibit any of the distinguishing properties of their component parts. The three aerated alkalis have a very distinct alkaline character, as they turn blue vegetable juices green, though not of so vivid a colour as the caustic alkali

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alkali does; and the borax is capable of receiving almost an equal quantity of its sedative acid, without losing all its alkaline properties.

In general, those neutral salts, consisting of fixed alkalies combined with acids, are more saturated than those composed of volatile alkali called ammoniacal salts, or those called aerated; which last are only composed by the combination of the aerial acid, united to any alkaline or earthy base.

The aerated alkalis are called also by the name of *mild* alkalis, because they possess no longer that sharp corroding quality which they exhibit when deprived of the aerial acid or fixed air; in which case they are termed caustic alkalis.

These aerated alkalis differ also from the caustic ones, not only on account of the mildness of their taste, from which comes their epithet of mild alkalis, but also by their property of crystallising, and by their effervescing with other acids, which expel the aerial one, the weakest of all acids we know.

Order IV. Earthy *Neutral Salts*.

The compounds of earths and acids which possess solubility are decomposed and precipitated by mild, but not by phlogisticated alkalis.

I. Calcareous earth combined with vitriolic acid.—

Vitriolated calx; Selenite; Gypsum. See p. 72. col. 1. *supra*.

The gypsum, or plaster, is not only found dissolved in various waters, but also in many places it forms immense strata. It is placed by all mineralogists among the earths, which it greatly resembles; but it rather belongs to the saline substances of the neutral kind, as appears by its constituent parts. When burnt, it generates heat with water, but in a less degree than lime does. Berg. Sciag. § 59.

This salt has a particular taste, neither bitter nor astringent, but earthy, when applied to the tongue; and it is owing to it that some waters, chiefly from pumps and wells, are called hard waters, because they lie heavy on the stomach.

It is unalterable whilst kept in a dry place; but on being exposed to a moist air, it is much altered, and suffers a kind of decomposition.

When exposed to fire so as to lose the water of its crystallisation, it assumes a dead white colour; and it is then what we call plaster of Paris; but if the fire is too strong, it melts and vitrifies, after losing the vitriolic acid with which it is saturated. See Gypsum.

The most famous quarries of gypsum in Europe, are those of Montmartre, near Paris. See *Journal de Physique*; 1780, vol. xvi. p. 289 and 1782, vol. xix. p. 173.

It is found also in the vegetable kingdom.—Mr Model found that the white spots in the root of rhubarb are a selenitical or gypseous earth. (*Journal de Phys.* vol. vi. p. 14.)

What is called fossil flour (*farine fossile* in French), generally found in the fissures of rock and gypseous mountains, is very different from the agaricus mineralis p. 71. col. 1. and from the lac lunæ, p. 87. col. 1.; as it is a true gypseous earth, already described p. 72. col. 1. which, according to Mongez, is of a white and shining colour, though sometimes it assumes a reddish or bluish colour, on account of some martial mixture.

II. Nitre of lime, (*Calx nitrata*).

This earthy salt is sometimes found in water, but very sparingly. It is said that the chalk hills in some parts of France become spontaneously impregnated with nitrous acid, which may be washed out, and after a certain time they will become impregnated with it again. It is a combination of the nitrous acid with calcareous earth. (*Berg. Sciagr.*)

1. It is deliquescent; and is soluble in twice its weight of cold water, or in an equal weight of boiling water.
2. Its taste is bitter.
3. Is decomposed by fixed alkalies, which form the cubic and the prismatic nitres.
4. But caustic volatile alkali cannot decompose it.
5. It does not deflagrate in the fire; yet paper moistened with a saturated solution of it crackles in burning.
6. In a strong heat it loses its acid.
7. Its solution does not trouble that of silver in nitrous acid.
8. The vitriolic acid precipitates its basis.
9. As does likewise the acid of sugar.
10. One hundred parts of it contain, when well dried, about 33 of nitrous acid, 32 of calcareous earth, and 35 of water.

It exists in old mortar, and in the mother liquor of nitre; and also in the chalk rocks near Roche Guyon, in France. (*Kirwan.*)

III. Muriatic chalk, or fixed salt ammoniac. *Acidum salis communis terra calcarea saturatum.*

This somewhat deliquesces, or attracts the humidity of the air. It is found in the sea water.

It is with great impropriety that this salt has obtained the name of ammoniac, on account only of its being formed in the chemical laboratories during the decomposition of the ammoniacal salt with lime, in the process for making the caustic volatile alkali. In this case, the muriatic acid unites to the calcareous basis, while this last gives its water to the volatile alkali; which, therefore, comes over in a fluid caustic state: but if chalk is employed instead of lime, the volatile alkali receives the aerial acid instead of water, and comes over in a concrete form. In neither case, the new combination of calcareous earth with muriatic salt has any volatile alkali to deserve the name of ammoniacal salt. (*Macquer.*)

1. This earthy salt has a saline and very disagreeable bitter taste. It is supposed to be the cause of that bitterness and nauseous taste of sea-water.
2. It fuses in the fire, and becomes phosphorescent, after undergoing a strong heat.
3. It becomes hard, so as to strike fire with steel.
4. It is then the phosphorus of Homberg.
5. It is decomposable by ponderous earth and fixed alkalis.

6. And

6. And also by the vitriolic or nitrous acid; which expel the muriatic acid, to unite with the calcareous basis. *(Mongez.)*
7. Its solution renders that of silver in the nitrous acid turbid, at the same time that
8. It makes no change in that of nitrous selenite.
9. It obstinately retains its acid in a red heat.
10. One hundred parts of this earthy salt contain, when well dried, about 42 of marine acid, 38 of calcareous earth, and 20 of water.
11. It is found in mineral waters, and in the salt works at Saltzburg. *(Kirwan.)*

IV. Aerated chalk, *(Calx aerata.)*

Whenever calcareous earth is oversaturated with the aerial acid, it becomes a true earthy neutral salt; becomes soluble in water, and has a slight pungent bitter taste. It is commonly found dissolved in waters, in consequence of an excess of the aerial acid. When this greatly abounds, the water is said to be hard *(cruda)*. By boiling or by evaporation, it deposits streaks or crusts of calcareous matter.

But when the calcareous earth is only saturated with the aerial acid without excess, it is not easily soluble; it is then the calcareous spar, p. 71. col. 2. and is properly referred to the class of earths, p. 71. col. 1.

V. Vitriolated ponderous earth. *Terra ponderosa vitriolata; barytes vitriolata.*

This earthy salt, known by the name of ponderous spar, is a combination of the ponderous earth described in p. 75. col. 1. with the vitriolic acid; and has been already treated of.

The nitrous ponderous earth, according to Bergman, has not yet been found, although it may perhaps exist somewhere, and of course be discovered in nature.

VI. Muriatic barytes, marine baro-selenite. *Barytes salita.*

This earthy salt consists of marine acid united to the ponderous earth. It is said to have been found in some mineral waters in Sweden; and may be known by its easy precipitability with vitriolic acid, and by the great insolubility and weight of this resulting compound, which is the true ponderous spar of the preceding section.

VII. Aerated ponderous earth. *Barytes aerata.*

This earthy neutral salt was found by Dr Withering in a mine at Alston-moor in the county of Cumberland in England. He says that it is very pure, and in a large mass. This substance is a new acquisition to mineralogy, and may be turned to useful purposes in chemistry.

1. It effervesces with acids, and melts with the blow-pipe, though not very readily.
2. In a melting furnace, it gave some signs of fusion; but did not feel caustic when applied to the tongue, nor had it lost its property of effervescing with acids.
3. But the precipitated earth from a saturated solution of it in the marine acid, by the mild vegetable or mineral alkali being burned, and thrown into water, gave it the properties of lime-water, having an acrid taste in a high-degree: and a single drop of it added to the solutions of vitriolated salts, as the Glauber's salt, vitriolated tartar, vitriolic ammoniac, alum, Epsom salt, selenite, occasioned immediately a precipitation; from whence it appears to be the nicest test to discover the vitriolic acid. By it the marine acid may also be easily freed from any mixture of vitriolic acid, by means of this calx of ponderous earth. See Chemistry n° 1049. *et. seq.*

VIII. Vitriolated magnesia.

This earthy neutral salt is called by the English *Epsom salt; Sel d'Angleterre* by the French, and also *sel de Sedlitz, de Seydschutz, sel amer, sel cathartique amer*, &c. These various names are given to it, either on account of its properties, it being a very mild purgative; or from the places where it is found, besides many others, as in the waters of Egra, of Creutzbourg, Obernental, Umea, &c. It has also been found native, mixed with common salt and coaly matter, germinating on some free stones in coal mines. See *Kirwan's Mineralogy*, p. 183.

1. It has a very bitter taste.
2. It is soluble in one part and a half of its weight of cold water: but in hot water, a given weight of it dissolves the double of this salt.
3. It effloresces when exposed to a dry atmosphere, and is reduced to a white powder.
4. Exposed to the fire, it loses the water of its crystallisation, and is reduced into a friable mass.
5. This earthy salt is decomposed by fixed and volatile alkalies.
6. Lime-water precipitates the magnesia from its solution, the calcareous earth of lime-water combining itself with the vitriolic acid, and forming a selenite. *N. B.* By this test the vitriolated magnesia is easily distinguished from the vitriolated mineral alkali or Glauber's salt, which it resembles.
7. But crude chalk, or aerated calcareous earth, has not such an effect in the same case; which shows how much the efficacy of this substance, viz. the calcareous earth, is diminished merely by its union with the aerial acid.
8. When urged by the flame with the blow-pipe, it froths; and may be melted by being repeatedly urged with that instrument.
9. With borax it effervesces, and also when burned with the microcosmic salt.
10. According to Bergman, 100 weight of this salt contains only 19 parts of pure magnesia, 33 of vitriolic acid: and 48 of water. But
11. According to Kirwan, 100 parts of it contain about 24 of real vitriolic acid, 19 of magnesian earth, and 57 of water.

IX. Nitrated magnesia; nitrous Epsom salt.

This earthy salt is usually found together with nitre. It is a combination of the nitrous acid with the magnesian earth.

1. It has an acrid taste, very bitter.
2. Attracts the moisture from the atmosphere, and deliquesces.
3. Is very soluble in water.

Earthy Neutral Salts.

4. Is easily decomposable by fire.
5. The ponderous aud calcareous earths decompose it, and also the alkalies.
6. On being urged by the blow-pipe, it swells up with some noise, but does not detonate.
7. If saturated solutions of nitrous selenite and of this salt be mixed, a precipitate will appear; but,
8. Neither vitriolic acid, nor mild magnesia, will occasion any turbidness in its solution.
9. One hundred parts of this salt contain about 36 of real nitrous acid, 27 of magnesian earth, and 37 of water.

It exists in old mortar, and is found also in the mother liquor of nitre. As lime-water decomposes it, M. de Morveau has indicated the use of this process, not only to complete its analysis; but also to separate, in large quantities, and at a very cheap rate, the magnesian from the calcareous earth, as M. Mongez relates upon this subject.

X. Muriatic magnesia. *Magnesia salita*.

This earthy salt is a combination of magnesian earth with the muriatic acid. According to Bergman, it is found in the sea in greater plenty than any other salt except the sea-salt.

1. It has a very bitter taste: and being always mixed in the sea-water, it is the principal cause o its bitterness.
2. It is very delisquescent, and soluble in a small quantity of water.
3. All the alkalies, even the caustic volatile alkali and lime, decompose it by precipitating its basis.
4. The vitriolic, nitrous, and boracic acids expel the muriatic acid from the base of this neutral salt.
5. Its solution does not trouble that of nitrous or marine selenite; but,
6. It causes a cloud in the nitrous solution of silver.
7. The vitriolic acid throws down no visible precipitate from the solution of this neutral salt.
8. It loses its acid in a red heat.

XI. Aerated magnesia.

Common magnesia, with an excess of aerial acid is a true neutral salt, like the aerated selenite of p. 96, col. 1. and becomes soluble in cold water. Otherwise it is scarce soluble at all; and is then classed among the earths.

This neutral salt is decomposable by fire, by which its water and its acid are expelled; and it may become phosphoric.

When urged by fire, it agglutinates a little: and some pretended that it melts. But it must be in an impure state to vitrify at all.

The three mineral acids, and the alkalies, dissolve this salt with effervescence, by expelling the aerial acid.

XII. Argillaceous earth combined with vitriolic acid. The *alum* kind. See Alum, and Chemistry-*Index*.

a. With a small quantity of clay; native or plumose alum.

It is found on decayed alum ores in very small quantities; and therefore, through ignorance, the alabastrites and selenites, both of which are found among most of the alum slates, are often substituted in its stead, as is also sometimes the asbestus, notwithstanding the great difference there is between the alum and these both in regard to their uses and effects.

b. With a greater quantity of pure clay; white alum ore.

1. Indurated pale-red alum ore, (*Schistus aluminis Romanus*.) It is employed at Lumini, not far from Civita Vecchia in Italy, to make the pale-red allum called *roch allum*. This is, of all alum ores, the most free from iron; and the reddish earth which can be precipitated from it, does not show the least marks of any metallic substance.

c. With a very large quantity of martial clay, which likewise contains an inflammable substance: Common alum ore. This is commonly indurated and slaty, and is therefore generally called *alum slate*.

It is found,

1. With parallel plates, having a dull surface; from Andrarum in the province of Skone, Hunneberg and Billingen in the province of Westergottland, Rodoen in the province of Jemtland, and the island of Oeland, &c. In England, the great alum works at Whitby in Yorkshire are of this kind.
2. Undulated and wedge-like, with a shining surface. This at the first sight resembles pit-coal; it is found in great abundance in the parish of Nas in Jemtland.

XIII. Argillaceous earth saturated with muriatic acid. *Argilla salita*.

Professor Bergman says, that the combinations of the argillaceous earth with the nitrous, muriatic, and aerial acids, had not yet been found naturally formed as far as he knew. But Dr Withering affirms, that he found the muriatic argil to exist in a considerable quantity, in the Nevil Holt water, when he analysed that mineral water about the year 1777: and he adds, that it is probably contained also in the Ballycastle water in Ireland.

XIV. Argillaceous earth mixed with volatile alkali.

[Although this mixture is by no means a neutral salt, this seems to be the place to treat of it according to the order of saline substances adopted in this article.]

The greatest part of the clays contain a volatile alkali, which discovers itself in the distillation of the spirit of sea-salt, &c.

Order V. Metallic Salts.

The native salts belonging to this division may be distinguished by the phlogisticated alkali, which precipitates them all. The few which have saline properties, according to the definition of salts formerly given, shall be mentioned here; referring the rest to the mineralised metals; as the *luna cornea*, the saline quicksilver or muriatic mercury, &c.

Metallic Neutral Salts.

I. Vitriol of copper; blue vitriol. *Vitriolum veneris, seu cyprium.*

This neutral metallic salt is a combination of the vitriolic acid with copper, and is found in all *cement waters*, as they are called. Its colour is a deep blue; and being long exposed to the air, it degenerates into a rusty yellow blue. Urged by the flame of the blow-pipe on a piece of charcoal, it froths at first with noise, giving a green flame, and the metallic particles are often reduced to a shining globule of copper, leaving an irregularly figured scoria. But with borax the scoria is dissolved, and forms a green glass.

This salt rarely occurs crystallised: but is often found naturally dissolved in water in Hungary, Sweden, and Ireland: from this water a blue vitriol is generally prepared. These natural waters are called *cementatory* or *cementing* ones. According to Monet, this concrete salt, when found naturally formed, only proceeds from the evaporation of such waters. It is also occasionally extracted from sulphurated copper ores after torrefaction. See CHEMISTRY-*Index*, at *vitriol*.

II. Muriatic copper, or marine salt of copper. *Cuprum salitum.*

This salt has been found in Saxony, in the mine of Johngeorgenstadt. 1. It is of a greenish colour, and foliated texture. 2. It is moderately hard. 3. Sometimes it is transparent and crystallised.

It has been taken for a kind of mica: but Professor Bergman found it to consist of copper and marine acid, with a little argillaceous earth.

Another specimen of a purer sort was deposited in the museum of Upsal. This is of a bluish green colour, and friable. It effervesced with nitrous acid, to which it gave a green colour: and by adding a proper solution of silver, a *luna cornea* was formed, by which the presence of the muriatic acid was ascertained. (*Kirwan* and *Bergman.*)

III. Martial vitriol; vitriol of iron. Common green vitriol or copperas.

This is the common green vitriol, which is naturally found dissolved in water, and is produced in abundance by decayed or calcined marcasites.

This metallic neutral salt results from the combination of the vitriolic acid with iron.

1. It is of a greenish colour when perfectly and recently crystallised; but,
2. Effloresces by being exposed to the air, becomes yellowish, and is covered with a kind of rust. Sometimes it becomes white by long standing.
3. It requires six times its weight of water, in the temperature of 60 degrees, to be dissolved.
4. It has an astringent, harsh, and acidulous taste.
5. Exposed to a moderate heat, even to that of the sunshine, it falls into a yellowish powder: but,
6. On being exposed to a sudden heat, it melts; and on cooling, assumes a whitish brown colour.
7. When strongly urged by fire, it loses its acid, becomes of a dark red colour, and is then called *colcothar;* a powder which is employed in polishing metals, and to which the artists have applied the improper name of *crocus martis*, though this name only belongs to the yellow preparations of the iron-calces, used in pharmacy and in enamelling, &c.
8. Pure fixed alkali precipitates the iron from its solution in deep green flakes; the mild alkali, in a greenish white colour; pure volatile alkali, in so deep a green, that it appears black; but the mild volatile alkali precipitates it in a greyish-green colour.
9. All vegetable astringents, as the tincture of tea, quinquina, gales, &c. precipitate the iron in a black colour: hence they are used as tests to discover its presence in chemical analyses; and it is from this black precipitate that the common writing ink is made, being diluted in water, and there suspended by the Arabic or Senegal gums.
10. One hundred parts of this salt, recently crystallised, contain 20 of real vitriolic acid, 25 of iron, and 55 of water.
11. Its acid is known by this, that its solution mixes without turbidity with the solutions of other salts that contain vitriolic acid; as Epsom, selenite, vitriolated tartar, &c.
12. And the basis of this metallic salt is known by the black colour produced by the solution of vegetable astringents.
83. On being urged by the flame thrown by the blow-pipe, it offers the same phenomena as the vitriol of copper, except that it does not colour the flame.

Green vitriol is frequently found native, either in coal mines or in the cavities of pyritaceous mines, or adhering to their scaffolds in a stalactitical form. It is found also in small round stones, called *ink-stones*, of a white, red, grey, yellow, or black colour, which are almost soluble in water, and contain a portion of copper and zinc. Also sometimes in form of schistus or slaty pyritaceous stones. But the greatest part of that in use is prepared by art, from the martial pyrites or mundic. See CHEMISTRY, n° 619.

IV. Aerated iron. *Ferrum aeratum.*

This metallic salt is a combination of the aerial acid with iron; and is found in the light chalybeate waters, where it is dissolved by an excess of this acid.

Mr Lane was the first who discovered in England the action of the aerial acid on iron, when the water is impregnated with that menstruum. The late R. Rouelle demonstrated the same phenomenon in France upon this and other metals. But Professor Bergman seems to have preceded them both nearly about the same time, though neither had any knowledge of each other's discoveries.

The great volatility of this acid is the cause why this neutral salt is not often found. For the mere evaporation of the ferruginous mineral waters, in order to analyse them, is sufficient to let loose the aerial acid; so that the iron which was there dissolved by its power falls down to the bottom in the form of a light ore, which amounts to nearly $\frac{1}{10,000}$ of the weight of the water; and when

when fresh retains so much phlogiston as to obey the magnet, as Bergman says.

V. Vitriol of cobalt, or vitriolated cobalt.

This metallic salt results from the combination of the vitriolic acid with cobalt.

1. When found native, it is always in an efflorescent state; whence it arises that, in this case,
2. Its colour is greenish, mixed with a grey tint: but,
3. It is of a rosy colour when artificially made;
4. Effloresces when exposed to the action of the atmosphere; and,
5. Takes then a greenish colour mixed with a pale purple, or a *Lilias colour*, as the French call it.
6. It is difficultly soluble in water; and,
7. Its solution is of a red colour.
8. The phlogisticated alkali precipitates the cobalt from the solution of this salt, which with borax gives an azure glass.

By the above qualities, chiefly the rosy colour of the solution of this neutral salt, its basis is sufficiently distinguished. As to its acid, it is easily known by the same tests as those of the preceding vitriols.

It is said to be found native in small pieces, mixed with a greenish efflorescence in cobalt mines. (*Kirwan* and *Mongez*.)

VI. Vitriol of zinc, vitriolated zinc, or white vitriol.

This neutral metallic salt results from the combination of vitriolic acid with zinc.

1. Its colour is white. It,
2. Requires little more than twice its weight of water to dissolve it in the temperature of 60 degrees of Fahrenheit's thermometer, and deposits a greyish yellow powder.
3. Its specific gravity is 2000.
4. Its taste is very styptic.
5. It mixes uniformly with vitriolic neutral salts.
6. Precipitates nitrous or marine selenites from their solutions, by which its acid is ascertained.
7. It is precipitable in a whitish powder by alkalies and earths; but,
8. Neither iron, copper, nor zinc, precipitate it: by which circumstance its basis is sufficiently indicated.
9. If it contains any other metallic principle, this may be precipitated by adding more zinc to the solution; excepting iron, which will of itself precipitate by exposure to the air or boiling in an open vessel.
10. One hundred parts of this metallic salt contain 22 of vitriolic acid, 20 of zinc, and 58 of water.
11. Urged by fire, it loses a good part of its acid.
12. Treated with the blow-pipe it exhibits nearly the same phenomena as other metallic vitriols; except only that the flame is brilliant when the zinc is reduced, and gives out white flocs called *flowers of zinc*.

This neutral metallic salt is sometimes found native, mixed with vitriol of iron, and in the form of white hairy crystals; or in a stalactitical form in the mines of Hungary, or as an efflorescence on ores of zinc. It is also found dissolved in mineral waters, and generally with some proportion of vitriols of iron and copper. Bergman says it is sometimes produced by the decomposition of pseudogalæna, or black-jack; but this rarely happens, because this substance does not readily decompose spontaneously.

But that in common use is mostly prepared at Goslaar, from an ore which contains zinc, copper, and lead, mineralised by sulphur and a little iron. The copper is first separated as much as possible: the remainder after torrefaction and distillation is thrown red-hot into water and lixiviated. It is never free from iron. (*Kirwan*, *Mongez*.)

VII. Vitriolated nickel, or vitriol of nickel.

This neutral metallic salt results from the combination of the vitriolic acid with nickel. It exists sometimes in consequence of the decomposition of the sulphureous ores of this semimetal. It is found native, efflorescing on Kupfer-nickel; and generally mixed with vitriol of iron.—It is of a green colour, as well as its solution. It is precipitated by zinc; but when joined with iron, this last is not precipitated by the same.

Its origin is perhaps owing to the decomposition of the pyritaceous and sulphureous ore of Kupfer-nickel, mentioned by Wallerius. This ore contains a great quantity of arsenic and sulphur, as well as cobalt, nickel, and iron. And if it comes to be decomposed in the bowels of the earth, it is natural to expect that the vitriolic acid of the sulphur will attack the nickel and the iron, with which it will form neutral metallic salts (*Mongez*, *Kirwan*.)

VIII. Muriatic manganese. *Manganesium salitum*.

M. Hielm is the only person who has as yet found this middle salt in some mineral waters of Sweden. It is composed by the combination of the regulus of Manganese with muriatic acid.

1. It is precipitated of a whitish yellow colour, by the Prussian (phlogisticated) alkali; and of a brownish yellow, by the mineral alkali. 2. It does not crystallise in any distinct form. 3. It abstracts the moisture of the air. 4. To obtain its basis free from iron, it must be precipitated by the mineral alkali; redissolved in nitrous acid; then calcined until this acid is expelled; and the residuum is to be treated with distilled vinegar, which will then take up only the manganese. (*Kirwan*.)

Order. VI. TRIPLE SALTS.

THE neutral salts hitherto enumerated are such as are composed of two ingredients only; but sometimes three or more are so united as not to be separated by crystallization. The vitriols that we are acquainted with are hardly ever pure; and two or three of them sometimes are joined together.

Sometimes likewise it happens that neutral salts join earthy salts, and earthy salts metallic ones. Bergman generally distinguishes compound salts according to the

Triple Neutral Salts.

the number of their principles, whether the same acid be joined to several bases, or the same base to different acids; or, lastly, whether several menstrua and several bases are joined together. Hence arise salts triple, quadruple, &c. which the diligence of aftertimes must illustrate. The most remarkable examples of triple and quadruple native salts which have yet occurred are,

I. Mineral alkali, with a small quantity of calcareous earth. *Alkali salis communis*. Aphronitrum.

This is so strongly united with the calcareous earth, that the latter enters with it into the very crystals of the salt: though by repeated solutions the earth is by degrees separated from it, and falls to the bottom after every solution.

It grows in form of white frost on walls, and under vaults; and in places where it cannot be washed away by the rain.

Hence it would appear, that this is not only a *triple*, but a *multiple* salt; as these pieces of old mortar covered with this white frost, on ancient walls, are the very same from which the saltpetre makers extract the mother-water of nitre, after mixing therewith the vegetable ashes, to furnish the alkaline base to it. M. Fourcroy says in his seventeenth Lecture, that this mother-water contains not only nitre, but five other kinds of salt, viz. the *marine salt*, *nitrous magnesia*, *calcareous nitre*, *magnesia nitrata*, and *calx salita*; to which the chemists of Dijon add the *digestive salt of Sylvius*, and in some cases various *vitriols* with *alkaline* or *earthy bases*.

When it contains any considerable quantity of the calcareous earth, its chrystals become rhomboidal, a figure which the calcareous earth often assumes in shooting into chrystals: but when it is purer, the crystals shoot into a prismatic figure.

This is a circumstance which necessarily must confuse those who know the salts only by their figure; and shows, at the same time, how little certainty such external marks afford in a true distinction of things.

This salt is very often confounded with the *sal mirabile Glauberi*.

II. Common salt with magnesia; or muriatic mineral alkali contaminated by muriatic magnesia.

This is a compound of the common salt with muriatic magnesia: and by the expression *contaminated (inquinatum)* of professor Bergman, we may suppose that the magnesian salt is not intimately united to the alkaline base.

This triple salt is very deliquescent; a quality it owes to its integrant part, the muriatic magnesia, (p. 79. col. 1.) For the pure muriatic alkali does not deliquesce: but this degree of purity is seldom found, even in the native fossil of *sal gem*, (p. 93. col. 2.) In general all the earthy marine salts are very deliquescent, as the muriatic chalk, the muriatic barytes, and the muriatic magnesia. *Bergman*, *Macquer*, and *Mongez*.

III. Mineral alkali with succinous acid and phlogiston. This substance will be afterwards mentioned among the *inflammables*.

IV. Vitriolated magnesia with vitriol of iron. Epsom salt contaminated with copperas.

Found in some mineral waters, according to Mr Monet, *(Treatise on Mineral Waters.)*

V. Native-alum contaminated by copperas. Vitriolated argil with vitriol of iron.

Found in the aluminous schistus. It sometimes effloresces in a feathery form. Perhaps this is the *plumose alum* of the ancients.

VI. Native alum, contaminated by sulphur.

At the places about Wednesbury and Bilston, in Staffordshire, where the coal-pits are on fire, this substance sublimes to the surface; and may be collected, in considerable quantity, during dry or frosty weather.

A similar compound substance sublimes at the Solfaterra near Naples.

VII. Native alum contaminated by vitriolated cobalt.

In the mines of Herregrund and Idria this salt may be seen shooting out into long slender filaments. Perhaps this is the *trichites* of the Greeks.

1. Dissolved in water, it immediately betrays the presence of vitriolic acid upon the addition of terra ponderosa salita (muriatic acid saturated with heavy earth).
2. By the addition of phlogisticated alkali, a precipitate of cobalt is thrown down, which makes blue glass with borax or microcosmic salt. (*Berg. Sciag.*)

VIII. Vitriol of copper with iron.

This salt is of a bluish-green colour. It is the *vitriolum ferreo cupreum cyaneum* of Linnæus. Its colour varies, being sometimes more or less green, and sometimes more or less blue. It is found at Saltzberg and at Falhun. This vitriol is called *vitriol of Hungary*, because it is found in the Hungarian mines of this kind. *(Mongez.)*

IX. Vitriol of copper, iron, and zinc.

This is the *vitriolum ferreo zinceo cupreum cyaneum* of Linnæus. Its colour is of a blue inclining to green. If rubbed on a polished surface of iron, the copper is not precipitated thereby, as it happens to the blue vitriol; which shows that the vitriolic acid is perfectly saturated in this salt by the three metallic bases.

X. Vitriol of copper and zinc.

This is the blue vitriol from Goslar. According to Mongez it is the *vitriolum zinceo-cupreum cæruleum* of Linnæus.

XI. Vitriol of iron and zinc.

This is the green vitriol from Goslar in the Hartz. According to Mongez, this is the *vitriolum zinceo-ferreum viride* of Linnæus, 105. 6. Its colour is a pale-green cast.

XII. Vitriol of iron and nickel.

This salt is of a deep-green colour, and is contained in the ochre, or decayed parts of the nickel, at the cobalt-mines of Los, in the province of Helsingland.

Class III. Mineral INFLAMMABLE Substances.

To this class belong all those subterraneous bodies that are dissoluble in oils, but not in water, which they repel;

Inflammables.

repel; that catch flame in the fire; and that are electrical.

It is difficult to determine what constitutes the difference between the purer sorts of this class, since they all must be tried by fire, in which they all yield the same product; but those which in the fire show their differences by containing different substances, are here considered as being mixed with heterogeneous bodies: that small quantity of earthy substance, which all phlogista leave behind in the fire, is, however, not attended to.

I. Inflammable air; fire damp.

This aeriform substance is easily known by its property of inflaming when mixed with twice or thrice its bulk of common atmospheric air; and it is asserted to be the real phlogiston almost pure. See Aerology-*Index* and *Inflammable Air*.

It admits considerable varieties, according to the nature of the substances from which it is produced, and often gives different residuums upon combustion, some of which are of the acid kind. If it is produced from charcoal, it yields aerial acid or fixed air: from solutions of metallic substances in the vitriolic, nitrous, or marine acids, it yields these respective acids, as M. Lavoisier asserts.

Æther, converted into vapour in a vacuum, gives a permanent elastic vapour, which is inflammable. The atmosphere, which floats round the fraxinella, is inflammable from the admixture of its vapours, which seem to be of the nature of an essential oil: so that on approaching the flame of a candle under this plant, in hot weather, it takes fire in an instant; although the essential oil, extracted from this plant by distillation, is not inflammable on account of the watery particles mixed with it, as M. Bomare asserts.

Mr Scheele is of opinion, that every inflammable air is composed of a very subtile oil. This coincides with the idea entertained by chemists of their phlogiston; and is confirmed by the fact, of its being naturally found in those springs from whence issues petrol, whose exhalations are very inflammable.

The residuum, which remains in the atmosphere after the combustion of inflammable air, is extremely noxious to animals. Doctor Priestley takes it to be a combination of phlogiston with pure air, and on this account calls it *phlogisticated air*. But M. Lavoisier, on the contrary, considers it to be a primitive substance of an unchangeable nature, and gives it the singular name of *atmospheric mephitis*.

II. Hepatic air.

This air seems to consist of sulphur, held in solution in vitriolic or marine air. It is inflammable when mixed with three quarters of its bulk of common air. Nitre will take up about half the bulk of this air; and when saturated with it, will turn silver black: but if strong dephlogisticated nitrous acid be dropped into this water, the sulphur will be precipitated.

One hundred cubic inches of this air may hold eight grains of sulphur in solution in the temperature of 60°; and more if hotter.

Atmospheric air also decomposes hepatic air.

It is found in many mineral waters, and particularly in the hot baths of Aix-la-Chapelle. The cause and manner of their containing sulphur which was long a problem, has at last been happily explained by Mr Bergman.

It plentifully occurs in the neighbourhood of volcanoes and in several mines.

Hepatic air is easily obtained by art, from all sorts of liver of sulphur, whether the base be an alkali, an earth, or a metal, if any acid is poured upon it; and the better, if use be made of the marine acid, because it contains phlogiston enough, and does not so strongly attract that of the *hepar sulphuris*. For this reason the nitrous acid is not fit for this process, as it combines itself with the phlogiston, and produces nitrous air. It may also be produced, by distilling a mixture of sulphur and powdered charcoal, or of sulphur and oil, &c. See the detached article *Hepatic Air*, and Aerology-*Index*.

III. Phlogiston combined with aerial acid; black lead, or wadd. *Plumbago*. See the detached article *Black-Lead*.

It is found,

a. Of a steel-grained and dull texture. It is naturally black, but when rubbed it gives a dark lead colour.

b. Of a fine scaly, and coarse-grained texture; coarse black-lead.

IV. Mineral tallow. *Serum minerale*.

This was found in the sea on the coasts of Finland in the year 1736. Its specific gravity is 0.770; whereas that of tallow is 0.969. It burns with a blue flame, and a smell of grease, leaving a black viscid matter, which is with more difficulty consumed.

It is soluble in spirit of wine only when tartarised: and even then leaves an insoluble residuum; but expressed oils dissolve it when boiling.

It is also found in some rocky parts of Persia, but seems mixed with petrol, and is there called *schebennaad*, *tsienpen*, *kodreli*.

Dr Herman of Strasburg mentions a spring in the neighbourhood of that city, which contains a substance of this sort diffused through it, which separates on ebullition, and may then be collected. (*Kirwan*).

V. Ambergris. *Ambra grisea*.

It is commonly supposed to belong to the mineral kingdom, although it is said to have doubtful marks of its origin (A).

a. It

(A) Ambergris, according to the assertion of M. Aublet (in his *Histoire de la Guiane*), is nothing more than the juice of a tree inspissated by evaporation into a concrete form. This tree grows in Guyana, and is called

Inflammables.

a. It has an agreeable ſmell, chiefly when burnt:

b. Is conſumed in an open fire:

c. Softens in a ſlight degree of warmth, ſo as to ſtick to the teeth like pitch.

d. It is of a black or grey colour; and of a dull or fine grained texture (B).

The grey is reckoned the beſt, and is ſold very dear. This drug is brought to Europe from the Indies. It is employed in medicine; and alſo as a perfume (C).

VI. Amber. *Ambra flava*, *ſuccinum*, *electrum*, Lat. *Carabé*, French. *Agtſtein*, *Bernſtein*, Germ.

This ſubſtance is dug out of the earth, and found on the ſea-coaſts. According to the experiments of M. Bourdelin, it conſiſts of an inflammable ſubſtance, united with the acid of common ſalt, which ſeems to have given it its hardneſs.

It is ſuppoſed to be of vegetable origin, ſince it is ſaid to be found together with wood in the earth.

By Diſtillation it yields water, oil, and a volatile acid ſalt, which the abovementioned author has thought to be the acid of common ſalt united with a ſmall portion of phlogiſton.

Inſects, fiſh, and vegetables, are often found included in it, which teſtify its having once been liquid.

It is more tranſparent than moſt of the other bitumens; and is doubtleſs the ſubſtance which firſt gave riſe to *electrical experiments* (on account of the power it poſſeſſes of attracting little bits of ſtraw, or of other light ſubſtances, when rubbed).

Its varieties are reckoned from its colour and tranſparency. It it is found,

A·

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called *cuma* but has not been inveſtigated by other botaniſts. When ſome branches are broken by high winds, a large quantity of the juice comes out; and if it chances to have time to dry, various maſſes (ſome of which had been ſo large as to weigh 1200 pounds and more) are carried into the rivers by heavy rains, and through them into the ſea: afterwards they are either thrown into the ſhore or eaten by ſome fiſh, chiefly the ſpermaceti whale, known by the name of *Phyſeter-macrocephalus* among ichthyologiſts. This kind of whale, is very greedy of this gum-reſin, and ſwallows ſuch large quantities when they meet with it, that they generally become ſick; ſo that thoſe employed in the fiſhery of theſe whales, always expect to find ſome amber mixed with the excrements and remains of other food in the bowels of thoſe whales who are lean. Various authors, among whom is Father Santos in his *Ethiopia Orientalis*, who travelled to various places of the African coaſt, and Bomare, ſay, that ſome ſpecies of birds are fond of eating this ſubſtance as well as the whales and other fiſhes. This accounts very well for the claws, beaks, bones, and feathers of birds, parts of vegetables, ſhells, and bones of fiſh, and particularly for the beaks of the cuttle fiſh or *ſepia octopedia*, that are ſometimes found in the maſs of this ſubſtance. Dr Swediar, however, attended only to theſe laſt, though he had mentioned alſo the other ſubſtances in his paper inſerted in the Philoſophical Tranſactions for 1783; wherein he attempts to eſtabliſh an opinion, that the amber is nothing elſe but a preternaturally hardened dung, or feces, of the phyſeter whale. Dr Withering and Mr Kirwan have embraced this notion; as did alſo, inadvertently, the editors of this Work. See AMBERGRIS.

(B) Mr Aublet brought ſpecimens of this gum-reſin, which he collected on the ſpot, from the cuma tree at Guiane. It is of a whitiſh-brown colour with a yellowiſh ſhade, and melts and burns like wax on the fire. The ſingularity of this gum-reſin is, that it imbibes very ſtrongly the ſmell of the aromatic ſubſtances which ſurround it; and it is well known that perfumers avail themſelves very conſiderably of this advantage. M. Rouelle examined very carefully this ſubſtance brought over by Mr Aublet, and found that it produced the very ſame reſults as in other good kinds of amber. Beſides Mr Aublet's authority, which is deciſive, as being grounded upon direct proofs of fact, Rumphius, quoted by Bergman, long ſince mentioned a tree called *Nanarium*, whoſe inſpiſſated juice reſembles amber. It cannot therefore at preſent be doubted that the origin of this phlogiſtic ſubſtance is the vegetable kingdom, although it may be often found and reputed as a product of the foſſile kind.

This ſubſtance being analyſed by Meſſrs Geoffroy and Newman, quoted M. Fourcroy, yielded them the ſame principles as the bitumens; viz. an acid ſpirit, a concrete acid ſalt, ſome oil, and a charry reſiduum: which evidently evinces, that all theſe fat and oily foſſile ſubſtances have their origin from the other two kingdoms of nature.

(C) Ambergris is not only brought from the Eaſt Indies, but from the coaſts of the Bahama Iſlands, Braſil, Madagaſcar, Africa, China, Japan, the Molucca iſlands, the coaſts of Coromandel, Sumatra, &c. Dr Lippert, in a treatiſe he publiſhed at Vienna 1782, entitled *Phlogiſtologia Mineralis*, has copied chiefly from Wallerius what he aſſerts of this ſubſtance. He affirms that there are eight known ſpecies of amber; five of a ſingle colour, viz. the white and the black from the iſland of Nicobar, in the gulph of Bengal, the aſh-coloured, the yellow, and the blackiſh; and two variegated, viz. the grey coloured with black ſpecks, and the grey with yellow ſpecks. This laſt he aſſerts to be the moſt eſteemed on account of its very fragrant ſmell, and to come from the South coaſt of Africa and Madagaſcar, as well as from Sumatra; and that the black dark coloured amber is often found in the bowels of cetaceous fiſhes. The ſame author adds alſo from Wallerius, that by diſtilling the oil of yellow amber (*ſuccinum*) with three parts and a half of fuming nitrous acid, a reſiduum remains like roſin, which emits a perfect ſmell of muſk; whence ſome conclude, that the ambergris belongs to the foſſile kind: the contrary, however, is evinced in the preceding note.

Inflammables.

A. Opaque.
a. Brown.
b. White.
c. Blackiſh.
B. Tranſparent.
a. Colourleſs.
b. Yellow.

The greateſt quantity of European amber is found in Pruſſia; but it is, beſides, collected on the ſea-coaſt of the province of Skone, and at Biorko; in the lake Malaren in the province of Upland; as alſo in France and in Siberia. It is chiefly employed in medicine and for making varniſhes (D).

VII. Rock-oil.

This is an inflammable mineral ſubſtance, or a thin bitumen, of a light brown colour, which cannot be decompoſed; but is often rendered impure by heterogeneous admixtures. By length of time it hardens in the open air, and then reſembles a vegetable reſin; in this ſtate it is of a black colour, whether pure or mixed with other bodies. It is found,

A. Liquid.

1. Naphtha.

This is of a very fragrant ſmell, tranſparent, extremely inflammable, and attracts gold. It is collected on the ſurface of the water in ſome wells in Perſia. See NAPHTHA.

2. Petrol.

This ſmells like the oil of amber, though more agreeable; and likewiſe very readily takes fire. It is collected in the ſame manner as the Naphtha from ſome wells in Italy. See PETROLEUM.

B. Thick and pitchy; *Petroleum tenax.* Barbadoes-tar.

This reſembles ſoft pitch.

It is found at the Dead Sea in the Holy Land; in Perſia, in the chinks of rocks, and in ſtrata of gypſum and limeſtone, or floating on water; alſo in Siberia, Germany, and Switzerland, in coal-pits: and in America: likewiſe in Colebrookdale in England.

C. Elaſtic petrol.

This is a very ſingular foſſil, found of late in England.

By its colour and conſiſtency, it exactly reſembles the Indian-rubber, or the gum-reſin, from the north part of Braſil, called *caoutchouc.* It is of a dark brown colour, almoſt black; and ſome is found of a yellowiſh brown caſt, like the ſame gum-reſin.

With reſpect to its elaſtic conſiſtence, it hardly can be diſtinguiſhed from it, except in the coheſion of its particles, which is weaker.

It has the ſame property of rubbing off from paper the traces of black-lead pencils.

It burns likewiſe with a ſmoky flame; and alſo melts into a thick oily fluid; but emits a diſagreeable ſmell, like the foſſile pitch, or Barbadoes tar.

It

Inflammables.

(D) Amber, ſays M. Fourcroy, is found in ſmall detached pieces, for the moſt part under coloured ſands, diſperſed in beds of pyritaceous earth; and above it is found wood, charged with a blackiſh bituminous matter. Hence it is ſtrongly ſuppoſed that it is a reſinous ſubſtance, which has been altered by the vitriolic acid of the pyrites, notwithſtanding that we know that acids, when concentrated, always blacken and charry reſinous ſubſtances. In fact, the chemical analyſis of this ſubſtance rather confirms that ſuppoſition.

The ſingular opinion of Dr Girtanner, about the yellow amber being produced by a kind of ants, may be ſeen in *Journal de Phyſique* for March 1786, page 227. Or ſee the article AMBER in this Dictionary.

The colour, texture, tranſparency, and opacity of this ſubſtance, have ſhown ſome other varieties beſides theſe mentioned in the text. The principal ones are the following:

6. The yellow ſuccinum, 7. The coloured green or blue by foreign matter. 8. The veined ſuccinum,	opaque.	9. The white, 10. The pale-yellow, 11. The citron-yellow, 12. The deep-red,	tranſparent.

The golden yellow tranſparent amber, mentioned in the text, is what the ancients called *chryſolectrum*, and the white opaque was called *leucolectrum.*

But we muſt be cautious about the value of the ſpecimens remarkable for their colour, ſize, tranſparency, and the well-preſerved inſects they contain internally; ſince there is a probability of deception, ſeveral perſons poſſeſſing the art of rendering it tranſparent and coloured, and of ſoftening it, ſo as to introduce foreign ſubſtances, &c. into it at pleaſure.

M. Fourcroy ſays, that two pieces of this ſubſtance may be united, by applying them to one another, after being wet with oil of tartar and heated. And Wallerius mentions, that pieces of yellow amber may be ſoftened, formed into one, and even diſſolved by means of oil of turnip-ſeed, in a gentle heat; and that according to ſome authors, it may be rendered pure and tranſparent, by boiling it in rape-ſeed oil, linſeed oil, ſalt-water, &c.

Mr Macquer ſays, that for the purpoſe of making varniſh, this ſubſtance muſt undergo beforehand a previous decompoſition by torrefaction, in order to be diſſolved by linſeed-oil or eſſential oils. See VARNISH.

Beſides the making of varniſhes, this ſubſtance was much employed formerly in making various pieces of ornament and jewellery. The beſt pieces were cut, turned, carved, or plained, to make vaſes, heads of canes, collars, bracelets, ſnuff-boxes, beads, and other toys, ſmall fine cheſts, &c. But after diamonds and beautiful hard ſtones were brought into uſe, theſe trinkets are little conſidered in Europe: nevertheleſs, they are ſtill ſent to Perſia, China, and to various other eaſtern nations, who eſteem them ſtill as great curioſities.

Inflammables.

It is found in the same earthy and stony beds as petrol. Some specimens are of a cylindrical form, like bits of thin branches or stalks of vegetables, though much more flexible, being perfectly elastic.

M. Magellan observes, that this fossil seems to favour the opinion of those mineralogists, "who believe that these oily combustibles derive their origin from the vegetable kingdom. It seems worth trying, whether pieces of asphaltum, buried in damp beds of sparry rubbish, or other kind of earths, would take the same elastic consistence. But since many beds of shells and other fossile substances, both of the vegetable and animal kind, as impressions of various plants, and the remains of various quadrupeds, &c. have been found in different parts of the globe, whose individual species undoubtedly exist no longer alive unless in far distant climates, and in the most remote countries from the spot where their exuvia are dug out; why should we not allow that this new fossil may be the same original elastic gum, now growing naturally in Brasil, China, and other hot climates, only altered in its smell, and in the tenacity of its particles, by its long deposition during centuries in the bowels of the earth?"

This elastic petrol was found in 1785, near Cassel-town, in the county of Derbyshire in England, but in very inconsiderable quantities.

D. Hardened rock-oil; fossile pitch. *Petroleum induratum, Pix montana.*

1. Pure asphaltum.

This leaves no ashes or earthy substance when it is burnt.

It is a smooth, hard, brittle, inodorous, black or brown substance. When looked through in small pieces, appears of a deep red colour. It swims in water.

It breaks with a smooth shining surface.—Melts easily: and, when pure, burns without leaving any ashes; but if impure, leaves ashes or a slag.

According to M. Monet, it contains sulphur, or at least the vitriolic acid.

It is slightly and partially acted on by alcohol and æther.

From this, or the preceding substance, it is probable the asphaltum was prepared that the Egyptians used in embalming their dead bodies, and which is now called *mummia.*

It is found also on the shores of the Red Sea, in the Dead Sea, in Germany, and France.—(*Kirwan.*)

And it comes likewise from Porto Principe, in the island of Cuba. (*Brun.*)

It is found also in many parts of China: and is employed as a covering to ships by the Arabs and Indians. (*Fourcroy.*)

2. Impure; *Pix montana impura.* Pissaphaltum.

This contains a great quantity of earthy matter, which is left in the retort after distillation, or upon the piece of charcoal, if burnt in an open fire; it coheres like a slag, and is of the colour of black-lead: but in a calcining heat, this earth quickly volatilises, so that the nature of it is not yet known.

It is found in Mossgrufvan in Norberg, and in Grengierberget, both in the province of Westmanland; and also in other places.

The pissaphaltum is of a mean consistence between the asphaltum and the common petroleum. It is the very bitumen which is collected in Auvergne in France in the well called *de la Pege,* near Clermont Ferrand.

VIII. Jet. *Gagas, Saccinum nigrum.*

This is a very compact bitumen, harder than asphaltum, always black, and susceptible of a good polish. It becomes electrical when rubbed; attracts light bodies like the yellow amber; and it swims on water.

It seems to be nothing else than a black amber, or succinum; but specifically lighter, on account of the greater portion of bitumen that enters into its composition. When burned, it emits a bituminous smell. See the article JET.

IX. Mineral phlogiston united with earths.

A. With calcareous earth.

1. With pure calcareous earth. This is the fetid or swine spar formerly described.

B. United with calcareous, argillaceous, ponderous, and siliceous earth and vitriolic acid. Liverstone: *Lapis hepaticus.*

C. With an argillaceous earth; Pit or Stone Coal.

1. With a small quantity of argillaceous earth and vitriolic acid. *Lithanthrax.* See the articles COAL and PIT-COAL.

This is of a black colour, and of a shining texture: it burns with a flame, and is mostly consumed in the fire; but leaves, however a small quantity of ashes.

a. Solid coal. *b.* Slaty coal.

2. Culm-coal, called *kolm* by the Swedes.

This has a greater quantity of argillaceous earth and vitriolic acid, and a moderate proportion of petrol.

It has the same appearance with the preceding one, though of a more dull texture: it burns with a flame; and yet is not consumed, but leaves behind a slag of the same bulk or volume as the coal was.

From England, and among the alum rocks at Moltorp and Billingen in the province of Westergottland.

3. Slate-coal.

This coal contains abundance of argillaceous earth. It burns with a flame by itself, otherwise it looks like other slates.

It is found at Gullerasen in the parish of Rettwik, in the province of Dalarne, and also with the coals at Boserup in Skone.

This seems to be the same with the bituminous schistus, already described among the argillaceous earths.

4. Cannel-coal.

Mr Kirwan has put together this variety of coal with that other called *Killkenny-coal,* tho' they have some different properties.

The cannel-coal is of a dull black colour; breaks easily in any direction; and, in its fracture, presents a smooth conchoidal surface, if broken transversely.

It contains a considerable quantity of petrol, in in a less denser state than other coals; and burns with a bright lively flame, but is very apt to fly in pieces in the fire. It is said, however, to be entirely deprived of this property, by being previously immersed in water for some hours.

Its specific gravity is about 1270; and being of an uniform hard texture may be easily turned in the lathe, and receive a good polish.

It is from this kind of coal that small vases, as ink-stands, various trinkets, and other curiosities, are made in England, which appear as if made of the finest jet.

5. Kilkenny-coal.

This contains the largest proportion of petrol or asphaltum; burns with less flame and smoke, and more slowly, though intensely, than the cannel-coal.

The quantity of earth in this coal does not exceed one-twentieth of its weight. Its specific gravity is about 1400. It is frequently mixed with pyrites.

It is found in the county of Kilkenny, belonging to the province of Leinster in Ireland. The quality of this coal burning almost without smoke, is mentioned in a proverb by which the good qualities of that country are expressed.

6. Sulphureous coal.

This consists of the former kinds of coal, mixed with a notable proportion of pyrites: hence it is apt to moulder and break when exposed to the air. It contains yellow spots that look like metal; and burns with a sulphureous smell, leaving either red ashes, or a slag, or both. Water acts upon it, after it has mouldered. Its specific gravity is = 1500, or more.

Besides the above varieties, schistus, micaceous schistus, and gneiss, are frequently found in the neighbourhood of coal-mines, so penetrated with petrol bitumen as to constitute an inferior species of coal; but the bitumen being burnt, they preserve their form, and in some measure their hardness. Also some grey slates, that are so soft as to be scraped with the nail, and are greasy to the touch, burn like coal.

All the differences of coal arise from a mixture of the varieties already mentioned; and it is observable, that wherever coals exist, slates are generally found near them. Salt or mineral springs are also often found in their neighbourhood. (*Kirwan.*)

7. Bovey coal. *Xylanthrax.*

This is of a brown, or brownish black colour, and of a yellow laminar texture.

The laminæ are frequently flexible when first dug, though generally they harden when exposed to the air.

It consists of wood penetrated with petrol or bitumen; and frequently contains pyrites, alum, and vitriol.

Its ashes afford a small quantity of fixed alkali, according to the German chemists; but according to Mr Mills, they contain none.

By distillation it yields an ill smelling liquor, mixed with a volatile alkali and oil, part of which is soluble in spirit of wine, and part insusible, being of a mineral nature.

It is found in England, France, Italy, Swisserland, Germany, Ireland, &c. (*Kirwan.*)

8. Peat. *Geanthrax.*

There are two sorts of inflammable substances known by this name, viz.

The first of a brown, yellowish brown, or black colour, found in moorish grounds; in Scotland, Holland, and Germany. When fresh, it is of a viscid consistence, but hardens by exposure to the air. It consists of clay mixed with calcareous earth and pyrites; and sometimes contains common salt. While soft, it is formed into oblong pieces for fuel, after the pyritaceous and stony matters are separated. When distilled, it affords water, acid, oil, and volatile alkali. Its ashes contain a small proportion of fixed alkali. They are either white or red, according as it contains more or less ochre or pyrites.

The second is found near Newbury in Berkshire. It contains but little earth; but consists chiefly of wood, branches, twigs, roots of trees, with leaves, grass, straw, and weeds. (*Kirwan.*)

9. Stone-turf.

Cronstedt has ranged the turf among the fossils of his appendix; but as that called in England by the name of *stone-turf* contains a considerable proportion of peat, it may be mentioned with propriety in this class.

Soon after it is dug out from the ground, where it keeps a soft consistence, it at first hardens; but afterwards it crumbles by long exposure to the air.

As to the other common turf, it only consists of mould interwoven with the roots of vegetables; but when these roots are of the bulbous kind, or in a large proportion, they form the worst kind of turf.

Although it may appear incredible, it is nevertheless a real fact, that in England pit-turf is advantageously employed in Lancashire to smelt the iron-ore of that county. Mr Wilkinson, brother-in law to Dr Priestley, and famous for his undertakings in the extensive iron-works, perhaps the greatest in Europe, makes use of pit-turf in his large smelting furnaces of that province

Those fossil substances, which furnish fuel for the various purposes of human life, are distinguished by the name of *coals*, on account of their being a succedaneum for wood and other vegetable productions, which when dry or of an oleaginous kind serve for the same uses. If these vegetable substances are deprived of the access of air, by covering them after ignition, the half consumed remainder, which is of a black colour, is called by the name of *coal* or *charcoal*; and from hence the fossil which affords fuel has also

Inflammables.

alſo been called by the ſame name, though of a very different nature.

Pit-coal and earth-coal are ſynonymous, and mean coals dug out of a pit or from the earth. But the lithanthrax denotes ſtone-coal, and more properly indicates the cannel-coal, which has the greateſt ſimilarity to a ſtony ſubſtance, by the dull appearance of its fractures and by the uniform texture of its parts.

All theſe coals are in general a bituminous black or brown and dark ſubſtance: for the moſt part they have a lamellated texture, which breaks eaſily, and always with a ſhining ſurface.

The varieties of pit-coals abovementioned are the moſt remarkable, by which they may be diſtinguiſhed from one another. But they are far from being homogeneous in each kind; as the accidental qualities, and the various proportions of their component parts, produce a far greater number of properties, which renders them more or leſs fit for different purpoſes; though theſe are generally overlooked, and confounded with the common one of affording fuel for making fire to warm our rooms, or for culinary operations.

This foſſile bitumen, as Fourcroy remarks, being heated in contact with a body in combuſtion, and a free acceſs of air, kindles the more ſlowly, and with more difficulty, as it is more weighty and compact. When once kindled, it emits a briſk and very durable heat, and burns for a long time before it is conſumed. If extinguiſhed at a proper time, the remaining cinders may ſerve ſeveral times for a new firing with a ſmall addition of freſh coals. The matter that is burned, and produces the flame, appears very denſe, as if united to another ſubſtance which retards its deſtruction. Upon burning, it emits a particular ſtrong ſmell, which is not at all ſulphureous when the earth-coal is pure, and contains no pyrites.

When the combuſtible, oily, and moſt volatile parts, contained in the earth-coal, are diſſipated and ſet on fire by the firſt application of heat; if the combuſtion is ſtopped, the bitumen retains only the moſt fixed and leaſt inflammable part of its oil, and is reduced to a true charry ſtate, in combination with the earthy and fixed baſe. Pit-coals in this charry ſtate are called *coaks*, which are capable of exciting the moſt intenſe heat; and are employed all over Britain in the ſmelting of iron, copper, and other metallic ores, to the greateſt advantage. See COAKS, COAL, COALERY, and PIT-COAL (E).

X. The

† Nat. Hiſt. of the Mineral Kingdom.

(E) The coal-metals, or ſtone ſtrata incloſing coals, are very numerous. Mr Williams † gives the following general account of thoſe in Scotland.

The ſand-ſtones. Of theſe there is a great variety, diſtinguiſhable by colour, texture, and degrees of hardneſs, generally diſpoſed into thick, middling, and thin ſtrata. The only ſpecies our author takes notice of is the regular broad-bedded free-ſtone of a laminated texture. This commonly riſes in thin or middling ſtrata; appearing at the edges of a ſection, when broken or cut, to be formed of thin lamina or layers of ſand, equally laid on the whole breadth of the ſtone, and well cemented together. A great deal of both red and white free-ſtone riſe in layers of five or ſix inches, and ſo upwards, with regular ſtreaks of a fifth or ſixth part of an inch appearing the whole length of the ſtone, when the edge of a ſlab is poliſhed, as if ſo many gentle waves of water had formed the layer. The regularity of the ſtructure of this ſtone correſponds exactly with the regularity of its layers; and our author is of opinion, that the ſlaggy grey-ſtrata of free ſtone, with many of the black and grey-ſtrata of coal metals, the grey ſlate, as well as many other thin ſtrata of the coal metals, may be ranked with this free ſtone for perfect and regular ſtratification.

Along with theſe he claſſes ſome of the thin argillaceous ſtrata. "Many of the grey regularly ſtratified mountain limeſtones (ſays he) are alſo ſtreaked or ſtriped; and the ſtreaks in theſe appear more conſpicuous when broken than the ſtreaked free ſtones. Some of the hard regularly ſtratified mountain rocks are alſo ſtratified; and in all theſe three kinds of ſtones, the ſtreaks are regularly and exactly parallel to the bed of the ſtone."

Another remarkable inſtance of regularity of ſtrata is met with in the grey ſlaggy ſtrata of Caithneſs.—Throughout all the low country of Caithneſs, a ſquare of about 10 or 15 miles, there are bluiſh argillaceous ſtrata, with generally a ſmall quantity of lime in the compoſition of the ſtone, which is indurated to a greater degree than is common to ſuch thin ſtrata. The ſtone is ſtrong and tough, every where diſpoſed in thin broad-bedded, regular ſtrata; and in ſeveral parts of the country the flags are ſo thin and regular, and are raiſed ſo light and broad, that they are uſed for covering houſes; and three or four of them will cover the ſide of a ſmall one. Our author mentions a gentleman who has an eſtate on the ſouth ſide of the Pentland firth, and who in a bay there raiſes flags of any ſize and thickneſs he pleaſes; "ſo truly flat and ſmooth, that he has only to ſquare the edges to make of them good loft-floors, partitions, cheſts, mangers, roofs of houſes; in ſhort, he does every thing with them. The face of theſe flags are as ſmooth and true a plane, as if artificially finiſhed by the beſt workman."

In moſt coal fields there are a great variety of ſtrata of different kinds accompanying and lying between the ſeams of coal, of all ſorts of colours, conſiſtencies, and dimenſions; all of them blended together without any certain order or regularity; ſo that if there be 20 ſeams of coal, it is poſſible that there may be as many different roofs; that is, the ſtratum which is the immediate roof of one ſeam of coal, ſhall differ from that of another ſeam in quality, thickneſs, and colour, ſo that perhaps no two of the twenty ſhall be in any reſpect alike.

The various kinds of coal-roofs (*a*) commonly met with are the following.

1. Ba-

(*a*) The ſtratum which is placed immediately above a ſeam of coal, is called the roof of the coal; and that which is placed immediately below the ſeam, is called the pavement of the coal: which three, viz. the ſtratum of coal, and its roof and pavement, with the other concomitant ſtrata lying above and below them, always preſerve their ſtations and paralleliſm; that is, are all ſtretched out and ſpread one above another upon the ſame inclining plane, and have the ſame line of bearing and of declivity.

Inflammables.

X. The mineral phlogiston or bitumen, united with the vitriolic acid: sulphur or brimstone. See the article SULPHUR.

This is very common in the earth, and discovers itself in many and various forms. It is found,

A. Native. *Sulphur nativum.*

In this the two constituent parts are mixed in due proportion in regard to each other, according to the rules of that attraction which is between them. It is easily known,

1. By its inflammability, and by its flame.
2. By its smell when burnt; and,

O 2

3. By

1. *Basaltes.* This is very common in Scotland, where it is frequently called *whin* stone; and at Borrowstounness there are several thick beds of it between the seems of coal. One of them being the immediate roof of a seam of coal there at Hillhouse lime quarry, there is a thin seam of coal beneath a beautiful bed of columnar basaltes. In the Bathgate hills to the southward of Linlithgow, also, there are several strata of coal blended with those of basaltes. These basaltine strata are always very hard, frequently very thick, and generally of a black or blackish grey colour. "there are but few people (says Mr Williams) sufficiently versed in natural history, to know that they are basaltes, as this kind of rock, both in England and Scotland, goes by the name of *whin rock.* In the north of Scotland it is called *skurdy;* and among the miners in Cornwall it has the name of *cockle* (*b*)."—

2. Strata of *limestone* of various thicknesses are met with in different coal-fields. Sometimes the lime is the immediate roof; but sometimes there is an argillaceous stratum of about the thickness of a foot between the coal stratum and that of lime. In the coal-fields at Gilmerton, near Edinburgh, are several beds of limestone, some of them very good, and of considerable thickness. At Blackburn in West Lothian, also, there is a stratum of limestone six or seven feet thick, which is the immediate roof of a seam of coal about five or six feet thick. At Carlops and Spittlehaugh in Tweedale, they have a seam of coal immediately below their lime quarries, which they work for burning their lime.

3. *Post-stone,* a kind of thick and solid stratum of free stone, is one of the roofs of coal, generally without the intervention of any argillaceous stratum, though sometimes a stratum of this kind is interposed. Frequently this kind of stone is rendered very hard by a mixture of iron or pyrites. In most coal fields, thinner strata of free stone are met with as the roofs of coal seems.

4. *Dogger-band,* as it is called by the Scots colliers, is frequently met with as the roof of coal seams. This name is applied to various substances. Sometimes they call strata of iron-stone *dogger bands;* sometimes the name is restricted to the ball iron-stone; sometimes to pyrites; and sometimes the dogger band is a kind of imperfect stone, composed of several heterogeneous mixtures, among which pyrites bears a considerable proportion, and by which the whole is so strongly bound together, that it is frequently very difficult to break through it.

5. *Whin-stone,* properly so called, not of a basaltic nature. These roofs are always very hard, and of various colours, as black, blackish grey, brown, red, &c. sometimes not above two or three feet in thickness, but sometimes much more.

6. *Post-stone,* of a softer nature than that already mentioned. This has no mixture of ferruginous matter.

7. *Regular strata of free-stone,* of various colours, textures, and thicknesses, but not sufficiently thick to deserve the name of *post-stone,* which our author thinks they do not, unless they are above three or four feet. These thin strata of free stone are very numerous in coal fields, and very frequently form the roofs of coal-seams. Some of them are three or four feet thick, while others do not exceed three or four inches. They make good roofs, easily cut through, and may be readily quarried out for other purposes.

8. *Grey-bands,* or grey-coloured free-stone, frequently form the roofs of coal seams. A great number of them are generally arranged in one place, lying immediately above one another; and they are frequently found of all degrees of thickness from one to twenty inches, though the most common dimensions are from two to six. By the Scots colliers these are called *grey sekes* as well as grey bands. Frequently they are found of moderate hardness, and sufficiently strong to make good flags and covers for sewers. These roofs are strong and safe when the stone partakes of the nature of the coal, and has a black or blackish grey colour; but when they have a mixture of tilly or argillaceous matter, they are more friable.

9. *Blaes,* when hard, strong, and well stratified, are reckoned tolerably good coal-roofs. These are always of a bluish-black or black-grey colour, and are of great variety in respect to hardness and strength. Some of the strongest and hardest are either entirely black or greyish black; while some of the different shades of black are pretty thick, and others are but thin. The thickest, however, are not above 18 inches, and the thinnest two or three inches or less. The medium thickness is from one foot to three or four inches. Some of them are sufficiently hard to make a good and safe coal-roof; but they seldom acquire such a degree of hardness as to give any considerable obstruction in sucking. All of them seem to have a considerable quantity of black argillaceous matter in their composition; and the strong blaes have also a considerable quantity of sand; often also containing a large portion of empyreumatic oil, and sometimes have a considerable mixture of coaly matter. There is a great variety both in the thickness and quantity of these blaes found above seams of coal. In some places the thinnest strata make the immediate roof; in others, the thickest. Sometimes we find only five or six inches of blaes upon the coal; in others as many fathoms, or even much more; and it is common to find them of all the intermediate thicknesses.

10. *Whitish*

(b) We must observe, however, that according to Bergman and other eminent mineralogists, the cockles or shirls ought not to be confounded with basaltes; which last name does not at all fit those substances. See Volcanic Products in the Appendix to this article.

Inflammables.

3. By its producing a liver of sulphur, when mixed with a fixed alkali, like that made from artificial sulphur. It is found,

a. Pellucid, of a deep yellow colour.

b. Opaque, white, and greyish. These are found in Siberia, at Bevieux in Swisserland, and at Solfatara near Naples.

c. Crystallised in octoedral prisms, with blunted points.

d. Transparent. Mr Davila had been informed that this was brought from Normandy in France. *(Brun.)*

1. Native sulphur is found in different forms, *viz.* either in solid pieces of indeterminate figure, running in veins through rocks; or in small lumps, in gypsum and limestones; in considerable quantities at Solfatara, and in the neighbourhood of volcanoes; or crystallised in pale, transparent, or semitransparent, octogonal, or rhomboidal crystals, in the cavities of quartz; and particularly in the matrices of ores; or in the form of small needles over hot springs, or near volcanoes *(Kirwan)*.

Some-

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10. *Whitish and ash-coloured argillaceous strata*, of middling strength, are frequently found to be the immediate roofs of coal. Some of these are of middling thickness, others thin. They are commonly found from two inches to two feet in thickness. A great many of these roofs are very dangerous on account of their fragility; while others are quite safe, owing to the more perfect formation of their strata, or to some ingredient in their composition.

11. *Streaked roofs*. These are of two sorts: 1. Such as are composed chiefly of sand, with a very small mixture of clay and blaes; and, 2. Those composed principally of clay or blaes with a small quantity of sand. Some of these have large, others small, streaks or ribs. Mr Williams says that he has seen them so beautifully streaked as to resemble the finest striped cotton stuffs. These stripes or streaks always lie exactly parallel to one another, as well as to the bed of the stone, and are always spread out the whole breadth of the stratum. Their colours are various in different strata, some of the stripes being nearly black and white, others white and red, and others yellow and red. In some the stripes appear of a lighter and darker grey colour. Some of the finely striped stones have their streaks about a quarter of an inch in diameter; sometimes less: and it is common to see stripes from a quarter to three quarters of an inch broad; but in the finely striped stones it is rare to find them a full inch thick without some different shade on one side or other of the stripe. The second kind of these streaked roofs, viz. such as are composed of blaes, with a smaller mixture of sand, differ but little from the former; only the colours are not always so bright, nor the stripes so fine; neither is the roof quite so hard.

12. *The soft blae roofs* sometimes consist of pretty thick strata; others of such as are thin or of middling thickness. There are likewise arrangements or classes of regularly stratified blaes, found immediately above seams of coal, from three or four inches to several fathoms in thickness, though some are even met with little exceeding one inch in thickness; though in the same place there might be a considerable thickness of blaes above the coal, taking in all the different strata, thick and thin, which lay above it. Some of these roofs have an oily appearance on the outside, and through all the fissures and joints of the strata; that is, they appear smooth and glossy, and are very slippery to the touch. Others have no appearance of this kind; but all of them are tender, weak, and fragile, so that they make a very indifferent and dangerous roof.

13. Another kind of coal-roof consists likewise of *blaes*, but such as are *imperfectly stratified*. It is altogether the same in quality and colour as the last, the only difference that can be distinguished being in the different degrees of stratification. The beds of this kind are not perfect, but unequal; whence it is a bad and dangerous roof, as great pieces of it are frequently apt to fall down by reason of the inequality and different joints of the strata. Some of these blaes appear in thick, and others in thin or middling thick beds: while some have an oily smoothness, called by the Scots colliers *creeshy* (greasy) *blaes*. It is owing to this oiliness particularly that these kinds of roofs are so dangerous; for the oil pervades the joints, and, rendering them slippery, makes the pieces more apt to fall out as soon as the coal is worked away from below them. Some of these have such a quantity of natural oil, that they will flame a little in the fire; and in some places there are hard blaes which will burn when fire is set to them, though they will not consume. At Pitfirran in Fifeshire there is a species of these blaes so inflammable, that when fire is set to one corner of a hillock it will burn throughout the whole; nevertheless it is not reduced in bulk by this combustion, nor does it produce any ashes. Instead of this it becomes considerably harder than before, and acquires a pale red colour. By reason of its hardness, it is proper for being laid upon horse and foot paths, but is not so for roads over which heavy wheel-carriages pass.

14. *Soft blaes not stratified at all.* Of these there is no more than one bed from two or three inches to several fathoms in thickness, without any others either above or below it. They are as common as any above the coal seams; but their substance is not always uniform throughout the whole stratum. Some of them are found divided into small angular masses, and others into larger ones; but whether these are uniform or not, they always make a bad and dangerous roof. These argillaceous strata are sometimes called *beds of till*; the uniform sort are called *dauk*, and the glebous kind *lipey* blaes, by the Scots colliers. Both the uniform and glebous soft blaes frequently contain a quantity of ball iron-stone, though some of it contains none at all. The regular continuous strata of iron-stone are commonly found in stratified soft blaes. There is a variety of soft coal roofs of a grey colour, and of which some are regularly stratified, and some not.

15. Re-

Inflammables.

Sometimes it is formed in old privies: of this Mr Magellan saw some lumps that were found in a very old one at Paris.

2. United with clay in the aluminous ore of La Tolfa, and also at Tarnowitz in Silesia. This last resembles a light grey earth: when dry, bursts or cracks in the water like marle; and possesses a strong peculiar smell like camphor. If distilled, the sulphur sublimes. One hundred parts of this earth afford eight of sulphur, besides gypsum and a quantity of iron.

3. Mixed with clay, iron, and selenite. This compound is of a grey, brown, or black colour, found near Rome, Auvergne, Spain, and Iceland.

4. With limestone in the form of a calcareous hepar. This is found at Tivoli, near Rome, and elsewhere in Italy. It is sometimes dissolved in mineral waters, three pounds of which contain as much as 25 grains of sulphur. It often forms incrustations on the brinks of these springs.

5. In the form of an alkaline hepar. This is said to be found in some waters in Russia; as will be hereafter noticed.

6. United to iron and clay of pyrites, &c. of which hereafter.

7. United to metallic substances, as hereafter specified.

B. Saturated with metals (F).

1. With iron. Pyrites, or copperas-stone; *Pyrites*.

Inflammables.

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15. *Regularly soft grey coal-roofs*.—Of these there are several sorts. Some have a considerable quantity of sand in the composition of the strata; and many of these are as regularly stratified as any coal-metals whatever. Numbers are found very thin, and others of middling thickness; though in all cases they are so tender and friable, that they make very bad and dangerous roofs. Some of them indeed look pretty well at first; but they soon crumble and come down, especially when they have been exposed to the air. This, in the opinion of Mr Williams, is owing partly to their having too much clay in their composition, and partly to the want of a sufficient quantity of natural cement to connect the several particles of the stone together.

16. *Soft grey regular strata*, or grey bands of an argillaceous kind; and of these there is likewise a considerable variety. Some are of a dark, others of a lighter grey; some thick, others thin: they are very numerous in coal-fields, and are frequently to be found as the immediate roofs of coal. These, as well as the black kinds, are found in all quantities or degrees of thickness above different coals, from a few inches up to several fathoms; but whether they be in great or small quantity, the roof they compose is generally very frail and tender.

17. *Soft grey argillaceous bands, imperfectly stratified*. These differ little or nothing in substance from the former; the only difference is in the stratification. Many of the strata of the former are of a middling thickness, or rather thin, finely and regularly spread out, and every part of each stratum of an equal thickness. But this sort, though it has the appearance of strata, is clumsy and irregular; that is, the several beds are unequal, and divided by many irregular joints into unequal misshapen masses, which makes this a very bad roof; the masses being apt to separate at the joints, and to fall down when the coal is worked out from below them.

18. *Soft grey argillaceous beds* of metal or coal roofs *not stratified at all*. These are of two kinds, *viz*. 1. such as are found broken or formed in the stratum into glebes or masses; and, 2. such as are found in one uniform mass throughout the whole bed, without any division into masses or strata. These grey soft roofs are of all degrees of thickness, from a few inches up to many fathoms, as well as the black; and there is but very little difference between them in any respect excepting the colour. But in this, as well as in the black unstratified blaes, and that both in the glebous and uniform beds, ball or glebous iron-stone is frequently found; and strata of iron-stone are also found in the stratified soft grey blaes.

19. *White and ash-coloured soft argillaceous coal roofs*; and of these there is also a great variety. Some of this kind are regularly stratified, others imperfectly, and some not at all. Some of the whitish argillaceous roofs are compounded of gritty sand and clay; others appear to be chiefly composed of pure clay; and some of a loamy clay. Those which are regularly stratified and mixed with sand, either coarse or fine, are of great variety with regard to thickness and the arrangements of the strata; but all of them are tender and fragile, and thus make very troublesome and dangerous roofs.

20. *Whitish argillaceous roofs, stratified*, and of a homogeneous quality, or not mixed with sand. Some of these are finely and perfectly stratified, and are of different degrees of hardness; but in general, make but a weak roof. Some of them are found in irregular strata, with all the other varieties and imperfections already mentioned.

21. *White and ash-coloured argillaceous coal-roofs*, not *stratified at all*. Sometimes these are found in very thick beds in the coal-fields; and some of these, as well as of the black soft roofs, rise in glebes and masses of different sizes; while others are homogeneous throughout the whole bed, however thick, from two or three inches to several fathoms. Some of these beds of white argillaceous marle-like matter are found to be a sandy or loamy clay; others a pure homogeneous clay, which does not feel gritty between the fingers nor in the mouth. The shades and varieties of this kind are as numerous as those of any of the foregoing; and all of them, by the Scots colliers, are called *dauk*, whatever be their colour. Mr Williams informs us, that he has frequently taken some of these fine white clays to wash his hands, and has found them answer almost as well as soap.

(F) Sulphur is the most common mineraliser of metals; and therefore most of its combinations with those substances fall to be ranked hereafter among the metallic ores.

Inflammables.

rites. This is the ſubſtance from which moſt ſulphur is prepared, and is therefore ranked here with all its varieties. It is hard, and of a metallic ſhining colour.

A. Pale yellow pyrites; *Pyrites ſubflavus*. Marcaſite. This is very common, and contains a proportionable quantity of ſulphur with reſpect to the iron; when once thoroughly inflamed, it burns by itſelf.

a. Of a compact texture; *Polita piedra del ynca, Hiſpanorum*.
b. Steel-grained.
c. Coarſe-grained.
d. Cryſtalliſed. It ſhoots moſtly into cubical and octoedral figures, though it alſo cryſtalliſes into innumerable other forms.

B. Liver-coloured marcaſite. Its colour cannot be deſcribed, being betwixt that of the preceding marcaſite and the azure copper ore. The iron prevails in this kind; it is therefore leſs fit to have ſulphur extracted from it, and alſo for the ſmelting of copper ores. It is found,

a. Of a compact texture.
b. Steel-grained.
c. Coarſe-grained.

C. Variouſly combined with iron and other metallic ſubſtances.

1. With iron and copper; forming yellow or marcaſitical copper ore.
2. With iron, ſilver, and lead; potters lead ore.
3. With iron and zinc; mock lead, black jack or blende.
4. With iron and arſenic; arſenical pyrites.
5. With iron and cobalt.
6. With iron and biſmuth.
7. With iron and nickel.
8. With iron and gold; pyritical gold ore.
9. With ſilver; glaſs ſilver ore.
10. With copper; grey or vitreous copper ore.
11. With lead; potters lead ore.
12. With biſmuth.
13. With quickſilver; cinnabar.
14. With arſenic; orpiment, realgar.

XI. Mineral phlogiſton mixed with metallic earths.

This is not found in any great quantity: in regard to its external appearance, it reſembles pit-coal; and the fat ſubſtance contained in it, at times, partly burns to coal, and partly volatiliſes in a calcining heat.

The only known varieties of this kind are,

A. *Minera cupri phlogiſtica*.

When it has been inflamed, it retains the fire, and at laſt burns to aſhes, out of which pure copper can be ſmelted.

B. *Minera ferri phlogiſtica*.

This is not very different in its appearance from the pit-coal or foſſile pitch, but it is ſomewhat harder to the touch. There are two varieties of this ſpecies:

1. Fixt in the fire; *Minera ferri phlogiſtica fixa*.

Expoſed to a calcining heat, it burns with a very languid though quick flame; it preſerves its bulk, and loſes only a little of its weight. It yields above 30 per cent. of iron.

a. Solid, which reſembles black ſealing-wax.
b. Cracked, and friable.

2. Volatile in the fire.

This is unalterable in an open fire, either of charcoal, or even upon a piece of charcoal before the flame of the blow-pipe; but under a muffle the greateſt part of it volatiliſes, ſo that only a ſmall quantity of calx of iron remains. It is found,

a. Solid.
b. Cracked.

This laſt kind leaves more aſhes: theſe aſhes, when farther expoſed to the fire, become firſt yellowiſh-green, and afterwards reddiſh-brown; when, beſides iron, they then alſo diſcover ſome marks of copper: it has, however, not been poſſible to extract any metallic ſubſtance from them, the effects of the loadſtone, and the colour communicated to the glaſs of borax, having only given occaſion to this ſuſpicion.

Metals.

Class IV. METALLIC SUBSTANCES.

Metals are thoſe minerals which, with reſpect to their volume, are the heavieſt of all known bodies. Some of them are malleable; and ſome may be decompounded; and, in a melting heat (G), be brought back again to their former ſtate by the addition of the phlogiſton they had loſt in their decompoſition. See Metallurgy, Part I. Sect. i. and Chemistry-*Index* at *Metallic Calces* and *Metals*.

All the metallic ſubſtances contain phlogiſton; and when, to a certain degree, deprived of it, fall into a powder like an earth; but their attractions for phlogiſton are different.

Moſt of them, when melted in a common way, and expoſed to the air, have an earthy cruſt formed upon the ſurface, which cannot again be reduced to metal without the addition of ſome inflammable matter. The baſe metals have this property.

But the noble metals, *viz*. platina, gold, and ſilver, are ſo firmly united to the phlogiſton, that they never calcine under fuſion, however long continued; and, after being changed into a calx in the liquid way, when melted in the fire, they reaſſume their metallic form without any other phlogiſton than what is contained in the matter of heat.

Quick-

(G) The various degrees of heat required to reduce metals to a fluid ſtate, are ſeen in the following table, which was extracted, for the moſt part, by Dr Withering, from the printed treatiſes of the late celebrated Profeſſor Bergman. It exhibits, in a ſimple view, 1. The ſpecific gravity of each metal; 2. The degree of heat by Fahrenheit's ſcale, in which it melts; 3. The quantity of phlogiſton it requires for its ſaturation; and 4. Its

METALS.

Quickfilver holds a kind of middle place: for, like the bafe metals, it may be calcined, though not readily; and, like the noble ones, it may be reduced by heat alone.

We may therefore reckon four noble or perfect metals; *viz.* gold, platina, filver, and mercury; becaufe, when calcined, they recover their phlogifton without the addition of any phlogiftic fubftance.

But as tin, lead, copper, and iron, cannot be reduced without fuch addition, thefe are called *ignoble* and *imperfect* or *bafe metals*. *Kirwan's Mineralogy.*

However, all thofe eight metals (even mercury, when folid) are malleable to a confiderable degree, and are called *entire metals*. But

Bifmuth, zinc, antimony, arfenic, cobalt, nickel, manganefe, molybdena, and wolfram, are fcarce at all malleable, and hence they are called *femimetals*. Nevertheless, zinc and purified nickel are more malleable than any of the other femimetals; fo that we have four perfect or noble metals, four imperfect or bafe, eight entire, and nine femimetals (H).

2

Order

4. Its attraction to the fame faturating phlogifton. We muft, however, obferve, that if the fecond column be compared with that of Wedgwood's thermometer, their great difagreements betray fome fundamental error in the affumed data: for the degrees of heat affigned by Mr Wedgwood for melting gold, filver, and copper, are more than quadruple of thofe affigned by Bergman, and that for melting iron is more than eleven times greater; although they both nearly agree in the red heat of iron, which Bergman fays to be 1050 degrees, and Wedgwood 1077. Mr Magellan is of opinion, that the fault lies in Mortimer's thermometer, which Bergman quotes with fome diffidence (Sect. 197. of his *Sciagraphia*); and thinks it probable, that the changes caufed by heat, on this metallic thermometer, are in a much lefs increafing proportion by intenfe fire, than thofe indicated by the contradiction of the pure clay, happily employed by Wedgwood in his thermometer. He therefore added another column to this table, marked *Wedgw.* with the degrees of the melting heats already afcertained by this laft thermometer, as being the neareft to truth.

Metals.	Specific Gravity.	Melting Heat. *Berg.*	Melting Heat. *Wedgw.*	Saturating Phlogifton.	Attraction to faturating Phlogifton.
Gold	19,640	1301	5237	394	1 or 2
Platina	21,000			756	1 or 2
Silver	10,552	1000	4717	100	3
Quickfilver	14,110	—40	—40	74	4
Lead	11,352	595		43	10
Copper	8,876	1450	4587	312	8
Iron	7,800	1601	17977	342	11
Tin	7,264	415		114	9
Bifmuth	9,670	494		57	7
Nickel, common	7,000	1301		156	11
Nickel, pure	9,000	1601		109	5
Arfenic	8,308				
Cobalt, common / pure	7,700	1450 / 1601			
Zinc	6,862	699		182	11
Antimony	6,860	809		120	6
Manganefe	6,850	Very great		227	11

N. B. By faturating phlogifton, Profeffor Bergman means to exprefs the proportionate quantities taken away from each metallic fubftance, when diffolved by means of acids, and of courfe reduced to a calciform ftate. The laft column only expreffes their attraction to this part of their phlogifton, not to that which ftill remains united to them in a calciform ftate. *Withering.*

(H) Mr Mongez remarks, that the following are the general properties of metals, when confidered as phyfical bodies; *viz.* their opacity, great fpecific gravity, ductility, tenacity, cryftallization, flavour, and even fmell, at leaft in fome of them.

It is from their denfity that their gravity and opacity proceed; this laft being fuch, that, even reduced to the thinneft plates, no rays of light can pafs through their particles, unlefs there remains an interftice or pore quite free from the metallic fubftance. Gold leaf muft, however, be excepted, which exhibits a fine green by tranfmitted light.

As to their cryftallization, it has been found to take place whenever they are pure, and left to cool very flowly by themfelves, after having been perfectly fufed. (See *Journal de Phyfique* for July 1781, p. 74) The flavour and fmell abovementioned are very perceptible in the reguline fubftances of arfenic and antimony, as well as in lead, copper, and iron.

All metals are conductors of electricity; and more perfectly fo than any other bodies during their union with phlogifton.

They

Metals. Gold.

Order I. Noble or Perfect Metals.

I. Gold; *Aurum sol chymicorum.* See the articles Gold; also Chemistry-*Index*; and Metallurgy, Part II. sect. 1.

This is esteemed the principal and first among the metals; and that partly for its scarcity, but chiefly for the following qualities:

1. It is of a yellow shining colour.
2. It is the heaviest of all known bodies, its specific gravity to water being as 19,640 to 1000.
3. It is the most tough and ductile of all metals; because one grain of it may be stretched out so as to cover a silver wire of the length of 98 yards, by which means $\frac{1}{7,000,000}$ of a grain becomes visible to the naked eye.
4. Its softness comes nearest to that of lead, and consequently it is but very little elastic.
5. It is fixed and unalterable in air and water, and is indestructible by the common action of fire.
6. When melted, it reflects a bluish-green colour from its surface.
7. It dissolves in aqua-regia, in the dephlogisticated marine acid, and also (according to Crell ‡) in an acid obtained by distilling vitriolic acid from off manganese.
8. When mixed with a volatile alkali and a little of the acid of nitre, by means of precipitation out of aqua-regia, it burns off quickly, in the least degree of heat, with a strong fulmination.
9. It is dissolved, in *forma sicca*, by the liver of sulphur, and also somewhat by the glass of bismuth (I).
10. It is not carried away by the antimony during the volatilisation of that semi-metal, and is therefore conveniently separated from other metals by the help of crude antimony; in which process the other metals are partly made volatile, and fly off with the antimony, and partly unite with the sulphur, to which the gold has no attraction, unless by means of some uniting body, or by a long digestion (K).

11. The

‡ Journal de Physique, Oct. 1785, p. 297.

They are soluble either in nitrous acid and in dephlogisticated marine acid, or in aqua-regia; and are precipitable in some degree by caustic alkalies; and except platina by the Prussian alkali.

When dephlogisticated, they communicate a tinge to borax and to microcosmic salt, or at least render them opaque.

They assume a convex surface when melted, and even a globular form, if in a small quantity; and though they mix for the most part with one another whilst fused, yet they refuse to unite with unmetallic substances, even their own calces, iron only excepted, which does to its own calx slightly dephlogisticated and to plumbago. Nickel also, and some others, may contain sulphur in their reguline state.

Metals, when calcined, are capable of uniting with other calces and salts.

Three of the metallic calces have been found to be of an acid nature; *viz.* the arsenical, molybdenic, and tungstenic; from which, by analogy, the nature of other calces may be conjectured.

The phlogiston contained in metals is in a pure state; viz. without water and aerial acid, with which it is invariably accompanied in all other compounds except acid airs and sulphur.

When metallic substances are naturally found in the earth united to their full share of phlogiston, and consequently possessing their peculiar properties, they are called *native*.

But when they are found more or less deprived of their phlogiston and of their properties, combined with other substances, they are then called *mineralised.* This is the most common state of the mineral kingdom. The substance so combined with them is called the *mineraliser*, and the whole is called *ore;* by which name are also distinguished these earths and stones in which metallic substances are contained.

But if both metallic substances are mixed together in their metallic or reguline form, without the loss of phlogiston, they are then said to be alloyed.

When the mineraliser is of a saline nature, and renders the metallic combination soluble in less than 20 times its weight of water, the compound is ranged among salts. Thus the vitriols of iron, copper, and zinc, are rather classed with salts than with ores.

The most common mineralisers are, sulphur, arsenic, and fixed air or aerial acid. The least common are the vitriolic and the marine acids. The phosphoric has been found only in two instances; *viz.* united to lead, discovered by Gahn; and to iron, in the siderite, as Mr Meyer believes.

Those metallic substances, mineralised by aerial acid, are called *calciform ores.*

M. Magellan observes, that if the new doctrine of the French chemists, who assert, that calces of metals are a compound of dephlogisticated or vital air with the metallic substance, were just, all calciform ores should produce this vital air instead of aerial acid, when they are reduced to their metallic form; which is not the case; neither should all the base metals and semimetals absolutely require the mixture of some phlogistic substance in order to their being reduced from the state of calces to their metallic form, which otherwise would be quite useless, if their reduction simply consisted in their separation from the vital or dephlogisticated air.

(I) Neither sulphur nor fixed alkali, has any action on gold; but the liver of sulphur, which is a compound of both, can dissolve it in the dry way; so that if a proper quantity of gold-leaves be put in a crucible together with liver of sulphur, and it be melted in a brisk fire, the gold is thoroughly dissolved; and if the whole be diluted in water, the gold will be kept in the solution, and even pass through the filtre along with it.

(K) Antimony is used also to refine gold from its alloy, as it attenuates and carries off all other metallic substances

I

Perfect Metals. Gold.

11. The phosphorus is said to have ingress into gold (L).
12. If mixed with a less portion of silver, platina, copper, iron, and zinc, it preserves tolerably well its ductility. But,
13. When mixed with tin, it becomes very brittle; and it attracts likewise the smoke of that metal, so as to be spoiled if melted on an hearth where tin has been lately melted (M).
14. It requires a strong heat before it melts, nearly as much or a little more than copper.
15. It mixes or amalgamates readily with quicksilver. See Metallurgy, Part II. sect. I. (N).
16. It is not dissolved by the glass of lead, and therefore remains on the cupel.

A. Native gold. With respect to the figure or the quantity in which gold is found in one place, it is by miners divided into,

1. Thin superficial plated or leaved gold; which consists of very thin plates or leaves, like paper.
2. Solid or massive, is found in form of thick pieces.
3. Crystallised, consists of an angular figure.
4. Wash gold, or gold dust, is washed out of sands, wherein it lies in form of loose grains and lumps (O). See other distinctions of form under the article Gold.

B. Mineralised gold. This is an ore in which the gold is so far mineralised, or so entangled in other bodies, as not to be dissolved by the aqua-regia.

1. Mineralised with sulphur by means of iron. Marcasitical gold-ore; *Pyrites aureus*.
2. By means of quicksilver. It is found in Hungary.
3. By means of zinc and iron, or silver. The Schemnitz blende.

See other varieties of mineralised gold ores under the detached article Gold, already referred to.

Perfect Metals. Silver.

II. Silver: *Argentum, Luna*. See the article Silver. See also Chemistry-*Index*; and Metallurgy, Part II. sect. iii. and Part III. sect. iii.

This metal is,

a. Of a white shining colour.
b. Its specific gravity to water is, according to Cronstedt, as 11,091 to 1000; according to Bergman, = 10,552; and according to Kirwan, 11,095.
c. It is very tough or ductile, so that a grain of it may be stretched out to three yards in length and two inches in breadth.
d. It is unalterable in air, water, and fire.
e. It dissolves in the acid of nitre, and also by boiling in the acid of vitriol.
f. If precipitated out of the acid nitre with the common salt, or with its acid, it unites so strongly with this last acid, that it does not part from it, even in the fire itself, but melts with it into a mass like glass, which is called *luna cornea* (P.)

substances mixed with it, without excepting the silver; whilst lead leaves this last behind, and even adds some of its own to the gold. *Paucton*, p. 659.

(L) Gold, reduced into thin leaves, is not acted upon by the phosphoric acid in the humid way, though the fire be urged till luminous decrepitations take place; but when it passes that point which separates the humid from the dry way, Mr Margraaf observed that some purple scoria were formed, which is an indication that this concrete acid had partly calcined the gold during its fusion. *Elements de Chymie de Dijon*, Vol. III. p. 131.

Besides this, a drop of the phosphoric acid on the solution of gold by aqua-regia precipitates the metal in its revived state, as asserted by the academicians of Dijon. *Magellan*.

(M) The fumes of a single grain of tin are capable of rendering hard eight ounces of gold; but it easily recovers its malleability by being melted on the fire. (*Wallerius* and *Bomare's* Mineralogy.) But when gold is mixed with arsenic, cobalt, nickel, bismuth, or with the regulus of antimony, it only loses great part of its malleability; and when in a certain proportion, it may be calcined and vitrified with them.—(*Fabroni.*)

(N) Bergman doubts if ever gold has been found perfectly pure; and Mr Kirwan says that it is very seldom found so, being generally alloyed with silver, copper, or iron, or all three. As to the gold commonly used in toys and other objects of luxury, every one knows that it is purposely debased by the artists with copper or other metals; and of late it has been employed in various pieces of jewellery, to form ornaments of various colours: thus a great alloy of silver (viz. one-third part), gives it a shade of a green colour; a similar quantity of copper, a reddish one; a mixture of arsenic, or filings of steel, in the proportion of one-fourth part, gives it a bluish cast; so that having the yellow naturally in the pure gold, and the white in pure silver, the jewellers have almost all the colours to diversify their work. Even in the currency of money, there is none coined out of pure gold, which, by common agreement, is called *gold of 24 carats*. The gold coin of England, France, and Portugal, only contains 22 parts of pure gold, and two of alloy, viz. it is only 22 carats, in the common saying: that of Spain is but of $21\frac{19}{32}$ carats: but the ducat of Holland is of $23\frac{24}{32}$ carats; and the zecchino of Venice, of $23\frac{28}{32}$ carats: which last therefore, it would seem, is the purest gold coin of Europe. (*Paucton's Metrologie.*)

(O) M. Daubenton, in his Methodical Tables of Minerals, enumerates eight sorts of native gold, viz. 1. In powder; 2. In grains; 3. In small spangles; 4. In masses or lumps; 5. In filaments; 6. In branches like vegetables; 7. In lamella; and 8. In octoedral crystals.—He observes also, that gold, in its reguline state, is formed, either, 1. Into angular crystals, composed of yellow octoedres; or, 2. Into irregular yellow masses, which, being broken, show a granular substance.

(P) The marine acid attracts the calx of silver, but cannot remove its phlogiston; and therefore cannot dissolve *g.* It does not unite with the semi-metal nickel during the fusion.

h. It amalgamates easily with quicksilver.

i. It is in the dry way dissolved by the liver of sulphur.

k. It has a strong attraction to sulphur, so as readily to take a reddish yellow or black colour when it is exposed to liver vapours.

l. It has no attraction to arsenic; whence, when the red arsenical silver ore, or *rothgulden ertz* of the Germans, is put into the fire, the arsenic flies off, and leaves the sulphur (which in this compound was the *medium uniens*,) behind, united with the silver in form of the glass silver ore, or glass ertz.

m. It is not dissolved by the glass of lead, and consequently it remains on the cupel.

n. It is exhaled or carried off by volatile metals and acids; as by the vapours of antimony, zinc, and the acid of common salt.

o. According to Cronstedt, it melts more easily than copper; and this was a general opinion. But the contrary, as Mr Magellan remarks, has been proved by means of the nice thermometer lately invented by Wedgewood.—See Thermometer.

Silver is found,

A. Native or pure; which most generally is nearly of 16 carats standard (q).

1. Thin, superficial, plated or leaved.
2. In form,
   - *a.* Of snaggs, and coarse fibres.
   - *b.* Of fine fibres. Capillary silver.
   - *c.* Arborescent.
   - *d.* Crystalline or figured. This is very rare: it has distinct fibres, with shining surfaces.

B. Mixed or alloyed with other metals.

The following are the known instances of these mixtures:

1. United to gold, (*Bergman's Sciagraphia*, § 154.)
2. Mixed with copper; (*Berg. Sc.* § 155.)
3. United to gold and copper; (*Berg. Sc.* § 156.)
4. Amalgamated with mercury, found in the mines of Salberg; (*Foster's notes to Brunnich.*)
5. United to iron; (*Berg. Sc.* § 157.)
6. United to lead, sometimes in such quantities as to be worth the expences attending the separation.
7. United to arsenic; (*Journal de Physique*, 1778, p. 50.)
8. United to antimony; (*Berg. Sc.* § 159.)
9. Joined to the regulus of arsenic and iron; (*Berg. Sc.* § 160.)
10. Mixed with the alkaline limestone from Annaberg, described by Mr Justi; (*Brunnich.*)
11. Sandy silver-ore, without any metallic shining.
12. Silver-ore in a red-brown schistus, described by Lehman: it is composed of argillaceous earth, micaceous hematites, sulphur, calcareous spar, fluor mineralis, lead, and silver.—It contains about seven or eight ounces of silver on the hundred weight.
13. Soft silver-ore. It is found among the marles and argillaceous earths; and is of various colours, either singly or mixed.

C. Dissolved and mineralised.

(1.) With sulphur alone. Glass silver ore.

This is ductile, and of the same colour as lead; but, however, becomes blacker in the air. It has therefore, though very improperly, got the name of *glass-ore*; for that name rather belongs to the *minera argenti cornea*, or horn silver ore, if indeed any silver ore can be considered as glassy.

It is found,

1. In crusts, plates, or leaves.
2. Grown into
   - *a.* Snaggs, and
   - *b.* Crystalline figures.

   It is generally either of a lamellar or a grained texture.

The glass silver ore is the richest of all silver ores; since the sulphur, which is united with the silver in this ore, makes but a very small quantity of its weight

(2.) Arsenico-martial silver ore, *Weill ertz*, Germ)

This ore contains silver and iron mineralised by arsenic; the arsenic in a larger proportion than the iron. This is the *Pyrites argenteus* of Henckel.

1. It is a hard substance, of a white shining appearance, and of a compact, lamellar, or fibrous texture. (*Kirwan*, sp. 7.)
2. Of a yellowish white colour, and of a striated structure, resembling bismuth, but much harder. (*Kirwan*, sp. 3.)—It is found near Guadanal canal in Spain.
3. Near the same place is found also another ore of the same kind, which is very soft and easily cut; and when cut, has a brilliant metallic appearance. It consists of conchoidal laminæ. The quintal contains only from four to six ounces of silver; but it is easily reduced by evaporating the arsenic, which then leaves the silver slightly contaminated with iron. (*Kirwan*, sp. 4.)

(3.) With

dissolve it in its metallic state, (*Bergman.*) However, the marine acid, if well concentrated, or rather reduced into an aerial form, dissolves silver in its metallic state, (*Fabroni.*)

Mr Scheele, and after him Mr Bertholet, assert positively, that the marine acid, being dephlogisticated by its distillation over manganese in the form of a yellow air or gas, dissolves all the metals, without excepting gold, silver, or mercury. See Scheele's Essay 5. § 25. H.

The vitriolic acid being distilled also over the manganese, dissolves silver, gold, and mercury, as Dr Crell asserts, (*Journal de Physique*, Oct. 1785, p. 297.)

Silver is precipitated from the vitriolic and nitrous acids by the marine; and from the nitrous, in great measure, by the vitriolic, (*Kirwan.*)

(q) Wallerius distinguishes seven species of silver: (see the article Silver). Daubenton reckons eight varieties of *native white silver*, arising from their peculiar forms.

Perfect Metals. Silver.

(3.) With sulphur and arsenic. The red or ruby-like silver ore. The *rothgulden* of the Germans.

The colour of this ore varies as the proportion of the ingredients varies in the mixture, viz. from dark grey to deep red; but when it is rubbed or pounded, it always gives a red colour.

a. Grey arsenical silver ore.
1. Plated, crusted, or leaved.
2. Solid.

b. The red arsenical silver ore:
1. Plated crusted, or leaved;
2. Solid or scaly.
3. Crystallised (R.)

In this last form it shows the most beautiful red colour, and is often semitransparent. It contains about 60 *per cent.* in silver.

(4.) With sulphur, little arsenic, and iron.—*Schwartz ertz Schwartz gulden, Silber mulm.* Germ.)

This is a friable, weathered, decayed ore.

a. Of a black or sooty colour; and is therefore called by the Germans *silberschwartz*, or *russigtes-ertz*.

(5.) With sulphurated arsenic and copper. The *weissgulden* of the Germans.

This, in its solid form, is of a light grey colour, and of a dull and steel-grained texture. Its proportion of silver is from 10 to 30 *per cent.*

(6) With sulphurated arsenic and iron. The *weisertz*, or white silver ore of the Germans.

This is an arsenical pyrites, which contains Silver; it occurs in the saxon mines, and so exactly resembles the common arsenical pyrites, as not to be distinguished from it by sight alone, or without other means.

(7.) With sulphurated antimony.

a. Of a dark grey and somewhat brownish colour; the *laberetz* of the Germans.

b. Of a blackish blue colour.
1. In form of capillary crystals. *Federertz*, or plumose silver ore.

(8.) With iron, arsenic, and cobalt, mineralised by sulphur.

This ore looks like the *weissgulden* described above; but is distinguished by the rose coloured particles of cobalt, dispersed through dark brown, blackish, or grey, and sometimes shining solid mass. It is to this species of ores that the silver goose dung ore belongs.

(9.) With sulphurated copper and antimony.—The Dal *fah-lertz*.

This resembles both in colour and texture the dark-coloured weissgulden. When rubbed, it gives a red powder.

a. Solid.

b. Crystallised.

Perfect Metals. Platina.

(10.) With sulphurated zinc. The *pechblende* of the Germans.

This is a zinc ore, mock lead, or blende, which contains silver, and is found among rich silver and gold ores.

a. Of a metallic changeable colour.
1. Solid and with fine scales.
2. In form of balls. The *kugel-ertz*, or ball ore.

b. Black mock lead, or blende, found in Saxony. This is also found,
1. ~~Solid, and with~~ fine scales;
2. And in form of balls.

(11.) With sulphurated lead; potters ore. *Galena; bleyglanz.*

(12.) With sulphurated lead and antimony, called *striperz.*

(13.) With sulphurated iron. *Silberhalitgier kies;* marcasite holding silver.

(14.) With sulphurated and arsenical cobalt; dendrites being sometimes found in the stone.

These kinds keep well in water; but generally wither in the air, and lose the silver they contain.

(15.) Mineralised by sulphur, with regulus of antimony and barytes. The butter-milk ore.

This is found in the form of thin particles, on granular spar, (*Kirwan*, sp. 13.)

(16.) Combustible silver ore.

This is a black and brittle substance, and leaves about 6 per cent. of silver in its ashes. It is in fact a coal in which silver is found. (*Kirwan*, sp. 14.)

(17.) With the acid of common salt. *Minera argenti cornea. Hornetz*, or horn-silver ore.

This is the scarcest silver ore; it is of a white or pearl colour, changeable or varying on the surface, semi-transparent, and somewhat ductile both when crude and when melted. It cannot be decomposed without some admixture of such substances as attract the acid of sea-salt.

III. Platina del Pinto; *Juan blanca.*

This metal is a recent discovery of our times; and is described with great accuracy by Scheffer, in the Acts of the Royal Academy of Sciences at Stockholm for the year 1752; as also by Dr Lewis, in the Philosophical Transactions for the year 1754, vol. xlviii. and by many other writers. By these descriptions we are convinced of the resemblance this metal bears to gold; and therefore we must allow it to be called *white gold.* It has, however, a variety of distinguishing qualities

P 2

(R) Wallerius mentions the six following varieties of this notable ore in his *Species* 388, viz. 1. The red opaque, like cinnabar, from Andreasberg in the Hartz, and from Salberg in Westmannia: 2. The bluish, from Freiberg and Annaberg: 3. The grey, from Freiberg and Andreasberg: 4. The red transparent amorphous, of the garnet colour, from Potosi and Ioachimstal: 5. The red transparent, crystallised into prismatic decaedres, or dodecaedres, from Hungary, Alsace, and the Duchy of Deux Ponts: 6. The only superficially red ore, from Salberg and Ehrenfriederichsdorf.

Perfect Metals. Quickfilver

lities befides its colour, which afcertain its peculiar nature: All which, with its hiftory, ufes, &c. are particularly defcribed under the detached article Platina. See alfo Chemistry-*Index*; and Metallurgy, Part II. Sect. ii.

1. It is of a white colour.
2. It is fo refractory in the fire, that there is no degree of heat yet found by which it can be brought into fufion by itfelf, the burning-glafs excepted. But, when mixed with other metals and femimetals, it melts very eafily, and efpecially with arfenic, both in its metallic form and in form of a calx or glafs.

IV. Quickfilver, mercury. *Hydrargyrum*, *Argentum vivum*, *Mercurius*. See the article Quicksilver; Chemistry-*Index*, at *Mercury*; and Metallurgy, Part II. fect. viii.

Mercury diftinguifhes itfelf from all metals by the following qualities (s.)

a. Its colour is white and fhining, little darker than that of filver.

b. It is fluid in the cold, and divifible by the leaft force; but, as it only fticks to a few bodies to which it has an attraction, it is faid that it does not wet.

c. It is volatile in the fire.

d. It attracts the other femimetals and metals: and unites with them all except cobalt and nickel, with which it cannot by any means yet known be made to mix. This union is called *amalgamation*. This amalgamation, or mixtion of metallic bodies, according to the readinefs with which they unite or mix, is in the following progreffion, viz. gold, filver, lead, tin, zinc, bifmuth, copper, iron, and the regulus of antimony; the three latter, however, do not very readily amalgamate. The iron requires a folution of the vitriol of iron, as a medium to promote the union.

e. It diffolves in fpirit of nitre, out of which it is precipitated by a volatile alkali, and common falt, in form of a white powder; but if a fixed alkali is ufed, a yellow powder or calx is obtained (t).

f. But

(s) It were almoft fuperfluous, fays Mr Kirwan, to mention any other character of quickfilver than its liquidity, to diftinguifh it from other metals. In regard to this property, Bergman obferves, that mercury conftitutes one extreme among the metals, and platina the other; fince it requires to be melted only fuch a degree of heat as is rarely wanting in our atmofphere, and boils at the 600 degrees nearly after lead melts. See the table at p. 111. *Note*. But when the cold is increafed to the temperature denoted by 40 degrees below 0 both of Fahrenheit's and of the Swedifh thermometer, which both coincide in that point (fince 212—32, or 180 : 100 :: 32+40, or 72 : 40), this metal concretes like any other metal, and becomes quite folid; (fee Philofophical Tranfactions for 1783, p. 303.) Mercury in its common ftate, therefore, according to Bergman (Treatife of *Elect. Attract.*), is to be confidered as a metal in fufion; and fince in its folid ftate it is nearly as malleable as lead, it by no means ought to be placed among the femimetals, otherwife every other entire metal fhould be confidered as brittle, for none is malleable when in fufion.

(t) 1. Mercury is diffolved with great rapidity by nitrous acid: the liquor is of a greenifh-blue colour, but lofes it afterwards and becomes limpid. This folution, when made without heat, is ufed as a teft for the analyfis of mineral waters, and has different properties from that made with the help of heat. In the firft cafe, fays Bergman, very little phlogifton is loft, and the falt eafily cryftallifes, being white and fcarcely acrid. It is not precipitated by diftilled water; but by cauftic vegetable alkali, it is precipitated of a yellowifh colour; by mild alkali, the precipitation is white; by mineral alkali, it is yellow, but it foon grows alfo white; by volatile alkali, it turns to a greyifh-black colour; by Glauber's falt or by pure vitriolic acid, the precipitation is white, granulated, and in a fmall quantity; nor, if this precipitant has been fparingly ufed, does this colour appear in lefs than an hour; by muriatic acid, or common falt, the precipitation is alfo white, but in a large quantity, and in curdles.

2. But if the mercurial folution be put over a fand-heat, it may be charged with a quantity of mercury equal almoft to its weight. According to the chemifts of Dijon, 10 ounces of nitrous acid may diffolve eight of mercury. The action of the folvent becomes ftronger with the heat; emits great quantity of vapours; and if not taken from the fire, will be too far evaporated. Diftilled water will precipitate from this folution a white calx, becaufe it is more dephlogifticated, and the folvent is overcharged with it; and the water changing the denfity of the liquor, diminifhes the adhefion of the calx, as Fourcroy remarks. This white calx will turn yellow, if boiling water be poured on it. The vegetable alkali precipitates it of a brownifh yellow, which by degrees affumes a pale yellow tinge: the mild vegetable, and the mineral alkalies, produce nearly the fame colour; though when this laft is employed, the colour turns afterwards to white. The precipitation by volatile alkali is quite white alfo; that by the vitriolic acid is yellow; and finally, a copious, white mucilaginous matter is the precipitate by the marine acid.

3. This folution by nitrous acid is very cauftic; corrodes and deftroys animal fubftances; when it falls on the fkin, ftains it of a deep purple brown colour, which appears black: the ftains do not go off before the feparation of the epidermis, which falls away in fcales or a kind of fcars. It is ufed in furgery as a powerful efcharotic, and is called *mercurial water*.

4. The fame folution, by cooling, is fufceptible of forming cryftals, which vary from one another according to circumftances: for the moft part they are like needles; are very cauftic; redden the fkin; and detonate when put on burning coals, provided they be dry. They are called *mercurial nitre*, which fufes when heated in a crucible; exhales reddifh fumes; affumes a deep yellow colour, which afterwards turns to orange,

and

Perfect Metals. Quickſilver

f. But it requires a boiling heat to diſſolve it in oil of vitriol (U).

g. It is not affected by the acid of common ſalt, unleſs it be previouſly diſſolved by other acids (V); in which caſe only they both unite with one another, and may be ſublimed together; this ſublimate is a ſtrong poiſon.

h. It unites with ſulphur by grinding; and then produces a black powder called *æthiops mineralis* (W), which ſublimes into a red ſtriated body called *factitious cinnabar*.

i. The ſulphur is again ſeparated from the quickſilver, by adding iron or lime, to which the ſulphur attaches itſelf, leaving the quickſilver to be diſtilled over in a metallic form; but if a fixed alkali be uſed, ſome part of the quickſilver will remain diſſolved in the reſiduum, which is a liver of ſulphur.

Quickſilver is found,

A. Native, or in a metallic ſtate. *Mercurius nativus*, or *virgineus*.

This is found in the quickſilver mines at Idra in Friuli, or the Lower Auſtria, in clay, or in a black ſlaty *lapis ollaris*, out of which it runs, either ſpontaneouſly, or by being warmed even in the hands.

B. United to gold or ſilver. *Hydrargyrum argento vel auro adunatum*.

Mr Kirwan aſſerts, on the authorities of Monet and Lin, Von Gmelin, that in Sweden and Germany mercury has been found united to ſilver in the form of a ſomewhat hard and brittle amalgam.

Romé de l'Iſle had a ſpecimen of this natural amalgam from Germany, which is imbedded in a quartzoſe maſs, and mixed with cinnabar, as Mr Mongez aſſerts; and he adds, that in the royal cabinet, at the king's garden at Paris, is depoſited another fine ſpecimen of this mercurial ore, which was found cryſtalliſed in the mine called *Carolina* at Muchel-lanſberg in the duchy of Deux Ponts. M. de l'Iſle ſpeaks alſo very poſitively of a ſpecimen of native gold from Hungary, which ſeems to be a natural amalgam of gold and mercury. It is compoſed of quadrangular priſms, of a greyiſh yellow colour, and of a brittle texture. This ſpecimen is alſo in the king's cabinet at the royal garden at Paris.

Mr Kirwan, ſpeaking of the method of examining the purity of gold by the moiſt way, ſuppoſes, with Sir Torbern Bergman, that there are natural amalgamations of mercury with gold and ſilver: and Neumann obſerves, that ſometimes a mineral, containing gold or ſilver, is met with among mercurial ores, although this is a great rarity.

It is evident, therefore, that there naturally exiſt

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and at laſt to a brilliant red: in this ſtate it is called *red precipitate*, or *arcanum corallinum*. It muſt be made in a matraſs with a gentle heat if it is deſigned to be corroſive for chirurgical purpoſes.

(U) 1. The vitriolic acid, concentrated and boiling hot, ſeizes on mercury, and preſently reduces it if urged by heat to a kind of white powder, which turns yellow by the affuſion of hot water, but does not diſſolve in it: this is called *turbith mineral*: but if cold water, inſtead of hot, was poured in the white maſs, the powder would not change its white colour into yellow as was ſaid above about the nitrous ſolution.

2. If Mercury be rarefied by heat into vapours, and theſe meet with thoſe of marine acid in the ſame ſtate, a corroſive ſublimate will be formed. This metallic ſalt ſhoots into cryſtals pointed like daggers, which are the ſtrongeſt of all poiſons. But there are various other proceſſes found in chemical authors to make this ſalt with more or leſs trouble. See Chemistry, n° 814—818.

3. If corroſive ſublimate be mixed with tin and diſtilled, a very ſmoking liquor is produced, called by the name of its inventor the *ſmoking liquor of Libavius*. See Chemistry, n° 810.

The muriatic acid in the ſublimate is not ſaturated, and from hence proceeds its great corroſive power; for if a freſh quantity of mercury be added to it, and ſublimed a ſecond or third time, a ſweet, or mixed ſublimate, called *mercurius dulcis*, is produced, which is not poiſonous, and is given internally as a purgative, or an emetic, according to the doſe. See Chemistry, n° 819.

(V) Muriatic acid does not act upon quickſilver unleſs this laſt be previouſly deprived of as much phlogiſton, as $\frac{74}{100}$ of the quantity contained in the hundred of ſilver, or of $\frac{80}{182}$ in the hundred of zinc. (See Bergman's *Sciagraphia*, and his treatiſe *De Phlogiſti quantitate*.)

(W) The academicians of Dijon ſay, that the true proportion to make this æthiops, is that of one part of brimſtone with four of mercury. Fourcroy directs only one of mercury, with three of flowers of ſulphur, to be triturated, till the mercury is extinguiſhed. A black powder is then produced, which is the æthiops mineral. The combination is better effected when the mercury is mixed with the fuſed ſulphur: by agitating this mixture, it becomes black, and eaſily takes fire; it ſhould be then taken from the fire, and the flame ſhould be extinguiſhed a little after, ſtirring the maſs till it becomes into ſolid clots. If this ſubſtance be expoſed to a great degree of heat, it takes fire, the ſulphur is conſumed, and a ſubſtance remains which is of a violet colour when pulveriſed. This powder being put into matraſſes, till their bottom become red by the force of fire, is ſublimed after ſome hours, and artificial cinnabar is found in the top of the veſſels cryſtalliſed into brown red needles.

Mercury, divided by means of a rapid and continual motion, as that of a mill-wheel, gradually changes itſelf into a very fine black powder, which is called *æthiops per ſe*, on account of its colour, in order to diſtinguiſh it from this *æthiops mineralis* mentioned in the text.

Perfect Metals. Quickfilver

ift various ores of quickfilver, amalgamated with filver, gold, and other minerals, although they be but feldom met with.

C. Mineralifed,

[1.] With fulphur.

A. Pure cinnabar, *Cinnabaris nativa*.

a. Loofe or friable cinnabar like red ochre.

b. Indurated or folid cinnabar. It is of a deep red colour; and, with refpect to its texture, is either,

1. Steel-grained;
2. Radiated;
3. Compofed of fmall cubes, or fcaly; or
4. Cryftallifed, in a cubical form; it is tranfparent, and deep red like a ruby.

B. Impure cinnabars.

(1.) A mercurial ore is found in Idria, fays Gellert, where the mercury lies in an earth or ftone, as if it were in a dead form; and has the appearance of a red-brown ironftone; but it is much heavier than that. It contains from three quarters to feven eighths of the pureft mercury; leaves, after diftillation, a very black ftrong earth behind; and gives fome marks of cinnabar.

2.) Liver ore, which is moft common in Idria, and has its name from its colour.—Outwardly it refembles an indurated ironclay; but its weight difcovers that its contents are metallic. It yields fometimes 80 pounds of quickfilver per hundred weight.

3. Burning ore; *brand-erz* in German. This ore may be lighted at the candle; and yields from nine to 50 pounds of quickfilver per hundred weight. *Brunnich.*

[2.] With iron by fulphur. Pyritous cinnabar. Sir Torbern Bergman inferted this ore in the 177th fection of his *Sciagraphia*, and feems doubtful whether this be a diftinct fpecies from the cinnabar; as the iron is perhaps, fays he, only mechanically diffufed therein. Mr Mongez remarks, that there are but a few inftances of cinnabar in which iron is not found in its calcined form; though, in the act of the ore being reduced, it paffes to its metallic ftate, and becomes capable of being acted on by the loadftone.

Another pyritous ore of cinnabar was found at Menidot, near St Lo in Lower Normandy. It confifted in grains of different fizes, of a red brown colour: they had a vitriolic tafte and fulphureous fmell. Found alfo at Almaden in Spain, and at Stahlberg in the Palatinate, though at this laft place they are of a dodecaedral form.

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[3.] With filver by the aerial acid, and fulphur.

This feems to be a native precipitate *per fe*, or calx of mercury. It is faid to have been lately found in Idria, in hard compact maffes of a brownifh-red colour; fee *Journal de Phyfique* for January 1784, p. 61. If this account can be relied upon, it will prove, that quickfilver, even in a calciform ftate is naturally found mineralifed with filver by means of fulphur.

[4.] With fulphur and copper.

This ore is blackifh grey, of a glaffy texture, and brittle; crackles and fplits exceffively in the fire; and when the quickfilver and fulphur are evaporated, the copper is difcovered by its common opaque red colour in the glafs of borax, which, when farther forced in the fire, or diluted, becomes green and tranfparent. It is found at Mufchlanfberg in the duchy of Deux Ponts.

[5.] Mineralifed by the marine and vitriolic acids.

Mineralogy owes the difcovery of this ore to Mr Woulfe, who publifhed an account of it in the Philofophical Tranfactions for 1776. It was found in the duchy of Deux Ponts, at the mine diftinguifhed by the name of *Obermofchal.* It had a fpar-like appearance. This ore is either bright and white, or yellow or black. It was mixed with cinnabar in a ftony matrix; and being well mixed with one-third of its weight of vegetable alkali, afforded cubic and octagonal cryftals; that is, falt of Sylvius and vitriolated tartar.

The marine falt of this mercury is in the ftate of fublimate corrofive.

Order II. Imperfect or base Metals.

I. Tin. *Stannum; Jupiter.* (See the detached article Tin: Alfo Chemistry-*Index;* and Metallurgy, Part II. fect. vi. and Part III. fect. vi.)

This is diftinguifhed from the other metals by the following characters and qualities, It is,

a. Of a white colour, which verges more to the blue than that of filver.

b. It is the moft fufible of all metals; and,

c. The leaft ductile; that is, it cannot be extended or hammered out fo much as the others (x).

d. In

(x) Tin is fufficiently ductile to be beaten into very thin leaves. But ductility and extenfibility are two different properties, lefs connected with one another than is generally imagined. Iron and fteel are drawn into exquifite fine wire, but cannot be beat into very thin leaves. Tin, on the other hand, is beat into fine leaves, and may be extended between rollers to a confiderable furface. The tin-fheet ufed in various arts, is commonly about $\frac{1}{760}$th part of an inch; but may be extended twice as much in its dimenfions without difficulty. Notwithftanding this extenfibility, tin cannot be drawn into wire, on account of the weak cohefion of its particles. A tin wire, however, of one-tenth of an inch diameter, is able to fupport a weight of 49½ pounds, according to Fourcroy. Gold and filver poffefs both properties of ductility and extenfibility the moft eminently of all metallic bodies; whilft lead, notwithftanding its flexibility and foftnefs, cannot be made either into leaves or wire of any finenefs.

Imperfect Metals. Tin.

d. In breaking or bending, it makes a crackling noise.

e. It has a smell particular to itself, and which cannot be described.

f. In the fire it is easily calcined to white ashes, which are 25 per cent. heavier than the metal itself. During this operation, the phlogiston is seen to burn off in form of small sparkles among the ashes or calx.

g. This calx is very refractory; but may, however, with a very strong degree of heat be brought to a glass of the colour of colophony. But this calx is easily mixed in glass compositions, and makes with them the white enamel.

h. It unites with all metals and semimetals; but renders most of them very brittle, except lead, bismuth, and zinc.

i. It amalgamates easily with quicksilver.

k. It dissolves in aqua-regia, the spirit of sea-salt, and the vitriolic acid; but is only corroded into a white powder by the spirit of nitre. The vegetable acid, soaps, and pure alkaline salts, also corrode this metal by degrees.

l. Its specific gravity to water is as 7400 to 1000, or as 7321 to 1000.

m. Dissolved in aqua-regia, which for this purpose ought to consist of equal parts of the spirit of nitre and sea-salt, it heightens the colour of the cochineal, and makes it deeper; for otherwise that dye would be violet.

(1.) Native Tin.

The existence of native tin has long been questioned: but it has undoubtedly been found some years ago in Cornwall, as Mr Kirwan remarks.

1. Malleable tin, in a granular form, and also in a foliaceous shape, issuing out of a white hard matter like quartz: but which, after being properly assayed, proved to be arsenical crystals; a circumstance that evinces its being native tin, since the arsenic could not remain in this form if the tin had been melted. It appeared like a thick, jagged, or scolloped lace or edging; and was found near St Austle in Cornwall.

2. In the form of crystalline metallic laminæ, or laminated crystals, rising side by side out of an edging, which shone like melted tin: they were almost as thin as flakes or scales of talc, intersecting each other in various directions, with some cavities between them, within which appeared many specks and granules of tin, that could be easily cut with a knife: this was also found in Cornwall.

3. In a massy form, more than one inch thick in some places, and inclosed in a kind of quartzous stone; or rather in an hard crust of crystallised arsenic.

(2.) Calciform Ores of Tin.

A. In form of a calx, *Stannum calciforme.*

A. Indurated, or vitrified.

1. Mixed with a small portion of the calx of arsenic.

a. Solid tin ore, without any determinate figure. Tin-stone.

It resembles a garnet of a blackish brown colour, but is much heavier; and has been considered at the English tin-mines as a stone containing no metal, until some years ago it began to be smelted to great advantage.

B. Crystallised.

a. Tin spar, or white tin ore. This is generally of a whitish or grey colour; sometimes it is yellowish, semi-transparent, and crystallised, either of a pyramidical form, or irregularly.

b. Tin-grains. This ore, like the garnets, is of a spherical polygonal figure; but seems more unctuous on its surface.

1. In large grains.
2. In small grains.

B. Mixed with metals.

1. With the calx of iron, as in the garnet.
2. With manganese. See the *Semimetals.*

C. Mineralised.

1. With sulphur and iron.
2. With sulphur. *Aurum musivum.*

This was discovered by Professor Bergman, among some minerals which he received from Siberia. He observed two sorts of it, analogous to the two artificial combinations of tin with sulphur.

1. One nearly of the colour of zinc, and of a fibrous texture, which contained about 20 *per cent.* of sulphur, and the remainder tin.
2. The other enveloped the former like a crust; resembled aurum musivum; and contained about 40 *per cent.* of sulphur, a small proportion of copper, and the remainder tin. *Mem. Stockh.* for 1721, p. 328.

At Huel Rock, in St Agnes in Cornwall, there has been found a metallic vein, nine feet wide, at 20 yards beneath the surface. Mr Raspe was the first who discovered this to be a sulphurated tin-ore: it is very compact, of a bluish white colour, approaching to grey steel, and similar to the colour of grey copper ore: it is lamellar in its texture, and very brittle. It consists of sulphur, tin, copper, and some iron. Mr Raspe proposes to call it *bell-metal ore.*

According to Mr Klaproth's analysis of this ore, 119 grains contain 30 of pure sulphur; 41 of tin; 43 of copper; two of iron; and three grains of the stony matrix. In another specimen of the same sulphurated tin-ore from Cornwall, there were in the hundred 25 parts of sulphur, 34 of tin, 36 of copper, three of iron, and two of the stony matrix.

II. Lead; *Plumbum, Saturnus.* (See the article Lead, and Chemistry-*Index*: Also Metallurgy, Part II. sect. v. and Part III. sect. vii.)

The

Imperfect Metals. Lead.

The properties of lead are as follows.

a. It is of a bluish white colour when fresh broke, but soon dulls or sullies in the air.

b. It is very heavy; viz. to water as 11,325 to 1000.

c. It is the softest metal next to gold; but it has no great tenacity, and is not in the least sonorous.

d. It is easily calcined; and by a certain art in managing the degrees of the fire, its calx becomes white, yellow, and red.

e. This calx melts easier than any other metallic calx to a glass, which becomes of a yellow colour, and semitransparent. This glass brings other bodies, and the imperfect metals, into fusion with it.

f. It dissolves, 1st, In the spirit of nitre; 2dly, In a diluted oil of vitriol, by way of digestion; 3dly, In the vegetable acid; 4thly, In alkaline solutions; and 5thly, In expressed oils, both in the form of metal and of calx.

g. It gives a sweet taste to all solutions.

h. It amalgamates with quicksilver.

i. With the spirit of sea-salt it has the same effect as silver, whereby is produced a *saturnus corneus*.

k. It does not unite with iron, when it is alone added to it in the fire.

l. It works on the cupel, which signifies that its glass enters into certain porous bodies, destitute of phlogiston and alkaline salts.

m. It melts in the fire before it is made red-hot, almost as easily as the tin.

n. Its calx or glass may be reduced to its metallic state by pot-ashes.

[1.] Native Lead.

For proofs of lead being naturally found in its metallic state, see the article LEAD.—It may be here added, that Henckel likewise affirms its existence, in his *Flora Saturnisans;* (see Kirwan's *Elements of Mineralogy*, p. 297, 298.) Wallerius asserts, that it has been so found in Poland, a specimen of which was kept in the collection of Richter; and adds, that a similar one found at Schneberg, was seen in the collection of Spener. (*Mineralogy*, vol. ii. p. 301.)

Dr Lawson, in his English edition of Cramer's Art of Essaying Metals, says, that some pure native malleable lead had been lately found in New England; (p. 147.) And lastly, Professor Bergman did not hesitate to insert, by itself alone, the *plumbum nativum*, in Sect. 180. of his *Sciagraphia*.

[2.] Calciform Lead.

Lead is found,

A. In the form of a calx.

A. Pure.

a. Friable lead ochre, native ceruse.

b. Indurated lead spar, or spatose lead ore.

i. Radiated, or fibrous.

1. White, from Mendip-hills, in England.

ii. Crystallised in a prismatic figure.

1. White, from Norrgrufva in Westmanland.

2. Yellowish green, from Zchopau in Saxony.

B. Mixed.

1. With the calx of arsenic, arsenical lead spar.

2. Indurated.

a. White. Mr Cronstedt has tried such an ore from an unknown place in Germany, and found that no metallic lead could be melted from it by means of the blow-pipe, as can be done out of other lead spars; but it must be performed in a crucible. (See the article LEAD, par. iii.)

3. With a calcareous earth.

This ore effervesces with aqua-fortis, and contains 40 *per cent.* of lead: on which account it is placed here rather than among the calcareous earths.

B. Mineralised.

1. With sulphur alone: the *bley-schweiff*, or *bley-glanz*, of the Germans.

a. Steel-grained lead ore.

b. Radiated, or antimoniated lead ore.

c. Tessellated, or potter's lead-ore.

At Villach in Austria there is said to be found a potter's lead-ore, which contains not the least portion of silver.

2. Mineralised by the vitriolic acid.

This ore was discovered by Mr Monnet. It occurs sometimes, though rarely, in the form of a white ponderous calx; and seems to originate from the spontaneous decomposition of the sulphurated lead-ores abovementioned.

3. By the acid of phosphorus.

This ore was lately discovered by Ghan; and is of a greenish colour, by reason of a mixture of iron. See the article LEAD, par. 6.

4. With sulphurated silver. *Galena;* also called *bleyglanz* by the Germans. Potter's ore.

a. Steel-grained.

b. With small scales.

c. Fine-grained.

d. Of a fine cubical texture; and,

e. Of coarse cubes. These two varieties are found in all the Swedish silver-mines.

f. Crystallised.

The steel-grained and scaly ores are of a dim and dull appearance when they are broken, and their particles have no determined angular figure: they are therefore in Swedish commonly called *blyschweif;* in opposition to the cubical ores, which are called *blyglanz*. The most part of the ores called *blyglanz* contain silver, even to 24 ounces *per cent.* of which we have instances in the mines of Salberg, where it has been observed, that the coarse cubical lead ores are generally the richest in silver, contrary to what is commonly taught in books; the reason of which may perhaps be, that, in making the essays on those two ores, the coarse cubical can be chosen purer or freer

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freer from the rock than the fine cubical ores.

5. With sulphurated iron and silver. This is found,

a. Fine-grained. *b.* Fine cubical. *c.* Coarse-cubical. When this ore is scorified, it yields a black slag; whereas the preceding lead-ores yield a yellow one, because they do not contain any iron.

6. With sulphurated antimony and silver; antimoniated or radiated lead-ore. This has the colour of a blyglanz, but is of a radiated texture.

It is found,

a. Of fine rays and fibres; and,

b. Of coarse rays or fibres. The lead in this ore prevents any use being made of the antimony to advantage; and the antimony likewise in a great measure hinders the extracting of the silver.

7. Mineralised by arsenic

This ore was lately discovered in Siberia—Externally it is of a pale, and internally of a deep red colour. See the article LEAD, par. 10.

C. Mixed with earth; stony, or sandy lead ores.

These consist either of the calciform or of the galena kind, intimately mixed and diffused through stones and earth, chiefly of the calcareous or of the barytic genus. See LEAD, par. 11.

Uses, &c. *of Lead.* See LEAD, and the other articles above referred to.

III. Copper; *Cuprum*, *Venus*, *Æs*. (See the article COPPER: Also CHEMISTRY-*Index*; and METALLURGY, Part II. sect. iv. and Part III. sect. iv.)

This metal is,

a. Of a red colour.

b. It is pretty soft and tough.

c. The calx of copper being dissolved by acids becomes green, and by alkalies blue.

d. It is easily calcined in the fire into a blackish blue substance, which, when rubbed to a fine powder, is red; when melted together with glass, it tinges it first reddish brown, and afterwards of a transparent green or sea-green colour.

e. It dissolves in all the acids, and likewise in alkaline solutions. It is easier dissolved when in form of a calx than in a metallic state, especially by the acids of vitriol and sea-salt, and the vegetable acid.

f. Vitriol of copper is of a deep blue colour; but the vegetable acid produces with the copper a green salt, which is verdigris.

g. It can be precipitated out of the solutions in a metallic state; and this is the origin of the precipitated copper of the mines called *Ziment copper*.

h. It is not easily amalgamated with quicksilver; but requires for this purpose a very strong trituration, or the admixture of the acid of nitre.

i. It becomes yellow when mixed with zinc, which has a strong attraction to it, and makes brass, pinchbeck, &c.

Imperfect METALS. Copper.

k. When the metal is exposed to the fire, it gives a green colour to the flame in the moment it begins to melt, and continues to do so afterwards, without losing any thing considerable of its weight.

[1.] Native copper.

Copper found naturally in a metallic state, is called *virgin* or *native copper*. It is met with,

1. Solid.

2. Friable, in form of small, and somewhat coherent grains. Precipitated or ziment copper.

[2.] Calciform.

Copper, in form of a calx, is found,

1.) Pure.

A. Loose or friable; *Ochra veneris.*

1. Blue; *Cæruleum montanum.* Very seldom found perfectly free from a calcareous substance.

2. Green; *Viride montanum.* Both this and the former colour depend on menstrua, which often are edulcorated or washed away.

3. Red. This is an efflorescence of the glass copper ore.

B. Indurated. Glass copper-ore.

a. Red. This is sometimes as red as seal ing wax, and sometimes of a more liver-brown colour.

It is always found along with native copper, and seems to have lost its phlogiston by way of efflorescence, and to be changed into this form. It is likewise found with the sulphurated copper, improperly called *glass copper-ore.*

2.) Mixed.

A. Loose or friable; *Ochra veneris friabilis impura.*

1. Mixed with a calcareous substance; *Cæruleum montanum.* In this state copper-blue is mostly found. It ferments during the solution in aquafortis.

2. Mixed with iron. Black. It is the decomposition of the Fahlun copper ore.

B. Indurated.

1. Mixed with gypsum, or plaster. Green.

2. Mixed with quartz. *a.* Red, from Sunnerskog in the province of Smoland.

3. Mixed with lime. *a.* Blue. This is the *Lapis Armenus*, according to the accounts given of it by authors.

3.) Cupreous stones.

Analogous to the calciform copper ores, are,

1. The *lapis armenus.* } See the detached article COPPER, n° 7.
2. The turquoise. }

[3.] Dissolved and mineralised; *Cuprum mineralisatum.*

A. With sulphur alone. Grey copper-ore; also called, improperly, *glass copper-ore.*

a. Solid, without any certain texture, and very soft, so that it can be cut with a knife almost as easily as black lead.

b. Fine cubical. In Smoland this is sometimes

times found decomposed or weathered, and changed into a deep mountain blue.

B. With sulphurated iron. *Minera cupri pyritacea;* yellow copper ore. Marcasitical copper ore; *Pyrites cupri.* This is various both in regard to colour and in regard to the different proportion of each of the contained metals; for instance,

a. Blackish grey, inclining a little to yellow; *Pyrites cupri griseus.* When decayed or weathered, it is of a black colour; is the richest of all the varieties of this kind of copper ore, yielding between 50 and 60 *per cent.* and is found in Spain and Germany.

b. Reddish yellow, or liver brown, with a blue coat on the surface; *Minera cupri lazurea,* This ore yields between 40 and 50 *per cent.* of copper, and is commonly said to be blue, though it is as red, when fresh broken, as a red copper regulus.

c. Yellowish green; *Pyrites cupri flavo viridescens.* This is the most common in the north part of Europe: and is, in regard to its texture, found,

1. Solid, and of a shining texture.
2. Steel grained, of a dim texture.
3. Coarse-grained, of an uneven and shining texture.
4. Crystallised marcasitical copper ore.
   a. Of long octoedrical crystals.

d. Pale yellow. This cannot be described but as a marcasite, though an experienced eye will easily discover some difference between them. It yields 22 *per cent.* of copper.

e. Liver-coloured.

C. With sulphurated silver, arsenic, and some iron, Fallow copper-ore; which contains only a few ounces of silver. This ore is found in Hungary and Germany, where it is called *black copper ore.*

D. With sulphurated arsenic and iron. White copper ore.

E. Pyritous copper, with arsenic and zinc.

According to Mr Monnet, this ore is found at Catharineberg in Bohemia. It is of a brown colour; of a hard, solid, compact, granular texture; and contains from 18 to 30 *per cent.* of copper.

F. Dissolved by the vitriolic acid; *Vitriolum veneris.* See the article copper, n° xiii.

G. With phlogiston. Copper coal ore, consisting of the calces of copper, mixed with a bituminous earth.

H. Mineralised by the muriatic acid. This ore was found in Saxony, and had been generally mistaken for a micaceous substance, which in fact it greatly resembles. It has not yet been found in large masses, but only in a superficial form, like a crust over other ores. It is moderately hard and friable; of a fine green colour, and sometimes of a bluish green, crystallised in a cubic form, or with a foliated texture, or in little scales resembling green mica or talc. This ore is easily dissolved by nitrous acid: the solution takes a green colour; and the metal may be precipitated on a polished plate of iron. If some drops of a nitrous solution of silver be mixed with it, a white powder of *luna cornea* will be precipitated, which discovers the presence of the muriatic acid in this ore.

The uses of copper are very numerous, although not thoroughly known to every one. Several of these have been mentioned under the detached article, and in CHEMISTRY. Others of great importance may be here added. Its great ductility, lightness, strength, and durability, render it of very extensive utility. Blocks, or bars of copper, are reduced into flat sheets of any thickness, by being first heated by the reverberation of the flame, in a low vaulted furnace, properly constructed for the purpose; and then immediately applied between large rollers of steel, or rather of case-hardened iron, turned by a water-wheel or by the strength of horses, so that the hot metal is there quickly squeezed; and the operation is repeated, bringing the rollers every time nearer to one another, till the metallic sheet acquires the intended thickness.

These copper sheets are very advantageously employed in sheathing the bottoms of men of war and other vessels, which by this means are prevented from being attacked by the sea worms, and are kept clean from various marine concretions, so as to sail with considerably greater swiftness. Copper sheets are also employed to cover the tops of buildings instead of slates or earthen tiles, as is used in Sweden; and some architects have begun to introduce the use of copper covering into Great Britain, which is much lighter, and may be used with great advantage, although it must be much dearer in prime cost.

Sundry preparations of copper are employed in painting, staining, and for colouring glass and enamels. See GLASS and ENAMEL.

The solution of copper in aqua-fortis stains marble and other stones of a green colour; when precipitated with chalk or whiting, it yields the green and the blue verditer of the painters. According to Lewis, a solution of the same metal in volatile spirits stains ivory and bones: when macerated for some time in the liquor, they become of a fine blue colour, which, however, tarnishes by exposure to the air, and becomes green afterwards.

The same author prepared elegant blue glasses, by melting common glass, or powdered flint and fixed alkaline salt, with blue vitriol, and with an amalgam of copper; fine green ones were made with green verditer, and with blue verditer, as well as with the precipitate of copper made by fixed alkalies, and with a precipitate by zinc; and a reddish glass was produced by the calx and scoria of copper made by fire alone. Even in this vitreous state, it seems as if a continuance of fire had the same effect in regard to colour, as air has upon copper in other forms; as some of the most beautiful blue glasses, by continued fusion, have changed

Imperfect METALS. Copper.

changed to a green colour. See farther the article BRASS *in the Glass-trade*.

Verdegris is a preparation of copper dissolved by the vegetable acids, which act on this metal, dissolving it very slowly, but in considerable quantities. It produces a fine green pigment for painting both in oil and water colours, inclining more or less to the bluish according to circumstances.

So great is the tenacity of copper, that a wire of a tenth of an inch in diameter is capable of supporting 299.5 pounds weight before it breaks.—Copper may be drawn into very fine wire, and beaten into extremely thin plates. The German artists, chiefly those of Nurenberg and Ausburg, are said to possess the best method for giving to these thin plates of copper a fine yellow colour like that of gold. See the articles *BRASS-Colour* and *BRASS-Leaf*.

The parings or shreds of these very thin leaves of yellow copper being well ground on a marble plate, are reduced to a powder similar to gold, which serves to cover, by means of some gum-water, or other adhesive fluid, the surface of various moulding or other pieces of curious workmanship, giving them the appearance of real bronze, and even of fine gold; at a very trifling expence; because the gold colour of this metallic powder may be easily raised and improved by stirring it on a wide earthen bason over a slow fire.

In some of its states, copper is as difficulty extended under the hammer as iron, but proves softer to the file, and never can be made hard enough to strike a spark with flint or other stones; from whence proceeds the use that is made of this metal for chisels, hammers, hoops, &c. in the gun-powder works.

The vitriolic acid does not act on copper unless concentrated and boiling: during this solution a great quantity of sulphureous gas flies off; afterwards a brown thickish matter is found, which contains the calx of the metal partly combined with the acid. By solution and filtration, a blue solution is obtained, which being evaporated to a certain degree, produces after cooling long rhomboidal crystals of a beautiful blue colour, called vitriol of copper; but if this solution be merely exposed a long time to the air, it affords crystals, and a green calx is precipitated, a colour which all calces of this metal assume when dried by the air. Blue vitriol, however, is seldom formed by dissolving the metal directly in the vitriolic acid. That sold in the shops is mostly obtained from copper pyrites. It may also be made by stratifying copper-plates with sulphur, and cementing them together for some time; because the vitriolic acid of the sulphur being disengaged, attacks and corrodes the metal, forming a metallic salt, which by affusion of water yields perfect crystals of blue vitriol. See VITRIOL.

The nitrous acid, on the contrary, dissolves copper when cold with great rapidity; and a great quantity of smoaking air or gas flies off, which, on being received in a pneumatic apparatus, and mixed in a glass tube with atmospheric air, shows its good or bad quality for the respiration of living animals, according as the common bulk is more or less diminished. This is one of the most important of Dr Priestley's discoveries; and various instruments known by the name of *eudiometers* have been since invented for making these experiments with ease and satisfaction. See EUDIOMETER.

But the most common use of copper is to make all sorts of large stills, boilers, pots, funnels, and other vessels employed by distillers, dyers, chemists, and various other manufacturers, who make use of large quantities of hot liquors in their various operations.

Although copper when pure is extremely valuable, on account of its ductility, lightness, and strength, it is, however, less useful on many occasions from the difficulty of forming large masses of work, as it is not an easy matter to cast copper solid, so as to retain all its properties entire. For if the heat be not sufficiently great, the metal proves deficient in toughness when cold; and if the heat be raised too high, or continued for a length of time, the copper blisters on the surface when cast in the moulds: so that the limits of its fusion are very contracted. And from these circumstances pure copper is rendered less applicable to several purposes.

We find, however, that the addition of a certain proportion of zinc removes almost all these inconveniences, and furnishes a mixed metal more fusible than copper, very ductile and tenacious when cold, which does not so readily scorify in a moderate heat, and which is less apt to rust from the action of air and moisture.

Copper is the basis of sundry compound metals for a great number of mechanical and œconomical uses of life, such as brass (Y), prince's-metal, tombac, bell-metal, white copper, &c. See CHEMISTRY, n° 1154, &c.

If the mixture is made of four to six parts of copper, with one part of zinc, it is called *Prince's-metal*. If more of the copper is taken, the mixture will be of a deeper yellow, and then goes by the name of *tombac*.

 Bell-

(Y) Brass is frequently made by cementing plates of copper with calamine, where the copper imbibes one-fourth or one-fifth its weight of the zinc which rises from the calamine. The process consists in mixing three parts of the calamine and two of copper with charcoal dust in a crucible, which is exposed to a red heat for some hours, and then brought to fusion. The vapours of the calamine penetrate the heated plates of copper, and add thereby to its fusibility. It is of great consequence for the success of this process to have the copper cut into small pieces, and intimately blended with the calamine. See CHEMISTRY, n° 1154.

In most foreign founderies the copper is broken small by mechanical means with a great deal of labour; but at

Bell-metal is a mixture of copper and tin, forming a compound extremely hard and sono rous, and is less subject to alterations by exposure to the air than any other cheap metal. On this account it is advantageously employed in the fabrication of various utensils and articles, as cannons, bells, statues, &c. in the composition of which, however, other metals are mixed in various proportions, according to the fancy and experience of the artist.

White-copper is prepared with arsenic and nitre, as mentioned under CHEMISTRY, n° 1157.

But the principal kind of white-copper is that with which speculums of reflecting telescopes are made. See the article SPECULUM.

VII. Iron; *Ferrum, Mars.* This metal is,

a. Of a blackish blue shining colour.

b. It becomes ductile by repeated heating between coals and hammering.

c. It is attracted by the loadstone, which is an iron ore; and the metal itself may also be rendered magnetical.

d. Its specific gravity to water is as 7,645, or 8000 : 1000.

e. It calcines easily to a black scaly calx, which, when pounded, is of a deep red colour.

f. When this calx is melted in great quantity with glass compositions, it gives a blackish brown colour to the glass; but in a small quantity a greenish colour, which at last vanishes if forced by a strong degree of heat.

g It is dissolved by all salts, by water, and likewise by their vapour. The calx of iron is dissolved by the spirit of sea-salt and by aqua-regia.

h. The calx of the dissolved metal becomes yellow, or yellowish brown: and in a certain degree of heat it turns red.

i. The same calx, when precipitated from acids by means of the fixed alkali, is of a greenish colour; but it becomes blue when precipitated by means of an alkali united with phlogiston; in which last circumstance the phlogiston unites with the iron: these two precipitates lose their colour in the fire, and turn brown.

k. The vitriol of iron is brown.

Iron is found,

[1.] Native. See the detached article IRON.

[2.] In form of calx.

A. Pure.

A. Loose and friable. Martial ochre; *Minera ochracea.*

1. Powdery; *Ochra ferri.* This is commonly yellow or red, and is iron which has been dissolved by the vitriolic acid.

2. Concreted. Bog-ore.

a. In form of round porous balls.

b. More solid bars.

c. In small flat pieces, like cakes or pieces of money.

d. In small grains.

e. In

at Bristol the workmen employ an easier method. A pit is dug in the ground of the manufacture about four feet deep, the sides of which are lined with wood. The bottom is made of copper or brass, and is moveable by means of a chain. The top is made also of brass with a space near the centre, perforated with small holes, which are luted with clay; through them the melted copper is poured, which runs in a number of streams into the water, and this is perpetually renewed by a fresh stream that passes through the pit. As the copper falls down it forms itself into grains, which collect at the bottom. But great precaution is required to hinder the dangerous explosions which melted copper produces when thrown into cold water; which end is obtained by pouring small quantities of the metal at once. The granulated copper is completely mixed with powdered calamine, and fused afterwards. The process lasts eight or ten hours, and even some days, according to the quality of the calamine.

It is a wonderful thing, says Cramer, that zinc itself, being simply melted with copper, robs it of all its malleability; but if it be applied in form of vapour from the calamine, the sublimates, or the flowers, it does not cause the metal to become brittle.

The method mentioned by Cramer to make brass from copper, by the volatile emanations of zinc, seems to be preferable to any other process, as the metal is then preserved from the heterogeneous parts contained in the zinc itself, or in its ore. It consists in mixing the calamine and charcoal with moistened clay, and ramming the mixture to the bottom of the melting pot, on which the copper, mixed also with charcoal, is to be placed above the rammed matter. When the proper degree of heat is applied, the metallic vapour of the zinc contained in the calamine will transpire through the clay, and attach itstlf to the copper, leaving the iron and the lead which were in the calamine retained in the clay, without mixing with the upper metal. Dr Watson says that a very good metallurgist of Bristol, named John Champion, has obtained a patent for making brass by combining zinc in the vapours form with heated copper plates; and that the brass from this manufacture is reported to be of the finest kind: but he knows not whether the method there employed is the same with that mentioned by Cramer.

Brass is sometimes made in another way, by mixing the two metals directly; but the heat requisite to melt the copper makes the zinc burn and flame out, by which the copper is defrauded of the due proportion of zinc. If the copper be melted separately, and the melted zinc poured into it, a considerable and dangerous explosion ensues; but if the zinc is only heated and plunged into the copper, it is quickly imbibed and retained. The union, however, of these two metals succeeds better if the flux composed of inflammable substanees be first fused in the crucible, and the copper and zinc be poured into it. As soon as they appear thoroughly melted, they are to be well stirred, and expeditiously poured out, or else the zinc will be inflamed, and leave the red copper behind.

e. In lumps of an indeterminate figure.

All theſe are of a blackiſh brown, or a light brown colour.

B. Indurated. The blood-ſtone; *Hæmatites*.

(1.) Of an iron colour; *Hæmatites cœruleſcens*. This is of a bluiſh grey colour; it is not attracted by the loadſtone, yields a red powder when rubbed, and is hard.

a. Solid, and of a dim appearance when broken.

b. Cubical, and of a ſhining appearance when broken.

c. Fibrous, is the moſt common *torrſten* of Sweden.

d. Scaly: the *eiſenram* of the Germans.

1. Black.
2. Bluiſh grey. When this is found along with marcaſite, it is not only attracted by the loadſtone, but is of itſelf really a loadſtone.

e. Cryſtalliſed.

1. In octoedrical cryſtals.
2. In polyedrical cryſtals.
3. In a cellular form.

Theſe varieties are the moſt common in Sweden, and are very ſeldom blended with marcaſite or any other heterogeneous ſubſtance except their different beds. It is remarkable, that when theſe ores are found along with marcaſite, thoſe particles which have lain neareſt to the marcaſite are attracted by the loadſtone, although they yield a red or reddiſh brown powder, like thoſe which are not attracted by the load-ſtone: it is likewiſe worth obſervation, that they generally contain a little ſulphur, if they are imbedded in a limeſtone rock.

(2.) Blackiſh brown bloodſtone; *Hæmatites nigreſcens*. Kidney ore. This yields a red or brown powder when it is rubbed; it is very hard, and is attracted by the loadſtone.

a. Solid, with a glaſſy texture.

b. Radiated.

c. Cryſtalliſed.

1. In form of cones, from Siberia.
2. In form of concentric balls, with a facetted ſurface. Theſe are very common in Germany, but very ſcarce in Sweden.

(3.) Red bloodſtone; *Hæmatites Ruber*. Red kidney ore.

a. Solid, and dim in its texture.

b. Scaly. The *eiſenram* of the Germans. This is commonly found along with the iron-coloured iron glimmer, and ſmears the hands.

c. Cryſtalliſed, in concentric balls, with a flat or facetted ſurface.

(4.) yellow blood-ſtone; *Hæmatites flavus*.

a. Solid.

b. Fibrous.

The varieties of the colours in the blood-ſtone are the ſame with thoſe produced in the calces of iron made by dry or liquid menſtrua and afterwards expoſed to different degrees of heat.

B. Mixed with heterogeneous ſubſtances.

A. With a calcareous earth. White ſpathoſe iron ore. The *ſtahlſtein* of the Germans.

B. With a ſiliceous earth. The martial jaſper of Sinople.

C. With a garnet earth. Garnet and cockle or ſhirl.

D. With an argillaceous earth. The bole.

E. With a micaceous earth. Mica.

F. With manganeſe.

G. With an alkali and phlogiſton. Blue martial earth. Native Pruſſian-like blue.

1. Looſe or powdery.

H. With an unknown earth, which hardens in water. Tarras; *Cementum*.

1. Looſe or granulated; *Terra Puzzolana*. This is of a reddiſh brown colour, is rich in iron, and is pretty fuſible.
2. Indurated; *Cementum induratum*. This is of a whitiſh yellow colour, contains likewiſe a great deal of iron, and has the ſame quality with the former to harden ſoon in water when mixed with mortar. This quality cannot be owing to the iron alone, but rather to ſome particular modification of it occaſioned by ſome accidental cauſes, becauſe theſe varieties rarely happen at any other places except where volcanoes have been, or are yet, in the neighbourhood.

[3.] Diſſolved or mineraliſed.

A. With ſulphur alone.

A. Perfectly ſaturated; *Ferrum ſulphure ſaturatum*. Marcaſite.

B. With very little ſulphur. Black iron ore. Iron ſtone.

This is either attracted by the loadſtone, or is a loadſtone itſelf attracting iron; it reſembles iron, and yields a black powder when rubbed.

1.) Magnetic iron ore. The loadſtone, *Magnes*.

a. Steel-grained, of a dim texture, from Hogberget in the pariſh of Gagnœf in Dalarne: it is found at that place almoſt to the day, and is of as great ſtrength as any natural loadſtones were ever commonly found.

b. Fine grained, from Saxony.

c. Coarſe-grained, from Spetalſgrufvan at Norberg, and Kierrgrufvan, both in the province of Weſtmanland. This loſes very ſoon its magnetical virtue.

d. With coarſe ſcales, found at Sandſwœr in Norway. This yields a red powder when rubbed.

2.) Refractory iron ore. This in its crude ſtate is attracted by the loadſtone.

a. Giving a black powder when rubbed; *Tritura atra*. Of this kind are,

1. Steel-grained.
2. Fine grained.

3. Coarſe

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3. Coarse grained.

This kind is found in great quantities in all the Swedish iron mines, and of this most part of the fusible ores consist, because it is commonly found in such kinds of rocks as are very fusible: and it is as seldom met with in quartz as the hæmatites is met with in limestone.

b. Rubbing into a red powder. These are real hæmatites, that are so far modified by sulphur or lime as to be attracted by the loadstone.

1. Steel-grained.
2. Fine-grained. Emery. This is imported from the Levant: it is mixed with mica, is strongly attracted by the loadstone, and smells of sulphur when put to the fire.
3. Of large shining cubes.
4. Coarse, Scaly. The *eisenglimmer* or *eisenran.*

[4.] Mixed with various fossile substances.

1. With sulphur and clay; Pyrites.
2. With arsenic; called *misspickel* by the Germans, and *plate mundic* in Cornwall.
3. With sulphurated arsenic. Arsenical pyrites.
4. With vitriolic acid. Martial vitriol.
5. With phlogiston. Martial coal ore.
6. With other sulphurated and arsenicated metals. See these in their respective arrangements.

Uses and Properties of Iron. Iron is the most common metal in nature, and at the same time the most useful in common life; notwithstanding which, its qualities are perhaps very little known.

Iron has a particular and very sensible smell when strongly rubbed or heated; and a styptic taste, which it communicates to the water in which it is extinguished after ignition. Its tenacity, ductility, and malleability, are very great. It exceeds every other metal in elasticity and hardness, when properly tempered. An iron wire of one-tenth of an inch thick is able to support 450 pounds weight without breaking, as Wallerius asserts.

Iron drawn into wire as slender as the finest hairs. It is more easily malleable when ignited than when cold; whereas other metals, though ductile when cold, become quite brittle by heat.

It grows red-hot sooner than other metals: nevertheless it melts the most difficultly of all, platina and manganese excepted. It does not tinge the flame of burning matters into bluish or greenish colours, like other imperfect metals, but brightens and whitens it; hence the filings of iron are used in compositions of fire-works, to produce what is called *white-fire.*

Iron, or rather steel, expands the least of all hard metals by the action of heat; but brass expands the most: and on this account these two metals are employed in the construction of compound pendulums for the best sort of regulating clocks for astronomical purposes.

Iron, in the act of fusion, instead of continuing to expand, like the other metals, shrinks, as Dr Lewis observes; 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, and tin, put in the respective metals in fusion, sink quickly to the bottom. But in its return to a consistent state, instead of shrinking, like other metals, it expands; sensibly rising in the vessel, and assuming a convex surface, whilst the others subside, and appear concave. This property of iron was first taken notice of by Reamur, and excellently fits it for receiving impressions from the moulds into which it is cast, being forced into their minutest cavities. Even when poured thick into the mould, it takes, nevertheless, a perfect impression; and it is observed, that cast iron is somewhat larger than the dimensions of the mould, whilst cast figures of other metals are generally smaller.

The vitriolic acid dissolves iron readily, and forms green vitriol.

This acid requires to be diluted with 304 times its quantity of water, to enable it effectually to dissolve iron; and, during the dissolution, a strong aerial fluid arises, called *inflammable air,* which, on being mixed with atmospheric air, takes fire at the approach of the flame of a candle. A glass phial, of about two ounces measure, with one third of inflammable air, and the rest of common air, produces a very loud report if opened in the same circumstance; and if it be filled with two-thirds of inflammable air, mixed with one of dephlogisticated air, the report will be as loud as the explosion of a pistol with gunpowder.

Dilute nitrous acid dissolves iron; but this saline combination is incapable of crystallising. Strong nitrous acid corrodes and dephlogisticates a considerable quantity of iron, which falls to the bottom.

Marine acid likewise dissolves iron, and this solution is also incrystallisable.

The Prussian acid precipitates iron from its solutions in the form of Prussian blue.

This metal is likewise sensibly acted upon by alkaline and neutral liquors, and corroded even by those which have no perceptible saline impregnation; the oils themselves, with which iron utensils are usually rubbed to prevent their rusting, often promote this effect in some measure, unless the oils have been previously boiled with litharge or calces of lead.

Galls, and other astringent vegetables, precipitate iron from its solutions, of a deep blue or purple colour, of so intense a shade as to appear black. It is owing to this property of iron that the common writing ink is made. The infusion of galls, and also the Prussian alkali, are tests of the presence of iron by the colours they produce on any fluid. Acids, however, dissolve the coloured precipitates by the former; and hence it arises that the marine acid is successfully applied to take off ink spots and iron stains from white linens. Alkalis, however, convert these iron precipitates into a brown ochre.

Iron has a strong affinity with sulphur. If a bar of iron be strongly ignited, and a roll of brimstone be applied to the heated end, it will combine

bine with the iron, and form a fusible mass, which will drop down. A vessel of water ought to be placed beneath for the purpose of receiving and extinguishing it, as the fumes would otherwise be very inconvenient to the operator.

A mixture of iron-filings and sulphur in powder, moistened with water, and pressed so as to form a paste, will in a few hours swell, become hot, fume, and even burst into a flame, if the quantity is large. The residuum furnishes martial vitriol. This process is similar to the decomposition of martial pyrites; from which some philosophers account for hot spring-waters and subterraneous fires. The mixture of water in this paste seems to be necessary to enable the vitriolic acid of the sulphur to act on the iron.

For other chemical properties of this metal, see Chemistry-*Index;* for its electrical and magnetic properties, see Electricity and Magnetism. For a more particular account of its nature and uses, and the methods of making and manufacturing it, see the articles Iron and Steel; also Metallurgy, Part II. sect. vii. and Part III. sect. v.

Order III. Semimetals.

I. Bismuth; tin-glass. *Visimutum, Bismutum, Marcasita officinalis.* It is,

a. Of a whitish yellow colour.

b. Of a laminated texture, soft under the hammer, and neverthelefs very brittle.

c. It is very fusible; calcines and scorifies like lead, if not rather easier: and therefore it works on the cuppel. It is pretty volatile in the fire.

d. Its glass or slag becomes yellowish brown, and has the quality of retaining some part of the gold, if that metal has been melted, calcined, and vitrified with it.

e. It may be mixed with the other metals, except cobalt and zinc, making them white and brittle.

f. It dissolves in aqua-fortis, without imparting to it any colour; but to the aqua-regia it gives a red colour, and may be precipitated out of both these solutions with pure water into a white powder, which is called *Spanish white.* It is also precipitated by the acid of sea-salt; which last unites with it, and makes the *visimutum corneum.*

g. It amalgamates easily with quicksilver. Other metals are so far attenuated by the bismuth, when mixed with it, as to be strained or forced along with the quicksilver through skins or leather.

Bismuth is found in the earth.

A. Native. This resembles a regulus of bismuth, but consists of smaller scales or plates.

1. Superficial, or in crusts.

2. Solid, and composed of small cubes.

B. In form of calx.

1. Powdery or friable; *Ochra visimuti.* This is of a whitish yellow colour; it is found in form of an efflorescence.

It has been customary to give the name of *flowers of bismuth* to the pale red calx of cobalt, but it is wrong; because neither the calx of bismuth, nor its solutions, become red, this being a quality belonging to the cobalt.

C. Mineralised bismuth. This is, with respect to colour and appearance, like the coarse tesselated potter's lead ore; but it consists of very thin square plates or flakes, from which it receives a radiated appearance when broken crosswise.

1. With sulphur.

a. With large plates or flakes.

b. With fine or small scales.

2. With sulphurated iron.

a. Of coarse wedge-like scales.

This mineralised bismuth ore yields a fine radiated regulus; for which reason it has been ranked among the antimonial ores by those who have not taken proper care to melt a pure regulus ore destitute of sulphur from it; while others, who make no difference between regulus and pure metals, have still more positively asserted it to be only an antimonial ore.

3. With sulphur and arsenic.

a. Of a whitish yellow or ash colour. It has a shining appearance; and is composed of small scales or plates, intermixed very small yellow flakes: It is of a hard and solid texture: Sometimes strikes fire with hard steel: Has a disagreeable smell when rubbed: Does not effervesce with aqua-fortis; but is partially dissolved by the same acid (z).

b. Grey, of a striated form; found at Helsingland in Sweden, and at Annaberg in Saxony.

c. With variegated colours of red, blue, and yellow grey; found at Schneeberg in Saxony.

d. With green fibres like an amianthus; at Misnia in Germany, and at Gillebeck in Norway.

e. With yellow red shining particles, called *mines de bismuth Tigrées* in French, at Georgenstadt in Germany, and at Annaberg in Saxony.

f. The *minera bismuthi arenacea,* mentioned by Wallerius and Bomare, belongs also to the same kind of the arsenicated ores.

4. By vitriolic acid. This ore is called *wismuth bluth* by the Germans. It is said to be of a yellowish, reddish, or variegated colour; and to be found mixed with the calx of bismuth, incrusting other ores. *Kirwan,* p. 334.

Uses, &c. *of Bismuth.* See the article Bismuth. Also Chemistry-*Index;* and Metallurgy, Part II. sect. x. and Part III. sect. viii.

II.

(z) This solution, being diluted with water, becomes a kind of sympathetic ink; as the words written with it on white paper, and dried, are not distinguished by the eye; but on being heated before the fire, they assume a yellowish colour.

Semi-metals. Zinc.

II. Zinc; ſpeltre. *Zincum.*

a. Its colour comes neareſt to that of lead, but it does not ſo eaſily tarniſh.

b. It ſhows a texture when it is broken, as if it were compounded of flat pyramids (A).

c. Its ſpecific gravity to water is as 6,900 or 7000 to 1000.

d. It melts in the fire before it has acquired a glowing heat; but when it has gained that degree of heat, it burns with a flame of a changeable colour, between blue and yellow. If in an open fire, the calx riſes in form of ſoft white flowers; but if in a covered veſſel, with the addition of ſome inflammable, it is diſtilled in a metallic form: in which operation, however, part of it is ſometimes found vitrified.

e. It unites with all the metals (B) except biſmuth and nickel, and makes them volatile. It is, however, not eaſy to unite it with iron without the addition of ſulphur. It has the ſtrongeſt attraction to gold and copper, and this laſt metal acquires a yellow colour by it; which has occaſioned many experiments to be made to produce new metallic compoſitions.

f. It is diſſolved by all the acids: of theſe the vitriolic acid has the ſtrongeſt attraction to it; yet it does not diſſolve it, if it is not previouſly diluted with much water.

g. Quickſilver amalgamates eaſier with zinc than with copper; by which means it is ſeparated from compoſitions made with copper.

h. It ſeems to become electrical by friction.

Zinc is found,

A. Native.

Zinc has been met with native, though rarely, in the form of thin and flexible filaments, of a grey colour, which were eaſily inflamed when applied to a fire. And Bomare affirms that he has ſeen many ſmall pieces of native zinc among the calamine-mines in the duchy of Limbourg and in the zinc-mines at Goſlar, where this ſemimetal was always ſurrounded by a kind of ferruginous yellow earth, or ochraceous ſubſtances. See the detached article ZINC.

B. In form of calx.

(1.) Pure.

a. Indurated.

1. Solid.
2. Cryſtalliſed.

This is of a whitiſh-grey colour, and its external appearance is like that of a lead ſpar; it cannot be deſcribed, but is eaſily known by an experienced eye.—It looks very like an artificial glaſs of zinc; and is found among other calamines at Namur and in England.

(2.) Mixed.

A. With a martial ochre.

1. Half indurated. Calamine; *Lapis calaminaris.*

a. Whitiſh yellow.

b. Reddiſh brown. This ſeems to be a mouldered or weathered blende.

B. With a martial clay or bole.

C. With a lead ochre and iron.

D. With quartz: Zeolite of Friburgh.

The real contents of this ſubſtance were firſt diſcovered by M. Pelletier. It was long taken for a true zeolite, being of a pearl colour, cryſtalliſed, and ſemitranſparent. It conſiſts of laminæ, diverging from different centres, and becoming gelatinous with acids. Its contents are 48 to 52 per cent. of quartz, 36 of calx of zinc, and 8 or 12 of water. (*Kirwan*, p. 318.)

C. Mineraliſed.

(1.) With ſulphurated iron. Blende, mock-lead, black-jack, mock-ore; *pſeudogalena* and *blende* of the Germans.

A. Mineraliſed zinc in a metallic form. Zinc ore. This is of a metallic bluiſh-grey colour, neither perfectly clear as a potter's ore, nor ſo dark as the Swediſh iron ores.

1. Of a fine cubical or ſcaly texture.
2. Steel-grained.

B. In form of calx. Blende. Mock-lead; *Sterile nigrum. Pſeudo-galena* (C.) This is found,

1. With courſe ſcales.

a. Yellow; ſemi tranſparent.

b. Greeniſh.

c. Greeniſh-

(A) It cannot be reduced into power under the hammer like other ſemimetals. When it is wanted very much divided, it muſt be granulated, by pouring it while fuſed into cold water; or filed, which is very tedious, as it ſtuffs and fills the teeth of the file. But if heated the moſt poſſible without fuſing it, Macquer aſſerts, that it becomes ſo brittle as to be pulveriſed in a mortar.

(B) It brightens the colour of iron almoſt into a ſilver hue; changes that of copper to a yellow or gold colour, but greatly debaſes the colour of gold and deſtroys its malleability. It improves the colour and luſtre of lead and tin, rendering them firmer, and conſequently fitter for ſundry mechanic uſes. Lead will bear an equal weight of zinc, without loſing too much of its malleability.—The proceſs for giving the yellow colour to copper, by the mixture of zinc, and of its ore called *calamine*, has been deſcribed above under the *Uſes of Copper*.

(C) The varieties of pſeudo-galena, or black-jack, are in general of a lamellar or ſcaly texture, and frequently of a quadrangular form, reſembling galena, They all loſe much of their weight when heated, and burn with a blue flame; but their ſpecific gravity is conſiderably inferior to that of true galena. Almoſt all contain a mixture of lead-ore. Moſt of them exhale a ſulphureous ſmell when ſcraped, or at leaſt when vitriolic or marine acid is dropped on them.

c. Greenish-black; *pechblende*, or *pitch blende* of the Germans.
d. Blackish-brown.
2. With fine scales,
a. White.
b. Whitish-yellow.
c. Reddish-brown.
3. Fine and sparkling; at Goslar called *braun blyertz*. Its texture is generally scaly; sometimes crystallised and semitransparent. It gives fire with steel; but does not decrepitate, nor smoke when heated: yet it loses about 13 *per cent*. of its weight by torrefaction.
a. Dark-brown.
b. Red, which becomes phosphorescent when rubbed; found at Scharfenberg in Misnia. (*Brunich*).
c. Greenish, yellowish-green, or red. It has different degrees of transparency, and is sometimes quite opaque. When scraped with a knife in the dark, it emits light, even in water; and after undergoing a white heat, if it is distilled *per se*, a siliceous sublimate rises, which shows it contains the sparry acid, probably united to the metal, since it sublimes.
4. Of a metallic appearance; *glanz blende*.
This is of a bluish-grey, of a scaly or steel-grained texture, and its form generally cubical or rhomboidal. It loses nearly one sixth of its weight by calcination; and after calcination it is more soluble in the mineral acids.
100 parts of this ore afforded to Bergman about 52 of zinc, 8 of iron, 4 of copper, 26 of sulphur, 6 of silex, and 4 of water.
5. Crystalline.
a. Dark-red, very scarce; found in a mine near Freyberg. Something like it is found at the Morgenstern and Himmelsfuste.
b. Brown. In Hungary and Transylvania.
c. Black. Hungary.
These varieties may easily be mistaken for rock crystals; but by experience they may be distinguished on account of their lamellated texture and greater softness. Their transparency arises from a very small portion of iron in them.
(2.) Zinc mineralised by the vitriolic acid.
This ore has been already described among the middle *Salts*, at *Vitriol of zinc*.
Uses, &c. *of zinc*. See the detached article Zinc: Also Chemistry-*Index;* aod Metallurgy, Part II. sect xii. and Part III. under sect. iii.

III. Antimony; *Antimonium Stibium*. This semimetal is,
a. Of a white colour almost like silver.
b. Brittle; and in regard to its texture, it consists of shining planes of greater length than breadth.

c. In the fire it is volatile, and volatilises part of the other metals along with it, except gold and platina. It may, however, in a moderate fire, be calcined into a light-grey calx, which is pretty refractory in the fire; but melts at last to a glass of a reddish-brown colour.
d. It dissolves in spirit of sea-salt and aqua-regia, but is only corroded by the spirit of nitre into a white calx; it is precipitated out of the aqua-regia by water.
e. It has an emetic quality when its calx, glass, or metal, is dissolved in an acid, except when in the spirit of nitre, which has not this effect.
f. It amalgamates with quicksilver, if the regulus, when fused, is put to it; but the quicksilver ought for this purpose to be covered with warm water: it amalgamates with it likewise, if the regulus of antimony be previously melted with an addition of lime.
Antimony is found in the earth.
A. Native. *Regulus antimonii nativus*.
This is of a silver colour, and its texture is composed of pretty large shining planes.
This kind was found in Carls Ort, in the mine of Salberg, about the end of the last century; and specimens thereof have been preserved in collections under the name of an arsenical pyrites, until the mine-master Mr Von Swab discovered its real nature, in a treatise he communicated to the Royal Academy of Sciences at Stockholm in the year 1748. Among other remarkable observations in this treatise, it is said, first, That this native antimony easily amalgamated with quicksilver; doubtless, because it was imbedded in limestone; since, according to Mr Pott's experiments, an artificial regulus of antimony may, by means of lime, be disposed to an amalgamation: Secondly, That when brought in form of a calx, is shot into crystals during the cooling.
B. Mineralised antimony.
(1) With sulphur.
This is commonly of a radiated texture, composed of long wedge-like flakes or plates; it is nearly of a lead-colour, and rough to the touch.
a. Of coarse fibres.
b. Of small fibres.
c. Steel-grained, from Saxony and Hungary.
d. Crystallised, from Hungary.
1. Of prismatical, or of a pointed pyramidal figure, in which last circumstance the points are concentrical.
Cronstedt mentions a specimen of this, in which the crystals were covered with very minute crystals or quartz, except at the extremities, where there was always a little hole: this specimen was given for a *flos ferri* spar.
(2.) With sulphur and arsenic. Red antimony ore; *Antimonium solare*.
This is of a red colour, and has the same texture with the preceding, though its fibres are not so coarse.

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a. With small fibres.
b. With abrupt broken fibres, from Braunsdorff in Saxony, and from Hungary.
All antimonial ores are somewhat arsenical, but this is more so than the preceding kinds.
(3.) With sulphurated silver. Plumose silver-ore, or *federertz* of the Germans.
(4.) With sulphurated silver, copper, and arsenic; the *dal fahl-ertz* of the Germans.
(5.) With sulphurated lead; radiated lead-ore.
(6.) By the aerial acid.
This ore was lately discovered by Mongez, among those of native antimony from the mine of Chalanges in Dauphiny. It consists of a group of white crystallised filaments of a needle-form appearance, diverging from a common centre, like zeolite. They are insoluble in nitrous acid; and, on being urged by the flame of a blow-pipe, upon a piece of charcoal, they are dissipated into white fumes, or antimonial flowers, without any smell of arsenic; from whence it follows, that these needle-formed crystals are a pure calx of antimony, formed by its combination with, or mineralised by, the aerial acid. See *Kirwan*, p. 325, and *Journal de Physique* for July 1787, p. 67.

Uses, &c. By the name of *antimony* is commonly understood the crude antimony (which is compounded of the metallic part and sulphur) as it is melted out of the ore; and by the name of *regulus*, the pure semimetal.

1. Though the regulus of antimony is a metallic substance, of a considerably bright white colour, and has the splendor, opacity, and gravity of a metal, yet it is quite unmalleable, and falls into powder instead of yielding or expanding under the hammer; on which account it is classed among the semimetals.
2. Regulus of antimony is used in various metallic mixtures, as for printing types, metallic speculums, &c. and it enters into the best sort of pewter ware.
3. It mixes with, and dissolves various metals; in particular it affects iron the most powerfully; and what is very remarkable, when mixed together, the iron is prevented from being attracted by the loadstone.
4. It affects copper next, then tin, lead, and silver; promoting their fusion, and rendering them all brittle and unmalleable: but it will neither unite with gold nor mercury; though it may be made to combine with this last by the interposition of sulphur. In this case it resembles the common Æthiops, and is thence called *antimonial Æthiops*.
5. Regulus of antimony readily unites with sulphur and forms a compound of a very faint metallic splendor: it assumes the form of long needles adhering together laterally: it usually formed naturally also in this shape. This is called *crude antimony*.
6. But though antimony has a considerable affinity to sulphur; yet all the metals, except gold and mercury, have a greater affinity to that compound. If therefore iron, copper, lead, silver, or tin, be melted with antimony, the sulphur will unite with the metal, and be separated from the regulus, which, however, takes up some part of the metal, for which reason it is called *martial regulus*, *regulus veneris*, &c.
7. When gold is mixed, or debased by the mixture of other metals, it may be fused with antimony; for the sulphur combines with the base metals, which, being the lighter, rise up into scoria, while the regulus remains united at the bottom with the gold; which being urged by a stronger degree of heat, is freed from the semimetal, which is very volatile. This method of refining gold is the easiest of all.
8. But the most numerous purposes to which this metal has been applied are those of the chemical and pharmaceutical preparations. Lemery, in his Treatise on Antimony, describes no less than 200 processes and formulæ; among which there are many good and many useless ones. The following deserve to be mentioned on account of their utility.
9. Antimony melts as soon as it is moderately red hot, but cannot sustain a violent degree of fire, as it is thereby dissipated into smoke and white vapours, which adhere to such cold bodies as they meet with, and are collected into a kind of farina or powder, called *flowers of antimony*.
10. If it be only moderately heated, in very small pieces, so as not to melt, it becomes calcined into a greyish powder destitute of all splendor, called *calx of antimony*. This calx is capable of enduring the most violent fire; but at last it will run into a glass of a reddish-yellow colour, similar to that of the hyacinth. The infusion made of this coloured antimonial glass, in acidulous wine (such as that of Bourdeaux) for the space of 5 or 6 hours, is a very violent emetic.
11. If equal parts of nitre and regulus of antimony be deflagrated over the fire, the grey calx which remains is called *liver of antimony*.
12. If regulus of antimony be melted with two parts of fixed alkali, a mass of a reddish-yellow colour is produced, which being dissolved in water, and any acid being afterwards added, a precipitate is formed of the same colour, called *golden sulphur of antimony*.
13. Fixed nitre, viz. the alkaline salt that remains after the deflagration of nitre, being boiled with small pieces of regulus of antimony, the solution becomes reddish; and, on cooling, deposits the antimony in the form of a red powder, called *mineral kermes*.
14. Equal parts of the glass, and of the liver of antimony, well pulverised and mixed with an equal quantity of pulverised cream of tartar, being put into as much water as will dissolve the cream of tartar, and boiled for 12 hours, adding now and then some hot water to replace what is evaporated, the whole is to be filtered while hot; then being evaporated to dryness, the saline matter that remains is the emetic tartar.
15. The regulus of antimony being pulverised, and distilled

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distilled with corrosive sublimate of mercury, a thick white matter is produced, which is extremely corrosive, and is called *butter of antimony*. This thick substance may be rendered limpid and fluid by repeated distillations.

16. On mixing the nitrous acid with this butter of antimony, a kind of aqua regia is distilled, called *bezoardic spirit of nitre*.

17. The white matter that remains from this last distillation may be redistilled with fresh nitrous acid; and the remainder being washed with water, is called *bezoar mineral*, which is neither so volatile nor so caustic as the antimonial butter. This butter being mixed with water, a precipitate falls to the bottom, which is very improperly called *mercurius vitæ*, for it is in fact a very violent emetic.

18. But if, instead of the regulus, crude antimony be employed, and the same operation be performed, the reguline part separates from the sulphur, unites to the mercury, and produces the substance which is called *cinnabar of antimony*.

19. Crude antimony being projected in a crucible, in which an equal quantity of nitre is fused, detonates; is calcined, and forms a compound called by the French *fondant de Retrou*, or *antimoine diaphoretique non lavé*. This being dissolved in hot water, falls to the bottom after it is cold; and after decantation is known, when dry, by the name of *diaphoretic antimony*. This preparation excites animal perspiration, and is a good sudorific. The same preparation may be more expeditiously made by one part of antimony with two and a half of nitre, mixed together and deflagrated: the residue of which is the mere calx of antimony, void of all emetic power.

20. And if the detonation be performed in a tubulated retort, having a large receiver, containing some water adapted to it, both a clyssus of antimony and the antimonial flowers may be obtained at the same time, as Neumann asserts.

21. When nitre is deflagrated with antimony over the fire, the alkaline basis of the nitre unites with the calx of the semimetal, which may be separated by an acid, and is called *materia perlata*. See farther the article Antimony; also Metallurgy, Part II. sect. ix.

IV. Arsenic. In its metallic form, is,

a. Nearly of the same colour as lead, but brittle, and changes sooner its shining colour in the air, first to yellow, and afterwards to black.

b. It appears laminated in its fractures, or where broken.

c. Is very volatile in the fire, burns with a small flame, and gives a very disagreeable smell like garlic.

d. It is, by reason of its volatility, very difficult to be reduced, unless it is mixed with other metals: However, a regulus may be got from the white arsenic, if it is quickly melted with equal parts of pot ashes and soap; but this regulus contains generally some cobalt, most of the white arsenic being produced from the cobalt ores during their calcination. The white arsenic, mixed with a phlogiston, sublimes likewise into octoedral crystals of a metallic appearance, whose specific gravity is 8,308.

Semi-metals. Arsenic.

e. The calx of arsenic, which always, on account of its volatility, must be got as a sublimation, is white, and easily melts to a glass, whose specific gravity is 5,000. When sulphur is blended in this calx, it becomes of a yellow, orange, or red colour; and according to the degrees of colour is called *orpiment* or yellow arsenic; *sandarach*, *realgar*, or red arsenic; and also *rubinus arsenici*.

f. This calx and glass are dissoluble in water, and in all liquids; though not in all with the same facility. In this circumstance arsenic resembles the salts; for which reason it also might be ranked in that class.

g. The regulus of arsenic dissolves in spirit of nitre; but as it is very difficult to have it perfectly free from other metals, it is yet very little examined in various menstrua.

h. It is poisonous, especially in form of a pure calx or glass: But probably it is less dangerous when mixed with sulphur, since it is proved by experience, that the men at mineral works are not so much affected by the smoke of this mixture as by the smoke of lead, and that some nations make use of the red arsenic in small doses as a medicine.

i. It unites with all metals, and is likewise much used by nature itself to dissolve, or, as we term it, to *mineralise*, the metals, to which its volatility and dissolubility in water must greatly contribute. It is likewise most generally mixed with sulphur.

k. It absorbs or expels the phlogiston, which has coloured glasses, if mixed with them in the fire.

Arsenic is found,

[1.] Native; called *Scherbencobolt* and *Fliegenstein* by the Germans.

It is of a lead colour when fresh broken, and may be cut with a knife, like black lead, but soon blackens in the air. It burns with a small flame, and goes off in smoke.

A. Solid and testaceous; *Scherbencobolt*.

B. Scaly.

C. Friable and porous; *Fliegenstein*.

(1.) With shining fissures.

This is by some called *Spigel cobalt*.

[2.] In form of a calx.

A. Pure, or free from heterogeneous substances.

1. Loose or powdery.

2. Indurated, or hardened. This is found in form of white semi-transparent crystals.

B. Mixed.

A. With sulphur.

1. Hardened.

a. Yellow. Orpiment; *Auripigmentum*.

b. Red. Native realgar, or sandarach.

B. With the calx of tin, in the tin-grains.

C. With sulphur and silver; in the *rothgulden* or red silver ore.

D. With calx of lead, in the lead-spar.

E. With calx of cobalt, in the efflorescence of cobalt.

[3.] Mineralised.

A. With sulphur and iron. Arsenical pyrites or marcasite. These kinds in Cornwall are called *silvery* or *white mundics* and *plate mundics*.

This alone produces red arsenic when calcined. It is of a deeper colour than the following.

B. With iron only. This differs with regard to its particles; being,

1. Steel-grained.
2. Coarse-grained.
3. Crystallised.

a. In an octoedral figure. This is the most common kind.

b. Prismatical. The sulphureous marcasite is added to this kind when red arsenic is to be made; but in Sweden it is scarcer than the sulphureous arsenical pyrites.

C. With cobalt, almost in all cobalt ores.

D. With silver.
E. With copper.
F. With antimony.
} See under *Silver*, *Copper*, and *Antimony*, *supra*.

For the *Uses of Arsenic*, see the detached article Arsenic, and Chemistry-*Index;* also Metallurgy, Part II. sect. xiii. and Part III. sect. viii.

V. Cobalt.

This semimetal is,

a. Of a whitish grey colour, nearly as fine-tempered steel.

b. Is hard and brittle, and of a fine-grained texture; hence it is of a dusky, or not shining appearance.

c. Its specific gravity to water is 6000 to 1000.

d. It is fixed in the fire, and becomes black by calcination: it then gives to glasses a blue colour, inclining a little to violet, which colour, of all others, is the most fixed in fire.

e. The concentrated oil of vitriol, aquafortis, and aqua-regia, dissolve it; and the solutions become red. The cobalt calx is likewise dissolved by the same menstrua, and also by the volatile alkali and the spirit of sea salt.

f. When united with the calx of arsenic in a slow (not a brisk) calcining heat, it assumes a red colour: the same colour is naturally produced by way of efflorescence, and is then called the *bloom* or *flowers of cobalt*. When cobalt and arsenic are melted together in an open fire, they produce a blue flame.

g. It does not amalgamate with quicksilver by any means hitherto known.

h. Nor does it mix with bismuth, when melted with it, without addition of some medium to promote their union.

[1.] Native cobalt. Cobalt with arsenic and iron in a metallic form.

Pure native cobalt has not yet been found: that which passes for such, according to Kirwan, is mineralised by arsenic. Bergman, however, in his Sciagraphia, has entered this present ore under the denomination of *native cobalt:* and certain it is, that among all the cobaltic ores, this is the nearest to the native state of this semimetal. It always contains a small quantity of iron, besides the arsenic, by which it is mineralised.

This is of a dim colour when broken, and not unlike steel. It is found,

a. Steel-grained, from Loos in the parish of Farila in the province of Helsingeland, and Schneeberg in Saxony.

b. Fine-grained, from Loos.

c. Coarse-grained.

d. Crystallised:

1. In a denditrical or arborescent form;
2. Polyhedral, with shining surfaces;
3. In radiated nodules.

[2.] Calciform cobalt. Cobalt is most commonly found in the earth mixed with iron.

A. In form of a calx.

1.) With iron without arsenic.

a. Loose or friable; cobalt ochre. This is black, and resembles the artificial zaffre.

b. Indurated: *Minera cobalti vitrea.* The schlacken or flag cobalt. This is likewise of a black colour, but of a glassy texture, and seems to have lost that substance which mineralised it, by being decayed or weathered.

1.) With arsenical acid; cobalt-blut, Germ. *Ochra cobalti rubra;* bloom, flowers, or efflorescence of cobalt.

a. Loose or friable. This is often found of a red colour like other earths, spread very thin on the cobalt ores; and is, when of a pale colour, erroneously called *flowers of bismuth.*

b. Indurated. This is commonly crystallised in form of deep red semitransparent rays or radiations: It is found at Schneeberg in Saxony.

B. Mineralised.

1.) With sulphurated iron.

This ore is of a light colour, nearly resembling tin or silver. It is found crystallised in a polygonal form.

a. Of a slaggy texture.

b. Coarse-grained.

This ore is found in Bastnasgrufva at Raddarshyttan in Westmanland, and discovers not the least mark of arsenic. The coarse-grained becomes slimy in the fire, and sticks to the stirring hook during the calcination in the same manner as many regules do: It is a kind of regule prepared by nature. Both these give a beautiful colour.

2.) With sulphur, arsenic, and iron. This resembles the arsenicated cobalt ore, being only rather of a whiter or lighter colour. It is found,

a. Coarse-grained.

b. Crystallised;

1. In a polygonal figure, with shining surfaces, or *glanzkobolt*. It is partly of a white or light colour, and partly of a somewhat reddish yellow.

3. With

(3.) With sulphurated and arsenicated nickel and iron; see *Kupfer-nickel*, below.

Uses, &c. See the article Cobalt. See also Chemistry-*Index*; and Metallurgy, Part II. sect. xi.

VI. Nickel; *Nicolum*. This is the latest discovered semimetal. It was first described by its discoverer Mr Cronstedt, in the Acts of the Royal Academy of Sciences at Stockholm for the years 1751 and 1754, where it is said to have the following qualities:

1. It is of a white colour, which, however, inclines somewhat to red.
2. Of a solid texture and shining in its fractures.
3. Its specific gravity to water is as 8,500 to 1000.
4. It is pretty fixed in the fire; but, together with the sulphur and arsenic, with which its ore abounds, it is so far volatile, as to rise in form of hairs and branches, if in the calcination it is left without being stirred.
5. It calcines to a green calx.
6. The calx is not very fusible, but, however, tinges glass of a transparent reddish-brown or jacinth colour.
7. It dissolves in aqua-fortis, aqua-regia, and the spirit of sea-salt; but more difficultly in the vitriolic acid, tinging all these solutions of a deep green colour. Its vitriol is of the same colour; but the colcothar of this vitriol, as well as the precipitates from the solutions, become by calcination of a light green colour.
8. These precipitates are dissolved by the spirit of sal ammoniac, and the solution has a blue colour; but being evaporated, and the sediment reduced, there is no copper, but a nickel regulus is produced.
9. It has a strong attraction to sulphur; so that when its calx is mixed with it, and put on a scorifying test under the muffle, it forms with the sulphur a regule: this regule resembles the yellow steel-grained copper-ores, and is hard and shining in is convex surface.
10. It unites with all the metals, except quicksilver and silver. When the nickel regulus is melted with the latter, it only adheres close to it, both the metals lying near one onother on the same plane; but they are easily separated with a hammer. Cobalt has the strongest attraction to nickel, after that of iron, and then to arsenic. The two former cannot be separated from one another but by their scorification; which is easily done, since,
11. This semimetal retains its phlogiston a long time in the fire, and its calx is reduced by the help of a very small portion of inflammable matter: it requires, however, a red heat before it can be brought into fusion, and melts a little sooner, or almost as soon, as copper or gold, consequently sooner than iron.

Nickel is found.

A. Native.

This is mentioned by Mr Rinman to have been lately met with in a mine of cobalt in Hesse. It is very heavy, and of a liver colour, that is, dark red. When pulverised and roasted under a muffle, it forms green excrescences, and smokes; but its smoke has no particular smell: and no sublimate, whether sulphureous or arsenical, can be caught. It is soluble in acids, and the solution is green; but a polished iron plate discovers no copper.

B. In form of a calx. Nickel ochre, aerated nickel.

1. Mixed with the calx of iron. This is green, and is found in form of flowers on kupfernickel.

C. Mineralised.

1. With sulphurated and arsenicated iron and cobalt; *Kupfernickel*. This is of a reddish yellow colour; and is found,
   - *a*. Of a flaggy texture.
   - *b*. Fine-grained; and
   - *c*. Scaly. These two are often from their colour confounded with the liver-coloured marcasite.
2. With the acid of vitriol. This is of a beautiful green colour, and may be extracted out of the nickel ochre, or efflorescence of the Kupfernickel.

For a full account of this semimetal, see the article. Nickel, and Chemistry-*Index*.

VII. Manganese. *Manganesium*.

The ores of this kind are in Swedish called *brunsten*; in Latin *sydereæ*, or *magnesiæ nigræ*, in order to distinguish them from the *magnesia alba officinalis*; and in French *manganese*, &c.

1. Manganese consists of a substance which gives a colour both to glasses and to the solutions of salts, or, which is the same thing, both to dry and to liquid menstrua, viz.
   - *a*. Borax, which has dissolved manganese in the fire, becomes transparent, of a reddish brown or hyacinth colour.
   - b. The microcosmic salt becomes transparent with it, of a crimson colour, and moulders in the air.
   - *c*. With the fixed alkali, in compositions of glass, it becomes violet; but if a great quantity of manganese is added, the glass is in thick lumps, and looks black.
   - *d*. When scorified with lead, the glass obtains a reddish brown colour.
   - *e*. The lixivium of deflagrated manganese is of a deep red colour.
2. It deflagrates with nitre, which is a proof that it contains some phlogiston.
3. When reckoned to be light, it weighs as much as an iron ore of the same texture.
4. When melted together with vitreous compositions, it ferments during the solution: but it ferments in a still greater degree when it is melted with the microcosmic salt.
5. It does not excite any effervescence with the nitrous acid: aqua-regia, however, extracts the colour out of the black manganese, and dissolves likewise a great portion of it, which by means of an alkali is precipitated to a white powder.

6. Such

Semi-metals. Molybdena.

6. Such colours as are communicated to glasses by manganese, are easily destroyed by the calx of arsenic or tin: they also vanish of themselves in the fire.
7. It is commonly of a loose texture, so as to colour the fingers like soot, though it is of a metallic appearance when broken.

Manganese is found,

[1.] Native; of the discovery and qualities of which, an account is given under the article MANGANESE in its alphabetical order. See also CHEMISTRY-*Index*.

[2.] Calciform.

A. Loose and friable.

a. Black; which seems to be weathered or decayed particles of the indurated kind.

B. Indurated.

1.) Pure, in form of balls, whose texture consists of concentric fibres. *Pura sphærica radiis concentratis.*

a. White; very scarce.

2.) Mixed with a small quantity of iron.

a. Black manganese, with a metallic brightness. This is the most common kind, and is employed at the glass-houses and by the potters. It is found,

1. Solid, of a flaggy texture.
2. Steel-grained.
3. Radiated.
4. Crystallised, in form of coherent hemispheres.

VIII. Molybdena.

A. Lamellar and shining, its colour similar to that of the potter's lead ore.

This substance resembles plumbago or black-lead; and has long been confounded with it, even by Cronstedt. But it possesses very different properties; in particular,

1. Its laminæ are larger, brighter: and, when thin, slightly flexible. They are of an hexagonal figure.
2. It is of a lead colour, and does not strike fire with hard steel.
3. Its specific gravity is = 4,569, according to Kirwan; and 4,7385, according to Brisson.
4. When rubbed on white paper, it leaves traces of a dark brown or bluish colour, as the plumbago or black lead does; but they are rather of an argentine gloss; by which circumstance the molybdena, according to Dr d'Arcet, may be easily distinguished from black-lead, as the traces made by this last are of a less brilliant, and of a deeper tinge.
5. In an open fire, it is almost entirely volatile and infusible. Microcosmic salt or borax scarcely affect it; but it is acted upon with much effervescence by mineral alkali, and forms with it a reddish mass, which smells of sulphur.
6. It consists of an acid of peculiar nature (see CHEMISTRY-*Index*.) united to sulphur. A small proportion of iron is commonly found in it, but this seems merely fortuitous: 100 parts of molybdena contain about 45 of this acid and 55 of sulphur.
7. It is decomposed either by detonation with nitre, or by solution in nitrous acid.
8. This acid is soluble in 570 times its weight of water in the temperature of 60; the solution reddens that of litmus, precipitates sulphur from the solution of liver of sulphur, &c. The specific gravity of the dry acid is 3,460.
9. This acid is precipitable from its solution in water by the Prussian alkali, and also by tincture of galls: the precipitate is reddish brown.
10. If this acid be distilled with three times its weight of sulphur, it reproduces molybdena.
11. The solution of this acid in water unites to fixed alkalies, and forms crystallisable salts; as it also does with calcareous earth, magnesia, and argil: these last combinations are difficultly soluble. It acts also on the base metals, and with them assumes a bluish colour.
12. This solution precipitates silver, mercury, or lead, from the nitrous acid, and lead from the marine, but not mercury.
13. It also precipitates barytes from the nitrous and marine acids, but no other earth. Molybdenous baroselenite is soluble in cold water.
14. This acid is itself soluble in the vitriolic acid by the assistance of heat; and the solution is blue when cold, though colourless while hot; it is also soluble in the marine acid, but not in the nitrous.
15. Molybdena tartar and ammoniac precipitate all metals from their solutions by a double affinity. Gold, sublimate corrosive, zinc, and manganese, are precipitated white; iron or tin, from the marine acid, brown; cobalt, red; copper, blue; alum and calcareous earth, white.
16. This acid has been lately reduced by Mr Hielm; but the properties of the regulus thus obtained are not yet published.
17. Mr Pelletier obtained also the regulus or molybdena, by mixing its powder with oil into a paste, and exposing it with powdered charcoal in a crucible to a very violent fire for two hours. See CHEMISTRY-*Index*, n° 14, 97.
18. This semimetal being urged by a strong fire for an hour, produces a kind of silvery flowers, like those of antimony.
19. Molybdena is said to be soluble in melted sulphur; which seems highly probable, as sulphur is one of its component parts.

See Farther the article MOLYBDENA, and CHEMISTRY-*Index*.

Semi-metals. Wolfram.

IX. Wolfram. *Wolfranum, Spuma Lupi*, Lat. See the detached article WOLFRAM.

This mineral has the appearance of manganese, blended with a small quantity of iron and tin.

1. With coarse fibres.

a. Of an iron-colour, from Altenberg in Saxony. This gives to the glass compositions, and also to borax and the microcosmic salt, an opaque whitish yellow colour, which at last vanishes.

X. Siderite. } See those words in the order of the
XI. Saturnite. } alphabet.

Ap-

APPENDIX.

Of Saxa and Petrifactions.

THOUGH the *Saxa*, and fossils commonly called *Petrifactions*, cannot, in strictness, be ranked in a mineral system, for the reasons formerly given; yet as these bodies, especially the latter, occupy so considerable a place in most mineral collections, and the former must necessarily be taken notice of by the miners in the observations they make in subterranean geography, it appeared proper to subjoin them in such an order as might answer the purpose for which they are regarded by miners and mineralogists.

Order I. Saxa. *Petræ.*

These may be divided into two kinds.

1. Compound saxa, are stones whose particles, consisting of different substances, are so exactly fitted and joined together, that no empty space, or even cement, can be perceived between them; which seems to indicate, that some, if not all, of these substances have been soft at the instant of their union.

2. Conglutinated stones, are stones whose particles have been united by some cementitious substance, which, however, is seldom perceivable, and which often has not been sufficient to fill every space between the particles: in this case the particles seem to have been hard, worn off, and in loose, single, unfigured pieces, before they were united.

I. Compound saxa.

A. Ophites. Scaly limestone with kernels or bits of serpentine stone in it.

1. *Kolmord marble.* It is white and green.
2. *Serpentino antico*, is white, with round pieces of black steatites in it. This must not be confounded with the *serpentino verde antico.*
3. The *Haraldsio marble.* White, with quadrangular pieces of a black steatites.
4. The *marmor pozzevera di Genova.* Dark green marble, with white veins. This kind receives its fine polish and appearance from the serpentine stone.

B. Stellsten or *gestelstein.* Granitello.

1. Of distinct particles. In some of these the quartzose particles predominate, and in others the micaceous: in the last case it is commonly slaty, and easy to split.
2. Of particles which are wrapt up in one another.
   a. Whitish grey.
   b. Greenish.
   c. Reddish.

C. Norrka. Murksten of the Swedes. *Saxum compositum mica, quartzo, et granato.*

1. With distinct garnets or shirl.
   a. Light grey.
   b. Dark grey.
   c. Dark grey, with prismatical, radiated, or fibrous cockle or shirl.
2. With kernels of garnet-stone.
   a. Of pale red garnet stone.

The first of this kind, whose slaty strata makes it commonly easy to be split, is employed for mill-stones, which may without difficulty be accomplished, if sand is first ground with them; because the sand wearing away the micaceous particles on the surfaces, and leaving the garnets predominant, renders the stone fitter for grinding the corn.

D. The whetstone, *Cos. Saxum compositum mica, quartzo, et forsan argilla martiali in nonnullis speciebus.*

1. Of coarse particles.
   a. White.
   b. Light grey.
2. Of fine particles.
   a. Liver-brown colour.
   b. Blackish grey.
   c. Light grey.
   d. Black. The table-slate, or that kind used for large tables and for school slates.
3. Of very minute and closely combined particles. The Turkey-stone *. This is of an olive colour, and seems to be the finest mixture of the first species of this genus. The best of this sort come from the Levant, and are pretty dear. The whetstone kinds, when they split easily and in thin plates, are very fit to cover houses with, though most of them are without those properties.

* See V. (p. 86. col. 1.)

F. Porphyry; *Porphyrites.* Italorum *porfido. Saxum compositum jaspide et feltspato, interdum mica et basalte* (D). See the article Porphyry.

a. Its colour is green, with light-green feltspat, *Serpentino verde antico.* It is said to have been brought from Egypt to Rome, from which latter place the specimens of it now come.
b. Deep red, with white feltspat.
c. Black, with white and red feltspat.
d. Reddish brown, with light red and white feltspat.
e. Dark grey, with white grains of feltspat also. The dark red porphyry has been most employed for ornaments in building; yet it is not the only one known by the name

(D) Great part of the hill of Bineves in Lochaber is composed of a kind of porphyry. It is remarkably fine, beautiful, and of an elegant reddish colour; "in which (says Mr Williams) the pale rose, the blush, and the yellowish white colours, are finely blended and shaded through the body of the stone; which is of a jelly like texture, and is undoubtedly one of the finest and most elegant stones in the world. On this hill also is found a kind of porphyry of a greenish colour, with a tinge of brownish red. It is smooth, compact, and heavy; of a close uniform texture, but has no brightness when broken. It has angular specks in it of a white quartzy substance."

name of *porfido*, the Italians applying the same name also to the black kind.

G. The *trapp* of the Swedes. *Saxum compositum jaspide martiali molli, seu argilla martiali indurata.* See the article Trapp.

This kind of stone sometimes constitutes or forms whole mountains; as, for example, the mountain called *Hunneberg* in the province of Westergotland, and at Drammen in Norway; but it is oftener found in form of veins in mountains of another kind, running commonly in a serpentine manner, contrary or across to the direction of the rock itself. It is not homogeneous, as may be plainly seen at those places where it is not pressed close together; but where it is pressed close it seems to be perfectly free from heterogeneous substances.—When this kind is very coarse, it is interspersed with feltspat; but it is not known if the finer sorts likewise contain any of it. Besides this, there are also some fibrous particles in it, and something that resembles a calcareous spar; this, however, does not ferment with acids, but melts as easy as the stone itself, which becomes a black solid glass in the fire. By calcination it becomes red, and yields in assays 12 or more *per cent.* of iron. No other sort of ore is to be found in it, unless now and then somewhat merely superficial lies in its fissures; for this stone is commonly, even to a great depth in the rock, cracked in acute angles, or in form of large rhomboidal dice. It is employed at the glass houses, and added to the composition of which bottles are made. In the air it decays a little, leaving a powder of a brown colour; it cracks commonly in the fire, and becomes reddish brown if made red-hot. It is found,

1. Of coarse chaffy particles.
   a. Dark grey.
   b. Black.
2. Coarse-grained.
   a. Dark grey.
   b. Reddish.
   c. Deep brown.
3. Of fine imperceptible particles.
   a. Black. The touchstone; *Lapis lydius.*
   b. Bluish.
   c. Grey.
   d. Reddish.

The black variety (3. *a.*) is sometimes found so compact and hard, as to take a polish like the black agate: it melts, however, in the fire to a black glass; and is, when calcined, attracted by the load-stone.

H. Amygdaloides. The carpolithi or fruit-stone rocks of the Germans.

It is a martial jasper, in which elliptical kernels of calcareous spar and serpentine stone are included.

a. Red, with kernels of white limestone, and of a green steatites. This is of a particular appearance, and when calcined is attracted by the loadstone; it decays pretty much in the air, and has some affinity with the trapp, and also with the porphyry. There are sometimes found pieces of native copper in this stone.

I. The *gronsten* of the Swedes.

Its basis is horneblende, interspersed with mica. It is of a dark green colour, and in Smoland is employed in the iron furnaces as a flux to the bog-ore.

K. The granite. *Saxum compositum feltspata, mica et quartzo, quibus accidentaliter interdum horneblende steatites, granatus et basaltes immixti sunt.* Its principal constituent parts are felt spat, or rhombic quartz, mica, and quartz. See the article Granite.

It is found,

(1.) Loose or friable. This is used at the Swedish brass-works to cast the brass in, and comes from France.

(2.) Hard and compact.
   a. Red.
      1. Fine-grained;
      2. Coarse-grained.
   b. Grey, with many and various colours (E).

II. Con-

(E) Mr Wiegleb has analysed a species of green granite found in Saxony. The crystals are heaped together, and form very compact layers; the colour sometimes an olive green, sometimes resembling a pear, and sometimes of a reddish brown: some of them being perfectly transparent, and others nearly so. According to Mr Warren, they contain 25 per cent. of iron; whence they have been called green ore of iron. An ounce of these crystals heated red hot in a crucible lost two grains in weight, and became of the colour of honey. The remainder was put into a retort, and distilled with marine acid, with which it evidently effervesced. The residuum was lixiviated with distilled water, fresh muriatic acid added, and the distillation and lixiviation repeated. The iron precipitated from this lixivium, and reduced partly to its metallic state, weighed two drachms. M. Wiegleb concludes, that the specimen contained two drams $26\frac{1}{2}$ grains of lime. From further experiments he concludes, that 100 parts of the substance contained 36.5 of siliceous earth; lime 30.8; iron 28.7; and water and fixed air 4.0.

Scotland is remarkable for a great number of excellent granites, little or nothing inferior to porphyry. Of these the following kinds are mentioned by Mr Williams.

1. The grey granite, or *moor-stone* as it is called in Cornwall, is very common in this country. In some places it shows no marks of strata; and in others it is disposed in thick unwieldly irregular beds, which are commonly broken transversely into huge masses or blocks of various sizes and shapes. There is a great variety in this kind of stones; some of them differing but little in appearance from basaltes; others are composed of almost equal parts of black and white grains, about the size of small pease, whence it is called *peasy whin* by the

II. Conglutinated faxa.

A. Of larger or broken pieces of ftones of the fame kinds conglutinated together. *Breccia.*

1. Of limeftone cemented by lime.

a. Calcareous breccia; the *marmi brecciati* of the Italians.

When thefe kinds have fine colours, they are polifhed and employed for ornaments in architecture and other œconomical ufes.

b. The *lumachella* of the Italians, or fhell marbles. Thefe are a compound of fhells and corals, which are petrified or changed into lime, and conglutinated with a calcareous fubftance When they have many colours, they

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the common people. In Galloway and other places it frequently has a longitudinal grain, as if the component parts had been all moved one way by a gentle flow of water. When this kind of granite begins to undergo a fpontaneous decompofition by expofure to the atmofphere, we obferve that it is compofed of pretty large grains of the figures of cubes, rhomboids, &c. fome of them fo large as to deferve the name of fragments; and the largeft of thefe are always of quartz or feldfpath, and talc.

2. Reddifh granite, of a gellied texture, which, Mr Williams fays, is one of the fineft and moft elegant ftones in the world. The mountains of Bineves, he fays, are principally compofed of this ftone; and it is found in great abundance in many other parts of Scotland, but he never faw it exhibit any marks of ftratification.

3. The fine reddifh granites, in which feveral fine fhades of colours are blended together, not fpread out in tints as in the former. Neither this nor the former are ftratified: "On the contrary (fays our author), both exhibit fuch a degree of uniform regularity, that in fome places there is no difference between a ftone and a mountain, excepting only in magnitude; as many mountains of granite are nothing more than one regularly uniform mafs throughout, in which not the leaft mark of a bed is to be feen, nor hardly a crack or fiffure, unlefs it be at the edge of fome precipice or declivity. Thefe two varieties of elegant red granite are met with in the Highlands and Lowlands of Scotland, in Galloway, and many other places. We often find maffes of talc fo large in this fecond variety, that fome of them may be called fragments, not difpofed in any order, but higgledy-piggledy through the body of the ftone.

4. Stratified reddifh granite, refembling the third in colour and quality, but not always quite fo pure or free from admixture of other ftony matter of a different quality. This variety frequently contains larger and fmaller fragments of fine laminated talc. Mr Williams, however, has feen this kind of granite difpofed in pretty regular ftrata in the fhires of Moray and Nairn, and other parts of Scotland.

5. Granite of a white and whitifh colour, generally of a granulated texture, containing a great quantity of mica, or fmall-leaved talc, and the grains of quartz fometimes large and angular. This variety is fubject to fpontaneous decompofition; part frequently diffolves and falls into lakes, in fuch an exceedingly fine and attenuated ftate, that it does not fink in the water. "I have found (fays Mr Williams) this fubftance in many places where water had been accidentally drained off, refembling fine fhell marle, only much lighter. When thoroughly dry, it is the lighteft foffile fubftance I ever handled; and, when blanched with rain, it is as white as fnow. This variety of granite is either not ftratified, or exhibits thick irregular beds. It frequently contains a confiderable quantity of talc, in maffes and fcales too large to be called mica."

Our author is of opinion, that this fine white fubftance produced from the decompofition of the granite, is the true kaolin of the Chinefe, one of the component parts of porcelain ware. "The authors of the Hiftory of China (fays he) informs us, that the fine procelain ware is compofed of two different foffile fubftances, called by them *petuntfe* and *kaolin*. We are further told, that the petuntfe is a fine white vitrefcible ftone, compact and ponderous, and of confiderable brightnefs in the infide when broken, which they grind to a fine powder; and that the kaolin is not a ftone, but a fine white earthy fubftance, not vitrifiable, at leaft not in the heat of a common potter's furnace; that they mix the kaolin and the flour of the petuntfe together, and form a pafte of this mixture, which they mould into all forts of porcelain veffels. Now, from the beft accounts of of this matter which I have been able to obtain, after a good deal of fearch and inquiry, it appears to me, that the fediment which I have mentioned above is the true kaolin; and that as the fine white glaffy quartz, which is found in irregular maffes, and in irregular difcontinuous veins or ribs, in fome of the rocks of fchiftus, is the true petuntfe; and if this obfervation is really true, it deferves to be remarked, that Scotland is as well furnifhed with the beft materials for making fine porcelain as moft countries in the world. The fpecies of quartz which I fuppofe to be petuntfe is of a pure fine uniform glaffy texture, femitranfparent, and of a pure fnowy whitenefs. A broken piece of this ftone, and a newly broken piece of fine porcelain, are very like one another. There is a great quantity of petuntfe, or pure white quartz, in many places of Scotland, particularly in the north and Highlands. There is a confiderable quantity of it upon the fhore and wafhed by the tide between Banff and Cullen, generally in pretty large maffes in rocks of bluifh fchiftus; and to the beft of my memory it is very fine of the kind. There is alfo a confiderable quantity of it in difcontinous ribs and maffes, in rocks of blue fchift, about three or four miles north of Callendar in Monteith, upon the fide of the high road which runs parallel to Lochleodunich, which I think alfo very fine. In fome places this fort of quartz is tinged with a flefh colour from the neighbourhood of iron, which renders it unfit for porcelain; but there is plenty to be found of a pure white in almoft all parts of Scotland, without any mineral tinge whatever. The kaolin is perhaps as plentiful in Scotland as the petuntfe, there being many extenfive lakes eafily drained, which contain a confiderable depth of it; and moreover, it is to be found in many places that have been lakes, which are now laid dry by accident. There is a quantity of kaolin about they are called *marbles*, and employed for the same purposes as the preceding (F).

2. Of kernels of jasper cemented by a jaspery substance. *Breccia jaspidia: Diaspro brecciato* of the Italians.

Of this kind specimens from Italy are seen in collections. A coarse jasper breccia is said to be found not far from Frejus in Provence in France.

3. Of siliceous pebbles, cemented by a jaspery substance,

100 yards below the high road upon the south side of a bridge, about a mile and a half or two miles south of the inn of Aviemore in the Highlands. It lies beneath a stratum of peat bog, in a place which has been a lake, but is now drained by the river Spey cutting through one side of the mound which formed the lake.—There is more than one stratum of the kaolin in this place, and some of it is exceedingly white, especially when blanched by the rain; and there is a white granite rock up the rivulet, at some distance above the bridge, the decomposition and dissolution of which is supposed to produce this fine and curious sediment. Several lakes in the Highlands of Scotland are nearly full of kaolin. One of them is situated in the country of Stratherig in Inverness-shire, less than a mile north of the public road, and upon the west side of the farm of Drimin. It is a pretty long lake, and there is a considerable depth of kaolin in it, which may be drained at a moderate expence; and, if I remember well, the granite rocks which surround it are pretty white and fine. If the kaolin originates from coloured granite, it is good for nothing, especially if it contains the least tinge of iron, because this will discolour and spoil the beauty of the porcelain; but wherever white granite is found composed of quartz, feldspath, and mica, without any admixture of shirl, and especially iron, the kaolin should be diligently sought after in that neighbourhood. Lochdoon, in Galloway, is said to contain a great quantity of kaolin. It was drained some years ago on the supposition of its containing shell marle; but on trying the substance contained in it, it was found not to be marle but kaolin. These substances may easily be mistaken for one another at first; but they are easily distinguished by trying them with acids, the marle readily effervescing with the weakest, and the kaolin not at all with the strongest acid liquors."

6. Grey composite granite is a very beautiful stone, and when broken looks as if composed of small fragments of various sizes and shapes, not unlike calve's-head jelly. When polished, the fragments appear as if set or inlaid in a fine pellucid or water coloured matter. There is a single stratum of very curious composite granite, a little to the west of Lossiemouth, in the county of Moray, in Scotland, of about six or eight feet thick. It is composed chiefly of grains and fragments of various bright and elegant colours, most of which are as large as pease and beans, all fine, hard, and semipellucid; there is about an eighth part of good lead ore in the composition of this stone, of the kind commonly called potter's ore; and it is likewise remarkable, that there is no other granite in that neighbourhood but this single stratum, all the strata above and below it being mostly a coarse, imperfect, grey sand-stone.

7. Granite of a loose friable texture, subject to spontaneous decomposition, and reduction to granite gravel. There is a remarkable rock of this kind near the Queen's-ferry in Scotland, on the road to Edinburgh, which appears in prodigious thick irregular strata. This rock seems to be composed chiefly of quartz, shirl, and some iron; and produces excellent materials for the high roads.

8. In many parts of the north of Scotland, in the Highlands, and in Galloway, there is found an excellent species of grey granite, composed chiefly of red and black coloured grains. This is a fine and very durable stone, very fit for all kinds of architecture.

In speaking of these stones, Mr Williams observes, that the finer and most elegant red granites, and the finest granite-like porphyries, so much resemble one another, that he does not attempt to distinguish them; and Scotland is remarkable for a great number and variety of them. "The elegant reddish granite of Bineves, near Fort William (says he), is perhaps the best and most beautiful in the world; and there is enough of it to serve all the kingdoms on earth, though they were all as fond of granite as ancient Egypt. There are extensive rocks of red granite upon the sea-shore to the west of the ferry of Ballachylish in Appin, and likewise at Strontian, as well as many other parts of Argyleshire. I have seen beautiful red granite by the road side, near Dingwall, and in several other parts of the north of Scotland, which had been blown to pieces with gunpowder, and turned off the fields. There are extensive rocks of reddish granite about Peterhead and Slains, and both of red and grey granite in the neighbourhood of Aberdeen. The hill of Cruffel in Galloway, and several lower hills and extensive rocks in that neighbourhood, are of red and grey granite, where there are great varieties of that stone, and many of them excellent. Upon the sea shore near Kinnedore, west of Lossiemouth, in Moray, there is a bed of stone about eight feet thick, which I think should be called a composite granite. It is composed of large grains, or rather small pieces of bright and beautiful stones of many different colours; and all the stony parts are exceedingly hard, and fit to receive the highest polish. About a sixth or eighth part of it also consists of lead ore, of that species called potter's ore. The separate stony parts composing this stratum are all hard, fine, solid, and capable of the most brilliant polish; and if solid blocks can be raised free from all cracks and blemishes, I imagine, from the beauty and variety of colours of the stony part, and the quantity of bright lead ore which is blended through the composition and body of the stone, that this would be a very curious and beautiful stone when polished."

(F) The stones called *Ludi Helmontii* or *Paracelsi*, have some similarity in their form to the *brecciæ, a. b.*: for they are composed of various lumps of a marly whitish-brown matter, separated into a great number of polygonous compartments, of various sizes, formed of a whitish-yellow crust of a red calcareous spar, sometimes substance, or something like it. The plum-pudding stone of the English; *Breccia silicea.* Its basis, which at the same time is the cement, is yellow; wherein are contained single flinty or agaty pebbles, of a grey colour or variegated. This is of a very elegant appearance when cut and polished: it is found in England and Scotland (G).

4. Of quartzose kernels combined with an unknown cement. *Breccia quartzosa.*

5. Of kernels of several different kinds of stones. *Breccia saxosa.*

a. Of kernels of porphyry, cemented by a porphyry or coarse jaspery substance; *Breccia porphyrea.*

b. Of kernels of several saxa; *Breccia indeterminata.*

c. Of conglutinated kernels of sandstone; *Breccia arenacea.* This kind consists of sandstone kernels, which have been combined a second time together.

The abovementioned brecciæ of themselves must demand the distinctions here made between, but which perhaps may seem to be carried too far,

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times pyritous, which often rise a little above the external surface, and inclose each of them on the inside. According to Bomare, the *ludus stellatus helmontii,* found in the county of Kent, is covered with a kind of striated selenite resembling the zeolite. They are for the most part of a globose figure, seldom flat, but often convex on the outside; and sometimes with a concave surface.

According to Wallerius, the *ludus helmontii* loses by calcination about half of its weight; and, on being urged by fire, is melted into a black glassy slag. It effervesces strongly with aqua-fortis, and this solution is of a yellow colour. But what seems very extraordinary, by adding to it some oil of tartar *per deliquium,* bubbles are produced, from which a great number of slender black threads or filaments are produced, sticking like a cobweb to the sides and bottom of the vessel.

These stones are found quite separate by themselves, as well as various stalagmites and crustaceous bodies, on the strata of argillaceous earth, in various parts of Europe, chiefly in Lorrain, Italy, England (in the counties of Middlesex and Kent), and elsewhere.

Wallerius ranges the *ludus helmontii* among the *tophi,* in the Spec. 425. of his system of Mineralogy. Paracelsus had attributed to these stones a lithontriptic power, and Dr Grew says that they are diuretic; but there is not the least proof of their really possessing such qualities.

(G) The breccia stratum, or plumpudding-rock, exhibits a singular appearance as it lies in the ground; being composed of water-rounded stones of all qualities and of all sizes, from small gravel up to large rounded stones of several hundreds weight each; the interstices being filled up with lime and sand. It frequently also contains lime and iron. Sometimes it exhibits a grotesque and formidable appearance; containing many large bullets of various sizes and shapes, without any marks of regular stratification, but looking like one vast mass of bullets of unequal thickness; and in this manner frequently swelled to the size of a considerable mountain. It is frequently cemented very strongly together; so that parts of the hills composed of it will frequently overhang in dreadful precipices, less apt to break off than other rocks in the same situation; one reason for which, besides the strength of the cement, is, that the breccia, when composed of bullets, is less subject to fissures and cutters than other rocks; being frequently found in one solid mass of great extent and thickness. Some of the plumpudding-rocks are made up of smaller parts, coming near to the size of coarse gravel. It is evident however, that all the parts of the breccia, whether coarse or fine, have been rounded by agitation in water, as the rocks differ nothing in appearance from the coarser and finer gravel found upon the beach of the sea, excepting only that the parts are strongly cemented together in the rocks, and are loose upon the shores of the ocean.

Some of the breccia is composed of finely rounded stones of various and beautiful colours, about the size of plums or nuts, all very hard and fine. Were this species sawed and polished, it would appear as beautiful and elegant as any stone in Europe; much resembling mosaic work in small patterns.

In general, the breccia is regularly stratified or not according to the size of the component parts of the stone. Such rocks as are composed of round gravel and small bullets are generally very regular in their stratification, while those which contain bullets somewhat larger in size are commonly disposed in thick and coarse beds, and such rocks as are made up of the largest kind of bullets seldom show any marks of stratification at all.

Among many other places in Scotland, where breccia or pudding-stone abounds, there are extensive rocks and high cliffs of it upon the south shore at the west end of the Pentland Frith, to the westward of Thurso in Caithness, which stretch quite across the county of Caithness into Sutherland; and in Sutherland as well as Caithness, this rock is of a rough contexture, and appears in pretty high hills, deep glens, overhanging rocks, and frightful precipices, to the west of Brora, Dunrobin, and Dornoch, which gives it a grotesque and formidable appearance in that country. This range of breccia stretches also quite through Sutherland, and likewise through Rossshire, the west side of Ferndonald, and Dingwall, where it exhibits the very same phenomena as in Sutherland and in Caithness. It continues the same longitudinal line of bearing, which is nearly from north-east to south-west, quite through the highland countries of Inverness and Perthshire; and it forms considerable hills, and very high and rugged rocks, upon both sides of that beautiful piece of fresh water Lochness. Much of the stone here as well as in other places in this range, is composed of large bullets; the rock is very hard and strong, and it hangs in frighthful precipices upon both sides of the lake, through which rock General far, since their particles are so big and plain as to be easily known from one another. These stones are a proof both of the subversions which the mountains in many centuries have undergone, and of some hidden means which nature makes use of in thus cementing different kinds of stones together. Any certain bigness for the kernels or lumps in such compounds, before they deserve the name of *breccia*, cannot be determined, because that depends on a comparison which every one is at liberty to imagine. In some places, the kernels of porphyry have a diameter of six feet, while in others they are no bigger than walnuts. Sometimes they have a progressive size down to that of a find sandstone. Most of this kind of stone is fit for ornaments, though the workmanship is very difficult and costly.

B. Conglutinated stones of granules or sands of different kinds. Sandstone; *Lapis arenaceus*.

In this division are reckoned those which consist of such minute particles, that all of them cannot easily be discovered by the naked eye. The greatest part, however, consist of quartz and mica; which substances are the most fit to be granulated, without being brought to a powder.

1. Cemented by clay.
   a. With an apyrous or refractory clay. This is of a loose texture; but hardens, and is very refractory in the fire.
   b. With common clay.
2. With lime; resembles mortar made with coarse sand.
   a. Consisting of transparent and greenish grains of quartz and white limestone.
   b. Of no visible particles. This is of a loose texture, and hardens in the air.
3. With an unknown cement.
   a. Loose.
   b. Harder.
   c. Compact.
   d. Very hard.
4. Cemented by the rust or ochre of iron. Is found in form of loose stones at several places, and ought perhaps to be reckoned among the *mineræ arenaceæ* or sand ores; at least when the martial ochre makes any considerable portion of the whole.
5. Grit-stone. This is of greater or less hardness, mostly of a grey, and sometimes of a yellowish colour; composed of a siliceous and micaceous sand, and rarely of a sparry kind, with greater or lesser particles closely compacted and united by an argillaceous cement. It gives some sparks with steel, is indissoluble for the most part in acids, and vitrifiable in a strong fire. It is used for millstones and whetstones, sometimes for filtering stones and for building. *Fabroni*.

   N. B. The *argillaceous* girt has been before described, p. 89. col. 1.
6. Elastic. A singular species of sandstone, of which a specimen was shown some years ago to the Royal Academy of Sciences at Paris by the Baron de Dietrich. It is flexible and elastic; and consists of small grains of hard quartz, that strike fire with tempered steel, together with some micaceous mixture. The elasticity seems to depend on the micaceous part, and softness of the natural gluten between both. It is said, that this elastic stone was found in Brazil, and brought to Germany by his excellency the Marquis de Lavradio.

   There are also two tables of white marble, kept in the palace Borghese at Rome, which have the same property, But the sparry particles of their substance, though transparent, are rather soft; may be easily separated with the nail, and effervesce with aqua-fortis; and there is also in it a little mixture of small particles of talc or mica. Se *Journ. de Phys.* for Oct. 1784, p. 275. See also the article Marble (*Elastic.*)

C. Stones and ores cemented together; *Mineræ arenaceæ*.

1. Of larger fragments.
   a. Mountain green, or *viride montanum cupri*, and pebbles cemented together, from Siberia.
   b. Potters lead-ore, with limestone, slate-kernels, and shells.
   c. Yellow or marcasitical copper ore, with small pebbles.
2. Of smaller pieces.
   a. Potter's lead-ore with a quartzose sand.
   b. Mountain green with sand from Siberia.
   c. Cobalt ore with sand.
   d. Martial ochre with sand.

Order II. Mineral changes, or Petrifactions.

These are mineral bodies in the form of animals or vegetables, and for this reason no others belong to this order than such as have been really changed from the subjects of the other two kingdoms of nature.

I. Earthy changes; *Terræ larvatæ*.

A. Extraneous bodies changed into a lime substance, or calcareous changes; *Larvæ calcareæ*.

(1.) Loose or friable. Chalky changes; *Cretæ larvatæ*.

a. In

neral Wade cut a fine military road upon the south side of the lake, at a great expence of time, labour, and gunpowder. These rocks are seen stretching through the mountains of Stratherig into Badenoch, where it forms a remarkable rock and precipice called *Craigdow* or the *Black Rock*. The same range is again seen farther towards the south-west, in several places to the south of the Black Mount, and in the country of Glenorchy in Argyleshire: and Mr Williams supposes, that the longitudinal line of this rock, so far as it has been just pointed out, is little less than 200 miles, and in some places it spreads eight or ten miles in what may be called the latitudinal line across the bearing of the rocks.

a. In form of vegetables.
b. In form of animals.
1. Calcined or mouldered shells; *Humus conchaceus*.
(2.) Indurated; *Petrifacta calcarea*.
a. Changed and filled with solid limestone.
1. In form of animals.
2. In form of vegetables.
b. Changed into a calcareous spar; *Petrifacta calcarea spatosa*.
1. In form of animals.
2. In form of vegetables.

B. Extraneous bodies changed into a flinty substance. Siliceous changes; *Larvæ siliceæ*. These are, like the flint,
(1) Indurated.
a. Changed into flints.
1. Carnelians in form of shells, from the river Tomm in Siberia.
2. Agat in form of wood. Such a piece is said to be in the collection of Count Tessin.
3. Coralloids of white flint, (*Millepora*.)
4. Wood of yellow flint.

C. Extraneous bodies changed into clay. Argillaceous changes; *Larvæ argillaceæ*.
A. Loose and friable.
1. Of porcelain clay.
a. In form of vegetables.
A piece of white porcelain clay from Japan, with all the marks of the root of a tree, has been observed in a certain collection.
B. Indurated,
1. In an unknown clay.
a. In form of vegetables. *Osteocolla*. It is said to be changed roots of the poplar tree, and not to consist of any calcareous substance.
A sort of fossile ivory is said to be found, which has the properties of a clay; but it is doubtful if it has been rightly examined.

II. Saline extraneous bodies, or such as are penetrated by mineral salts. *Corpora peregrina insalita*. *Larvæ insalitæ*.
A. With the vitriol of iron.
1. Animals.
a. Human bodies have been twice found in the mine at Falun in Dalarne; the last was kept a good many years in a glass-case, but began at last to moulder and fall to pieces.
2. Vegetables.
a. Turf, and
b. Roots of trees.
These are found in water strongly impregnated with vitriol. They do not burn with a flame, but only like coal in a strong fire; neither do they decay in the air.

III. Extraneous bodies penetrated by mineral inflammable substances, or mineral phlogstion.
A. Penetrated by the substance of pit-coals.
1. Vegetables, which commonly have been woods, or appertaining to them.
a. Fully saturated. *Gagas*, Jet. (See p. 104. col. 2.) The jet is of a solid shining texture.
b. Not perfectly saturated; *Mumia vegetabilis*. It is loose; resembles umber, and may used as such.
B. Penetrated by rock-oil or asphaltum.
1. Vegetables.
a. Turf.
The Egyptian mummies cannot have any place here, since art alone is the occasion that those human bodies have in length of time been penetrated by the asphaltum, in the same manner as has happened naturally to the wood in pit coal strata. See MUMMY.
C. Penetrated by sulphur which has dissolved iron, or by marcasite and pyrites. *Pyrite impregnata. Petrifacta pyritacea*.
1. Animals.
a. Human.
b. Bivalves.
c. Univalves.
d. Insects.

IV. Metals in form of extraneous bodies; *Larvæ metalliferæ*.
A. Silver; *Larvæ argentiferæ*.
(1.) Native.
a. On the surfaces of shells.
(2.) Mineralised with copper and sulphur.
a. Fahlertz, or grey silver ore in form of ears of corn, &c. and supposed to be vegetables, are found in argillaceous slate at Frankenberg and Tahlitteren in Hesse.
B. Copper; *Larvæ cupriferæ*.
(1.) Copper in form of calx.
a. In form of animals, or of parts belonging to them.
1. Ivory and other bones of the elephant. The Turcois or Turquoise; which is of a bluish green colour, and much valued in the east.
At Simore in Languedoc bones of animals are dug, which during the calcination assume a blue colour; but it is not probable that the blue colour is owing to copper.
(2.) Mineralised copper, which impregnates extraneous bodies; *Cuprum mineralisatum corpora peregrina ingressum*.
A. With sulphur and iron. The yellow or marcasitical copper ore that impregnates.
1. Animals.
a. Shells.
b. In form of fish.
B. With sulphur and silver. Grey silver ore or fahlerts, like ears of corn, from the slatequaries in Hesse.
C. Changes into iron; *Larvæ ferriferæ*.
(1.) Iron in form of calx, which has assumed the place or the shape of extraneous bodies; *Ferrum calciforme corpora peregrina ingressum*.
a. Loose; *Larve ochraceæ*.
1. Of vegetables.
Roots of trees, from the lake Langelma in Finland. See the acts of the Swedish Academy of Sciences for the year 1742.

b. Indu-

b. Indurated; *Larvæ hæmatiticæ.*

1. Of vegetables.

(2.) Iron mineralised, assuming the shape of extraneous bodies.

a. Mineralised with sulphur. Marcasite. *Larvæ pyritaceæ.*

V. Extraneous bodies decomposing, or in a way of destruction; *Corpora peregrina in gradibus destructionis considerata.* Mould; *Humus.* Turf; *Turba.*

A. From animals. Animal-mould; *Humus animalis.*

1. Shells. *Humus conchaceus.*

2. Mould of other animals; *Humus diversorum animalium.*

B. Vegetable mould; *Humus vegetabilis.*

1. Turf; *Turba.*

a. Solid, and hardening in the air; *Turba solida aere indurescens.* This is the best of the kind to be used for fuel, and comes nearest to the pit-coals. It often contains a little of the vitriolic acid.

b. Lamelated turf; *Turba foliata.* This is in the first degree of destruction.

2. Mould of lakes; *Humus lacustris.* This is a black mould which is edulcorated by water.

3. Black mould; *Humus ater.* This is universally known, and covers the surface of that loose earth in which vegetables thrive best.

Order III. Volcanic Products (h)

I. Slags; *Scoriæ vulcanorum.*

Slags are found in great abundance in many places of the world, not only where volcanoes yet exist, but likewise where no subterraneous fire is now known: Yet, in Mr Cronstedt's opinion, they cannot be produced but by means of fire. These are not properly to be called *natural,* since they have marks of violence, and of the last change that mineral bodies can suffer without the destruction of the world: nor are they *artificial,* according to the universally received meaning of this word. We cannot, however, avoid giving them a place here, especially after having admitted the petrifactions; and shall therefore arrange the principal of them, according to their external marks.

A. Iceland agate; *Achates islandicus niger.*

It is black, solid, and of a glassy texture; but in thin pieces it is greenish and semitransparent like glass-bottles, which contain much iron. The most remarkable circumstance is, that such large solid masses are found of it, that there is no possibility of producing the like in any glass-house.

It is found in Iceland, and in the island of Ascension: The jewellers employ it as an agate, though it is too soft to resist wear.

B. Rhenish millstone; *Lapis molaris Rhenanus.*

Is blackish-grey, porous, and perfectly resembles a sort of slag produced by mount Vesuvius. A variety of lava, according to Kirwan.

C. Pumice-stone; *Pumex.*

It is very porous and blistered, in consequence of which it is specifically very light. It resembles that frothy slag which is produced in the iron furnaces.

1. White.

2. Black.

The colour of the first is perhaps faded or bleached, because the second kind comes in that state from the laboratory itself, *viz.* the volcanoes.

D. Pearl slag; *Scoriæ constantes globulis vitreis conglomeratis.*

It is compounded of white and greenish glass particles, which seem to have been conglutinated while yet soft or in fusion. Found on the Isle of Ascension.

E. Slag-sand or ashes; *Scoriæ pulverulentæ, cineres vulcanorum.*

This is thrown out from volcanoes in form of larger or smaller grains. It may perhaps be the principle of the Terra Puzzolana; because such an earth is said at this time to cover the ruins of Herculaneum near Naples, which history informs us was destroyed by a volcano during an earthquake

II. Lavas.

Lava has been generally understood to denote the aggregate mass of melted matters which flow out of the mouths, or burst out from the sides, of burning mountains. According to Mr Kirwan, however, lavas are the immediate produce of liquefaction or vitrification by the volcanic fires, and "should carefully be distinguished from the subsequent productions affected by the water either in a liquid or fluid state, which generally is ejected at the same time." And of lavas, so distinguished, he describes several varieties. See the article Lava, in the order of the alphabet; where the nature, origin, kinds, and phenomena of lavas, are copiously described and explained.

III. Basaltes.

This sort of stone was by Cronstedt, in the first edition of his Mineralogy, ranked among the garnet earths, and confounded with the shoerls; an impropriety which was pointed out by Bergman in his *Sciagraphia,* sect. 120.—Mr Kirwan considers basaltes as an imperfect lava, and ascribes its origin both to fire and water. He describes it as found, either, 1. In opaque triangular or polyangular columns; which is the proper basaltes: Or, 2. In amorphous masses of different magnitudes; forming solid blocks, from the smallest size to that of whole mountains: which kind is called *trapp.* See the detached article Basaltes (i); where its species and varieties

(h) For the nature, history, theory, &c. of volcanoes, see the article Volcano.

(i) In that article, p. 46. col. 1. l. 9. *dele* the words, "The English miners call it *cockle,* the German *schoerl.*" —P 47 col. 2. l. 28. for "a kind of marble," read "a volcanic production." The *Lapis Lydius,* or Touchstone, mentioned in the same paragraph, should have been specified to be of the sort called *Trapp.*

rieties are particularly described, and different opinions stated concerning its formation. See also the article Trapp.—Some plausible arguments against the volcanic origin of basaltes will be mentioned in the course of the subjoined note (K), extracted from *Williams's Natural History of the Mineral Kingdom.*

Appendix. Volcanic Products

(K) There is a great variety of basaltes in Scotland, particularly of the grey kinds; some of which are capable of the highest degree of polish. A good black kind is met with on the south side of Arthur's Seat near Edinburgh, where it forms a smooth perpendicular rock, with several of the columns broken off, and the suspended pieces threatening to fall down upon the passengers below. This stone is capable of receiving a fine polish; and, in the opinion of Mr Williams, would be fit for all sorts of ornaments about sepulchral monuments. It will polish to a bright and beautiful black which will be unfading.

There is another kind, heavy and hard, of a black, or blackish-grey colour; of which great quantities have been carried from the Frith of Forth to pave the streets of London. This, for the most part, is coarsely granulated in the inside, though sometimes the grain is pretty fine. Sometimes it is bright in the inside when broken. It is composed of grains of quartz and shirl of different sizes, and commonly contains some iron. It always appears in thick, irregular, beds, some of which are enormously thick; and seldom or never equally so: on the contrary, where it is found uppermost, it frequently swells into little hills of various sizes. Most of the small islands in the Frith of Forth are composed of this kind of stone; as well as some hills in the neighbourhood of Inverkeithing and of Edinburgh.

The known characteristic of the basaltes is to form itself into balls, columns, and other regular figures. The columnar kind assumes a pentagonal, hexagonal or heptagonal figure; but quadrangular columns are not common. They are all smooth on the outside, and lie parallel and contiguous to one another; sometimes perpendicular, sometimes inclining, in proportion to the position of the stratum which is thus divided: If the stratum lies horizontal, the columns are perpendicular; if inclining, the pillars also incline in exact proportion to the declivity of the strata, being always broken right across the stratum. Some are of one piece from top to bottom; others divided by one or more joints laid upon one another, which form a column of several parts. The rock called the *Giant's Causeway* in Ireland is a pretty good specimen of the jointed columnar basaltes: but there is a more beautiful species above Hillhouse lime-quarry, about a mile south of Linlithgow in Scotland; and a coarser one near the toll-bar north side of Queen's Ferry, and several other places in Fife. In some places the basaltes are formed into magnificent columns of great length; and in others afford an assemblage of small and beautiful pillars resembling a range of ballustrades or organ pipes. Some of the columns on the south side of Arthur's Seat already mentioned are very long; and there are likewise magnificent columns of great length in the island of Egg, and others of the Hebrides. These columns, when broken, are frequently of a black, or blackish grey, in the inside; some of them being composed of small grains, which gives them an uniform and smooth texture; but much of this species of stone has larger grains in its composition, rough, sharp, and unequal, when broken. All the grains, however, are fine, hard, and bright; and the stone in general is capable of a fine polish.

The other species of basaltes which forms itself into distinct masses, assumes sometimes a quadrangular, sometimes an oval, globular, or indeterminate figure. They are found of all sizes from the size of an egg to that of an house: but though they differ in shape from the columnar basaltes, they agree in almost every other respect; whence Mr Williams thinks that they are only to be accounted a variety of the columnar kind. It is common to see one stratum of the basaltine rocks exhibiting, in one place, regular pillars or globes; and near these, very irregular ones, differing very little from the common cutters found in all rocks; and at no great distance, the same rock is found to run into one entire mass, exhibiting no tendency to be broken or divided into any columns whatever, Of this the rock of Arthur's Seat is an instance. Some of these only produce solid masses of different figures and sizes; while others produce quantities of a softer, friable, stony matter, of the same quality in which the hard masses of different figures are found imbedded. Pretty good specimens of the second kind or variety of basaltes are met with on the road-side between Cramond bridge and the Queen's Ferry, and in several other places in the Lothians and in Fife.

The crustated basaltes are of two kinds; 1. Such as have the crusts more dry and friable than the internal parts; and, 2. Such as are dry and friable throughout the whole mass.

The first of these has not only a crust of the friable matter adhering to it, but is likewise imbedded in a quantity of the same. Our author has seen many quarries of this kind of basaltes dug for the high roads, in which the quantity of soft friable matter greatly exceeded that of the hard masses, and in which incrusted stones of various sizes and shapes appeared. In such quarries, some of the largest masses have only a few coats of penetrable friable matter, surrounding a nucleus which varies in size, but is uniformly hard throughout; and we shall find other yolks in the same quarry imbedded in the softer matter, which, when broken, exhibit a nest of stones including one another like the several coats of an onion. These crustated basaltes which envelope one another are a curious species of stone. The several coats of surrounding matter differ nothing in quality from the stones contained in them, and some of the inner crusts are often very hard; but the nucleus within, though small, is always the hardest. The decomposition by the weathering of the softer matter found surrounding and enveloping the harder masses of stone in this and the second spe-

cies

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cies of basaltine rocks, has produced a phenomenon frequently met with in Great Britain, especially in Scotland, which greatly puzzles many. It is very common in low grounds, and upon some moderate eminences, to see a prodigious multitude of stones of all shapes and sizes, very hard, and pretty smooth on the outside. These stones are sometimes so numerous and large, that it is often found impracticable to clear a field of them. Where those stones are a species of basaltes, which they commonly are, and of the second species of basaltes described above, they always originate from a decomposition of the more soft or friable parts of those rocks, which moulder or fall away, and leave the harder stones detached and scattered about, and the decomposed matter dissolves by degrees, and becomes good corn mould.

Here Mr Williams takes occasion to contest the opinion of those who think that stones grow or vegetate like plants. He owns indeed that they increase in bulk: but this, he says, is only in such situations as are favourable for an accretion of matter carried down and deposited by the water; in all other situations they grow less and less. "Others (says he) imagine, that these stones (on which this extraneous matter has been deposited) were rolled about; that the asperites and sharp angles were by that means worn off; and that they were all at last deposited as we see them, by the waters of the universal deluge: and, having their obtuse sides and angles, as if they had been rounded by rolling in water, makes these gentlemen confident that they are right; and if we did not frequently find stones exactly of the same figure, size, and quality in the rock, it would be very difficult to overthrow this hypothesis. I have taken great pains to investigate this point, having frequently examined circumstances; and never failed to discover the stratum of rock which those detached stones originally belonged to. "The strata or beds of the several species of basaltes spread as wide, and stretch as far, as the other concomitant strata in the neighbourhood where they are found: but they often lie very flat, or with a moderate degree of declivity; and consequently, when the softer and more friable matter found in the interstices of these rocks, which incloses and binds the harder masses in their native beds, is decomposed, the harder stones must then lie scattered wide upon the face of the ground."

The second species of the crustated basaltes, viz. that which is dry and friable throughout the whole mass, is generally of a coarse and granulated texture, and of all the various shades of grey colours; from a rusty black to a light-coloured grey. This kind of crustated basaltes is developed when the masses are either broken or in a state of decomposition; and there are masses of it of all sizes and shapes found in the rocks, resembling the second and third species of the basaltes; appearing alike smooth on the outside, with obtuse angles; in short, resembling the basaltes in every respect: but when they are exposed to the external air and weather for any considerable time, the several incrustations decay, decompose, and crumble down by degrees. When they quarry this species of basaltes for the roads, they are able to break and pound them small with ease; but the harder species are so hard and cohesive, that they are with the greatest difficulty broken into sufficiently small parts.

Composite basaltes resembles the three last species, in figure, colour, and all other external appearances; being distinguishable from them only in the internal structure or grain of the stone. It resembles some of the granites, as consisting of much larger grains than the other basaltes. Many of the larger grains in the composite basaltes are more than an eighth part of an inch over, and some more than a fourth; appearing with smooth flat surfaces, and of a tabulated texture, exactly resembling the quartzy grains so commonly found in the composition of most of the granites. The chief, if not the only, distinguishable difference between the grains in each of them is the colour. They are evidently large grains of quartz, &c. which exhibit flat shining surfaces in both. Those grains or fragments are commonly white, yellowish, red, or black, in the composition of most of the granites; whereas they are often seen of a pale blue, or a bluish grey colour, in the composite basaltes, and some of them approaching to white. It is only in the *internal* structure, however, that these basaltes have any resemblances to the granites; in all the external characters, they differ nothing from the rest of their own genus.

A fifth species of basaltes is indurated through the whole stratum, solid and uniform through all its parts, and exhibiting only such cracks and fissures or cutters as are commonly met with in other hard beds of stones. Many beds of this species are frequently met with in the coal-fields, and the miners are often obliged to sink through them in their coal-pits. "The Salisbury craigs at Edinburgh (says our author) might be singled out as a good example of this species of stone, were it not that part of the same stratum is formed into columns on Arthur's seat; though, I believe, this is no good exception, as it evidently appears that the beds of basaltes which are formed into columns, globes, &c. only assume these figures where they are exposed to the influence of the external air, or have but little cover of rock above them. When any of those beds strike deep under the cover of several other strata, they are not found in columns, &c. Nothing but an uniform mass then appears, although the same bed is regularly formed near the surface; which proves that the columnar and other basaltes are formed by shrinking and chapping.

"The strata of basaltes spread as wide, and stretch as far in the longitudinal bearing, as the other different strata which accompany them in the countries where they are found. The rocks of basaltes also are generally found in very thick strata; and that generally in places where no other rock is found above the basaltes, the strata of it are often very unequal in thickness. But this, in general, is only in situations where no other rock is found above it; for when it fairly enters into the surface of the earth, so as to have other regular strata above it, which is seen in an hundred places in the Lothians, Fife, and other parts of Scotland, it then appears pretty equal in thickness, as equal as most other beds of such great thickness are; and yet it is remarkable, that although most of the strata of basaltes are of great thickness, there are frequently thin

strata

Appendix. Volcanic Products

ſtrata of various kinds found both above and below it. We have numerous examples of this in all the parts of Scotland where baſaltes is found; as for inſtance, there are thin and regular ſtrata ſeen and quarried both above and below the thick bed of that rock in the Saliſbury craigs near Edinburgh. In the Bathgate hills, ſouth of Linlithgow, and many other parts of Scotland, there are ſeveral ſtrata of baſaltes, and likewiſe of coal, limeſtone, freeſtone, and other concomitants of coal blended promiſcuouſly *ſtratum ſuper ſtratum;* and the baſalt is frequently found immediately above, and immediately below regular ſtrata of coal; of courſe baſaltes *is not the lava of volcanoes.* We can prove to ocular demonſtration, from the component parts, and from the ſituation, ſtretch, and bearing of the ſtrata of baſaltes, that they are real beds of ſtone, coeval with all the other ſtrata which accompany them; and are blended with them in the ſtructure of that part of the globe where they are found, as they dip and ſtretch as far every way as the other ſtrata found above and below them. If baſaltes, therefore, be a volcanic production, the other ſtrata muſt of neceſſity be ſo likewiſe. But how volcanoes ſhould produce coal, and how that coal ſhould come into contact with burning lava, is not a little problematical: or rather it is ſtrangely abſurd to imagine that burning lava can come into contact with coal without deſtroying it.

The regularly ſtratified quartzy white-mountain rock is ſcarce or rather not to be found in moſt parts of Britain. In the Highlands, however, it is very common; and in ſome places of them Mr Williams has ſeen it ſtratified as regularly as any of the ſand-ſtones, with other regular ſtrata of different qualities immediately above and below it; and ſometimes compoſing large and high mountains entirely of its own ſtrata. This ſtone is exceedingly hard, dry, and brittle, full of cracks and ſharp angles; the different ſtrata ſometimes moderately ſolid, but often naturally broken into ſmall irregular maſſes, with angles as ſharp as broken glaſs, and of an uniformly fine and granulated texture, reſembling the fineſt ſugar-loaf. There are large and high mountains of this ſtone in Roſsſhire and Inverneſsſhire, which, in a clear day, appear at a diſtance as white as ſnow, without any ſort of vegetation on them except a little dry heath round the edge of the hill.

Minerva.

MINERVA, or Pallas, in Pagan worſhip, the goddeſs of ſciences and of wiſdom, ſprung completely armed from Jupiter's brain; and on the day of her nativity it rained gold at Rhodes. She diſputed with Neptune the honour of giving a name to the city of Athens; when they agreed that whoſoever of them ſhould produce what was moſt uſeful to mankind, ſhould have that advantage. Neptune, with a ſtroke of his trident, formed a horſe; and Minerva cauſed an olive to ſpring from the ground, which was judged to be moſt uſeful, from its being the ſymbol of peace. Minerva changed Arachne into a ſpider, for pretending to excel her in making tapeſtry. She fought the giants; favoured Cadmus, Ulyſſes, and other heroes; and refuſed to marry Vulcan, chooſing rather to live in a ſtate of celibacy. She alſo deprived Tireſias of ſight, turned Meduſa's locks into ſnakes, and performed ſeveral other exploits.

Minerva is uſually repreſented by the poets, painters, and ſculptors, completely armed, with a compoſed but agreeable countenance, bearing a golden breaſtplate, a ſpear in her right-hand, and her ægis or ſhield in the left, on which is repreſented Meduſa's head encircled with ſnakes, and her helmet was uſually entwined with olives.

Minerva had ſeveral temples both in Greece and Italy. The uſual victim offered her was a white heifer, never yoked. The animals ſacred to her were the cock, the owl, and the baſiliſk.

Minervæ Caſtrum, Arx Minervæ, Minervium, or *Templum Minervæ,* (anc. geogr.), a citadel, temple, and town on the Ionian ſea, beyond Hydrus; ſeen a great way out at ſea. Now *Caſtro,* a town of Otranto in Naples. E. Long. 19. 25. N. Lat. 46. 8.

Minervæ Promontorium (anc. geogr.), the ſeat of the Sirens, a promontory in the Sinus Paeſtanus, the ſouth boundary of Campania on the Tuſcan coaſt; ſo called from a temple of Minerva on it: ſituated to the ſouth of Surrentum, and therefore called *Surrentinum.* Now *Capo della Minerva,* on the weſt coaſt of Naples, over-againſt the iſland Capri.

Minervalia Mingrelia.

MINERVALIA, in Roman antiquity, feſtivals celebrated in honour of Minerva, in the month of March; at which time the ſcholars had a vacation, and uſually made a preſent to their maſters, called from this feſtival *Minerval.*

MINGRELIA, anciently Colchis, a part of Weſtern Georgia, in Aſia; bounded on the eaſt by Iberia, or *Georgia* properly ſo called; on the weſt, by the Euxine Sea; on the ſouth, by Armenia, and part of Pontus; and on the north, by Mount Caucaſus.

Colchis, or Mingrelia, is watered by a great many rivers; as the Corax, the Hippus, the Cyaneus, the Chariſtus, the Phaſis, where the Argonauts landed, the Abſarus, the Ciſſa, and the Ophis, all emptying themſelves into the Euxine Sea. The Phaſis does not ſpring from the Mountains in Armenia, near the ſources of the Euphrates, the Araxes, and the Tigris, as Strabo, Pliny, Ptolemy, Dionyſius, and after them Arrian, Reland, Calmet, and Sanſon, have falſely aſſerted; but riſes in Mount Caucaſus; and flows not from ſouth to north, but from north to ſouth, as appears from the map of Colchis or Mingrelia in Thevenot's collection, and the account which Sir John Chardin gives of that country. This river forms in its courſe a ſmall iſland called alſo *Phaſis;* whence the pheaſants, if Iſidorus is to be credited, were firſt brought to Europe, and thence called by the Greeks *Phaſiani.* The other rivers of Colchis are conſiderable.

The whole kingdom of Colchis was in ancient times very pleaſant and fruitful, as it is ſtill where duly cultivated; abounded in all the neceſſaries of life; and was enriched with many mines of gold, which gave occaſion to the fable of the Golden Fleece and the Argonautic expedition ſo much celebrated by the ancients.

Sir John Chardin tells us, that this country extends above 100 miles in length and 60 in breadth; being not near ſo extenſive as the ancient Colchis, which reached from the frontiers of Iberia or Georgia Proper, weſtward to the Palus Mæotis: that it is beautifully diverſified with hills, mountains, valleys, woods, and plains, but badly cultivated: that there are all the kinds of fruits which are found in England, growing wild, but taſteleſs and inſipid for want of culture: that, if the natives underſtood the art of making wines, thoſe of this country would be the fineſt in the world: that there are many rivers which have their ſource in mount Caucaſus, particularly the Phaſis, now called the *Rione:* that the country abounds in beeves, hogs, wild boars, ſtags, and other veniſon; and in partridges, pheaſants, and quails; that falcons, eagles, pelicans, lions, leopards, tigers, wolves, and jackals, breed on Mount Caucaſus, and ſometimes greatly annoy the country: that the people are generally handſome, the men ſtrong and well made, and the women very beautiful; but both ſexes very vicious and debauched: that they marry their nieces, aunts, or other relations, indifferently; and take two or three wives if they pleaſe, and as many concubines as they will: that they not only make a common practice of ſelling their children, but even murder them, or bury them alive, when they find it difficult to bring them up: that the common people uſe a ſort of paſte, made of a plant called *góm*, inſtead of bread; but that of the better ſort conſiſts of wheat, barley, or rice: that the gentry have an abſolute power over their vaſſals, which extends to life, liberty, and eſtate: that their arms are the bow and arrow, the lance, the ſabre or broad-ſword, and the buckler: that they are very naſty; and eat ſitting croſs-legged upon a carpet, like the Perſians; but the poorer ſort upon a mat or bench, in the ſame poſture: that the country is very thin of inhabitants, no leſs than 12,000 being ſuppoſed to be ſold yearly to the Turks and Perſians: that the principal commodities exported from it are, honey, wax, hides, caſtor, martin-ſkins, flax-ſeed, thread, ſilk, and linen-cloth; but that there are no gold or ſilver mines now, and very little money: that the revenue of the prince or viceroy amounts to about 20,000 crowns *per annum:* that the inhabitants call themſelves *Chriſtians;* but that both they and their prieſts are altogether illiterate, and ignorant of the doctrines and precepts of Chriſtianity: that their biſhops are rich, have a great number of vaſſals, and are clothed in ſcarlet and velvet: and that their ſervice is according to the rites of the Greek church, with a mixture of Judaiſm and Paganiſm.

The cities of moſt note in this country in ancient times were Pityus; Dioſcurias, or Dioſcorias, which was ſo called from Caſtor and Pollux, two of the Argonauts, by whom it is ſuppoſed to have been founded, and who in Greek are ſtyled *Dioſcuroi*, at preſent known by the name of *Savatapoli;* Aea on the Phaſis, ſuppoſed to be the ſame as Hupolis; *Phaſis*, ſo called from the river on which it ſtood; Cyta, at the mouth of the river Cyaneus, the birth place of the famous Medea, called from thence, by the poets, *Cytæis;* Saracæ, Zadris Surium, Madia, and Zoliſſa. As for modern cities, it does not appear that there are any here conſiderable enough to merit a deſcription; or, if there are, they ſeem to be little, if at all, known to Europeans.

MINHO, a great river in Spain, which taking its riſe in Galicia, divides that province from Portugal, and falls into the Atlantic at Caminha.

MINIATURE, in a general ſenſe, ſignifies repreſentation in a ſmall compaſs, or leſs than the reality.

MINIATURE-PAINTING;

A DELICATE kind of painting, conſiſting of little points or dots; uſually done on vellum, ivory, or paper, with very thin, ſimple water-colours.—The word comes from the Latin *minium*, "redlead;" that being a colour much uſed in this kind of painting. The French frequently call it *mignature*, from *mignon*, "fine, pretty," on account of its ſmallneſs and delicacy: and it may be ultimately derived from μικρος "ſmall."

Miniature is diſtinguiſhed from other kinds of painting by the ſmallneſs and delicacy of its figures and faintneſs of the colouring; on which account it requires to be viewed very near.

Sect. I. *Of Drawing and deſigning.*

To ſucceed in this art, a man ſhould be perfectly ſkilled in the art of deſigning or drawing: but as moſt people who affect the one, know little or nothing of the other, and would have the pleaſure of painting without giving themſelves the trouble of learning to deſign (which is indeed an art that is not acquired without a great deal of time, and continual application), inventions have been found out to ſupply the place of it; by means of which a man deſigns or draws, without knowing how to deſign.

The firſt is chalking: that is, if you have a mind to do a print or deſign in miniature, the backſide of it on another paper, muſt be blackened with ſmall-coal, and then rubbed very hard with the finger wrapped in a linen cloth: afterwards the cloth muſt be lightly drawn over the ſide ſo blackened that no black grains may remain upon it to ſoil the vellum you would paint upon; and the print or draught muſt be faſtened upon the vellum with four pins, to keep it from ſhifting. And if it be another paper that is blackened, it muſt be put between the vellum and the print, or draught, with the blackened ſide upon the vellum. Then, with a blunted pin or needle, you muſt paſs over the principal lines or ſtrokes of the print, or draught, the contours, the plates of the drapery, and over every thing elſe that muſt be diſtinguiſhed; preſſing ſo hard, that the ſtrokes may be fairly marked upon the vellum underneath.

Copying by ſquares is another convenient method for ſuch as are but little ſkilled in the art of deſigning, and would copy pictures, or other things, that cannot be chalked. The method is this: The piece muſt be divided

Drawing and Designing.

divided into many equal parts by little squares, marked out with charcoal; if the piece be clear and whitish, and the black can be fairly seen upon it; or with white chalk, if it be too brown and dusky. After which, as many squares of equal dimensions must be made on white paper, upon which the piece must be designed; because, if this be done immediately upon vellum, (as one is apt to miscarry in the first attempt), the vellum may be soiled with false touches. But when it is neatly done upon paper, it must be chalked upon the vellum in the manner before described. When the original and the paper are thus ordered, observe what is in each square of the piece to be designed; as a head, an arm, a hand, and so forth; and place it in the corresponding part of the paper. And thus finding where to place all the parts of the piece, you have nothing to do but to form them well, and to join them together. By this method you may reduce or enlarge a piece to what compass you please, making the squares of your paper greater or less than those of the original; but they must always be of an equal number.

To copy a picture, or other thing, in the same size and proportion, another method is, to make use of varnished paper, or of the skin of a hog's bladder, very transparent, such as is to be had at the gold-beaters. Talc or isinglass will likewise do as well. Lay any one of those things upon your piece; through it you will see all the strokes and touches, which are to be drawn upon it with a crayon or pencil. Then take it off; and fastening it under paper or vellum, set up both against the light in the manner of a window; and with a crayon, or a silver needle, mark out upon the paper or vellum you have put uppermost, all the lines and touches you shall see drawn upon the varnished paper, bladder, talc, or isinglass, you have made use of, and which will plainly appear through this window.

After this manner, making use of the window, or of glass exposed to the light, you may copy all sorts of prints, designs, and other pieces, on paper or vellum; laying and fastening them under the paper or vellum upon which you would draw them. And it is a very good and a very easy contrivance for doing pieces of the same size and proportion.

If you have a mind to make pieces look another way, there is nothing to be done but to turn them; laying the printed or drawn side upon the glass, and fastening the paper or vellum upon the back of it; remembering to let your lights fall on the left side.

A good method likewise to take a true copy of a picture in oil, is to give a touch of the pencil upon all the principal strokes, with lake tempered with oil; and to clap upon the whole a paper of the same size: then passing the hand over it, the touches of the lake will stick and leave the design of your piece expressed upon the paper, which may be chalked like other things. But you must remember to take off with the crumb of bread what remains of the lake upon the picture before it be dry.

You must likewise make use of pounce, made of powdered charcoal put in a linen-rag; with which the piece you would copy must be rubbed, after you have pricked all the principal strokes or touches, and fastened white paper or vellum underneath.

But a surer and easier help than all these, for one who knows nothing of designing, is a mathematical compass; it is generally made of ten-pieces of wood, in form of rulers, half a quarter of an inch thick, half an inch broad, and a foot long, or more, according as you have a mind to draw pieces of a greater or less size. To facilitate the construction of this instrument, a figure is given, with an explanation of the manner in which it is to be used.

Plate CCCXIV.

The little board A is to be of fir, and covered with linen or any other cloth; because the piece you copy, and the vellum or paper you copy upon, must be fixed upon it. Upon this board must the compass also be fixed with a pin, by the end of the first foot B, deep enough to keep it close, but not so deep as to hinder it from turning easily. When you have a mind to reduce things, place your original on the side of the foot C, and the vellum or paper you would draw upon on the side of the foot B; removing the vellum, or drawing it nearer, according as you intend to reduce or enlarge.

In order to enlarge a piece, you have nothing to do but to change the places of your original and your copy; placing the last towards C, and the other on the side of B.

And in both one and the other method, a crayon or leaden needle must be put in the foot under which the vellum lies; and a pin, a little blunted, in that over the original, with which all the traces are to be followed; conducting the pin with one hand, and with the other pressing gently upon the crayon or needle that marks the vellum. When the crayon or needle bears sufficiently upon the vellum, you have no occasion to touch it.

By this instrument you may also draw in equal dimensions: but in order to this, the compass must be fixed in another manner upon the board; for if it is to be fastened upon it by the middle at D, your original and your copy must be fixed on each side of this middle foot, at the equal distances, or from corner to corner: that is, from C to E, when the pieces are large. One may likewise draw several copies at once of equal and different dimensions.

When your piece is marked out upon the vellum, you must pass with a pencil of very clear carmine over all the traces, to the end they may not be effaced as you work: then clean your vellum with a crumb of bread, that no black may remain upon it.

Your vellum must be pasted upon a little plate of brass or wood, of the size you would make your piece, to keep it firm and tight: but this pasting must be on the edges of your vellum only, and behind the plate; for which purpose your vellum must exceed your plate above an inch on every side: for the part you paint upon must never be pasted; because it would not only give it an ill look, but you could not take it off if you would. Cut off the little shags and locks of the vellum; and wetting the fair side with a linen-cloth dipped in water, clap the other upon the plate with a clean paper between them: so much as hangs over must be pasted upon the back of the plate, drawing it equally on all sides, and hard enough to stretch it well.

Sect. II. *Of Materials.*

The chief colours made use of for painting in miniature, are

Carmine.
Venice and Florence lake.

 Rose

Colours, &c.

Rose pink.
Vermilion.
Red-lead.
Brown red.
Red orpiment.
Ultramarine.
Verditer.
Indigo.
Gall-stone.
Yellow-ochre.
Dutch pink.
Gamboge.
Naples yellow.
Pale masticot.
Deep yellow masticot.
Ivory-black.
Lamp-black.
True Indian ink.
Bistre, or wood-soot.
Raw umber.
Burnt umber.
Sap-green.
Verdigris.
Flake-white.
Crayons of all colours.
Gold and silver shells.
Leaf-gold and leaf-silver.

The seven transparent colours, which are used where writing is seen through the colour.

Liquid { Lake. Blue. Yellow. Grass-green. Dark-green. Purple-colour. Brown.

Most of these colours necessary for miniature-painting may easily be prepared by attending to the directions given under the article *Colour-Making*.

As colours taken from earth and other heavy matter are always too coarse, be they never so well ground, especially for delicate work, because of a certain sand remaining in them; the finest parts may be drawn out by diluting them with the finger in a cup of water. When they are well steeped, let them settle a while: then pour out the clearest, which will be at top, into another vessel. This will be the finest, and must be let dry; and when it is used, must be diluted with gum-water.

If you mix a little of the gall of an ox, a carp, or an eel, particularly of the last, in green, black, grey, yellow, and brown, colours, it will not only take away their greasy nature, but also give them a lustre and brightness they have not of themselves. The gall of eels must be taken out when they are skinned, and hung upon a nail to dry; and when you would use it, it must be diluted with brandy; add a little of it mixed with the colour you have diluted already. This likewise makes the colour stick better to the vellum, which it hardly does when it is greasy: moreover, this gall hinders it from scaling.

Some colours are made clearer by fire; as yellow ochre, brown red, ultramarine, and umber: all others are darkened by it. But if you heat the said colours with a sharp fire, they change; for the brown-red becomes yellow; yellow ochre becomes red; umber reddens also. Cerus by fire takes the colour of citron, and is often called *masticot*. Observe, that yellow ochre heated, becomes more tender than it was, and softer than brown red. Likewise brown red heated becomes softer than fine yellow ochre. Both are very proper. The finest and truest ultramarine, heated upon a red-hot iron, becomes more glittering; but it wastes, and is coarser and harder to work with in miniature.

All these colours are diluted in little cups of ivory, made on purpose, or in sea-shells, with water in which gum arabic and sugar-candy are put. For instance, in a glass of water put a piece of gum as big as a walnut, and half that quantity of sugar-candy. This last hinders the colours from scaling when they are laid on, which they generally do when they want it, or the vellum is greasy.

This gum-water must be kept in a neat bottle corked; and you never must take any out of it with a pencil that has colour upon it, but with a quill or some such thing.

Some of this water is put in the shell with the colour, you would temper, and diluted with the finger till it be very fine. If it be too hard, you must let it soften in the shell with the said water before you dilute it. Afterwards let it dry: and do thus with every colour, except lily-green, sap-green, and gamboge, which must be tempered with fair water only. But ultramarine, lake, and bistre, are to be more gummed than other colours.

If you make use of sea-shells, you must let them steep two or three days beforehand in water: then cleanse them in boiling-hot water, mixed with vinegar, in order to carry of a certain salt, which otherwise sticks to them, and spoils the colours that are put to them.

To know whether colours are sufficiently gummed, you have nothing to do but to give a stroke of the pencil upon your hand when they are diluted, which dries immediately; if they chap and scale, there is too much gum; if they rub out by passing the finger over them, there is too little. It may be seen likewise when the colours are laid on the vellum, by passing the finger over them. If they stick to it like a powder, it is a sign there is not gum enough, and more must be put to the water with which you temper them: but take care you do not put too much; for that makes the colour extremely hard and dry. It may be known likewise by their glueiness and brightness: so the more they are gummed, the darker they paint; and when you have a mind to give a greater strength to a colour than it has of itself, you have nothing to do but to give it a great deal of gum.

Provide yourself with an ivory pallet, very smooth, as big as your hand; on one side of which the colours for the carnation, or naked parts of a picture, are to be ranged in the following manner. In the middle put a great deal of white, pretty largely spread; because it is the colour most made use of: and upon the edge, from the left to the right, place the following colours at a little distance from the white.

Masticot.
Dutch-pink.
Orpiment.

Colours, &c.

Yellow ochre.

Green; composed of verditer, Dutch pink, and white, in equal quantities.

Blue; made of ultramarine, indigo, and white, to a great degree of paleness.

Vermilion.

Carmine.

Bistre, and

Black.

On the other side of the pallet, spread some white in the same manner as for the carnation. And when you have a mind to paint draperies, or other things, place near the white the colour you would make them of, in order to work, as shall be shown hereafter.

The use of good pencils is a great matter. In order to make a good choice, wet them a little; and if the hairs keep close together as you turn them upon the finger, and make but one point, they are good: but if they close not together, but make several points, and some are longer than others, they are good for nothing. When they are too sharp-pointed, with only four or five hairs longer than the rest, yet closing all together, they are, notwithstanding, good; but they must be blunted with a pair of scissars, taking care at the same time you do not clip away too much. It is proper to have two or three sorts of them; the largest for laying the grounds and dead colouring, and the smallest for finishing.

To bring the hairs of your pencil to join close together and make a good point, you must often put the pencil just between your lips when you are at work; moistening and pressing it close with the tongue, even when there is colour upon it; for if there be too much, some of it is taken off by this means, and enough left for giving fine and equal touches. You need not apprehend this will do you any harm. None of the colours for miniature, except orpiment, when they are prepared, have either ill taste or ill quality. This expedient must especially be used for dotting, and for finishing, particularly the naked parts of a picture, that the touches may be neat and fair, and not too much charged with colour. As for draperies and other things, as well in dead colouring as in finishing, it is sufficient, in order to make the hairs of your pencil join well, and to unload it when it has too much colour, to draw it upon the edge of the shell, or upon the paper you must put upon your work to rest your hand on, giving some strokes upon it before you work upon your piece.

To work well in miniature, you must do it in a room that has but one window, and fix yourself very near it, with a table and desk almost as high as the window; placing yourself in such a manner, that the light may always come in on the left side, and never forward or on the right.

When you would lay a colour on all parts equally strong, as for a ground, you must make your mixtures in shells, and put in enough for the thing you design to paint; for if there be not enough, it is a great chance but the colour you mix afterwards is too dark or too light.

Sect. III. *Of Working.*

Of Working.

After having spoke of vellum, pencils, and colours, let us now show how they are to be employed. In the first place, then, when you would paint a piece, be it carnation, drapery, or any thing else, you must begin by dead-colouring; that is to say, by laying your colours on with liberal strokes of the pencil, in the smoothest manner you can, as the painters do in oil; not giving it all the force it is to have for a finishing; that is, make the lights a little brighter, and the shades less dark, than they ought to be; because in dotting upon them, as you must do after dead-colouring, the colour is always fortified, and would at last be too dark.

There are several ways of dotting; and every painter has his own. Some make their dots perfectly round; others make them a little longish; others hatch by little strokes that cross each other every way, till the work appears as if it had been wrought with dots. This last method is the best, the boldest, and the soonest done: wherefore such as would paint in miniature ought to use it, and to inure themselves from the first to dot in the plump and the soft way; that is to say, where the dots are lost, in a manner, in the ground upon which you work, and only so much appears as is sufficient to make the work seem dotted. The hard and the dry way is quite the reverse, and always to be avoided. This is done by dotting with a colour much darker than your ground, and when the pencil is not moistened enough with the colour, which makes the work seem rough and uneven.

Study likewise carefully to lose and drown your colours one in another, so that it may not appear where they disjoin; and to this end, soften or allay your touches with colours that partake of both, in such sort that it may not appear to be your touches which cut and disjoin them. By the word *cut*, we are to understand what manifestly separates and divides, and does not run in and blend itself with the neighbouring colours; which is rarely practised but upon the borders of drapery.

When your pieces are finished, to heighten them a little, give them a fine air; that is to say, give, upon the extremity of the lights, small touches with a colour yet lighter, which must be lost and drowned with the rest.

When the colours are dry upon your pallet or in your shells, in order to use them, they must be diluted with water. And when you perceive they want gum, which is seen when they easily rub off the hand or the vellum if you give a touch with them upon either, they must be tempered with gum-water instead of pure water, till they are in condition.

There are several sorts of grounds for pictures and portraitures. Some are wholly dark, composed of bistre, umbre, and Cologn earth, with a little black and white; others more yellow, in which is mixed a great deal of ochre; others greyer, which partake of indigo. In order to paint a ground, make a wash of the colour or mixture you would have it, or according to that of the picture or portraiture you would copy; that is to say, a very light lay, in which there is hardly any thing but water, in order to soak the vellum. Then pass another lay over that, somewhat thicker, and strike it on very smoothly with large strokes as quick as you can, not touching twice in the same place before it be dry; because the second stroke carries off what

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what has been laid on at the first, especially when you lean a little too hard upon the pencil.

Other dark grounds are likewise made of a colour a little greenish: and those are most in use, and the properest to lay under all sorts of figures and portraitures; because they make the carnation, or naked parts of a picture, appear very fine; are laid on very easily, and there is no occasion to dot them, as one is often obliged to do the others, which are rarely made smooth and even at the first; whereas in these one seldom fails of success at the first bout. To make them, you must mix black, Dutch pink, and white, all together; more or less of each colour, according as you would have them darker or lighter. You are to make one lay very light, and then a thicker, as of the first grounds. You may also make them of other colours, if you please; but these are the most common.

When you paint a holy person upon one of these grounds, and would paint a small glory round the head of your figure, you must not lay the colour too thick in that part, or you may even lay none at all, especially where this glory is to be very bright: but lay for the first time with white and a little ochre mixed together, of a sufficient thickness; and in proportion as you go from the place of the head, put a little more ochre; and to make it loose itself, and die away with the colour of the ground, hatch with a free stroke of the pencil, following the round of the glory, sometimes with the colour of which it is made, and sometimes with that of the ground, mixing a little white or ochre with the last when it paints too dark to work with: and do this till one be insensibly lost in another, and nothing can be seen to disjoin them.

To fill an entire ground with a glory, the brightest part is laid on with a little ochre and white, adding more of the first in proportion as you come nearer the edges of the picture: and when the ochre is not strong enough (for you must always paint darker and darker), add gall-stone, afterwards a little carmine, and lastly bistre. This first laying, or dead-colouring, is to be made as soft as possible; that is to say, let these shadowings lose themselves in one another without gap or intersection. Then the way is to dot upon them with the same colours, in order to drown the whole together; which is pretty tedious, and a little difficult, especially when there are clouds of glory on the ground. Their lights must be fortified in proportion as you remove from the figure, and finished as the rest, by dotting and rounding the clouds: the bright and obscure parts of which must run insensibly into one another.

For a day-sky, take ultramarine and a good deal of white, and mix them together. With this make a lay, as smooth as you can, with a large pencil and liberal strokes, as for grounds; applying it paler and paler as you descend towards the horizon; which must be done with vermilion or red lead, and with white of the same strength with that where the sky ends, or something less; making this blue lose itself in the red, which you bring down to the skirts of the earth, or tops of houses; mixing towards the end gall-stone and a good deal of white, in such a manner that the mixture be still paler than the former, without any visible intersection or parting between all these colours of the sky.

When there are clouds in the sky, you may spare the places where they are to be; that is to say, you need not lay on any blue there, but form them, if they are reddish, with vermilion, gall-stone, and white, with a little indigo; and if they are more upon the black, put in a good deal of the last; painting the lights of one and the other with masticot, vermilion, and white, more or less of any of these colours, according to the strength you would give them, or according to that of the original you copy; rounding the whole as you dot; for it is a difficult matter to lay them very smooth at the first painting: and if the sky is not even enough, you must dot it also.

It is at your pleasure to exempt the places of the clouds, for you may lay them upon the ground of the sky; heightening the bright parts by putting a good deal of white, and fortifying the shadows by using less. This is the shortest way.

A night or stormy sky is done with indigo, black, and white, mixed together; which is laid as for a day-sky. To this mixture must be added ochre, vermilion, or brown-red, for the clouds; the lights of which are to be of masticot, or red-lead, and a little white; now redder, now yellower, at discretion. And when it is a tempestuous sky, and lightning appears in some places, be it blue or red, it is to be done as in a day-sky, drowning and losing the whole together at the first forming or dead-colouring, and at the finishing.

Sect. IV. *Of Draperies.*

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To paint a blue drapery, put ultramarine near the white upon your pallet; and mix a part of the one with the other, till it makes a fine pale, and has a body. With this mixture you must form the brightest parts; and then adding more ultramarine, form such as are darker; and go on after this manner till you come to the deepest plaits and the thickest shades, where you must lay pure ultramarine: and all this must be done as for a first-forming or dead-colouring: that is to say, laying the colour on with free strokes of the pencil, yet as smooth as you can; losing the lights in the shadows with a colour neither so pale as the light nor so dark as the shades. Then dot with the same colour as in the first-forming, but a small matter deeper; that the dots may be fairly seen. All the parts must be drowned one in another, and the plaits appear without intersection. When the ultramarine is not dark enough to make the deeper shadows, how well soever it be gummed, mix a little indigo with it to finish them. And when the extremities of the lights are not bright enough, heighten them with white and a very little ultramarine.

A drapery of carmine is done in the same manner as the blue; except that in the darkest places there is to be a lay of pure vermilion, before you dead-colour with carmine, which must be applied at top; and in the strongest shades, it must be gummed very much. To deepen it the more, mix a little bistre with it.

There is likewise made another red drapery, which is first drawn with vermilion, mixing white with it to dead-colour the bright places, laying it pure and unmixed for those that are darker, and adding carmine

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mine for the grand shades. It is finished afterwards, like other draperies, with the same colours. And when the carmine with the vermilion do not darken enough, work with the first alone, but only in the deepest of the shades.

A drapery of lake is made in the same manner with that of carmine; mixing a good deal of white with it for the bright places, and very little for those that are dark. It is finished likewise with dotting; but you have nothing to do with vermilion in it.

Violet-draperies are likewise done after this manner; after making a mixture of carmine and ultramarine, putting always white for the bright parts. If you would have your violet be columbine or dove-colour, there must be more carmine than ultramarine: but if you would have it bluer and deeper, put more ultramarine than carmine.

A drapery is made of a flesh-colour, beginning with a lay made of white, vermilion, and very pale lake; and making the shades with the same colours, using less white in them. This drapery must be very pale and tender, because the stuff of this colour is thin and light; and even the shades of it ought not to be deep.

To make a yellow drapery, put a lay of masticot over all; then one of gamboge upon that, excepting the brightest places, where the masticot must be left entire; the dead-colour with ochre, mixed with a little gamboge and masticot, putting more or less of the last according to the strength of the shades. And when these colours do not darken enough, add gall-stone. And gall-stone pure aud unmixed is used for the thickest shades; mixing a little bistre with it, if there be occasion to make them still darker. You finish by dotting with the same colours you dead-coloured with, and losing the lights and the shades in one another.

If you put Naples-yellow, or Dutch-pink, in lieu of masticot and gamboge, you will make another sort of yellow.

The green drapery is made by a general lay of verditer; with which, if you find it too blue, mix masticot for the lights, and gamboge for the shades. Afterwards add to this mixture lily-green or sap-green, to shadow with; and as the shades are thicker, put more of these last greens, and even work with them pure and unmixed where they are to be extremely dark. You finish with the same colours, a little darker.

By putting more yellow, or more blue, in these colours, you may make different sorts of greens as you please.

To make a black drapery, you dead-colour with black and white, and finish with the same colour, putting more black as the shades are thicker; and for the darkest, mix indigo with it, especially when you would have the drapery appear like velvet. You may always give some touches with a brighter colour, to heighten the lights of any drapery whatsoever.

A white woollen drapery is made by a lay of white, in which there must be a very small matter of ochre, orpiment, or gall-stone, that it may look a little yellowish. Then dead-colour, and finish the shades with blue, a little black, white, and bistre; putting a great deal of the last in the darkest.

The light-grey is begun with black and white, and finished with the same colour deeper.

For a brown drapery, make a lay of bistre, white, and a little brown red; and shadow with this mixture, made a little darker.

There are other draperies, called *variable*, because the lights are of a different colour from the shades. These are mostly used for the vestments of angels, for young and gay people, for scarfs and other airy attire, admitting of a great many folds, and flowing at the pleasure of the wind. The most common are the violets: of which they make two sorts; one, where the lights are blue; and the other, where they are yellow.

For the first, put a lay of ultramarine and very pale white upon the lights; and shadow with carmine, ultaramarine, and white, as for drapery wholly violet; so that only the grand lights appear blue. Yet they must be dotted with violet, in which there is a great deal of white, and lost insensibly in the shades.

The other is done by putting upon the lights only, instead of blue, a lay of masticot; working the rest as in the drapery all violet, excepting that it must be dotted, and the light parts blended with the shadowy, that is, the yellow with the violet, with a little gamboge.

The carmine-red is done like the last; that is, let the lights be done with masticot, and the shades with carmine; and to lose the one in the other, make use of gamboge.

The lake-red is done like that of carmine.

The green is done as the lake; always mixing verditer with lily or sap green, to make the shades; which are not very dark.

Several other sorts of draperies may be made at discretion, always taking care to preserve the union of the colours, not only in one sort of cloth or so, but also in a group of several figures; avoiding, as much as the subject will allow, the putting of blue near the colour of fire, of green against black; and so of other colours which cut and disjoin, and whose union is not kind enough.

Several other draperies are made of foul colours, as brown-red, bistre, indigo, &c. and all in the same manner. Likewise of other colours, simple and compound; the agreement between which is always to be minded, that the mixture may produce nothing harsh and disagreeable to the eye. No certain rule can be laid down for this. The force and effect of your colours are only to be known from use and experience, and you must work according to that knowledge.

Linen cloths are done thus. After drawing the plaits or folds, as is done in a drapery, put a lay of white over all; then dead-colour and finish the shades with a mixture of ultramarine, black, and white, using more or less of the last, according to their strength or tenderness; and in the greatest deepenings put bistre, mixed with a little white; giving only some touches of this mixture, and even of pure bistre, upon the extremities of the greatest shadows, where the folds must be drawn, and lost with the rest.

They may be done in another manner, by making a general lay of this mixture of ultramarine, black, and

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and very pale white; and dead-colour (as has been said before) with the same colour, but a little deeper. And when the shades are dotted and finished, heighten the lights with pure white, and lose them with the deepenings of the linen. But of whatever sort you make them, when they are finished, you must give a yellowish teint of orpiment and white to certain places; laying it lightly on, and as it were in water; so that what is underneath may, notwithstanding, plainly appear, as well the shadows as the dotting.

Yellow linen-cloth is done by putting a lay of white, mixed with a little ochre. Then form and finish the shades with bistre, mixed with white and ochre; and in the thickest shades use pure bistre: and before you finish, give some teints here and there of ochre and white, and others of white and ultramarine, as well upon the shades as the lights; but let them be very bright: and drown the whole together in dotting, and it will look finely. As you finish, heighten the extremities of the lights with masticot and white. You may add to this sort of linen, as well as to the white, certain bars from space to space, as in Turkey-mantuas; that is, small stripes blue and red with ultramarine and carmine; one of red between two of blue, very bright and clear upon the lights, and deeper upon the shades. Virgins are pretty often dressed with veils of this sort (by Popish painters), and scarfs of this kind are put about necks that are bare; because they become the teint mighty well.

If you would have both these sorts of linen transparent, and the stuff or other thing that is beneath appear through them, make the first lay for them very light and clear, and mix in the colour to shadow with, a little of that which is underneath, especially towards the end of the shades; and only do the extremities of the lights, for the yellow with masticot and white; and for the white, with pure white.

They may be done in another manner, especially when you would have them altogether as clear as muslin, lawn, or gauze. To this end form and finish what is to be beneath, as if nothing was to be put over it. Then mark out the light and clear folds with white or masticot; and a shadow with bistre and white, or with black, blue, and white, according to the colour you would make them of: making the rest somewhat fainter: yet this is not necessary but for the parts that are not to be so clear.

Crape is done the same way; excepting that the folds of the shades and the lights, and the borders too, are to be marked out with little filaments of black upon what is underneath; which is likewise to be finished beforehand.

When you would make a stuff like watered tabby, make the waves upon it with a colour a little lighter, or a little darker, in the lights and the shades.

There is a manner of touching draperies which distinguishes the silken from the woollen. The last are more terrestrial and sensible; the others more light and fading. But it must be observed that this is an effect which depends partly upon the stuff and partly upon the colour; and for the employing these in a manner suitable to the subjects and the deepenings of painting, we shall here touch upon their different qualities.

We have no colour which partakes more of light, nor which comes nearer the air, than white; which shows it to be fickle and fleeting. It may, nevertheless, be held and brought to by some neighbouring colour, more heavy and sensible, or by mixing them together.

Blue is a most fleeting colour: and so we see, that the sky and the remotest views of a picture are of this colour; but it will become ligher and fickler in proportion as it is mixed with white.

Pure black is the heaviest and most terrestrial of all colours; and the more of it you mix with others, the nearer you bring them to the eye.

Nevertheless, the different dispositions of black and white make also their effects different: for white often makes black disappear, and black brings white more into view; as in the reflection of globes, or other figures to be made round, where there are always parts that fly as it were from the eye, and deceive it by the craft of art; and under the white are here comprehended all the light colours; as under the black, all the heavy colours,

Ultramarine is, then, soft and light.
Ochre is not so much so.
Masticot is very light; and so is verditer.
Vermilion and carmine come near this quality.
Orpiment and gamboge not so near.
Lake holds a certain mean, rather soft than rough.

Dutch pink is an indifferent colour, easily taking the quality of others. So it is made terrestrial by mixing it with colours that are so; and, on the contrary, the most light and fleeting by joining it with white or blue.

Brown-red, umber, dark-greens, and bistre, are the heaviest and most terrestrial, next to black.

Skilful painters, who understand perspective, and the harmony of colours, always observe to place the dark and sensible colours on the fore parts of their pictures; and the most light and fleeting they use for the distances and remote views. And as for the union of colours, the different mixtures that may be made of them will learn you the friendship or antipathy they have to one another. And upon this you must take your measures for placing them with such agreement as shall please the eye.

For the doing of lace, French-points, or other things of that nature, put over all a lay of blue, black, and white, as for linen; then heighten the flower-work with pure white: afterwards make the shades above with the first colour, and finish them with the same. When they are upon the carnation or naked parts of a picture, or upon any thing else that you would show through another, finish what is beneath, as if nothing was to be put over it: and at top, make the points or lace with pure white, shadowing and finishing them with the other mixture.

If you would paint a fur, you must begin with a kind of drapery, done, if it be dark, with bistre and white, making the shadowings of the same colour, with less white. If the fur be white, do it with blue, white, and a little bistre. And when this beginning, on first forming, is done, instead of dotting, draw small strokes, turning, now in one manner, now in another, according to the course and flatting of the hair. Heighten the lights of dark furs with ochre and white, and of the other with white and a little blue.

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For doing a building, if it be of ſtone, take indigo, biſtre, and white, with which make the beginning or firſt form of it; and for ſhadowing it, put leſs of this laſt; and more biſtre than indigo, according to the colour of the ſtone you would paint. To theſe you may likewiſe add a little ochre, both for the forming and the finiſhing. But to make it finer, you muſt give, here and there, eſpecially for old fabrics, blue and yellow teints, ſome with ochre, others with ultramarine, mixing always white with them, whether before the firſt-forming, provided they appear through the draught, or whether upon it, loſing or drowning them with the reſt when you finiſh.

When the building is of wood, as there are many ſorts, it is done at diſcretion; but the moſt ordinary way is to begin or firſt-form with ochre, biſtre, and white, and finiſh without white, or with very little; and if the ſhades are deep, with pure biſtre. In the other they add ſometimes vermilion, ſometimes green or black; in a word, juſt according to the colour they would give it, and they finiſh with dotting, as in draperies and every thing elſe.

Sect. V. *Of Carnations, or the naked parts of Painting.*

There are in carnation ſo many different colourings, that it would be a difficult thing to give general rules upon ſo variable a ſubject. Nor are they minded, when one has got, by cuſtom and practice, ſome habit of working eaſily: and ſuch as are arrived to this degree, employ themſelves in copying their originals, or elſe they work upon their ideas, without knowing how: inſomuch, that the moſt ſkilful, who do it with leſs reflection and pains than others, would likewiſe be more put to it to give an account of their maxims and knowledge in the matter of painting, if they were to be aſked what colours they made uſe of for ſuch and ſuch a colouring, a teint here, and another there.

Neverthleſs, as beginners want ſome inſtruction at the firſt, we will ſhew in general after what manner ſeveral carnations are to be done.

In the firſt place, after having drawn your figure with carmine, and ordered your piece, apply, for women and children, and generally for all tender colourings, a lay of white, mixed with a very little of the blue made for faces, of which we have told the compoſition; but let it hardly be ſeen.

And for men, inſtead of blue, they put in this firſt lay a little vermilion; and when they are old, a little ochre is mixed with it.

Afterwards follow all the traces with vermilion, carmine and white, mixed together; and begin all the ſhades with this mixture, adding white in proportion as they are weaker; and putting but little in the darkeſt, and none, in a manner, in certain places where ſtrong touches are to be given: for inſtance, in the corner of the eye; under the noſe; at the ears; under the chin; in the ſeparation of the fingers; in all joints; at the corners of the nails; and generally in every part where you would mark out ſeparations in ſhades that are obſcure. Neither need you fear to give to thoſe places all the force and ſtrength they ought to have as ſoon as you begin or firſt-form them, becauſe in working at top with green, the red you have put there is always weakened.

After having begun, or firſt-formed, or dead-coloured, with red, make blue teints with ultramarine and a great deal of white, upon the parts which fly from the eye; that is to ſay, upon the temples; under and in the corners of the eyes; on both ſides the mouth, above and below; a little upon the middle of the forehead; between the noſe and the eyes; on the ſide of the cheeks; on the neck and other places where the fleſh aſſumes a bluiſh caſt. Yellowiſh teints are likewiſe made with ochre or orpiment, and a little vermilion mixed with white, under the eye-brows, on the ſides of the noſe towards the bottom, a little underneath the cheeks, and upon the other parts which riſe and come nearer the eye. It is eſpecially from theſe teints that the natural complexion is to be obſerved, in order to catch it; for painting being an imitation of nature, the perfection of the art conſiſts in the juſtneſs and ſimplicity of the repreſentation, eſpecially in face-painting.

When, therefore, you have done your firſt lay, your dead colouring, and your teints, you muſt work upon the ſhades, dotting with green for the carnations or naked parts, mixing according to the rule we have given for the teints, a little blue for the parts which fly from the eye; and, on the other hand, making it a little yellower for thoſe that are more ſenſible; that is to ſay, which riſe, and come nearer the eye: and at the end of the ſhades, on the ſide of the light, you muſt blend and loſe your colour inſenſibly in the ground of the carnation with blue, and then with red, according to the places where you paint. If this mixture of green does not work dark enough at firſt, paſs over the ſhades ſeveral times, now with red, and now with green; always dotting: and this do till they are as they ſhould be.

And if you cannot with theſe colours give the ſhades all the force they ought to have, finiſh, in the darkeſt, with biſtre mixed with orpiment, ochre, or vermilion, and ſometimes with pure biſtre, according to the colouring you would make, but lightly, laying on your colour very clear.

You muſt dot upon the clear and bright places with a little vermilion or carmine, mixed with much white, and a very ſmall matter of ochre, in order to loſe them with the ſhadowy, and to make the teints die away inſenſibly into one another; taking care, as you dot, or hatch, to make your ſtrokes follow the turnings and windings of the fleſhy parts. For though the rule be to croſs always, this dotting or hatching ought to appear a little more here, becauſe it rounds the parts. And as this mixture might make a colouring too red, if it was always to be uſed, they work likewiſe in every part, to blend the teints and the ſhades, with blue and a little green, and much white, ſo mixed as to be very pale; excepting, nevertheleſs, that this colour muſt not be put upon the cheeks, nor upon the extremities of the clear parts, no more than the other mixture upon theſe laſt, which muſt be left with all their light; as certain places of the chin, of the noſe, and of the forehead, and upon the cheeks; which ought nevertheleſs to be redder than the reſt, as well as the feet, the hollows of the hands, and the fingers of both.

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Observe, that these two last mixtures ought to be so pale, that the work shall hardly be visible; for they serve only to soften it; to unite the teints with one another, and the shades with the lights, and to drown the traces. Care must likewise be taken that you work not too much with the red mixture upon the blue teints, nor with the blue upon the others; but change the colour from time to time, when you perceive it works too blue or too red, till the work be finished.

The white of the eyes must be shadowed with this same blue, and a little flesh-colour; and the corners, on the side of the nose, with vermilion and white; giving them a little touch of carmine. The whole is softened with this mixture of vermilion, carmine, white, and a very small matter of ochre.

The apples or balls of the eyes are done with the mixture of ultramarine and white; the last prevailing a little; adding a little bistre, if they are yellowish; or a little black, if they are grey. Make the little black circle in the middle, called the *crystal of the eye;* and shadow the balls with indigo, bistre, or black, according to the colour they are of; giving to each a small touch of pure vermilion round the crystal; which must be lost with the rest at the finishing. This gives vivacity to the eye.

The round or circumference of the eye is done with bistre and carmine; that is to say, the slits or partings, and the eye-lids, when they are large and bold; especially the upper ones; which must afterwards be softened with the red or blue mixtures we have mentioned before, to the end they may be lost in one another, and nothing seem intersected. When this is done, give a little touch of pure white upon the crystal, on the side of the lights. This makes the eye shine, and gives life to it.

The mouth is dead-coloured with vermilion, mixed with white; and finished with carmine, which is softened as the rest. And when the carmine does not work dark enough, mix a little bistre with it. This is to be understood of the corners in the separation in the lips; and particularly, of certain mouths half open.

The hands, and all the other parts of carnation, are done in the same manner as the faces; observing, that the ends of the fingers be a little redder than the rest. When your whole work is formed and dotted, mark the separations of all the parts with little touches of carmine and orpiment mixed together, as well in the shadowy as the light places; but a little deeper and stronger in the first, and lose them in the rest of the carnation.

The eye-brows and the beard are dead-coloured, as are the shades of carnations; and finished with bistre, ochre, or black, according to the colour they are of, drawing them by little strokes the way they ought to go; that is to say, give them all the nature of hair. The lights of them must be heightened with ochre and bistre, a little vermilion, and much white.

For the hair of the head, make a lay of bistre, ochre, and white, and a little vermilion. When it is very dark-coloured, use black instead of ochre. Afterwards form the shadowy parts with the same colours, putting less white in them; and finish with pure bistre, or mixed with ochre or black, by small strokes very fine, and close to each other, waving and buckling them according to the curling of the hair. The light parts must also be heightened by little strokes with ochre or orpiment, white, and a little vermilion. After which, lose the lights and the shades in each other, by working sometimes with a dark and sometimes with a light colour.

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And for the hair about the forehead, through which the skin is seen, it must be first formed with the colour thereof, and that of the carnation, working and shadowing with one and the other, as if you designed to paint none. Then form it, and finish with bistre. The lights are to be heightened as the other. Grey hair is dead-coloured with white, black, and bistre, and finished with the same colour, but deeper; heightening the bright and clear parts of the hair, as well as those of the eye brows and the beard, with white and very pale blue, after having formed them as the others, with the colour of the flesh or skin; and finish with bistre.

But the most important thing is to soften one's work; to blend the teints in one another, as well as the beard and the hair about the forehead, with the other hair and the carnation; taking especial care not to work rough and dry; and that the traces, turnings, and windings of the carnation, or naked parts, be not intersected. You must likewise accustom yourself to put white in your colours only in proportion as you work lighter or darker: for the colour you use the second time must be always a little stronger and deeper than the first, unless it be for softening.

Different colourings are easily made, by putting more or less of red, or blue, or yellow, or bistre, whether for the dead-colouring, or for the finishing.—That for women ought to be bluish; that for children a little red; and both fresh and florid. That for men ought to be yellower; especially when they are old.

To make a colouring of death, there must be a first lay of white and orpiment, or a very pale ochre: dead-colour with vermilion, and lake, instead of carmine, and a good deal of white; and afterwards work over it with a green mixture, in which there is more blue than any other colour, to the end the flesh may be livid and of a purple colour. The teints are done the same way as in another colouring; but there must be a great many more blue than yellow ones, especially upon the parts which fly from the sight, and about the eyes; and the last are only to be upon the parts which rise and come nearer the eye. They are made to die away in one another, according to the ordinary manner; sometimes with very pale blue, and sometimes with ochre and white, and a little vermilion; softening the whole together. The parts and contours must be rounded with the same colours. The mouth is to be, in a manner, of a quite violet. It is dead-coloured, however, with a little vermilion, ochre, and white; but finished with lake and blue: and to give it the deep strokes, they take bistre and lake; with which they likewise do the same to the eyes, the nose, and the ears. If it is a crucifix, or some martyr, upon whom blood is to be seen, after the finishing the carnation, form it with vermilion, and finish it with carmine, making in the drops of blood a little bright reflecting spark, to round them. For the crown of thorns, make a lay of sea-green and masticot;

shadow

Of Carnations

shadow it with bistre and green; and heighten the clear and light parts with masticot.

Iron is formed, or first laid, with indigo, a little black and white; and finished with pure indigo, heightening it with white.

For painting fire and flames, the lights are done with masticot and orpiment; and for the shades, they mix vermilion and carmine.

A smoke is done with black, indigo, and white, and sometimes with bistre; one may likewise add vermilion or ochre, according to the colour it is to be of.

Pearls are painted by putting a lay of white, and a little blue: they are shadowed and rounded with the same colour, deeper; a small white dot is made almost in the middle, on the side of the light; and on the other side, between the shadow and the edge of the pearl, they give a touch with masticot, to make the reflection; and under the pearls is made a little shadow of the colour of the ground they are upon.

Diamonds are made with pure black; then they heighten them with little touches of white on the side of the light. It is the same thing for any other jewels you have a mind to paint: there is nothing to be done but to change the colour.

For making a figure of gold, put a lay of shell-gold, and shadow it with gall stone. Silver is done the same way; excepting that it must be shadowed with indigo.

One great means to acquire a perfection in the art, is to copy excellent originals. We enjoy with pleasure and tranquillity the labour and pains of others. But a man must copy a great number before he is able to produce as fine effects: and it is better to be a good copier than a bad author.

Sect. VI. *Of Landscapes.*

In the first place, after having ordered the economy of your landscape as of your other pieces, you must form the nearest grounds or lands, when they are to appear dark, with sap or lily-green, bistre, and a little verditer, to give a body to your colour; then dot with this mixture, but a little darker, adding sometimes a little black to it.

For such pieces of ground as the light falls upon, and which are therefore clear and bright, make a lay of ochre and white: then shadow and finish with bistre. In some they mix a little green, particularly for shadowing and finishing.

There are sometimes upon the fore-part certain reddish lands; which are dead-coloured with brown-red, white, and a little green; and finished with the same, putting a little more green in them.

For the making of grass and leaves upon the fore-ground, you must, when that is finished, form with sea-green, or verditer, and a little white; and for those that are yellowish, mix masticot. Afterwards shadow them with lily-green, or bistre and gall-stone, if you would have them appear withered.

The grounds or lands at a little distance are formed with verditer, and shadowed and finished with sap-green, adding bistre for some of the touches here and there.

Such as are at a greater distance, are done with sea-green and a little blue; and shadowed with verditer.

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In a word, the farther they go, the more bluish they are to be made; and the farthest distances ought to be of ultramarine and white; mixing in some places small touches of vermilion.

Water is painted with indigo and white, and shadowed with the same colour, but deeper; and to finish it, instead of dotting, they do nothing but make strokes and traces without crossing; giving them the same turn with the waves, when there are any. Sometimes a little green must be mixed in certain places, and the light and clear parts heightened with pure white, particularly where the water foams.

Rocks are dead-coloured like buildings of stone; excepting that a little green is mixed for forming and shadowing them. Blue and yellow teints are made upon them, and lost with the rest in finishing. And when there are small branches, with leaves, moss, or grass, when all is finished, they are to be raised at top with green and masticot. They may be made yellow, green, and reddish, for appearing dry, in the same manner as on the ground. Rocks are dotted as the rest; and the farther they are off, the more greyish they are made.

Castles, old houses, and other buildings of stone and wood, are done in the manner abovementioned; speaking of those things, when they are upon the first lines. But when you would have them appear at a distance, you must mix brown-red and vermilion, with much white; and shadow very tenderly with this mixture; and the farther they are off, the weaker are the strokes to be for the separations. If they are covered with slate, it is to be made bluer than the rest.

Trees are not done till the sky be finished; one may, nevertheless, spare the places of them when they contain a good number; and however it be, such as come near the eye, are to be dead-coloured with verditer, mixing sometimes ochre; and shadowed with the same colours, adding lily green. Afterwards you must work leaves upon them by dotting without crossing: for this must be done with small longish dots, of a darker colour, and pretty full of it, which must be conducted on the side the branches go, by little tufts of a little darker colour. Then heighten the lights with verditer or sea-green, and masticot, making leaves in the same manner: and when there are dry branches or leaves, they are dead-coloured with brown-red or gall-stone, with white; and finished with gall-stone, without white, or with bistre.

The trunks of trees are to be dead-coloured with ochre, white, and a little green, for the light and clear parts; and for the dark, they mix black, adding bistre and green for shadowing one and the other. Blue and yellow teints are likewise made upon them, and little touches given here and there with white and masticot; such as you ordinarily see upon the bark of trees.

The branches which appear among the leaves are done with ochre, verditer, and white; or with bistre and white, according to the light they are placed in. They must be shadowed with bistre and lily-green.

Trees, which are at a little distance, are dead-coloured with verditer and sea-green; and are shadowed

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and finished with the same colours, mixed with lily-green. When there are some which appear yellowish, lay with ochre and white, and finish with gall-stone.

For such as are in the distances and remote views, you must dead-colour with sea-green; with which, for finishing, you must mix ultramarine. Heighten the lights of one and the other with masticot, by small disjoined leaves.

It is the most difficult part of landscape, in manner of miniature, to leaf a tree well. To learn, and break one's hand to it a little, the way is to copy good ones; for the manner of touching them is singular, and cannot be acquired but by working upon trees themselves; about which you must observe to make little boughs, which must be leafed, especially such as are below and toward the sky.

And generally, let your landscapes be coloured in a handsome manner, and full of nature and truth; for it is that which gives them all their beauty.

Sect. VII. *Of Flowers.*

It is an agreeable thing to paint flowers, not only on account of the splendour of their different colours, but also by reason of the little time and pains that are bestowed in trimming them. There is nothing but delight in it: and, in a manner, no application. You maim and bungle a face, if you make one eye higher than another; a small nose with a large mouth; and so of other parts. But the fears of these disproportions constrain not the mind at all in flower-painting; for unless they be very remarkable, they spoil nothing. For this reason most persons of quality, who divert themselves with painting, keep to flowers. Nevertheless, you must apply yourself to copy justly: and for this part of miniature, as for the rest, we refer you to nature, for she is your best model. Work, then, after natural flowers; and look for the teints and different colours of them upon your pallet: a little use will make you find them easily; and to facilitate this to you at the first, we shall, in the continuance of our design, show the manner of painting some; for natural flowers are not always to be had; and one is often obliged to work after prints, where nothing is seen but graving.

It is a general rule, that flowers are designed and laid like other figures; but the manner of forming and finishing them is different: for they are first formed only by large strokes and traces, which you must turn at the first the way the small ones are to go, with which you finish; this turning aiding much thereto. And for finishing them, instead of hatching or dotting, you draw small strokes very fine, and very close to one another, without crossing; repassing several times, till your dark and your clear parts have all the force you would give them.

Of Roses.—After making your first sketch, draw with carmine the red rose, and apply a very pale lay of carmine and white. Then form the shades with the same colour, putting less white in it: and lastly, with pure carmine, but very bright and clear at the first; fortifying it more and more as you proceed in your work, and according to the darkness of the shades. This is done by large strokes. Then finish; working upon it with the same colour by little strokes, which you must make go the same way with those of the graving, if it be a print you copy; or the way the leaves of the rose turn, if you copy after a painting, or after nature; losing the dark in the clear parts, and heightening the greatest lights, and the brightest or most lightsome leaves, with white and a little carmine. You must always make the hearts of roses, and the side of the shadow darker than the rest; and mix a little indigo for shadowing the first leaves, particularly when the roses are blown, to make them seem faded. The seed is dead-coloured with gamboge; with which a little sap-green is mixed for shadowing. Roses streaked with several colours, ought to be paler than others, that the mixture of colours may be better seen; which are done with carmine; a little darker in the shades, and very clear in the lights; always hatching by strokes. For white roses you must put a lay of white, and form and finish them as the red; but with black, white, and a little bistre; and make the seed a little yellower. Yellow roses are done by putting in every part a lay of masticot, and shadowing them with gamboge, gall-stone, and bistre; heightening the clear and light places with masticot and white.

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The stiles, the leaves, and the buds of all sorts of roses are formed with verditer, with which is mixed a little masticot and gamboge; and for shadowing them, they add sap-green, putting less of the other colours when the shades are deep. The outside of the leaves ought to be bluer than the inside: wherefore it must be dead-coloured with sea-green, and sap-green mixed with that for shadowing, making the veins or fibres on this side clearer than the ground, and those on the other side darker. The prickles which are upon the stiles and buds of roses, are done with little touches of carmine, which are made to go every way; and for those that are upon the stalks, they are formed with verditer and carmine, and shadowed with carmine and bistre: making the bottom of the stalks more reddish than the top: *i. e.* you must mix with the green, carmine and pure bistre.

Of Tulips.—As there is an infinity of tulips, different from one another, one cannot pretend to mention the colours with which they are all done. We will only touch upon the handsomest, called *streaked*; and these streaks are dead-coloured with very clear carmine in some places, and with darker in others; finishing with the same colour by little strokes, which must be carried the same way with the streaks. And in others is put first a lay of vermilion. Then they form them by mixing carmine, and finish them with pure carmine. In some they put Florence-lake over the vermilion instead of carmine. Some are done with lake and carmine mixed together, and with lake alone, or with white and lake for the first forming; whether it be rose-pink or Florence-lake. There are some of a purple colour, which are formed with ultramarine, carmine, or lake, sometimes bluer and sometimes redder. The manner of doing both one and the other is the same: there is no difference but in the colours. You must, in certain places, as between the streaks of vermilion, carmine, or lake, sometimes put blue made of ultramarine and white, and sometimes a very bright purple, which is finished by strokes as the rest, and lost with the streaks. There are some

likewise

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likewise that have sallow teints, that are made with lake, bistre, and ochre, according as they are: but this is only in fine and rare tulips, and not in the common ones. For shadowing the bottom of them, they ordinarily take indigo and white for such whose streaks are of carmine. For such as are of lake, they take black and white; with which, in some, bistre is mixed, and in others green. Some are likewise to be shadowed with gamboge and umber, and always by strokes and traces, that turn as the leaves turn. Other tulips are likewise done, called *bordered;* that is to say, the tulip is not streaked but on the edges of the leaves, where there is a border. It is white in the purple; red in the yellow; yellow in the red; and red in the white. The purple is laid with ultramarine, carmine, and white; shadowing and finishing it with this mixture. The border is spared; that is to say, let only a light lay of white be put there, and let it be shadowed with very bright indigo. The yellow is formed with gamboge, and shadowed with the same colour, mixing ochre and umber or bistre with it. The border is laid with vermilion, and finished with a very small matter of carmine. The red is formed with vermilion, and finished with the same colour, mixing carmine or lake with it. The bottom and the border are done with gamboge; and for finishing, they add gall-stone and umber, or bistre. The white is shadowed with black, blue, and white. Indian ink is very proper for this. The shadowings of it are very tender. It produces alone the effect of blue and white, mixed with the other black. The border of this white tulip is done with carmine. In all these sorts of tulips, they leave a nerve or sinew in the middle of the leaves that are brighter than the rest: and the borders are drowned at the bottom by small traces, turning crosswise; for they must not appear cut and separated, as the streaked or party-coloured. They make them likewise of several other colours. When they happen to be such whose bottoms on the inside are black, as it were, they form and finish them with indigo, as also the seed about the nozzle or stalk. And if the bottom is yellow, it is formed with gamboge, and finished by adding umbre or bistre. The leaves and the stalks of tulips are ordinarily formed with sea-green, and shadowed and finished with lily-green, by large traces all along the leaves. Some may likewise be done with verditer, mixing masticot with it, and shadowed with sap-green, that the green of the shades may be yellower.

The Anemony, or *Wind-flower.*—There are several sorts of them, as well double as single. The last are ordinarily without streaks. Some are made of a purple colour, with purple and white, shadowing them with the same colour; some redder; others bluer; sometimes very pale, and sometimes very dark. Others are formed with lake and white, and finished with the same, putting less white; some without any white at all. Others are formed with vermilion, and shadowed with the same colour, adding carmine. We see likewise white ones, and some of a citron colour. The last are laid with masticot; and one and the other shadowed and finished sometimes with vermilion, and sometimes with very brown lake, especially near the seed, at the bottom; which is often likewise of a blackish colour, that is done with indigo, or black and blue, mixing for some a little bistre; and always working by very fine strokes and traces, and losing the lights in the shades. There are others that are brighter and clearer at the bottom than any where else; and sometimes they are perfectly white there, though the rest of the flower be dark. The seed of all these anemonies is done with indigo and black, with a very little white, and shadowed with indigo; and in some it is raised with masticot. The double anemonies are of several colours. The handsomest have their large leaves streaked. Some are done, that is, the streaked or party-coloured, with vermilion, to which carmine is added for the finishing; shadowing the rest of the leaves with indigo; and for the small leaves within, a lay is put of vermilion and white, and they are shadowed with vermilion mixed with carmine, mixing here and there some stronger touches, especially in the heart of the flower, next the great leaves on the side of the shadow. They finish with carmine, by little strokes and traces, turning the same way with the mixed or party-colours, and the leaves. They form and finish the streaks or party-colours of some others, as well as the small leaves, with pure carmine; leaving, nevertheless, in the middle of the last, a little circle, in which is laid dark purple, which is lost with the rest. And when all is finished, they give some touches with this same colour round about the small leaves, especially on the side of the shadow; drowning them with the large ones, the remainder of which is shadowed either with indigo or black. In some, the small leaves are done with lake or purple, though the party-colours of the large ones be done with carmine. There are others, whose mixed colours are done with carmine, in the middle of most of the large leaves; putting in some places vermilion underneath, and losing these colours with the shadows of the bottom; which are done with indigo and white. The small leaves are laid with masticot, and shadowed with very dark carmine on the side of the shade, and with very clear on the side of the light, leaving there in a manner pure masticot, and giving only some little touches with orpiment and carmine, to separate the leaves, which may be shadowed sometimes with a very little pale-green. There are double anemonies painted all red, and all purple. The first are formed with vermilion and carmine, in a manner without white, and shadowed with pure carmine, well gummed, that they may be very dark. Purple anemonies are laid with purple and white, and finished with white. In a word, there are double anemonies as there are single ones, of all colours; and they are done in the same manner. The green of one and the other is verditer; with which masticot is mixed for forming. It is shadowed and finished with sap-green. The stiles of them are a little reddish; wherefore they are shadowed with carmine mixed with bistre, and sometimes with green, after having laid them with masticot.

The Carnation and the Pink.—It is with pinks and carnations as with anemonies and tulips; that is, there are some mixt-coloured, and others of one single colour. The first are streaked and diversified sometimes with vermilion and carmine; sometimes with pure lake, or with white; some streaks very dark, and others very pale; sometimes by little streaks and diversifications, and sometimes by large ones. Their

bottoms

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bottoms are ordinarily ſhadowed with indigo and white. There are pinks of a very pale fleſh-colour, and ſtreaked and diverſified with another, a little deeper, made with vermilion and lake. Others, which are of lake and white, are ſhadowed and ſtreaked without white. Others all red, which are done with vermilion and carmine as dark as poſſible. Others all of lake. And, laſtly, there are others, wherein nature or fancy is the rule. The green of one and the other is ſea-green, ſhadowed with lily-green or ſap-green.

The Red-lily.—It is laid with red-lead, formed with vermilion, and in the deepeſt of the ſhades with carmine; and finiſhed with the ſame colour by ſtrokes and traces, turning as the leaves turn. The clear and light parts are heightened with red lead and white. The ſeed is done with vermilion and carmine. The green parts are done with verditer, ſhadowed with lily or ſap-green.

The Day-lily.—There are three ſorts of them:

1. The gridelin, a little red;
2. The gridelin, very pale; and,
3. The white.

For the firſt they put a lay of lake and white, and ſhadow and finiſh with the ſame colour deeper; mixing a little black to deaden it, eſpecially in the darkeſt places.

The ſecond are laid with white, mixed with a very little lake and vermilion, in ſuch a manner that theſe two laſt colours are hardly ſeen. Afterwards they ſhadow with black and a little lake, working redder in the middle of the leaves, next the ſtalks; which ought to be, as alſo the ſeed, of the ſame colour, particularly towards the top; and at the bottom a little greener.

The ſtile of the ſeed is laid with maſticot, and ſhadowed with ſap-green.

The other day-lilies are done by putting a lay of pure white, and ſhadowing and finiſhing with black and white.

The ſtalks of theſe laſt, and the greens of them all, are done with ſea-green, and ſhadowed with ſap-green.

The Hyacinth, or *Purple-flower*.—There are four ſorts of them:

The blue, a little dark;
Others paler;
The gridelin;
And the white.

The firſt are laid with ultramarine and white; and ſhadowed and finiſhed with leſs white. Others are laid and ſhadowed with pale blue. The gridelines are formed with lake and white, and a very ſmall matter of ultramarine; and finiſhed with the ſame colour a little deeper. For the laſt they put a lay of white; then they ſhadow them with black, with a little white; and finiſh them all by ſtrokes and traces, following the turnings and windings of the leaves. The green and the ſtalks of ſuch as are blue, are done with ſea and lily-green very dark: and in the ſtalks of the firſt may be mixed a little carmine, to make them reddiſh. The ſtalks of the two others, as alſo the green, are formed with verditer and maſticot, and ſhadowed with ſap-green.

The Piony.—A lay of Venice-lake and white muſt be put on all parts pretty ſtrong: then ſhadow with leſs white, and with none at all in the darkeſt places: after which finiſh with the ſame colour by traces, turning them as for the roſe; gumming it very much in the deepeſt of the ſhades; and raiſing the lights and the edges of the moſt lightſome leaves with white and a little lake. Little veins are likewiſe made, which go like the ſtrokes in hatching, but are more viſible. The green of this flower is done with ſea-green, and ſhadowed with ſap green.

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Cowslips.—They are of four or five colours. There are ſome of a very pale purple.

The gridelin. The white and the yellow.

The purple is done with ultramarine, carmine, and white; putting leſs white for ſhadowing. The gridelin is laid with Venice-lake, and a very ſmall matter of ultramarine, with much white; and ſhadowed with the ſame colour deeper. For the white, a lay of white muſt be put; and they muſt be ſhadowed with black and white; and finiſhed, as the others, by traces or ſtrokes. The heart of theſe cowſlips is done with maſticot, in the ſhape of a ſtar, which is ſhadowed with gamboge, making a little circle in the middle with ſap-green. The yellow are laid with maſticot, and ſhadowed with gamboge and umber. The ſtiles, the leaves, and the buds, are formed with verditer, mixed with a little maſticot, and finiſhed with ſap-green; making the fibres or veins, which appear upon the leaves, with this ſame colour; and heightening the lights of the largeſt with maſticot.

The Ranunculus, or *Crow-foot*.—There are ſeveral ſorts of them: the fineſt are the orange-coloured. For the firſt, they put a lay of vermillion, with a very ſmall matter of gamboge; and add carmine for ſhadowing; finiſhing it with this laſt colour, and a little gall-ſtone. In the others may be put Venice-lake, inſtead of carmine, eſpecially in the heart of the flower. The orange-coloured are laid with gamboge, and finiſhed with gall-ſtone, vermilion, and a little carmine; leaving ſome little yellow ſtreaks. The green of the ſtalks is done with verditer and very pale maſticot; mixing lily-green to ſhadow them. That of the leaves is a little darker.

The Crocus.—Theſe are of two colours:

Yellow and purple. The yellow are formed with maſticot and gall-ſtone, and ſhadowed with gamboge and gall-ſtone: after which, upon each leaf, on the outſide, are made three ſtreaks, ſeparate from one another, with biſtre and pure lake; which are loſt, by little traces, in the bottom. The outſide of the leaves is left all yellow.—The purple is laid with carmine, mixed with a little ultramarine, and very pale white. They are formed and finiſhed with leſs white; making likewiſe, in ſome, purple ſtripes or ſtreaks, very dark, as in the yellow; and in others only ſmall veins. The ſeed of both is yellow, and is done with orpiment and gall-ſtone. For the ſtiles, they put a lay of white, and ſhadow with black, mixed with a little green. The green of this flower is formed with very pale verditer, and ſhadowed with ſap-green.

The Iris.—The Perſian iris is done by putting, for the inſide leaves, a lay of white, and ſhadowing them with indigo and green together, leaving a little white ſeparation in the middle of each leaf; and for

thoſe

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those on the outside, they put in the same place a lay of masticot, which is shadowed with gall-stone and orpiment; making little dark and longish dots over all the leaf, at a small distance from one another. And at the end of each are made large stains, with bistre and lake in some, and in others with pure indigo, but very black. The rest, and the outside of the leaves, are shadowed with black. The green is formed with sea-green, and very pale masticot, and shadowed with sap-green. The Susian iris is laid with purple and white, putting a little more carmine than ultramarine; and for the shades especially in the middle leaves, they put less white; and, on the contrary, more ultramarine than carmine; making the veins of this very colour, and leaving in the middle of the inside leaves a little yellow sinew. There are others which have this very sinew in the first leaves; the end of which only is bluer than the rest. Others are shadowed and finished with the same purple, redder: They have also the middle sinew on the outside leaves; but white and shadowed with indigo. There are likewise yellow ones; which are done by putting a lay of masticot and orpiment; shadowing them with gall-stone, and making the veins upon the leaves with bistre. The green of one and the other is done with sea-green, mixing a little masticot for the stiles. They are shadowed with sap-green.

The Jasmin.—It is done with a lay of white, and shadowed with black and white; and for the outside of the leaves, they mix a little bistre; making the half of each, on this side, a little reddish with carmine.

The Tuberose.—For the doing of this, they make a lay of white, and shadow with black, with a little bistre in some places; and for the outside of the leaves they mix a little carmine, to give them a reddish teint, particularly upon the extremities. The seed is done with masticot, and shadowed with sap-green. The green of it is laid with verditer, and shadowed with sap-green.

The Hellebore.—The flower of hellebore is done almost in the same manner; that is, let it be laid with white, and shadowed with black and bistre, making the outside of the leaves a little reddish here and there. The seed is laid with dark green, and raised with masticot. The green of it is foul and rusty, and is formed with verditer, masticot, and bistre; and finished with sap-green and bistre.

The White lily.—It is laid with white, and shadowed with black and white. The seed is done with orpiment and gall-stone. And the green is done as in the tuberose.

The Snow-drop.—It is formed and finished as the white lily. The seed is laid with masticot, and shadowed with gall-stone. And the green is done with sea and sap-green.

The Jonquil.—It is laid with masticot and gall-stone, and finished with gamboge and gall-stone. The green is formed with sea-green, and shadowed with sap green.

The Daffodil.—All daffodils, the yellow, the double, and the single, are done by putting a lay of masticot: they are formed with gamboge, and finished by adding umbre and bistre; excepting the bell in the middle, which is done with orpiment and gall-stone, bordered or edged with vermilion and carmine. The white are laid with white, and shadowed with black and white; excepting the cup or bell, which is done with masticot and gamboge. The green is sea-green, shadowed with sap-green.

The Marigold.—It is done by putting a lay of masticot, and then one of gamboge; shadowing it with this very colour, after vermilion is mixed with it: and for finishing, they add gall-stone and a little carmine. The green is done with verditer, shadowed with sap-green.

The Austrian Rose.—For making the Austrian rose, they put a lay of masticot, and another of gamboge. Then they form it, mixing gall-stone; and finish it with the last colour, adding bistre and a very small matter of carmine in the deepest shades.

The Indian Pink, or *French Marigold*.—It is done by putting a lay of gamboge; shadowing it with this colour, after you have mixed a good deal of carmine and gall-stone with it; and leaving about the leaves a little yellow border of gamboge, very clear in the lights and darker in the shades. The seed is shadowed with bistre. The green, as well of the rose as the pink, is formed with verditer, and finished with sap-green.

The Sun-flower.—It is formed with masticot and gamboge, and finished with gall-stone and bistre. The green is laid with verditer and masticot, and shadowed with sap-green.

The Passion-flower.—It is done as the rose, and the green of the leaves likewise; but the veins are done with a darker green.

Poetical pinks and Sweet-william.—They are done by putting a lay of lake and white; shadowing them with pure lake, with a little carmine for the last; which are afterwards dotted on all parts with little round dots, separate from one another; and the threads in the middle are raised with white. The green of them is sea-green, which is finished with sap-green.

The Scabious.—There are two sorts of scabious, the red and the purple. The leaves of the first are laid with Florentine lake, in which there is a little white; and shadowed without white: and for the middle, which is a great boss or husk in which the seed lies, it is formed and finished with pure lake, with a little ultramarine or indigo to made it darker. Then they make little white longish dots over it, at a pretty distance from one another, clearer in the light than in the shade, making them go every way. The other is done by putting a lay of very pale purple, as well upon the leaves as the boss in the middle; shadowing both with the same colour, a little deeper: and instead of little white touches for the seed, they make them purple; and about each grain they make out a little circle, and this over the whole boss or husk in the middle. The green is formed with verditer and masticot, and shadowed with sap-green.

The Sword or *Day-lily*.—It is laid with Florence lake, and very pale white; formed and finished with pure lake, very clear and bright in some places, and very dark in others; mixing even bistre in the thickest of the shades. The green is verditer, shadowed with sap-green.

Hepatica, or *Liverwort*.—There is red and blue. The last is done by putting on all parts a lay of ultramarine, white, and a little carmine or lake; shadow-

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ing the inside of the leaves with this mixture, but deeper; excepting those of the first rank; for which, and for the outside of every one of them, they add indigo and white, that the colour may be paler, and not so fine. The red is laid with lake-columbine and very pale white; and finished with less white. The green is done with verditer, masticot, and a little bistre; and shadowed with sap-green, and a little bistre, especially on the outside of the leaves.

The Pomegranate.—The flower of the pomegranate is laid with red lead; shadowed with vermilion and carmine; and finished with this last colour. The green is laid with verditer and masticot, and shadowed with sap green.

The Flower of the Indian Bean.—It is done with a lay of Levant-lake and white; shadowing the middle leaves with pure lake; and adding a little ultramarine for the others. The green is verditer, shadowed with sap-green.

The Columbine.—There are columbines of several colours: the most common are the purple, the gridelin, and the red. For the purple, they lay with ultramarine, carmine, and white; and shadow with this mixture, deeper. The gridelin are done the same way, putting a great deal less ultramarine than carmine. The red are done with lake and white, finishing with less white. There are some mixed flowers of this kind, of several colours; which must be formed and finished as the others, but paler, making the mixtures of a little darker colour.

The Lark's Heel.—These are of different colours, and of mixed colours: the most common are the purple, the gridelin, and the red; which are done as the columbines.

Violets and Pansies.—Violets and pansies are done the same way; excepting that in the last the two middle leaves are bluer than the others, that is, the borders or edges; for the inside of them is yellow: and their little black veins are made, which take their beginning from the heart of the flower, and die away towards the middle.

The Muscipula, or *Catch-fly*.—There are two sorts of it, the white and the red; the last is laid with lake and white, with a little vermilion, and finished with pure lake. As for the knot or nozzle of the leaves, it is formed with white and a very small matter of vermilion, mixing bistre or gall-stone to finish it. The leaves of the white are laid with white; adding bistre and masticot upon the knots, which are shadowed with pure bistre, and the leaves with black and white. The green of all these flowers is done with verditer and masticot, and shadowed with sap-green.

The Crown Imperial.—There are of two colours, the yellow and the red. The first is done by putting a lay of orpiment, and shadowing it with gall-stone and orpiment, with a little vermilion. The other is laid with orpiment and vermilion, and shadowed with gall-stone and vermilion; making the beginning of the leaves next the stile, with lake and bistre, very dark; and veins with this mixture, both in one and the other, all along the leaves. The green is done with verditer and masticot, shadowed with sap-green and gamboge.

The Cyclamen, or *Sowbread*.—The red is laid with carmine, a little ultramarine, and much white; and finished with the same colour, deeper; putting, in a manner, only carmine in the middle of the leaves, next the heart, and in the rest add a little more ultramarine. The other is laid with white, and shadowed with black. The stalks of one and the other ought to be a little reddish; and the green, verditer and sap-green.

The Gilliflower.—There are several sorts of gilliflowers; the white, the yellow, the purple, the red, and the mixed, of various colours. The white are laid with white, and shadowed with black, and, with a little indigo in the heart of the leaves. The yellow, with masticot, gamboge, and gall-stone. The purple are formed with purple and white; and finished with less white; making the colour brighter in the heart, and even a little yellowish. The red with lake and white; finishing them with white. The mixed-coloured are laid with white, and the mixtures are sometimes made with purple, in which there is much ultramarine; others again, in which there is more carmine. Sometimes they are of lake, and sometimes of carmine. Some are done with white, and others without white; shadowing the rest of the leaves with indigo. The seed of all is formed with verditer and masticot, and finished with sap-green. The leaves and stiles are laid with the same green, mixing sap-green to finish them.

Fruits, fishes, serpents, and all sorts of reptiles, are to be touched in the same manner as the figures of men are; that is, hatched or dotted.

Birds and all other animals are done like flowers, by strokes or traces.

Never make use, for any of these things, of white-lead. It is only proper in oil. It blackens like ink, when only tempered with gum; especially if you set your work in a moist place, or where perfumes are. Ceruss of Venice is as fine, and of as pure a white. Be not sparing in the use of this, especially in forming or dead colouring; and let it enter into all your mixtures, in order to give them a certain body, which will render your work gluish, and make it appear soft, plump, and strong.

The taste of painters is, nevertheless, different in this point. Some use a little of it, and others none at all, But the manner of the last is meagre and dry. Others use a great deal; and doubtless it is the best method, and most followed among skilful persons: for besides that it is speedy, one may by the use of it copy all sorts of pictures; which would be almost impossible otherwise; notwithstanding the contrary opinion of some who say, that in miniature we cannot give the force and all the different teints we see in pieces in oil. But this is not true, at least of good painters; and effects prove it pretty plainly: for we see figures, landscapes, pictures, and every thing else in miniature, touched in as grand, as true, and as noble a manner (though more tender and delicate), as they are in oil.

However, painting in oil has its advantages; were they only these, that it exhibits more work, and takes up less time. It is better defended likewise against the injuries of time; and the right of birth must be granted it, and the glory of antiquity.

But miniature likewise has its advantages; and without repeating such as have been mentioned already, it is neater and more commodious. You may easily carry all

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all your implements in your pockets, and work when and wherever you please, without such a number of preparations. You may quit and resume it when and as often as you will; which is not done in the other; in which one is rarely to work dry.

To conclude: In the art of painting, excellence does not depend upon the greatness of the subject, but upon the manner in which it is handled. Some catch the airs of a face well; others succeed better in landscapes: some work in little who cannot do it in large: some are skilled in colours who know little of design: others, lastly, have only a genius for flowers: and even the Bassans got themselves a fame for animals; which they touched in a very fine manner, and better than any thing else.

Minum | Minium.

MINIM, in music, a note equal to two crotchets, or half a semibreve. See Music.

MINIMS, a religious order in the church of Rome, founded by St Francis de Paula, towards the end of the 15th century. Their habit is a coarse black woollen stuff, with a woollen girdle, of the same colour, tied in five knots. They are not permitted to quit their habit and girdle night nor day. Formerly they went bare-footed, but are now allowed the use of shoes.

MINIMUM, in the higher geometry, the least quantity attainable in a given case.

MINISTER, a person who preaches, performs religious worship in public, administers the sacraments, &c.

Minister of State, a person to whom the prince intrusts the administration of government. See Council.

Foreign Minister, is a person sent into a foreign country, to manage the affairs of his province or of the state to which he belongs. Of these there are two kinds: those of the first rank are ambassadors and envoys extraordinary, who represent the persons of their sovereigns; the ministers of the second rank are the ordinary residents.

MINIUM, or Red-lead, is a calx of lead of a vivid red colour, which colour it acquires by a slow calcination and reverberation. See Chemistry, n° 1213. The minium in commerce is chiefly brought from Holland, where large quantities of it are manufactured.

The method in which minium is made in large quantities in general is this—They first burn lead in a furnace into a kind of litharge, by continually stirring it while melted with an iron rake; this they afterwards grind with two pair of stones, which deliver it from one to another, the first pair grinding it coarser, the second finer; these are worked by means of a mill which moves six pair of them at once. When thus reduced to a fine powder, it is washed and then put into a furnace, and is burnt with a reverberatory fire for two or three days, all the while they continue stirring it with a large iron rake, hung on a swivel or iron hook; and toward the end of the time they watch its being of the right colour. When this is doing, the fire must not be carried beyond a certain degree, lest the matter clod and run together.

The process by which minium is prepared is described in the following manner by M. Jars *. The furnace is of the reverberatory kind, with two fire-places at the ends; each fire-place being separated from the area, or body of the furnace, by a wall twelve inches high. The fire places are fifteen inches broad, and their length is equal to the breadth of the whole furnace, which is about eight or nine feet. The length of the area from one place to the other is nine or ten feet. The quantity of lead used in one operation is about 1500 pounds, of which nine parts are lead obtained from furnaces where the ore is smelted, and one part is lead extracted from the scoria which is formed in smelting the ore. This latter kind is said to be necessary, as the former could not alone be reduced into powder. All the lead is at once put into the area, the bottom of which is level. The calx, as fast as it is formed, is drawn to one side, by means of a rake suspended by a chain before the mouth of the furnace. In four or five hours the whole quantity of the lead is calcined, or, if any pieces remain uncalcined, they are separated, and kept for the next operation. The heat employed is that of a cherry-red, and the fire-places and mouth are kept open, that the air may accelerate the calcination. The powder or calx is to be frequently stirred to prevent its concreting, and when this operation has been continued about 24 hours, the matter is taken out of the furnace, and laid on a flat pavement. Then cold water is thrown on it, to give it weight, as the workmen say; but rather (as M. Jars thinks) to make it friable. It is then to be ground in a mill, and the finer part is separated by washing, while the coarser part, reserved for some following operation, is to be placed at the mouth of the furnace in order to retain the melted lead. The fine powder, which is now of a yellow colour, is again put into the same or a similar furnace, and exposed to a very moderate fire, from 36 to 48 hours; during which time, it is stirred frequently to prevent its concreting; and the powder gradually acquires its proper red colour. The minium is then to be taken out of the furnace, cooled, and sifted through an iron sieve placed in a cask.

* Mem. de l'Acad. Royal, 1770.

The bright colour of minium might render it valuable in painting, if it could stand with certainty in either oil or water. But as it is subject to become black, it cannot be safely trusted, except in hard varnishes: and is, therefore, seldom used in oil, or even in water, unless for very gross purposes, or as a ground for vermilion. The goodness of minium may be distinguished by the brightness of its colour: and the adulteration to which it is liable may be detected by putting an ounce of it into a crucible with an equal quantity of charcoal dust, well mixed together, and placing the crucible in a common fire sufficient to melt lead, which is to be covered with another small crucible inverted into it. When it has been continued for some time on the fire, take it out and strike it against

against the ground. The minium will thus be reduced to its metallic state; and its diminished weight, when freed from the charcoal dust and cold, will indicate the proportion of adulterated matter. Minium is also used as a flux in forming the enamel for grounds, and in glazing, &c.

In medicine, minium is used as an external application. It obtunds the acrimony of the humours, allays inflammations, and is excellent in the cleansing and healing of old ulcers: It is used on these occasions in many of the plasters and ointments of the shops. It was an ingredient in the officinal composition called *emplastrum deminio*, employed as a deficcative and cicatrizer; but now disused for that made in the same manner with litharge, because it does not stick so well, and is more difficult of preparation.

MINNIN, a stringed instrument of music among the ancient Hebrews, having three or four cords to it. See Plate CCCXIV. Though there is reason to question the antiquity of this instrument; both because it requires a hair-bow, which was a kind of plectrum not known to the ancients, and because it so much resembles the modern viol. Kircher took the figures of this, the machul, chinnor, and psaltery, from an old book in th Vatican library.

MINOR, a Latin term, literally denoting *less*; used in opposition to *major*, greater.

Minor, in law, denotes a person under age; or who by the laws of the country, is not yet arrived at the power of administering his own affairs, or the possession of his estate. Among us, a person is a minor till the age of twenty one: before which time his acts are invalid. See Age, and Infant.

It is a maxim in the common law of England, that in the King there is no minority, and therefore he hath no legal guardian; and his royal grants and assents to acts of parliament are good, though he has not in his natural capacity attained the legal age of twenty-one. It is also provided by the custom and law of parliament, that no one shall sit or vote in either house, unless he be twenty-one years of age. This is likewise expressly declared by stat. 7 and 8. Will. III. cap. 25. with regard to the house of commons.

Minor, in logic, is the second reposition of a formal or regular syllogism, called also the *assumption*.

Minor, in music, is applied to certain concords, which differ from or are lower than others of the same denomination by a lesser semitone or four commas. Thus we say, a third minor, or lesser third, or a sixth major and minor. Concords that admit of major and minor, i. e. greater and less, are said to be imperfect concords.

MINORCA, an island of the Mediterranean, situated between 39 and 40 degrees of North Latitude, and near four degrees of East Longitude. It is about 33 miles in length from north-west to south-east, in breadth from eight to twelve, but in general about ten miles; so that in size it may nearly equal the county of Huntingdon or of Bedfordshire. The form is very irregular; and the coasts are much indented by the sea, which forms a great number of little creeks and inlets, some of which might be very advantageous.

This island is one of those called by the ancient Romans *Baleares*, which arose from the dexterity of the inhabitants in using the sling. It fell under the power of the Romans, afterwards of the northern barbarians, who destroyed that empire. From them it was taken by the Arabs, who were subdued by the king of Majorca, and he by the king of Spain. The English subdued it in 1708, and the French in the late war; but it was restored to Britain by the treaty of Paris in 1763.

The air of this island is much more clear and pure than in Britain; being seldom darkened with thick fogs: yet the low valleys are not free from mists and unwholesome vapours; and in windy weather the spray of the sea is driven over the whole island. Hence it happens that utensils of brass or iron are extremely susceptible of rust, in spite of all endeavours to preserve them; and household-furniture becomes mouldy. The summers are dry, clear, calm, and excessively hot; the autumns moist, warm, and unequal; at one time perfectly serene, at another cloudy and tempestuous. During the winter there are sometimes violent storms, though neither frequent nor of long continuance; and whenever they cease, the weather returns to its usual serenity. The spring is always variable, but resembles the winter more than the summer. The changes of heat and cold are neither so great nor so sudden in this climate as in many others. In the compass of a year, the thermometer seldom rises much above the 80th, or falls below the 48th degree. In summer there is scarcely ever a difference of four or five degrees between the heat of the air at noon and at night; and in winter the variation is still less considerable. But this must be understood of a thermometer shaded from the influence of the solar beams: for if exposed to them it will often rise 12, 14, or 16 degrees higher than what we have mentioned; and in other seasons the difference between the heat of the air in the sun and the shade is much greater. Yet, even in the dog-days, the heat of the atmosphere, at least in open places, seldom surpasses that of human blood. The winds are very boisterous about the equinoxes, and sometimes during the winter. At other times they are generally moderate, and, according to the observations of seamen, they rarely blow in the same direction near the islands adjacent to the gulph of Lyons as in the open sea. During the summer there is commonly a perfect calm in the mornings and evenings; but the middle of the day is cooled by refreshing breezes which come from the east, and, following the course of the sun, increase gradually till two or three in the afternoon; after which they insensibly die away as night approaches. This renders the heat of the sun less dangerous and inconvenient; and if these breezes intermit for a day or two, the natives grow languid and inactive from the heat. The northerly winds in general are clear and healthy, dispel the mists, and make a clear blue sky; whilst those which blow from the opposite quarter, render the air warm, moist, and unhealthy. The north wind is superior in power to all the rest; which appears from hence, that the tops of all the trees incline to the south, and the branches on the north side are bare and blasted. The next to it in force is the north-west. Both are frequent towards the close of winter and in the spring; and, being dry and cold, they shrivel up the leaves of the vegetables, destroy their tender shoots, and are often excessively detrimental to the vineyards and rising

Minorca. fing corn. The piercing blafts at that feafon from the north-eaft, as they are more moift and more frequently attended with rain, are lefs prejudicial. The fouth and fouth-eaft winds are by much the moft unhealthy. In whatever feafons they blow, the air is foggy, and affects the breathing; but in the fummer feafon they are fultry and fuffocating. An exceffive dejection of fpirits is then a univerfal complaint; and on expofing the thermometer to the rays of the fun, the mercury has frequently rifen above the 100th degree. The weft wind is ufually drier than the fouth: the eaft is cold and bluftering in the fpring, and fultry in the fummer.

The weather in Minorca is generally fair and dry; but when it rains, the fhowers are heavy, though of fhort continuance, and they fall moft commonly in the night. The fky in fummer is clear, and of a beautiful azure, without clouds or rain; but moderate dews defcend regularly after funfet. In autumn the weather becomes lefs ferene; whirlwinds and thunder become frequent; and in the night-time lightning, and thofe meteors called *falling ftars*, are very common. Water-fpouts alfo are often feen at that feafon, and frequently break upon the fhore. A fudden alteration in the weather takes place about the autumnal equinox; the fkies are darkened with clouds, and the rains fall in fuch quantities, that the torrents thereby occafioned, pouring down from the hills, tear up trees by the root, carry away cattle, break down fences, and do confiderable mifchief to the gardens and vineyards. But thefe anniverfary rains are much more violent than lafting; always falling in fudden and heavy fhowers, with intervals of fair weather. They are accompanied with thunder, lightning, and fquals of wind, moft commonly from the north. Hail and fnow are often intermixed with the rains which fall in winter and in fpring; but the fnow, for the moft part, diffolves immediately; and ice is here an uncommon appearance.

The whole coaft of Minorca lies low; and there are only a few hills near the centre, of which the moft confiderable, named *Toro* by the inhabitants, may be feen at the diftance of 12 or 14 leagues from the land. The furface of the ifland is rough and unequal; and in many places divided by long narrow vales of a confiderable depth, called *barancoes* by the natives. They begin towards the middle of the ifland, and after feveral windings terminate at the fea. The fouth-weft fide is more plain and regular than towards the north-eaft; where the hills are higher, with low marfhy valleys betwixt them, the foil lefs fruitful, and the whole tract unhealthy to man and beaft. Near the towns and villages the fields are well cultivated, and inclofed with ftone-walls; but the reft for the moft part are rocky, or covered with woods and thickets. There are fome pools of ftanding water, but very few rivulets, which is the greateft defect about the ifland, as the inhabitants have fcarcely any wholefome water excepting what is faved from the clouds.

The foil is light, thin, and very ftony, with a good deal of fea-falt, and, in fome places, of calcareous nitre intermixed. In moft places there is fo little earth, that the ifland appears to be but one large irregular rock covered here and there with mould, and an infinite variety of ftones. Notwithftanding this, however, it is not only extremely proper for vineyards, but produces more wheat and barley than could at firft fight be imagined; and, if the peafants may be credited, it would always yield a quantity of corn and wine fufficient for the natives, did not the violence of the winds, and the exceffive drought of the weather, frequently fpoil their crops. The fields commonly lie fallow for two years, and are fown the third. About the latter end of winter, or the beginning of fpring, they are firft broke up: and next autumn, as foon as the rains fall, they are again ploughed and prepared for receiving the proper feeds. The tillage is very eafily performed; for a plough fo light as to be tranfported from place to place on the ploughman's fhoulder, and to be drawn by an heifer, or an afs fometimes affifted by an hog, is fufficient for opening fo thin a foil. The later the harveft happens, the more plentiful it proves. The barley is ufually cut down about the 20th of May, N. S. and the wheat is reaped in June, fo that the whole harveft is commonly got in by midfummer-day. The grain is not threfhed with flails as in England, but trodden out on a fmooth piece of rock by oxen and affes, according to the cuftom of the eaftern nations.

The natives of Minorca are commonly lean, thin, and well-built, of a middle ftature, and olive complexion; but their character is by no means agreeable. Such is the natural impetuofity of their temper, that the flighteft caufe provokes them to anger, and they feem to be incapable of forgiving or forgetting an injury. Hence quarrels break out daily, even among neighbours and relations; and family difputes are tranfmitted from father to fon; and thus, though lawyers and pettifoggers are very numerous in this country, there are ftill too few for the clients. Both fexes are, by conftitution, extremely amorous; they are often betrothed to each other while children, and marry at the age of 14. The women have eafy labours, and commonly return in a few days to their ufual domeftic bufinefs; but, left the family fhould become too numerous for their income, it is a practice among the poorer fort to keep their children at the breaft for two or three years, that by this means the mothers may be hindred from breeding.

Bread of the fineft wheat flour, well fermented and well baked, is more than half the diet of people of all ranks. Rice, pulfe, vermicelli, herbs and roots from the garden, fummer-fruits, pickled olives, and pods of the Guinea pepper, make up almoft all the other half, fo that fcarce a fifth of their whole food is furnifhed from the animal kingdom; and of this fifh makes by much the moft confiderable portion. On Fridays, and other faft days, they abftain entirely from flefh; and during Lent they live altogether on vegetables and fifh, excepting Sundays, when they are permitted the ufe of eggs, cheefe, and milk. Moft of their difhes are high-feafoned with pepper, cloves, cinnamon, and other fpices; and garlic, onions, or leeks, are almoft conftant ingredients. They eat a great deal of oil, and that none of the fweeteft or beft flavoured; ufing it not only with fallads, but alfo with boiled and fried fifh, greens, pulfe, &c. inftead of butter. A flice of bread foaked in boiled water, with a little oil and falt, is the common breakfaft of the peafants, well known by the name of *oleagua*. Their ordinary meals are very

very frugal, and confift of very little variety; but on feftivals and other folemn occafions their entertainments are to the laft degree profufe and extravagant, infomuch that the bill of fare of a country farmer's wedding-dinner would fcarce be credited.

With regard to other matters, the Minorquins are accufed of prodigious indolence in the way of bufinefs, and neglect of the natural advantages they poffefs. In the bowels of the earth are iron, copper, and lead-ores, of none of which any ufe hath been made except the laft. A lead-mine was worked to advantage fome time ago, and the ore fent into France and Spain for the ufe of the potteries in thofe countries. The proprietor difcontinued his work on fome fmall difcouragement; and indeed it is faid, that thefe people are of all mankind the moft eafily put out of conceit with an undertaking that does not bring them in mountains of prefent gain, or that admits of the flighteft probability of difappointing their moft fanguine expectations: nor will their purfe admit of many difappointments: and thus their poverty co-operating with their natural defpondence and love of eafe, is the principal caufe of their backwardnefs to engage in projects, though ever fo promifing, for the improvement of their private fortune, and the advantage of the commerce of their country. This lead-ore went under the name of *vernis* among the natives, as it was wholly ufed by the potters in varnifhing and glazing their earthen veffels.

There are few exports of any account, and they are obliged to their neighbours for near one-third of their corn, all their oil, and fuch a variety of articles of lefs confideration, that nothing could preferve them from a total bankruptcy, but the Englifh money circulated by the troops, which is exchanged for the daily fupplies of provifions increafed by the multiplication of vineyards, the breeding of poultry, and the production of vegetables, in a proportion of at leaft five to one fince the ifland has been in poffeffion of the Britifh. It will not require many words to enumerate their exports: they make a fort of cheefe, little liked by the Englifh, which fells in Italy at a very great price; this, perhaps, to the amount of 800 l. *per annum.*—The wool they fend abroad may produce 900 l. more. Some wine is exported; and, if we add to its value that of the home-confumption, which has every merit of an export, being nine parts in ten taken off by the troops for ready money, it may well be eftimated at 1600 l. a-year. In honey, wax, and falt, their yearly exports may be about 400 l. and this comes pretty near the fum of their exports, which we eftimate together at 18,000 l. Sterling *per annum.*

A vaft balance lies againft them, if we confider the variety and importance of the articles they fetch from other countries, for which they muft pay ready cafh. Here it may be neceffary to withdraw fome things from the heap, fuch as their cattle, fheep, and fowls, on which they get a profit: for the country does not produce them in a fufficient abundance to fupply them, efpecially when the Britifh have a fleet of men of war ftationed there.

Their imports are, corn, cattle, fheep, fowls, tobacco, oil, rice, fugar, fpices, hard-ware, and tools of all kinds; gold and filver lace; chocolate, or cocoa to make it; tobacco, timber, plank, boards, millftones, tobacco-pipes, playing cards, turnery ware, feeds, foap, faddles; all manner of cabinet-makers work, iron fpikes, nails, fine earthen-ware, glafs-lamps, brafiery, paper, and other ftationary wares; copperas, galls, dye-ftuffs, painters brufhes, and colours; mufical inftruments, mufic, and ftrings; watches, wine, fruit, all manner of fine and printed linens, muflins, cambrics, and laces; bottles, corks, ftarch, indigo, fans, trinkets, toys, ribbands, tape, needles, pins, filk, mohair, lanthorns, cordage, tar, pitch, rofin, drugs, gloves, fire-arms, gunpowder, fhot, and lead; hats, caps, velvet, cotton ftuffs, woollen cloths, ftockings, capes, medals, veftments, luftres, pictures, images, agnus Dei's books, pardons, bulls, relics, and indulgencies.

The ifland is divided into what they ftyle *terminos*, of which there were anciently five, now reduced to four, and refemble our counties. The termino of Ciudadella, at the north-weftern extremity of the ifland, is fo ftyled from this place, which was once a city, and the capital of Minorca. It makes a venerable and majeftic figure, even in its prefent ftate of decay, having in it a large Gothic cathedral, fome other churches and convents, the governor's palace, and an exchange, which is no contemptible pile.—There are in it 600 houfes, which, before the feat of government and the courts of juftice were removed to Mahon, were fully inhabited; and there are ftill more gentlemens families here than in all the reft of the ifland. It hath a port commodious enough for the veffels employed in the trade of Britain, which though in the poffeffion of a maritime power, is lefs than it formerly was. It is ftill, in the ftyle of the officers, *the beft quarters* (and there are none bad) in the country; and if there was a civil government, and the place made a free port, the beft judges are of opinion it would very foon become a flourifhing place again; and the fortifications, if it fhould be found neceffary, might then alfo be eafily reftored and improved.

The termino of Fererias is the next, a narrow flip reaching crofs from fea to fea, and the country little cultivated; it is therefore united to Mercandal. In this laft termino ftands Mont-toro in the very centre of the ifle, and the higheft ground, fome fay the only mountain in it; on the fummit of which there is a convent, where even in the hotteft months the monks enjoy a cool air, and at all times a moft delightful profpect. About fix miles north from Mont-toro ftands the caftle that covers Port Fornelles, which is a very fpacious harbour on the eaft fide of the ifland. There are in it fhoals and foul ground, which, to thofe who are unacquainted with them, render it difficult and dangerous; yet the packets bound from Mahon to Marfeilles frequently take fhelter therein; and while the Spaniards were in poffeffion of the ifle, large fhips and men of war frequented it. At a fmall diftance from this lies another harbour called *Adaia*, which runs far into the land; but being reputed unfafe, and being fo near Fornelles, is at prefent ufelefs. The country about it is, however, faid to be the pleafanteft and wholefomeft fpot in the ifland, and almoft the only one plentifully fupplied with excellent fpring-water; fo that the gardens are well laid out, and the richeft and fineft fruits grow here in the higheft perfection. Alair is the next termino, in which there is nothing remarkable.

remarkable but the capital of the ſame name, well ſituated on an eminence, in a pleaſant and tolerably cultivated country.

The termino of Mahon, at the ſouth-eaſt end of the iſland, is at preſent the moſt conſiderable of them all, containing about 60,000 Engliſh acres, and nearly one-half of the inhabitants in Minorca. The town of Mahon derives its name from the Carthagenian general Mago, who is univerſally allowed to be its founder.—It ſtands on an eminence on the weſt ſide of the harbour, the aſcent pretty ſteep. There are in it a large church, three convents, the governor's palace, and ſome other public edifices. It is large, but the ſtreets are winding, narrow, and ill-paved. The fortreſs of St Philip ſtands near the entrance of the harbour, which it covers, is very ſpacious, of great ſtrength, with ſubterranean works to protect the garriſon from bombs, large magazines, and whatever elſe is neceſſary to render it a complete fortification, and hath a numerous and well-diſpoſed artillery. Port Mahon is allowed to be the fineſt harbour in the Mediterranean, about 90 fathoms wide at its entrance, but within very large and ſafe, ſtretching a league or more into the land. Beneath the town of Mahon there is a very fine quay, one end of which is reſerved for the ſhips of war, and furniſhed with all the accommodations neceſſary for careening and refitting them; the other ſerves for merchantmen. On the other ſide the harbour is Cape Mola, where it is generally agreed a fortreſs might be conſtructed which would be impregnable, as the caſtle of St Philip was eſteemed before it was taken by the Britiſh, who beſtowed ſo much money upon it, that, though ſome works were erected at Cape Mola, it was not judged proper to proceed in the fortifications there at a freſh expence; at leaſt this is the only reaſon that hath been aſſigned. Minorca was taken by the Spaniards during the American war, and is now in their poſſeſſion.

MINORS, or Friers Minor, an appellation which the Franciſcans aſſume, out of ſhew of humility; calling themſelves *fratres minores*, i. e. leſſer brothers, and ſometimes *minorites*. There is alſo an order of regular minors at Naples, which was eſtabliſhed in the year 1588, and confirmed by Sextus V.

MINOS (fab. hiſt.), a king of Crete, ſon of Jupiter and Europa. He flouriſhed about 1432 years before the Chriſtian era. He gave laws to his ſubjects, which ſtill remained in full force in the age of the philoſopher Plato, about 1000 years after the death of the legiſlator. His juſtice and moderation procured him the appellation of the favourite of the gods, the confident of Jupiter, and the wiſe legiſlator, in every city of Greece; and, according to the poets, he was rewarded for his equity after death with the office of ſupreme and abſolute judge in the infernal regions. In this capacity he is repreſented ſitting in the middle of the ſhades, and holding a ſcepter in his hand. The dead plead their different cauſes before him; and the impartial judge ſhakes the fatal urn, which is filled with the deſtinies of mankind. He married Ithona, by whom he had Lycaſtes, who was the father of Minos II.

Minos II. was a ſon of Lycaſtes, the ſon of Minos I. and king of Crete. He married Paſiphae, the daughter of Sol and Perſeis, and by her he had many children. He increaſed his paternal dominions by the conqueſt of the neighbouring iſlands; but ſhowed himſelf cruel in the war which he carried againſt the Athenians, who had put to death his ſon Androgeus. He took Megara by the treachery of Scylla; and not ſatisfied with victory, he obliged the vanquiſhed to bring him yearly to Crete ſeven choſen boys, and the ſame number of virgins to be devoured by the Minotaur. This bloody tribute was at laſt aboliſhed when Theseus had deſtroyed the monſter. When Dædalus, whoſe induſtry and invention had fabricated the labyrinth, and whoſe imprudence in aſſiſting Paſiphae in the gratification of her unnatural deſires, had offended Minos, fled from the place of his confinement with wings, and arrived ſafe in Sicily; the incenſed monarch purſued the offender, reſolved to puniſh his infidelity. Cocalus, king of Sicily, who had hoſpitably received Dædalus, entertained his royal gueſt with diſſembled friendſhip; and, that he might not deliver to him a man whoſe ingenuity and abilities he ſo well knew, he put Minos to death. Minos died about 35 years before the Trojan war. He was father of Androgeus, Glaucus, and Deucalion; and two daughters, Phædra and Ariadne. Many authors have confounded the two Minoſes, the grandfather and the grandſon; but Homer, Plutarch, and Diodorus, prove plainly that they were two different perſons.

MINOTAUR (fab. hiſt.), a celebrated monſter, half a man and half a bull, according to this verſe of Ovid,

Semibovemque virum, ſemivirumque bovem.

It was the fruit of Paſiphae's amour with a bull. Minos refuſed to ſacrifice a white bull to Neptune, an animal which he had received from the god for that purpoſe. This offended Neptune, and he made Paſiphae the wife of Minos enamoured of this fine bull, which had been refuſed to his altars. Dædalus proſtituted his talents in being ſubſervient to the queen's unnatural deſires; and by his means, Paſiphae's horrible paſſions were gratified, and the Minotaur came into the world. Minos confined in the labyrinth this monſter, which convinced the world of his wife's laſciviouſneſs, and reflected diſgrace upon his family. The Minotaur uſually devoured the choſen young men and maidens which the tyranny of Minos yearly exacted from the Athenians. Theſeus delivered his country from this tribute, when it had fallen to his lot to be ſacrificed to the voracity of the Minotaur; and by means of Ariadne, the king's daughter, he deſtroyed the monſter, and made his eſcape from the windings of the labyrinth.—The fabulous tradition of the Minotaur, and of the infamous commerce of Paſiphae with a favourite bull, has been often explained. Some ſuppoſe that Paſiphae was enamoured of one of her huſband's courtiers called *Taurus;* and that Dædalus favoured the paſſions of the queen, by ſuffering his houſe to become the retreat of the two lovers. Paſiphae ſome time after brought twins into the world, one of whom greatly reſembled Minos and the other Taurus; and in the natural reſemblance of their countenance with that of their ſuppoſed fathers, originated their name, and conſequently the fable of the Minotaur.

MINOW, a very ſmall ſpecies of cyprinus, ſo well known that it needs no deſcription.

Minster, Minstrel.

MINSTER (Saxon, *Mynster* or *Mynstre*), anciently signified the church of a monastery or convent.

MINSTREL, an ancient term for a singer and instrumental performer.

The word *minstrel* is derived from the French *menestrier*, and was not in use here before the Norman conquest. It is remarkable, that our old monkish historians do not use the word *citharœdus*, *cantator*, or the like, to express a *minstrel* in Latin; but either *mimus*, *histrio*, *joculator*, or some other word that implies *gesture*. Hence it should seem that the minstrels set off their singing by mimicry or action, or, according to Dr Brown's hypothesis, united the powers of melody, poem, and dance.

The Saxons, as well as the ancient Danes, had been accustomed to hold men of this profession in the highest reverence. Their skill was considered as something divine, their persons were deemed sacred, their attendance was solicited by kings, and they were everywhere loaded with honours and rewards. In short, poets and their art were held among them in that rude admiration which is ever shown by an ignorant people to such as excel them in intellectual accomplishments. When the Saxons were converted to Christianity, in proportion as letters prevailed among them, this rude admiration began to abate, and poetry was no longer a peculiar profession. The poet and the minstrel became two persons. Poetry was cultivated by men of letters indiscriminately, and many of the most popular rhymes were composed amidst the leisure and retirement of monasteries. But the minstrels continued a distinct order of men, and got their livelihood by singing verses to the harp at the houses of the great. There they were still hospitably and respectfully received, and retained many of the honours shown to their predecessors the Bards and Scalds. And indeed, though some of them only recited the compositions of others, many of them still composed songs themselves; and all of them could probably invent a few stanzas on occasion. There is no doubt but most of the old heroic ballads were produced by this order of men. For although some of the larger metrical romances might come from the pen of the monks or others, yet the smaller narratives were probably composed by the minstrels who sung them. From the amazing variations which occur in different copies of these old pieces, it is evident they made no scruple to alter each other's productions, and the reciter added or omitted whole stanzas according to his own fancy or convenience.

In the early ages, as is hinted above, this profession was held in great reverence among the Saxon tribes, as well as among their Danish brethren. This appears from two remarkable facts in history, which show that the same arts of music and song were equally admired among both nations, and that the privileges and honours conferred upon the professors of them were common to both; as it is well known their customs, manners, and even language, were not in those times very dissimilar.

When King Alfred the Great was desirous to learn the true situation of the Danish army, which had invaded his realm, he assumed the dress and character of a minstrel; and taking his harp, and only one attendant (for in the earliest times it was not unusual for a minstrel to have a servant to carry his harp), he went with the utmost security into the Danish camp. And though he could not but be known to be a Saxon, the character he had assumed procured him a hospitable reception; he was admitted to entertain the king at table, and staid among them long enough to contrive that assault which afterwards destroyed them. This was in the year 878.

Minstrel.

About 60 years after, a Danish king made use of the same disguise to explore the camp of King Athelstan. With his harp in his hand, and dressed like a minstrel, Anlaff king of the Danes went among the Saxon tents, and taking his stand near the king's pavilion, began to play, and was immediately admitted. There he entertained Athelstan and his lords with his singing and his music; and was at length dismissed with an honourable reward, though his songs must have discovered him to have been a Dane. Athelstan was saved from the consequences of this stratagem by a soldier, who had observed Anlaff bury the money which had been given him, from some scruple of honour or motive of superstition. This occasioned a discovery.

From the uniform procedure of both these kings, it is plain that the same mode of entertainment prevailed among both people, and that the minstrel was a privileged character among both. Even as late as the reign of Edward II. the minstrels were easily admitted into the royal presence, as appears from a passage in Stow, which also shows the splendor of their appearance.

"In the year 1316, Edward II. did solemnise his feast of Pentecost at Westminster, in the great hall: where sitting royally at the table with his peers about him, there entered a woman adorned like a minstrel, sitting on a great horse trapped, as minstrels then used, who rode round about the tables, showing pastime; and at length came up to the king's table, and laid before him a letter, and forthwith turning her horse, saluted every one, and departed."—The subject of this letter was a remonstrance to the king on the favours heaped by him on his minions, to the neglect of his knights and faithful servants.

The messenger was sent in a minstrel's habit, as what would gain an easy admission; and was a woman concealed under that habit, probably to disarm the king's resentment: for we do not find that any of the real minstrels were of the female sex; and therefore conclude this was only an artful contrivance peculiar to that occasion.

In the 4th year of Richard II. John of Gaunt erected at Tetbury in Staffordshire, a court of minstrels, with a full power to receive suit and service from the men of his profession within five neighbouring counties, to enact laws, and determine their controversies; and to apprehend and arrest such of them as should refuse to appear at the said court, annually held on the 16th of August. For this they had a charter, by which they were empowered to appoint a king of the minstrels, with four officers, to preside over them. These were every year elected with great ceremony; the whole form of which is described by Dr Plott; in whose time, however, they seem to have become mere musicians.

Even so late as the reign of King Henry VIII. the reciters of verses or moral speeches learnt by heart, intruded without ceremony into all companies; not

Minstrel. only in taverns, but in the houses of the nobility themselves. This we learn from Erasmus, whose argument led him only to describe a species of these men who did not sign their compositions; but the others that did, enjoyed without doubt the same privileges.

We find that the minstrels continued down to the reign of Elizabeth; in whose time they had lost much of their dignity, and were sinking into contempt and neglect. Yet still they sustained a character far superior to any thing we can conceive at present of the singers of old ballads.

When Queen Elizabeth was entertained at Killingworth castle by the earl of Leicester in 1575, among the many devices and pageants which were exhibited for her entertainment, one of the personages introduced was that of an ancient minstrel, whose appearance and dress are so minutely described by a writer there present, and gives us so distinct an idea of the character, that we shall quote the passage at large.

"A person very meet seemed he for the purpose, of xlv. years old, apparelled partly as he would himself. His cap off: his head seemingly rounded tonsterwise: fair-kembed, that, with a sponge daintly dipt in a little capon's grease, was finely smoothed, to make it shine like a mallard's wing. His beard snugly shaven: and yet his shirt after the new trink, with ruffs fair starched, sleeked and glistering like a pair of new shoes, marshalled in good order with a setting stick, and strut, 'that' every ruff stood up like a wafer. A side [i. e. long] gown of Kendale green, after the freshness of the year now, gathered at the neck with a narrow gorget, fastened afore with a white clasp and a keeper close up to the chin; but easily, for heat, to undo when he list. Seemingly begirt in a red caddis girdle: from that a pair of capped Sheffield knives hanging a' two sides. Out of his bosom drawn from a lappet of his napkin edged with a blue lace, and marked with a D for Damian; for he was but a batchelor yet.

"His gown had side [i. e. long] sleeves down to mid leg, slit from the shoulder to the hand, and lined with white cotton. His doublet-sleeves of black worsted: upon them a pair of pointes of tawny chamlet laced along the wrist with blue threaden pointes. A wealt towards the hands of fustian-a-napes. A pair of red neather-stocks. A pair of pumps on his feet, with a cross cut at his toes for corns; not new indeed, yet cleanly blackt with soot, and shining as a shoing horn.

"About his neck a red ribband suitable to his girdle. His harp in good grace dependent before him. His wrest tyed to a green lace and hanging by: under the gorget of his gown a fair flaggon chain, (pewter for) silver, as a squire Minstrel of Middlesex, that travelled the country this summer season, unto fair and worshipful mens houses. From his chain hung a scutcheon, with metal and colour, resplendent upon his breast, of the ancient arms of Islington."

—This minstrel is described as belonging to that village. We suppose such as were retained by noble families wore their arms hanging down by a silver chain as a kind of badge. From the expression of Squire Minstrel above, we may conclude there were other inferior orders, as Yeomen Minstrels, or the like.

This minstrel, the author tells us a little below, "after three lowly courtesies, cleared his voice with a hem . . . and wiped his lips with the hollow of his hand for 'filing his napkin; tempered a string or two with his wrest; and, after a little warbling on his harp for a prelude, came forth with a solemn song, warranted for story out of King Arthur's acts, &c."

Towards the end of the 16th century, this class of men had lost all credit, and were sunk so low in the public opinion, that in the 39th year of Elisabeth a statute was passed by which "minstrels, wandering abroad," were included among "rogues, vagabonds, and sturdy beggars," and were adjudged to be punished as such. This act seems to have put an end to the profession, for after this time they are no longer mentioned.

Mint. MINT, the place in which the king's money is coined. See Coinage.

There were anciently mints in almost every county in England; but the only mint at present in the British dominions is that in the tower of London. The officers of the mint are, 1. The warden of the mint, who is the chief; he oversees the other officers, and receives the bullion. 2. The master-worker, who receives bullion from the warden, causes it to be melted, delivers it to the monyers, and, when it is coined, receives it again. 3. The comptroller, who is the overseer of all the inferior officers, and sees that all the money is made to the just assize. 4. The assay-master, who weighs the gold and silver, and sees that it is according to the standard. 5. The two auditors who take the accounts. 6. The surveyor of the melting; who, after the assay-master has made trial of the bullion, sees that it is cast out, and not altered after it is delivered to the melter. 7. The engraver; who engraves the stamps and dyes for the coinage of the money. 8. The clerk of the irons; who sees that the irons are clean and fit to work with. 9. The melter who melts the bullion before it be coined. 10. The provost of the mint; who provides for and oversees all the moneyers. 11. The blanchers; who anneal and cleanse the money. 12. The moneyers; some of whom forge the money, some share it, some round and mill it, and some stamp and coin it. 13. The porters who keep the gate of the mint.

Mint was also a pretended place of privilege, in Southwark, near the King's Bench, put down by statute. If any persons, within the limits of the mint, shall obstruct any officer in the serving of any writ or process, &c. or assault any person therein, so as he receive any bodily hurt, the offender shall be guilty of felony, and be transported to the plantations, &c. Stat. 9. Geo. I.

Mint-Marks. It hath been usual, from old time, to oblige the masters and workers of the mint, in the indentures made with them, "to make a privy mark in all the money that they made, as well of gold as of silver, so that another time they might know, if need were, and witte which moneys of gold and silver among other of the same moneys, were of their own making, and which not." And whereas, after every trial of the pix at Westminster, the masters and workers of the mint, having there proved their moneys to be lawful and good, were immediately entitled to receive their *quietus* under the great seal, and to be discharged

charged from all suits or actions concerning those moneys, it was then usual for the said masters and workers to change the privy mark before used for another, that so the moneys from which they were not yet discharged might be distinguished from those for which they had already received their *quietus:* which new mark they then continued to stamp upon all their moneys, until another trial of the pix gave them also their *quietus* concerning those.

The pix is a strong box with three locks, whose keys are respectively kept by the warden, master, and comptroller of the mint; and in which are deposited, sealed up in several parcels, certain pieces taken at random out of every *journey* as it is called; that is, out of every 15 pounds weight of gold, or 60 pounds weight of silver, before the same is delivered to the proprietors. And this pix is, from time to time, by the king's command, opened at Westminster, in the presence of the lord-chancellor, the lords of the council, the lords-commissioners of the treasury, the justices of the several benches, and the barons of the exchequer; before whom a trial is made, by a jury of goldsmiths impanelled and sworn for that purpose, of the collective weights of certain parcels of the several pieces of gold and silver taken at random from those contained in the pix; after which those parcels being severally melted, assays are then made of the bullion of gold and silver so produced, by the melting certain small quantities of the same against equal weights taken from the respective trial-pieces of gold and silver that are deposited and kept in the exchequer for that use. This is called the *trial of the pix;* the report made by the jury upon that trial is called the *verdict of the pix* for that time; and the indented trial-pieces just abovementioned, are certain plates of standard gold and standard silver, made with the greatest care, and delivered in upon oath, from time to time as there is occasion, by a jury of the most able and experienced goldsmiths, summoned by virtue of a warrant from the lords of the treasury to the wardens of the mystery of goldsmiths of the city of London for that purpose; and which plates being so delivered in, are divided each, at this time, into seven parts by indentures, one of which parts is kept in his majesty's court of exchequer at Westminster, another by the said company of goldsmiths, and two more by the officers of his majesty's mint in the tower; the remaining three being for the use of the mint, &c. in Scotland. The pix has sometimes been tried every year, or even oftener, but sometimes not more that once in several years: and from hence is understood how it comes to pass, that, among the pieces that are dated as well as marked, three or more different dates are sometimes found upon pieces impressed with the same mark; and again, that different marks are found upon pieces bearing the same date. These marks are first observable upon the coins of King Edward III.; the words above quoted concerning those marks are from the indentures made with the lord Hastings, master and worker to King Edward IV.; and the marks themselves continued to be stamped very conspicuously upon the moneys, till the coinage by the mill and screw was introduced and settled after the restoration, in the year 1662: since which time, the moneys being made with far greater regularity and exactness than before, these marks have either been totally laid aside, or such only have been used as are of a more secret nature, and only known to the officers and engravers concerned in the coinage: and indeed the constant practice that has ever since prevailed, of dating all the several pieces, has rendered all such marks of much less consequence than before.

Mint, in botany. See Mentha.

MINTURNÆ, a town of Compania between Sinuessa and Formiæ. It was in the marshes in this neighbourhood that Marius concealed himself in the mud to avoid the partizans of Sylla. The people condemned him to death; but when his voice alone had terrified the executioner, they showed themselves compassionate and favoured his escape.

MINUET, a very graceful kind of dance, consisting of a coupee, a high step, and a balance: it begins with a beat, and its motion is triple.

The invention of the minuet seems generally to be ascribed to the French, and particularly to the inhabitants of the province of Poictou. The word is said by Menage and Furetiere to be derived from the French *menue* or *menu*, "small, or little;" and in strictness signifies a small pace. The melody of this dance consists of two strains, which, as being repeated, are called *reprises*, each having eight or more bars, but never an odd number. The measure is three crotchets in a bar, and thus marked $\frac{3}{4}$, though it is commonly performed in the time $\frac{3}{8}$. Walther speaks of a minuet in Lully's opera of *Roland*, each strain of which contains ten bars, the sectional number being 5; which renders it very difficult to dance.

MINUTE, in geometry, the 60th part of a degree of a circle.

Minute *of Time*, the 60th part of an hour.

Minute, in architecture, usually denotes the 60th, sometimes the 30th, part of a module. See Architecture.

Minute is also used for a short memoir, or sketch of a thing taken in writing.

MINUTIUS Felix. See Felix.

MINYÆ, a name given to the inhabitants of Orchomenos in Bœotia, from Minyas king of the country. Orchomenos the son of Minyas gave his name to the capital of the country; and the inhabitants still retained their original appellation, in contradistinction to the Orchomenians of Arcadia. A colony of Orchomenians passed into Thessaly and settled in Iolchos; from which circumstance the people of the place, and particularly the Argonauts, were called *Minyæ*. This name they received, according to the opinion of some, not because a number of Orchomenians had settled among them, but because the chief and noblest of them were descended from the daughters of Minyas. Part of the Orchomenians accompanied the sons of Codrus when they migrated to Ionia. The descendants of the Argonauts, as well as the Argonauts themselves, received the name of *Minyæ*. They first inhabited Lemnos, where they had been born from the Lemnian women who had murdered their husbands. They were driven from Lemnos by the Pelasgi, about 1160 before the Christian era, and came to settle in Laconia, from whence they passed into Calliste with a colony of Lacedemonians.

Miquelets ‖ Mirabilis.

MIQUELETS, a name given to the Spaniards who inhabit the Pyrenean mountains on the frontiers of Arragon and Catalonia, and live by robbing.

MIQUELON, a ſmall deſart iſland to the ſouth-weſt of Cape May in Newfoundland, ceded to the French by the peace of 1763, for drying and curing their fiſh. W. Long. 54. 30. N. Lat. 47. 22.

MIRABILIS, MARVEL, or PERU: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking with thoſe of which the order is doubtful. The corolla is funnel-ſhaped above; the calyx inferior; the nectarium globular, containing the germen. The moſt remarkable ſpecies are,

1. The jalappa or common marvel of Peru. It has a large, thick, fleſhy root; an upright, thick, jointed ſtalk, dividing and branching numerouſly, widely, and erectly, a yard or more high; garniſhed with oblong, broad, oppoſite leaves; and all the branches and ſhoots terminated by numerous flowers in cluſters, of different colours in the varieties. Of this there are varieties with white flowers—with yellow flowers—with purple flowers—with red flowers—with white and yellow flowers—white and purple flowers—purple and yellow flowers—red and yellow flowers Several other varieties often riſe from ſeed; and it is remarkable, that although ſeveral of the above colours and variegations are ſometimes common to the ſame plant, yet it is rare that a plant of this ſpecies produces flowers of one of thoſe colours alone; ſometimes, however, the ſame plant will exhibit only white and purple flowers ſeparate, and ſometimes both colours in the ſame flowers, intermixed with the plain ones: the ſame is alſo obſervable in the red and yellow; others have plain flowers of ſeveral different colours, and ſometimes variegated flowers alſo on the ſame plants. This ſpecies has a large tap root, which, when cut acroſs, is not unlike that of the true jalap; but, when dried, is white, light, and ſpungy. 2. The longiflora, or long-flowered mirabilis, hath a large, thick, fleſhy root; a thick ſtalk, dividing low into many declinated ſpreading branches, extending two or three feet every way; large, heart-formed, hairy, viſcous leaves, in oppoſite pairs: and all the branches and ſhoots terminated by white flowers in cluſters, having very long tubes, nodding downward. 3. The dichotoma, dichotomous, or forked mirabilis, has a thick fleſhy root; an upright, thick, ſwollen, jointed ſtem, branching forkedly two or three feet high; oblong oppoſite leaves; and ſmalliſh red flowers at the axillas, ſingly and cloſe-ſitting.

All theſe plants flower in July, continuing in plentiful ſucceſſion until October, very conſpicuous and elegant. They have the ſingularity of being ſhut all day, and expanding towards the evening when the ſun declines; hence the inhabitants of the Indies, where they grow naturally, called them *four o'clock flowers*: their time of opening here, however, depends on the weather; for, if cloudy, or that the ſun is not very vehement, they often open great part of the day. They are naturally perennial in root; but in this country are commonly conſidered as annuals: for they riſe from ſeed in the ſpring, and the ſame year produce flowers and perfect ſeed; and if left to nature in the open air, totally periſh in winter, at the firſt attack of froſt or exceſſive wet. If in autumn, however, when the ſtalks begin to aſſume a ſtate of decay, the roots are taken up, and preſerved in ſand in a dry room all winter, and planted again in ſpring, they ſhoot out afreſh ſtronger than at firſt, and ſometimes obtain four or five feet ſtature, with very ſpreading heads; or if plants growing in pots, having the ſtems cut down in autumn, and the pots placed in a green-houſe, or garden-frames under glaſſes, the roots may alſo be preſerved ſound, and will ſhoot out again in ſpring as above.

Miracle.

The roots of all theſe plants are purgative; but require to be given in a great quantity to operate equal to the true jalap, which is the ſpecies of convolvulus. See CONVOLVULUS.

MIRACLE, in its original ſenſe, is a word of the ſame purport with *wonder*; but in its uſual and more appropriate ſignification, it denotes "an effect contrary to the eſtabliſhed conſtitution and courſe of things, or a ſenſible deviation from the known laws of nature."

That the viſible world is governed by ſtated general rules, or that there is an order of cauſes and effects eſtabliſhed in every part of the ſyſtem of nature which falls under our obſervation, is a fact which cannot be controverted. If the Supreme Being, as ſome have ſuppoſed, be the only real agent in the univerſe, we have the evidence of experience, that, in the particular ſyſtem to which we belong, he acts by ſtated rules. If he employs inferior agents to conduct the various motions from which the phenomena reſult, we have the ſame evidence that he has ſubjected thoſe agents to certain fixed laws, commonly called the *laws of nature*. On either hypotheſis, effects which are produced by the regular operation of theſe laws, or which are conformable to the eſtabliſhed courſe of events, are properly called *natural*; and every contradiction to this conſtitution of the natural ſyſtem, and the correſpondent courſe of events in it, is called a *miracle*.

If this definition of a miracle be juſt, no event can be deemed miraculous merely becauſe it is ſtrange, or even to us unaccountable; ſince it may be nothing more than a regular effect of ſome unknown law of nature. In this country earthquakes are rare; and for monſtrous births perhaps no *particular* and ſatisfactory account can be given: yet an earthquake is as regular an effect of the eſtabliſhed laws of nature as any of thoſe with which we are moſt intimately acquainted; and under circumſtances in which there would always be the ſame kind of production, the monſter is nature's genuine iſſue. It is therefore neceſſary, before we can pronounce any effect to be a true miracle, that the circumſtances under which it is produced be known, and that the common courſe of nature be in ſome degree underſtood: for in all thoſe caſes in which we are totally ignorant of nature, it is impoſſible to determine what is, or what is not, a deviation from its courſe. Miracles, therefore, are not, as ſome have repreſented them, appeals to our ignorance. They ſuppoſe ſome antecedent knowledge of the courſe of nature, without which no proper judgment can be formed concerning them; though with it their reality may be ſo apparent as to prevent all poſſibility of a diſpute.

Thus,

Miracle.

Thus, were a physician to cure a blind man of a cataract, by anointing his eyes with a chemical preparation which we had never before seen, and to the nature and effects of which we are absolute strangers, the cure would undoubtedly be *wonderful;* but we could not pronounce it *miraculous*, because, for any thing known to us, it might be the natural effect of the operation of the unguent on the eye. But were he to recover his patient merely by commanding him to see, or by anointing his eyes with spittle, we should with the utmost confidence pronounce the cure to be a miracle; because we know perfectly that neither the human voice nor human spittle have, by the established constitution of things, any such power over the diseases of the eye. No one is now ignorant, that persons apparently dead are often restored to their families and friends, by being treated in the manner recommended by the Humane Society. To the vulgar, and sometimes even to men of science, these effects appear very wonderful; but as they are known to be produced by physical agency, they can never be considered as miraculous deviations from the laws of nature. On the other hand, no one could doubt of his having witnessed a real miracle who had seen a person that had been four days dead come alive out of his grave at the *call* of another, or who had even beheld a person exhibiting all the *symptoms* of death instantly resuscitated merely by being *desired* to live.

Thus easy is it, in all cases in which the course of nature is understood, to determine whether any particular event be really a miracle; whilst in circumstances where we know nothing of nature and its course, even a true miracle, were it performed, could not be admitted as such, or carry any conviction to the mind of a philosopher.

If miracles be effects contrary to the established constitution of things, we are certain that they will never be performed on trivial occasions. The constitution of things was established by the Creator and Governor of the universe, and is undoubtedly the offspring of infinite wisdom pursuing a plan for the best of purposes. From this plan no deviation can be made but by God himself, or by some powerful being acting with his permission. The plans devised by wisdom are steady in proportion to their perfection, and the plans of infinite wisdom must be absolutely perfect. From this consideration, some men have ventured to conclude, that no miracle was ever wrought, or can rationally be expected; but maturer reflection must soon satisfy us that all such conclusions are hasty.

Man is unquestionably the principal creature in this world, and apparently the only one in it who is capable of being made acquainted with the relation in which he stands to his Creator. We cannot, therefore, doubt, but that such of the laws of nature as extend not their operation beyond the limits of this earth were established chiefly, if not solely, for the good of mankind; and if, in any particular circumstances, that good can be more effectually promoted by an occasional deviation from those laws, such a deviation may be reasonably expected. Were man, in the exercise of his mental and corporeal powers, subjected to the laws of physical necessity, the circumstances supposed would indeed never occur, and of course no miracle could be admitted. But such is not the nature of man.

Without repeating what has been said elsewhere (See METAPHYSICS, Part III. chap. v.) of necessity and liberty, we shall here take it for granted, that the relation between motives and actions is different from that between cause and effect in physics; and that mankind have such command over themselves, as that by their voluntary conduct, they can make themselves in a great degree either happy or miserable. We know likewise from history, that, by some means or other, almost all mankind were once sunk into the grossest ignorance of the most important truths; that they knew not the Being by whom they were created and supported; that they paid divine adoration to stocks, stones, and the vilest reptiles; and that they were slaves to the most impious, cruel, and degrading superstitions.

From this depraved state it was surely not unworthy of the common "Father of all" to rescue his helpless creatures, to enlighten their understandings that they might perceive what is right, and to present to them motives of sufficient force to engage them in the practice of it. But the understandings of ignorant barbarians cannot be enlightened by arguments; because of the force of such arguments as regard moral science they are not qualified to judge. The philosophers of Athens and Rome inculcated, indeed, many excellent moral precepts, and they sometimes ventured to expose the absurdities of the reigning superstition: but their lectures had no influence upon the multitude; and they had themselves imbibed such erroneous notions respecting the attributes of the Supreme Being, and the nature of the human soul, and converted those notions into first principles, of which they would not permit an examination, that even among them a thorough reformation was not to be expected from the powers of reasoning. It is likewise to be observed, that there are many truths of the utmost importance to mankind, which unassisted reason could never have discovered. Amongst these we may confidently reckon the immortality of the soul, the terms upon which God will be reconciled to sinners, and the manner in which that all-perfect Being may be acceptably worshipped; about all of which philosophers were in such uncertainty, that, according to Plato, "Whatever is set right, and as it should be, in the present evil state of the world, can be so only by the particular interposition of God (A)."

An immediate revelation from Heaven, therefore, was the only method by which infinite wisdom and perfect goodness could reform a bewildered and vicious race. But this revelation, at whatever time we suppose it given, must have been made directly either to some chosen individuals commissioned to instruct others, or to every man and woman for whose benefit it was ultimately intended. Were every person instructed in

(A) Ευ γαρ χρη ειδεναι, ὁ, τι περ αν σωθη τε και γενηται οἱον δει, εν τοιαυτη κατασταση πολιτειων. Θεου μοιραν αυτο σωσα De repub. Lib. 6.

in the knowledge of his duty by immediate inſpiration, and were the motives to practiſe it brought home to his mind by God himſelf, human nature would be wholly changed: men would not be maſters of their own actions; they would not be moral agents, nor by conſequence be capable either of reward or of puniſhment. It remains, therefore, that if God has been graciouſly pleaſed to enlighten and reform mankind, without deſtroying that moral nature which is eſſential to virtue, he can have done it only by revealing his truth to certain choſen inſtruments, who were the immediate inſtructors of their contemporaries, and through them have been the inſtructors of ſucceeding ages.

Let us ſuppoſe this to have been actually the caſe, and conſider how thoſe inſpired teachers could communicate to others every truth which had been revealed to themſelves. They might eaſily, if it was part of their duty, deliver a ſublime ſyſtem of natural and moral ſcience, and eſtabliſh it upon the common baſis of experiment and demonſtration; but what foundation could they lay for thoſe truths which unaſſiſted reaſon cannot diſcover, and which, when they are revealed, appear to have no neceſſary relation to any thing previouſly known? To a bare affirmation that they had been immediately received from God, no rational being could be expected to aſſent. The teachers might be men of known veracity, whoſe ſimple aſſertion would be admitted as ſufficient evidence for any fact, in conformity with the laws of nature; but as every man has the evidence of his own conſciouſneſs and experience that revelations from heaven are deviations from theſe laws, an aſſertion ſo apparently extravagant would be rejected as falſe, unleſs ſupported by ſome better proof than the mere affirmation of the teacher. In this ſtate of things, we can conceive no evidence ſufficient to make ſuch doctrines be received as the truths of God, but the power of working miracles committed to him who taught them. This would, indeed, be fully adequate to the purpoſe. For if there were nothing in the doctrines themſelves impious, immoral, or contrary to truths already known, the only thing which could render the teacher's aſſertion incredible, would be its implying ſuch an intimate communion with God as is contrary to the eſtabliſhed courſe of things, by which men are left to acquire all their knowledge by the exerciſe of their own faculties.—Let us now ſuppoſe ſome one of thoſe inſpired teachers to tell his countrymen, that he did not deſire them, on his *ipſe dixit*, to believe that he had any preternatural communion with the Deity, but that for the truth of his aſſertion he would give them the evidence of their own ſenſes; and after this declaration let us ſuppoſe him immediately to raiſe a perſon from the dead in their preſence, merely by calling upon him to come out of his grave. Would not the only poſſible objection to the man's veracity be removed by this miracle? and his aſſertion that he had received ſuch and ſuch doctrines from God be as fully credited, as if it related to the moſt common occurrence? Undoubtedly it would; for when ſo much preternatural *power* was viſibly communicated to this perſon, no one could have reaſon to queſtion his having received an equal portion of preternatural *knowledge*. A palpable deviation from the known laws of nature, in one inſtance, is a ſenſible proof that ſuch a deviation is poſſible in another; and in ſuch a caſe as this it is the witneſs of God to the truth of a man.

Miracles, then, under which we include prophecy, are the only direct evidence which can be given of divine inſpiration. When a religion, or any religious truth, is to be revealed from heaven, they appear to be abſolutely neceſſary to enforce its reception among men; and this is the only caſe in which we can ſuppoſe them neceſſary, or believe for a moment that they ever have been or will be performed.

The hiſtory of almoſt every religion abounds with relations of prodigies and wonders, and of the intercourſe of men with the gods: but we know of no religious ſyſtem, thoſe of the Jews and Chriſtians excepted, which appealed to miracles as the ſole evidence of its truth and divinity. The pretended miracles mentioned by Pagan hiſtorians and poets are not ſaid to have been publicly wrought to enforce the truth of a new religion contrary to the reigning idolatry. Many of them may be clearly ſhown to have been mere natural events; (ſee MAGIC). Others of them are repreſented as having been performed in ſecret on the moſt trivial occaſions, and in obſcure and fabulous ages long prior to the era of the writers by whom they are recorded. And ſuch of them as at firſt view appear to be beſt atteſted, are evidently tricks contrived for intereſted purpoſes; to flatter power, or to promote the prevailing ſuperſtitions. For theſe reaſons, as well as on account of the immoral character of the divinities by whom they are ſaid to have been wrought, they are altogether unworthy of examination, and carry in the very nature of them the completeſt proofs of falſehood and impoſture.

But the miracles recorded of Moſes and of Chriſt bear a very different character. None of them are repreſented as wrought on trivial occaſions. The writers who mention them were eye-witneſſes of the facts; which they affirm to have been performed publickly, in atteſtation of the truth of their reſpective ſyſtems. They are indeed ſo incorporated with theſe ſyſtems, that the miracles cannot be ſeparated from the doctrines; and if the miracles were not really performed, the doctrines cannot poſſibly be true. Beſides all this, they were wrought in ſupport of revelations which oppoſed all the religious ſyſtems, ſuperſtitions, and prejudices, of the age in which they were given: a circumſtance which of itſelf ſets them, in point of authority, infinitely above the Pagan prodigies, as well as the lying wonders of the Romiſh church.

It is indeed, we believe, univerſally admitted, that the miracles mentioned in the book of Exodus and in the four Goſpels, might, to thoſe who ſaw them performed, be ſufficient evidence of the divine inſpiration of Moſes and of Chriſt; but to us it may be thought that they are no evidence whatever, as we muſt believe in the miracles themſelves, if we believe in them at all, upon the bare authority of human teſtimony. Why, it has been ſometimes aſked, are not miracles wrought in all ages and countries? If the religion of Chriſt was to be of perpetual duration, every generation of men ought to have complete evidence of its truth and divinity.

To the performance of miracles in every age and in every country, perhaps the ſame objections lie as to the immediate inſpiration of every individual. Were

 thoſe

Miracle. those miracles universally received as such, men would be so overwhelmed with the *nature* rather than with the *force* of their authority, as hardly to remain masters of their own conduct; and in that case the very end of all miracles would be defeated by their frequency. The truth, however, seems to be, that miracles so frequently repeated would not be received as such, and of course would have *no* authority; because it would be difficult, and in many cases impossible, to distinguish them from natural events. If they recurred regularly at certain intervals, we could not prove them to be deviations from the known laws of nature, because we should have the same experience for the one series of events as for the other; for the regular succession of preternatural effects, as for the established constitution and course of things.

Be this, however, as it may, we shall take the liberty to affirm, that for the reality of the Gospel miracles we have evidence as convincing to the reflecting mind, though not so striking to vulgar apprehension, as those had who were contemporary with Christ and his apostles, and actually saw the mighty works which he performed. To the admirers of Mr Hume's philosophy this assertion will appear an extravagant paradox; but we hope to demonstrate its truth from principles which, consistently with himself, that author could not have denied. He has indeed endeavoured to prove *, that "no testimony is sufficient to establish a miracle;" and the reasoning employed for this purpose is, that "a miracle being a violation of the laws of nature, which a firm and unalterable experience has established, the proof against a miracle, from the very nature of the fact, is as entire as any argument from experience can be; whereas our experience of human veracity, which (according to him) is the sole foundation of the evidence of testimony, is far from being uniform, and can therefore never preponderate against that experience which admits of no exception." This boasted and plausible argument has with equal candour and acuteness been examined by Dr Campbell †; who justly observes, that so far is experience from being the sole foundation of the evidence of testimony, that, on the contrary, testimony is the sole foundation of by far the greater part of what Mr Hume calls firm and unalterable experience; and that if in certain circumstances we did not give an implicit faith to testimony, our knowledge of events would be confined to those which had fallen under the immediate observation of our own senses. For a short view of this celebrated controversy, in which the Christian so completely vanquishes the philosopher, see the word ABRIDGEMENT.

* Essay on Miracles.

† Dissertation on Miracles.

But though Dr Campbell has exposed the sophistry of his opponent's reasoning, and overturned the *principles* from which he reasons, we are persuaded that he might safely have joined issue with him upon those very principles. To us, at least, it appears that the testimony upon which we receive the Gospel miracles is precisely of that kind which Mr Hume has acknowledged sufficient to establish even a miracle. "No testimony (says he) is sufficient to establish a miracle, unless the testimony be of such a kind that its falsehood would be more miraculous than the fact which it endeavours to establish. When one tells me that he saw a dead man restored to life, I immediately consider with myself whether it be more probable that this person should either deceive or be deceived, or that the fact which he relates should really have happened. I weigh the one miracle against the other; and according to the superiority which I discover I pronounce my decision, and always reject the greater miracle." In this passage every reader may remark what did not escape the perspicacious eye of Dr Campbell, a strange confusion of terms: but as all miracles are equally easy to the Almighty; and as Mr Hume has elsewhere observed, that "the raising of a feather, when the wind wants ever so little of a force requisite for that purpose, is as real a miracle as the raising of a house or a ship into the air;" candour obliges us to suppose, that by talking of greater and less miracles, and of always rejecting the *greater*, he meant nothing more but that of two deviations from the known laws of nature he always rejects that which in itself is least probable.

If, then, we can show that the testimony given by the apostles and other first preachers of Christianity to the miracles of their Master would, upon the supposition that those miracles were not really performed, have been as great a deviation from the known laws of nature as the miracles themselves, the balance must be considered as evenly poised by opposite miracles; and whilst it continues so, the judgment must remain in a state of suspense. But if it shall appear, that in this case the false testimony would have been a deviation from the laws of nature less probable in itself than the miracles recorded in the Gospels, the balance will be instantly destroyed; and by Mr Hume's maxim we shall be obliged to reject the supposition of falsehood in the testimony of the apostles, and admit the miracles of Christ to have been really performed.

In this argument we need not waste time in proving that those miracles, as they are represented in the writings of the New Testament, were of such a nature, and performed before so many witnesses, that no imposition could possibly be practised on the senses of those who affirm that they were present. From every page of the Gospels this is so evident, that the philosophical adversaries of the Christian faith never suppose the apostles to have been themselves deceived, but boldly accuse them of bearing false witness. But if this accusation be well founded, their testimony itself is as great a miracle as any which they record of themselves or of their Master.

It has been shown elsewhere (see METAPHYSICS, n° 138.), that by the law of association, which is one of the laws of nature, mankind, in the very process of learning to speak, necessarily learn to speak the truth; that ideas and relations are in the mind of every man so closely associated with the words by which they are expressed in his native tongue, and in every other language of which he is master, that the one cannot be entirely separated from the other; that therefore no man can on any occasion speak falsehood without some *effort*; that by no effort can a man give consistency to an unpremeditated detail of falsehood, if it be of any length, and include a number of particulars; and that it is still less possible for several men to agree in such a detail, when at a distance from each other, and cross-questioned by their enemies.

This being the case, it follows, if the testimony of the

the apostles to their own and their Master's miracles be false, either that they must have concerted a consistent scheme of falsehood, and agreed to publish it at every hazard; or that God, or some powerful agent appointed by him, must have dissolved all the associations formed in their minds between ideas of sense and the words of language, and arbitrarily formed new associations, all in exact conformity to each other, but all in direct contradiction to truth. One or other of these events must have taken place; because, upon the supposition of falsehood, there is no other alternative. But such a dissolution and formation of associations as the latter implies, must, to every man who shall attentively consider it, appear to be as real a miracle, and to require as great an exertion of power, as the resurrection of the dead. Nor is the supposed voluntary agreement of the apostles in a scheme of falsehood an event less miraculous. When they sat down to fabricate their pretended revelation, and to contrive a series of miracles to which they were unanimously to appeal for its truth, it is plain, since they proved successful in their daring enterprise, that they must have clearly foreseen every possible circumstance in which they could be placed, and have prepared consistent answers to every question that could be put to them by their most inveterate and most enlightened enemies; by the statesman, the lawyer, the philosopher, and the priest. That such foreknowledge as this would have been miraculous, will not surely be denied; since it forms the very attribute which we find it most difficult to allow even to God himself. It is not, however, the *only* miracle which this supposition would compel us to swallow. The very *resolution* of the apostles to propagate the belief of false miracles in support of such a religion as that which is taught in the New Testament, is as great a miracle as human imagination can easily conceive.

When they formed this design, either they must have hoped to succeed, or they must have foreseen that they should fail in their undertaking; and in either case, they *chose evil for its own sake*. They could not, if they foresaw that they should fail, look for any thing but that contempt, disgrace, and persecution, which were then the inevitable consequences of an unsuccessful endeavour to overthrow the established religion. Nor could their prospects be brighter upon the supposition of their success. As they knew themselves to be false witnesses and impious deceivers, they could have no hopes beyond the grave: and by determining to oppose all the religious systems, superstitions, and prejudices of the age in which they lived, they wilfully exposed themselves to inevitable misery in the present life, to insult and imprisonment, to stripes and death. Nor can it be said that they might look forward to power and affluence when they should, through sufferings, have converted their countrymen; for so desirous were they of obtaining nothing but *misery* as the end of their mission, that they made their own persecution a test of the truth of their doctrines. They introduced the Master from whom they pretended to have received these doctrines as telling them, that "they were sent forth as sheep in the midst of wolves; that they should be delivered up to councils, and scourged in synagogues; that they should be hated of all men for his name's sake; that the brother should deliver up the brother to death, and the father the child; and that he who took not up his cross and followed after him was not worthy of him." The very system of religion, therefore, which they invented and resolved to impose upon mankind, was so contrived, that the worldly prosperity of its first preachers, and even their exemption from persecution, was incompatible with its success. Had these clear predictions of the Author of that religion, under whom the apostles acted only as ministers, not been verified, all mankind must have instantly perceived that their pretence to inspiration was false, and that Christianity was a scandalous and impudent imposture. All this the apostles could not but foresee when they formed their plan for deluding the world. Whence it follows, that when they resolved to support their pretended revelation by an appeal to forged miracles, they wilfully and with their eyes open, exposed themselves to inevitable misery, whether they should succeed or fail in their enterprise; and that they concerted their measures so as not to admit of a possibility of recompence to themselves, either in this life or in that which is to come. But if there be a law of nature, for the reality of which we have better evidence than we have for others, it is, that "no man can choose misery for its *own sake*," or make the acquision of it the ultimate end of his pursuit. The existence of other laws of nature we know by testimony and our own observation of the regularity of their effects. The existence of this law is made known to us not only by these means, but also by the still clearer and more conclusive evidence of our own consciousness.

Thus, then do miracles force themselves upon our assent in every possible view which we can take of this interesting subject. If the testimony of the first preachers of Christianity was true, the miracles recorded in the Gospel were certainly performed, and the doctrines of our religion are derived from heaven. On the other hand, if that testimony was false, either God must have miraculously effaced from the minds of those by whom it was given all the associations formed between their sensible ideas and the words of language, or he must have endowed those men with the gift of prescience, and have impelled them to fabricate a pretended revelation for the purpose of deceiving the world, and involving themselves in certain and foreseen destruction.

The power necessary to perform the one series of these miracles may, for any thing known to us, be as great as that which would be requisite for the performance of the other; and considered merely as exertions of preternatural power, they may seem to balance each other, and to hold the mind in a state of suspence. But when we take into consideration the different purposes for which these opposite and contending miracles were wrought, the balance is instantly destroyed. The miracles recorded in the Gospels, if real, were wrought in support of a revelation which, in the opinion of all by whom it is received, has brought to light many important truths which could not otherwise have been made known to men; and which, by the confession of its adversaries, contains the purest moral precepts by which the conduct of mankind was ever directed. The opposite series of miracles, if real, was performed to enable, and even to to compel, a company of Jews, of the lowest rank and of the narrowest education, to fabricate, with the view of inevitable destruction to themselves, a consistent scheme of falsehood, and by an appeal to forged miracles to impose it upon the world as a revelation from heaven. The object of the former miracles is worthy of a God of infinite wisdom, goodness, and power. The object of the latter is absolutely inconsistent with wisdom and goodness, which are demonstrably attributes of that Being by whom alone miricles can be performed. Whence it follows, that the supposition of the apostles bearing *false* testimony to the miracles of their Master, implies a series of deviations from the laws of nature infinitely less probable in themselves than those miracles: and therefore, by Mr Hume's maxim, we must necessarily reject the supposition of falsehood in the testimony, and admit the reality of the miracles. So true is it, that for the reality of the Gospel-miracles we have evidence as convincing to the reflecting mind, as those had who were contemporary with Christ and his apostles, and were actual witnesses to their mighty works.

MIRANDNA-DE-EBRO, a town of Spain in Old Castile, with a strong castle; seated in a country that produces excellent wine. The town is divided into two parts by the river, over which there is a handsome bridge. W. Long. 3. 10. N. Lat. 42. 52.

MIRADE, a town of Gascony in France, capital of the county of Astarac; seated on a mountain near the river Bause. E. Long. 0. 21. N. Lat. 42. 53.

MIRANDO-DE-DOURO or *Duero*, a strong town of Portugal, and capital of the province of Tra-los-Montes, with a bishop's fee. It is well fortified, and seated on a rock near the confluence of the river Douro and Fresna. W. Long. 5. 40. N. Lat. 41. 30.

MIRANDOLA, a town of Italy, and capital of a duchy of the same name, situated between the duchies of Mantua and Modena. It is a pretty large place, well fortified, and has also a strong citadel and fort. It has been several times taken and retaken; the last time by the king of Sardinia in 1742. E. Long. 11. 5. N. Lat. 44. 52.

MIRANDULA. See PICUS.

MIREVELT (Michael Jansen), portrait-painter, was the son of a Goldsmith, and born at Delft in 1568. His father, perceiving his early inclination for the arts, placed him at first with one of the Wierixes, of whom he learned to draw in crayons and to engrave. At the age of twelve he executed a print of the Samaritan woman; and not long after a figure of Judith holding the head of Holofernes. These juvenile performances attracted the notice of Anthony Blockland, an historical painter of great note; and under his instructions Mirevelt took up the pencil. He was very successful in his attempts at painting history; but finding portraits to be more profitable, he quitted the former by degrees, and applied himself to portrait painting only. His reputation according to De Piles, was so great, that he exacted what price for his pictures he pleased, never taking less than 150 florins a piece. The portraits drawn and painted by this artist are exceedingly numerous; and many of them were excellently engraved by William James Delft, his near relation, a very skilful artist. He died in 1641.

MIREVELT (Peter), son of Michael, was born at Delft in 1596, and died in 1632. In his manner of design, in his style of colouring, and in the delicacy of his pencil, he exactly resembled his father; and by the best judges of that time he was accounted to be in no degree inferior to him.

MIRIAM, sister of Aaron and Moses, makes two or three remarkable appearances in scripture. It was owing to her that her mother was employed by Pharaoh's daughter as nurse to Moses. She put herself at the head of the women of Israel after their passage through the Red Sea, in order to sing the song which the men had sung before. She joined with her brother Aaron in murmuring against Moses, and was severely chastised for that action; for she became leprous, and continued separate from the rest without the camp for seven days. She died before her brothers, though in the same year with them, and was buried at the public expence.

MIRROR, a name for a looking glass, or any polished body, whose use is to form the images of distant objects, by reflection of the rays of light. See REFLECTION

Mirrors are either plain, convex, or concave. The first reflect the rays of light in a direction exactly similar to that in which they fall upon them, and therefore represent bodies of their natural magnitude. The convex ones make the rays diverge much more than before reflection, and therefore greatly diminish the images of those objects which they show: while the concave ones, by collecting the rays into a focus, not only magnify the objects they show, but will burn very fiercely when exposed to the rays of the sun; and hence they are commonly known by the name of *burning mirrors*. See *BURNING-Mirrors*.

In ancient times the mirrors were made of some kind of metal; and from a passage in the Mosaic writings we learn that the mirrors used by the Jewish women were made of brass. The Jews certainly had been taught to use that kind of Mirrors by the Egyptians; from whence it is probable that brazen mirrors were the first kind used in the world. Any kind of metal, indeed, when well polished, will reflect very powerfully, but of all others silver reflects the most, tho' it has been in all countries too expensive a material for common use. Gold also is very powerful; and metals, or even wood, gilded and polished, will act very powerfully as burning mirrors. Even polished ivory, or straw nicely plaited together, will form mirrors capable of burning, if on a large scale.

Since the invention of glass, and the application of quicksilver to it, became generally known, it hath been universally employed for those plain mirrors used as ornaments to houses; but in making reflecting telescopes, they have been found much inferior to metallic ones. It doth not appear that the same superiority belongs to the metalline burning mirrors, considered merely as burning glasses; since the mirror with which Mr Macquer melted platina, though only 22 inches diameter, and which was made of quicksilvered glass, produced much greater effects than M. Villette's metalline speculum, which considerably exceeded it in size. It is very probable, however, that this mirror of M. Villette's was by no means so well polished as it ought to have been; as the art of preparing the metal for taking the finest polish has but lately been discovered and published in the Philosophical Transactions

tions by Mr Mudge. See *Glass-Grinding*, and the *Mechanical Part* of Optics.

MIRE-CROW, sea-crow, or *Pewit*. See Larus.

MISADVENTURE, in common language, signifies any unlucky accident which takes place without being foreseen.

Misadventure, in law, has an especial signification for the killing a man partly by negligence, and partly by chance. See Homicide.

MISANTHROPY (formed μισος, *hatred*, and ανθρωπος, a *man*); a general dislike or aversion to man, and mankind. In which sense it stands opposed to *philanthropy*, or the love of mankind.

MISCARRIAGE. See Abortion and Midwifery.

MISCHNA, or Misna, (from שנה, *iteravit*), a part of the Jewish Talmud.

The Mischna contains the text; and the Gemara, which is the second part of the Talmud, contains the commentaries: so that the Gemara is, as it were, a glossary on the Mischna.

The Mischna consists of various traditions of the Jews, and of explanations of several passages of scripture: these traditions serving as an explication of the written law, and supplement to it, are said to have been delivered to Moses during the time of his abode on the Mount; which he afterwards communicated to Aaron, Eleazar, and his servant Joshua. By these they were transmitted to the 70 elders, by them to the prophets, who communicated them to the men of the great sanhedrim, from whom the wise men of Jerusalem and Babylon received them. According to Prideaux's account, they passed from Jeremiah to Baruch, from him to Ezra, and from Ezra to the men of the great synagogue, the last of whom was Simon the Just; who delivered them to Antigonus of Socho: and from him they came down in regular succession to Simeon, who took our Saviour in his arms; to Gamuliel, at whose feet Paul was educated; and last of all to Rabbi Judah the Holy, who committed them to writing in the Mischna. But Dr Prideaux, rejecting this Jewish fiction, observes, that after the death of Simon the Just, about 299 years before Christ, the Mischnical doctors arose, who, by their comments and conclusions, added to the number of those traditions which had been received and allowed by Ezra and the men of the great synagogue; so that towards the middle of the second century after Christ, under the empire of Antoninus Pius, it was found necessary to commit these traditions to writing; more especially, as their country had considerably suffered under Adrian, and many of their schools had been dissolved, and their learned men cut off; and therefore the usual method of preserving their traditions had failed. Rabbi Judah on this occasion being rector of the school at Tiberias, and president of the sanhedrim in that place, undertook the work, and compiled it in six books, each consisting of several tracts, which altogether make up the number of 63. *Prid. Connect.* vol. ii. p. 468, &c. ed. 9. This learned author computes, that the Mischna was composed about the 150th year of our Lord; but Dr Lightfoot says, that Rabbi Judah compiled the Mischna about the year of Christ 190, in the latter end of the reign of Commodus; or, as some compute, in the year of Christ 220. Dr Lardner is of opinion, that this work could not have been finished before the year 190, or later. Collect. of Jewish and Heathen Testimonies, &c. vol. i. p. 178. Thus the book called the *Mischna* was formed; a book which the Jews have generally received with the greatest veneration. The original has been published with a Latin translation by Surenhusius, with notes of his own, and others from the learned Maimonides, &c. in 6 vols. fol. Amsterd. A. D. 1698—1703. (See Talmud). It is written in a much purer style, and is not near so full of dreams and visions as the Gemara.

MISDEMEANOUR, in law, signifies a crime. Every crime is a misdemeanour; yet the law has made a distinction between crimes of an higher and a lower nature; the latter being denominated *misdemeanours*, the former *felonies*, &c. For the understanding of which distinction, we shall give the following definition from Blackstone's Commentaries, vol. iv. 5.

"A crime, or misdemeanour, is an act *committed* or *omitted*, in violation of a public law, either forbidding or commanding it. This general definition comprehends both *crimes* and *misdemeanours*; which, properly speaking, are mere synonymous terms; though, in common usage, the word *crime* is made to denote such offences as are of a deeper and more atrocious dye; while smaller faults, and omissions of less consequence, are comprised under the gentler name of *misdemeanours* only."

MISE, in law-books, is used in various senses: thus it sometimes signifies costs or expences; in which sense it is commonly used in entering of judgments in actions personal. It is also used for the issue to be tried on the grand assize; in which case, joining of the mise upon the mere right, is putting an issue between the tenant and demandant, Who has the best or clearest right.

Mise also signifies a tax or tallage, &c. An honorary gift, or customary present from the people of Wales to every new king or prince of Wales, anciently given in cattle, wine, and corn, but now in money, being 5000 l. or more, is denominated a *mise*: so was the usual tribute or fine of 3000 merks paid by the inhabitants of the county palatine of Chester at the change of every owner of the said earldoms, for enjoying their liberties. And at Chester they have a mise-book, wherein every town and village in the county is rated what to pay towards the mise. The 27 Hen. VIII. c. 26. ordains that lords shall have all such mises and profits of their lands as they had in times past, &c.

Mise, is sometimes also corruptly used for *mease*, in law French *mees*, "a messuage;" as a *mise place*, in some manors, is such a messuage or tenement as answers the lord a heriot at the death of its owner. 2. *Inst.* 528.

MISENUM, or Misenus, (anc. geog.); a promontory, port, and town in Campania, situated to the south-west of Baiæ, in the Sinus Puteolanus, on the north side. Here Augustus had a fleet, called *Classis Misenensis*, for guarding the Mare Inferum; as he had another at Ravenna for the Superum.

On this peninsula a villa was built by Caius Marius, with a degree of elegance that gave great offence to the more austere among the Romans, who thought

Miser. it ill suited to the character of so rough a soldier. Upon the same foundation Lucullus, the plunderer of the eastern world, erected an edifice, in comparison of which the former house was a cottage; but even his magnificence was eclipsed by the splendour of the palace which the emperors raised upon the same spot. To these proud abodes of heroes and monarchs, which have long been levelled to the ground, a few fishing huts, as Mr Swinburn informs us, and a lonely public house, have succeeded; hither boatmen resort to tipple, perhaps on the identical site where the voluptuous masters of the world quaffed Chian and Falernian wines.

MISER, a parsimonious person who is at the same time rich; or a wretch covetous to extremity, whom avarice has divested of all the charities of human nature, and made even an enemy to himself.

Of this most unaccountable of all characters, many instances occur; some of them so extraordinary as almost to surpass belief. The following are here selected, as being of recent date, perfectly authentic, and the last of them in particular exhibiting an assemblage of qualities the most singular perhaps that ever centered in the same person. Too little dignified to merit a place in regular biography, yet too curious a variety of human character to pass unnoticed in this Work, the present seemed the only title under which it could with propriety be introduced.

1. In December 1790, died at Paris, literally of want, Mr Ostervald, a well-known banker. This man, originally of Neufchatel, felt the violence of the disease of avarice (for surely it is rather a disease than a passion of the mind) so strongly, that, within a few days of his death, no importunities could induce him to buy a few pounds of meat for the purpose of making a little soup for him. "'Tis true (said he), I should not dislike the soup, but I have no appetite for the meat; what then is to become of that?" At the time that he refused this nourishment, for fear of being obliged to give away two or three pounds of meat, there was tied round his neck a silken bag, which contained 800 assignats of 1000 livres each. At his outset in life, he drank a pint of beer, which served him for supper, every night at a house much frequented, from which he carried home all the bottle corks he could come at. Of these, in the course of eight years, he had collected as many as sold for 12 louis-d'ors, a sum that laid the foundation of his future fortune, the superstructure of which was rapidly raised by his uncommon success in stock-jobbing. He died possessed of three millions of livres (L. 125,000 sterling.)

2. The late John Elwes, Esq; was member for Berkshire in three successive parliaments. His family name was *Meggot;* and his father was a brewer of great eminence, and distinguished by no peculiarity of character: but his mother, though she was left nearly L. 100,000 by her husband, starved herself to death! At an early period of life he was sent to Westminster school, where he remained for 10 or 12 years. During that time he certainly had not misapplied his talents; for he was a good classical scholar to the last: and it is a circumstance not a little remarkable, though well authenticated, that he never read afterwards, nor had he ever any knowledge in accounts; to which may in some measure be attributed the total ignorance he was always in as to his affairs. From Westminster school Mr Meggot removed to Geneva, where he soon entered upon pursuits more agreeable to him than study. The riding-master of the academy there had then to boast perhaps of three of the best riders in Europe, Mr Worsley, Mr Elwes, and Sir Sidney Meadows. Of the three, Elwes was reckoned the most desperate; the young horses were always put into his hands, and he was the rough rider to the other two. Miser.

On his return to England, after an absence of two or three years, he was to be introduced to his uncle the late Sir Harvey Elwes, who was then living at Stoke in Suffolk, perhaps the most perfect picture of human penury that ever existed. The attempts at saving money were in him so extraordinary, that Mr Elwes perhaps never quite reached them, even at the last period of his life.—Of what temperance can do, Sir Harvey was an instance. At an early period of life he was given over for a consumption, and he lived till betwixt 80 and 90 years of age. On his death, his fortune, which was at least L. 250,000, fell to his nephew Mr Meggot, who by will was ordered to assume the name and arms of Elwes. To this uncle, and this property, Mr Elwes succeeded when he had advanced beyond the 40th year of his age. And for 15 years previous to this period, it was that he was known in the more fashionable circles of London. He had always a turn for play; and it was only late in life; and from paying always and not always being paid, that he conceived disgust at it. The theory which he professed, "that it was impossible to ask a gentleman for money," he perfectly confirmed by the practice; and he never violated this feeling to the latest hour of his life.

The manners of Mr Elwes were such—so gentle, so attentive, so gentlemanly, and so engaging—that rudeness could not ruffle them, nor strong ingratitude break their observance. He retained this peculiar feature of the old court to the last: but he had a praise beyond this; he had the most gallant disregard of his own person, and all care about himself, that can be imagined. The instances in younger life, in the most imminent personal hazard, are innumerable; but when age had dispoiled him of his activity, and might have rendered care and attention about himself natural, he knew not what they were: He wished no one to assist him: "He was as young as ever; he could walk; he could ride, and he could dance; and he hoped he should not give trouble even when he was old:" He was at that time 75.

It is curious to remark how he contrived to mingle small attempts at saving with objects of the most unbounded dissipation. After sitting up a whole night at play for thousands with the most fashionable and profligate men of the time, amidst splendid rooms, gilt sofas, wax lights, and waiters attendant on his call, he would walk out about four in the morning, not towards home, but into Smithfield, to meet his own cattle, which were coming to market from Thaydon-hall, a farm of his in Essex! There would this same man, forgetful of the scenes he had just left, stand in the cold and rain bartering with a carcass-butcher for a shilling! Sometimes, when the cattle did not arrive at the hour he expected, he would walk on in the mire to meet them; and more than once has gone on foot the whole

Miser.

whole way to his farm without ſtopping, which was 17 miles from London, after ſitting up the whole night. Had every man been of the mind of Mr Elwes, the race of innkeepers muſt have periſhed, and poſt-chaiſes have been returned back to thoſe who made them; for it was the buſineſs of his life to avoid both. He always travelled on horſeback. To ſee him ſetting out on a journey, was a matter truly curious; his firſt care was to put two or three eggs, boiled hard, into his great-coat pocket, or any ſcraps of bread which he found; baggage he never took: then mounting one of his hunters, his next attention was to get out of London into that road where turnpikes were the feweſt: then, ſtopping under any hedge where graſs preſented itſelf for his horſe, and a little water for himſelf, he would ſit down and refreſh himſelf and his horſe together.

The chief reſidence of Mr Elwes at this period of his life was in Berkſhire, at his own ſeat at Marcham. Here it was he had two natural ſons born, who inherit the greateſt part of his property by a will made about the year 1785. The keeping fox-hounds was the only inſtance in the whole life of Mr Elwes of his ever ſacrificing money to pleaſure; and may be ſelected as the only period when he forgot the cares, the perplexities, and the regret, which his wealth occaſioned. But even here every thing was done in the moſt frugal manner. Scrub, in the Beaux Stratagem, when compared with Mr Elwes's huntſman had an idle life of it. This famous huntſman might have fixed an epoch in the hiſtory of ſervants: for in a morning, getting up at four o'clock, he milked the cows; he then prepared breakfaſt for Mr Elwes or any friends he might have with him: then ſlipping on a green coat, he hurried into the ſtable, ſaddled the horſes, got the hounds out of the kennel, and away they went into the field. After the fatigues of hunting, he refreſhed himſelf by rubbing down two or three horſes as quickly as he could; then running into the houſe to lay the cloth, and wait at dinner; then hurrying again into the ſtable to feed the horſes—diverſified with an interlude of the cows again to milk, the dogs to feed, and eight hunters to litter down for the night.

In the penury of Mr Elwes there was ſomething that ſeemed like a judgment from heaven. All earthly comforts he voluntarily denied himſelf: he would walk home in the rain in London rather than pay a ſhilling for a coach; he would ſit in wet cloaths ſooner than have a fire to dry them; he would eat his proviſions in the laſt ſtage of putrefaction ſooner than have a freſh joint from the butchers; and he wore a wig for above a fortnight, which his biographer * ſaw him pick up out of a rut in a lane where they were riding. This was the laſt extremity of laudable œconomy; for to all appearance it was the caſt-off wig of ſome beggar!

* Mr Topham; from whoſe Life of John Elwes, Eſq; the particulars of this article are extracted.

Mr Elwes had now reſided about 13 years in Suffolk, when the conteſt for Berkſhire preſented itſelf on the diſſolution of the parliament; and when, to preſerve the peace of that county, he was nominated by Lord Craven. Mr Elwes, though he had retired from public buſineſs for ſome years, had ſtill left about him ſome of the ſeeds of more active life, and he agreed to the propoſal. It came farther enhanced to him, by the agreement, that he was to be brought in by the freeholders for nothing. All he did on the occaſion was dining at the ordinary at Reading; and he got into parliament for 18 pence!

Though a new man, Mr Elwes could not be called a young member; for he was at this time nearly 60 years old when he thus entered on public life. But he was in poſſeſſion of all his activity; and preparatory to his appearance on the boards of St Stephen's Chapel, he uſed to attend conſtantly during the races and other public meetings all the great towns where his voters reſided. At the different aſſemblies, he would dance amongſt the youngeſt to the laſt, after riding over on horſeback, and frequently in the rain, to the place of meeting. A gentleman who was one night ſtanding by, obſerved on the extraordinary agility of ſo old a man.—"O! that is nothing (replied another); for Mr Elwes, to do this, rode 20 miles in the rain, with his ſhoes ſtuck into his boots and his bag-wig in his pocket."

The honour of parliament made no alteration in the dreſs of Mr Elwes: on the contrary, it ſeemed at this time to have attained additional meanneſs; and nearly to have reached that happy climax of poverty, which has more than once drawn on him the compaſſion of thoſe who paſſed by him in the ſtreet. For the ſpeaker's dinners, however, he had one ſuit, with which the ſpeaker in the courſe of the ſeſſions became very familiar. The miniſter likewiſe was well acquainted with it; and at any dinner of oppoſition ſtill was his apparel the ſame. The wits of the minority uſed to ſay, "that they had full as much reaſon as the miniſter to be ſatisfied with Mr Elwes, as he had the ſame habit with every body." At this period of his life Mr Elwes wore a wig. Much about the time when his parliamentary life ceaſed, that wig was worn out; ſo then, being older and wiſer as to expence, he wore his own hair, which like his expences was very ſmall.

All this time the income of Mr Elwes was increaſing hourly, and his preſent expenditure was next to nothing; for the little pleaſures he had once engaged in he had now given up. He kept no houſe, and only one old ſervant and a couple of horſes: he reſided with his nephew: his two ſons he had ſtationed in Suffolk and Berkſhire, to look after his reſpective eſtates: and his dreſs certainly was no expence to him; for had not other people been more careful than himſelf, he would not have had it even mended.

When he left London, he went on horſeback to his country-ſeats with his couple of hard eggs, and without once ſtopping upon the road at any houſe. He always took the moſt unfrequented road, and uſed every ſhift to avoid turnpikes. Marcham was the ſeat he now chiefly viſited; which had ſome reaſon to be flattered with the preference, as his journey into Suffolk coſt him only two-pence half-penny, while that into Berkſhire amounted to four-pence!

As Mr Elwes came into parliament without expence, he performed his duty as a member would have done in the pure days of our conſtitution. What he had not bought, he never attempted to ſell; and he went forward in that ſtraight and direct path, which can alone ſatisfy a reflecting mind. Amongſt the ſmaller memorials of the parliamentary life of Mr Elwes may be noted, that he did not follow the cuſtom

ſtom of members in general, by ſitting on any particular ſide of the houſe, but ſat as occaſion preſented itſelf on either indiſcriminately; and he voted much in the ſame manner, but never roſe to ſpeak. In his attendance at the houſe, he was always early and late; and he never left it for dinner, as he had accuſtomed himſelf to faſting, ſometimes for 24 hours in continuance.

When he quitted parliament, he was, in the common phraſe, "a fiſh out of water!" The ſtyle of Mr Elwes's life had left him no domeſtic ſcenes to which he could retire—his home was dreary and poor—his rooms received no cheerfulneſs from fire; and while the outſide had all the appearance of a "Houſe to be Let," the inſide was a deſert; but he had his penury alone to thank for this, and for the want of all the little conſolations which ſhould attend old age, and ſmooth the paſſage of declining life. At the cloſe of the ſpring 1785, he wiſhed again to viſit, which he had not done for ſome years, his ſeat at Stoke. But then the journey was a moſt ſerious object to him. The famous old ſervant was dead; all the horſes that remained with him were a couple of worn-out broodmares; and he himſelf was not in that vigour of body in which he could ride 60 or 70 miles on the ſuſtenance of *two boiled eggs*. The mention of a poſt-chaiſe would have been a crime—"He afford a poſt-chaiſe, indeed! where was he to get the money?" would have been his exclamation. At length he was carried into the country as he was carried into parliament, free of expence, by a gentleman who was certainly not quite ſo rich as Mr Elwes. When he reached Stoke—the ſeat of more active ſcenes, of ſomewhat reſembling hoſpitality, and where his fox-hounds had ſpread ſomewhat like vivacity around,—he remarked, "he had expended a great deal of money once very fooliſhly; but that a man grew wiſer by time."

The rooms at this ſeat, which were now much out of repair, and would have all fallen in but for his ſon John Elwes, Eſq; who had reſided there, he thought too expenſively furniſhed, as worſe things might have ſerved. If a window was broken, there was to be no repair but that of a little brown paper, or that of piecing in a bit of broken glaſs; which had at length been done ſo frequently, and in ſo many ſhapes, that it would have puzzled a mathematician to ſay "what figure they deſcribed." To ſave fire, he would walk about the remains of an old greenhouſe, or ſit with a ſervant in the kitchen. During the harveſt he would amuſe himſelf with going into the fields to glean the corn on the grounds of his own tenants; and they uſed to leave a little more than common to pleaſe the old gentleman, who was as eager after it as any pauper in the pariſh. In the advance of the ſeaſon, his morning employment was to pick up any ſtray chips, bones, or other things, to carry to the fire, in his pocket—and he was one day ſurpriſed by a neighbouring gentleman in the act of pulling down, with ſome difficulty, a crow's neſt for this purpoſe. On the gentleman wondering why he gave himſelf this trouble—"Oh, Sir, (replied old Elwes), it is really a ſhame that theſe creatures ſhould do ſo. Do but ſee what waſte they make! They don't care how extravagant they are!"

As no gleam of favourite paſſion, or any ray of amuſement, broke through this gloom of penury, his inſatiable deſire of ſaving was now become uniform and ſyſtematic. He uſed ſtill to ride about the country on one of theſe mares—but then he rode her very economically, on the ſoft turf, adjoining the road, without putting himſelf to the expence of ſhoes, as he obſerved, "The turf was ſo pleaſant to a horſe's foot!" And when any gentleman called to pay him a viſit, and the boy who attended in the ſtables was profuſe enough to put a little hay before his horſe, old Elwes would ſlily ſteal back into the ſtable, and take the hay very carefully away. That very ſtrong appetite which Mr Elwes had in ſome meaſure reſtrained during the long ſitting of parliament, he now indulged moſt voraciouſly, and on every thing he could find. To ſave, as he thought, the expence of going to a butcher, he would have a whole ſheep killed, and ſo eat mutton to the—*end of the chapter*. When he occaſionally had his river drawn, though ſometimes horſe-loads of ſmall fiſh were taken, not one would he ſuffer to be thrown in again; for he obſerved, "He ſhould never ſee them again!" Game in the laſt ſtate of putrefaction, and meat that *walked about his plate*, would he continue to eat, rather than have new things killed before the old proviſion was finiſhed. With this diet—the *charnel-houſe of ſuſtenance*—his dreſs kept pace—equally in the laſt ſtage of *abſolute diſſolution*. Sometimes he would walk about in a tattered brown-coloured hat, and ſometimes in a red and white woollen cap, like a priſoner confined for debt. His ſhoes he never would ſuffer to be cleaned, leſt they ſhould be worn out the ſooner. But ſtill, with all this *ſelf-denial*—that penury of life to which the inhabitant of an *alms-houſe* is not doomed—ſtill did he think he was profuſe, and frequently ſay, "He muſt be a little more careful of his property." His diſquietude on the ſubject of money was now continual. When he went to bed, he would put five or ten guineas into a bureau; and then, full of his money, after he had retired to reſt, and ſometimes in the middle of the night, he would come down to ſee if it was there.

The ſcene of mortification at which Mr Elwes was now arrived was all but a denial of the common neceſſaries of life: and indeed it might have admitted a doubt, whether or not, if his manors, his fiſh-ponds, and ſome grounds in his own hands, had not furniſhed a ſubſiſtence, where he had not any thing *actually to buy*, he would not, rather than have *bought any thing*, have ſtarved. Strange as this may appear, it is not exaggerated.—He one day, during this period, dined upon the remaining part of a moor-hen, which had been brought out of the river by a *rat!* and at another eat an undigeſted part of a pike which a larger one had ſwallowed, but had not finiſhed, and which were taken in this ſtate in a net. At the time this laſt circumſtance happened, he diſcovered a ſtrange kind of ſatisfaction; for he ſaid to a friend, "Aye! this was killing two birds with one ſtone!" In the room of all comment—of all moral—let it be remarked, that at this time Mr Elwes was perhaps worth nearly *eight hundred thouſand pounds!* and, at this period, he had not made his will, of courſe was not ſaving from any ſentiment of affection for any perſon.

The ſummer of 1788 Mr Elwes paſſed at his houſe in Welbeck-ſtreet, London; and he paſſed that ſummer without any other ſociety than that of two maid-

Miser.

servants; for he had now given up the expence of keeping any male domestic. His chief employment used to be that of getting up early in a morning to visit some of his houses in Mary-le-Bone, which during the summer were repairing. As he was there generally at four o'clock in a morning, he was of course on the spot before the workmen; and he used contentedly to sit down on the steps before the door, to scold them when they did come. The neighbours who used to see him appear thus regular every morning, and who concluded, from his apparel, he was one of the workmen, observed, "there never was so punctual a man as the old carpenter." During the whole morning he would continue to run up and down stairs to see the men were not idle for an instant, with the same anxiety as if his whole happiness in life had been centered in the finishing this house, regardless of the greater property he had at stake in various places, and for ever employed in the *minutiæ* only of affairs. Indeed such was his anxiety about this house, the rent of which was not above L. 50 a-year that it brought on a fever which nearly cost him his life: but the fate which dragged him on thus strangely to bury him under the load of his own wealth, seemed as resistless as it was unaccountable.

In the muscular and unencumbered frame of Mr Elwes there was every thing that promised extreme length of life; and he lived to above 70 years of age without any natural disorder attacking him: but, as Lord Bacon has well observed, "the minds of some men are a lamp that is continually burning;" and such was the mind of Mr Elwes. Removed from those occasional public avocations which had once engaged his attention, money was now his only thought. He rose upon money—upon money he lay down to rest; and as his capacity sunk away from him by degrees, he dwindled from the real cares of his property into the puerile concealment of a few guineas. This little store he would carefully wrap up in various papers, and depositing them in different corners, would amuse himself with running from one to the other, to see whether they were all safe. Then forgetting, perhaps, where he had concealed some of them, he would become as seriously afflicted as a man might be who had lost all his property. Nor was the day alone thus spent—he would frequently rise in the middle of the night, and be heard walking about different parts of the house, looking after what he had thus hidden and forgotten.

During the winter of 1789, the last winter Mr Elwas was fated to see, his memory visibly weakened every day; and from the unceasing wish to save money he now began to fear he should die in want of it. Mr Gibson had been appointed his builder in the room of Mr Adams; and one day, when this gentleman waited upon him, he said with apparent concern, "Sir, pray consider in what a wretched state I am; you see in what a good house I am living; and here are five guineas, which is all I have at present; and how I shall go on with such a sum of money puzzles me to death. I dare say you thought I was rich; now you see how it is!"

Mr George Elwes having now settled at his seat at Marcham in Berkshire, he was naturally desirous that in the assiduities of his wife, his father might at length find a comfortable home. In London he was certainly most uncomfortable: but still, with these temptations before and behind him, a journey with any expence annexed to it was insurmountable. This, however, was luckily obviated by an offer from Mr Partis, a gentleman of the law, to take him to his ancient seat in Berkshire with his purse perfectly whole. But there was one circumstance still very distressing—the old gentleman had now nearly worn out his last coat, and he would not buy a new one; his son, therefore, with a pious fraud, contrived to get Mr Partis to buy him a coat and make him a present of it. Thus, formerly having had a good coat, then a bad one, and at last no coat at all, he was kind enough to accept one from a neighbour.

Mr Elwes carried with him into Berkshire five guineans and a half, and a half crown. Lest the mention of this sum may appear singular, it should be said, that previous to his journey he had carefully wrapped it up in various folds of paper, that no part of it might be lost. On the arrival of the old gentleman, Mr George Elwes and his wife did every thing they could to make the country a scene of quiet to him. But "he had that within" which baffled every effort of this kind. Of his heart it might be said, "there was no peace in Israel." His mind, cast away upon the vast and troubled ocean of his property extending beyond the bounds of his calculation, returned to amuse itself with fetching and carrying about a few guineas, which in that ocean was indeed a drop. But nature had now carried on life nearly as far as she was able, and the sand was almost run out. The first symptoms of more immediate decay was his inability to enjoy his rest at night. Frequently would he be heard at midnight as if struggling with some one in his chamber, and crying out, "I will keep my money, I will; nobody shall rob me of my property." On any one of the family going into his room, he would start from this fever of anxiety, and, as if waking from a troubled dream again hurry into bed, and seem unconscious of what had happened. At length, on the 26th of November 1789, expired this miserably rich man, whose property, nearly reaching to a million, extended itself almost through every county in England.

Miser. || Misfortune.

MISERICORDIA, in law, is an arbitrary fine imposed on any person for an offence: this is called *misericordia*, because the amercement ought to be but small, and less than that required by magna charta. If a person be outrageously amerced in a court that is not of record, the writ called *moderata misericordia* lies for moderating the amercement according to the nature of the fault.

MISFORTUNE. An unlucky accident.

Misfortune, or chance, in law, a deficiency of the will; or committing of an unlawful act by misfortune or chance, and not by design. In such case, the will observes a total neutrality, and does not co-operate with the deed; which therefore wants one main ingredient of a crime. See Crime.

Of this, when it affects the life of another, we have spoken under the article Homicide; and in this place have only occasion to observe, that if any accidental mischief happens to follow from the performance of a lawful act, the party stands excused from all guilt:

but

but if a man be doing any thing unlawful, and a consequence ensues which he did not foresee or intend, as the death of a man or the like, his want of foresight shall be no excuse; for being guilty of one offence, in doing antecedently what is in itself unlawful, he is criminally guilty of whatever consequence may follow the first misbehaviour.

MISFEASANCE, in law-books, signifies a trespass.

MISLETOE, in botany. See VISCUM.

MISNOMER, in law, a misnaming or mistaking a person's name. The Christian name of a person should always be perfect; but the law is not so strict in regard to surnames, a small mistake in which will be dispensed with to make good a contract, and support the act of the party. See PLEA *to indictment.*

MISPRISIONS, (a term derived from the old French, *mespris*, a neglect or contempt) are, in the acceptation of the law, generally understood to be all such high offences as are under the degree of capital, but nearly bordering thereon: and it is said, that a misprision is contained in every treason and felony whatsoever; and that, if the king so please, the offender may be proceeded against for the misprision only. And upon the same principle, while the jurisdiction of the star-chamber subsisted, it was held that the king might remit a prosecution for treason, and cause the delinquent to be censured in that court, merely for a high-misdemeanour: as happened in the case of Roger earl of Rutland, in 43 Eliz. who was concerned in the earl of Essex's rebellion. Misprisions are generally divided into two sorts; negative, which consist in the concealment of something which ought to be revealed; and positive, which consist in the commission of something which ought not to be done.

1. Of the first, or negative kind, is what is called *misprision of treason;* consisting in the bare knowledge and concealment of treason, without any degree of assent thereto: for any assent makes the party a principal traitor; as indeed the concealment, which was construed aiding and abetting, did at the common law; in like manner as the knowledge of a plot against the state, and not revealing it, was a capital crime at Florence, and other states of Italy. But it is now enacted by the statute 1 & 2 Ph. & Mar. c. 10. that a bare concealment of treason shall be only held a misprision. This concealment becomes criminal, if the party apprised of the treason does not, as soon as conveniently may be, reveal it to some judge of assize or justice of the peace. But if there be any probable circumstances of assent, as if one goes to a treasonable meeting, knowing beforehand that a conspiracy is intended against the king; or, being in such company once by accident, and having heard such treasonable conspiracy, meets the same company again, and hears more of it, but conceals it; this is an implied assent in law, and makes the concealer guilty of actual high-treason.

Misprision of felony is also the concealment of a felony which a man knows, but never assented to: for, if he assented, this makes him either principal or accessory. And the punishment of this, in a public officer, by the statute Westm. 1. 3 Edw. I. c. 9. is imprisonment for a year and a day; in a common person, imprisonment for a less discretionary time; and, in both, fine and ransom at the king's pleasure: which pleasure of the king must be observed, once for all, not to signify any extrajudical will of the sovereign, but such as is declared by his representatives, the judges in his courts of justice; *voluntas regis in curia, non in camera.*

2. Misprisions, which are merely positive, are generally denominated *contempt* or *high misdemeanours;* of which the principal is the *mal-administration* of such high officers as are in public trust and employment. This is usually punished by the method of parliamentary impeachment; wherein such penalties, short of death, are inflicted, as to the wisdom of the house of peers shall seem proper; consisting usually of banishment, imprisonment, fines, or perpetual disability. Hither also may be referred the offence of *embezzling the public money*, called among the Romans *peculatus;* which the Julian law punished with death in a magistrate, and with deportation, or banishment, in a private person. In England it is not a capital crime, but subjects the committer of it to a discretionary fine and imprisonment.—Other misprisions are, in general, such contempts of the executive magistrate as demonstrate themselves by some arrogant and undutiful behaviour towards the king and government: for a detail of which, *vide* Blackstone's Comment. iv. 22.

MISSAL, the Romish mass-book, containing the several masses to be said on particular days. It is derived from the Latin word *missa*, which, in the ancient Christian church, signified every part of divine service.

MISSEL-BIRD, a species of TURDUS.

MISSIO, among the Romans, was a full discharge given to a soldier after 20 years service, and differed from the *exauctoratio*, which was a discharge from duty after 17 years service. Every soldier had a right to claim his *missio* at the end of 20 years.

MISSION, in theology, denotes a power or commission to preach the gospel. Jesus Christ gave his disciples their mission in these words *Go and teach all nations*, &c.

The Romanists reproach the protestants, that their ministers have no mission, as not being authorised in the exercise of their ministry, either by an uninterrupted succession from the apostles, or by miracles, or by an extraordinary proof of a vocation.

There are many who deny any other mission necessary for the ministry than the talents necessary to discharge it.

MISSION is also used for an establishment of people zealous for the glory of God and the salvation of souls; who go and preach the gospel in remote countries and among infidels.

There are missions in the East as well as in the West Indies. Among the Romanists, the religious orders of St Dominic, St Francis, St Augustine, and the Jesuits, have missions in the Levant, America, &c. The Jesuits have also missions in China, and all other parts of the globe where they have been able to penetrate. There have been also several Protestant missions for diffusing the light of Christianity through the benighted regions of Asia and America. Of this kind has been the Danish mission planned by Frederic IV. in 1706. And the liberality of private benefactors in other countries has been also extended

to

to the support of missionaries among the Indians in America, &c.

MISSIONARY, an ecclesiastic who devotes himself and his labours to some mission, either for the instruction of the orthodox, the conviction of heretics, or the conversion of infidels. See JESUITS.

MISSISIPPI, also called the *river of St Louis*, in North America, is one of the largest in the world. Its source is unknown. It passes south through Louisiana, and runs above 2000 miles, till it falls into the gulph of Florida. Like the Nile, it has periodical inundations, by the melting of snow in the north, so that in May it overflows the country on each side, from 60 to 90 miles, and the inundation continues till near the end of July. In the lowest parts of the country there are morasses, lakes, and canals, along the banks, which are generally covered with trees, and in some places the course of the river is confined between high precipices. Its inundations always leave a great quantity of mud upon the land, and sometimes carry down trees to the river's mouth, where they form new islands, and render the entrance difficult.

MISSON (Francis Maximilian), whose pleadings before the parliament of Paris in favour of the reformers bear genuine marks of eloquence and ability, retired into England after the revocation of the edict of Nantz, and became a strenuous assertor of the Protestant religion. In the years 1687 and 1688 he travelled to Italy as governor to an English nobleman: in consequence of which he published at the Hague, "A new voyage to Italy," 3 vols. 12mo. which have been translated into English with many additions. He published also the "Sacred Theatre at Cevennes, or an account of Prophecies and Miracles performed in that part of Languedoc," London 1707. "Observations and Remarks of a Traveller," 12mo, Hague. He died at London in 1721.

MISSUS, in the Circensian games, were the matches in horse or chariot races. The usual number of *missus* or matches in one day was 24; though the emperor Domitian presented the people with 100. The last match was generally made at the expence of the people, who made a collection for the purpose; hence it was called *missus ærarius*, a subscription plate.

MIST, or FOG. See FOG.

MISTAKE, any wrong action committed, not thro' an evil design, but through an error of judgment.

MISTAKE, in Law. See IGNORANCE.

MISUSER, in law, is an abuse of any liberty or benefit; as "He shall make fine for his MISUSER." Old. Nat. Br. 149. By misuser a charter of a corporation may be forfeited; so also an office, &c.

MISY, in natural history, a species of the chalcantha, a fossile very common in the Turkish dominions, and sometimes found in the mines of Cremnitz in Hungary. It is a considerably firm substance, of an irregular texture, not compact; much resembling some of our more gaudy marcasites, but wanting in their hardness and weight. It is of no determinate shape or size; but is often found in small detached masses, which are usually broad, flat, and very rugged at the edges. As to its medical virtues, they are no other than those of the green vitriol.

MITCHELSTOWN, a post-town of Ireland, in the county of Cork and province of Munster in Ireland, 103 miles from Dublin. Here is a college for the support of 12 decayed gentlemen and 12 decayed gentlewomen, who have L. 40 yearly, and handsome apartments, and a chaplain at L. 100 a-year, with a house: divine service is daily performed in a neat chapel belonging to the college: the whole was founded by the late earl of Kingston. Here is also a most magnificent seat of Lord Kingsborough.—Fairs are held at this town 30th July and 12th November.

MITE, a small piece of money mentioned Luke xii. 59. and xxi. 2. In the Greek it is χοδραντης, i. e. *quadrans*, or a quarter of the Roman *denarius*; so that the mite was worth about seven farthings, or two pence sterling.

MITE, in zoology. See ACARUS.

MITELLA, BASTARD AMERICAN SANICLE: A genus of the digynia order, belonging to the decandria class of plants; and in the natural method ranking under the 13th order, *Succulentæ*. The calyx is quinquefid; the corolla pentapetalous, and inserted into the calyx; the petals pinnatifid; the capsule unilocular and bivalved, with the valves equal. There are two species, both natives of North America, rising with annual herbaceous stalks from five or six to eight or nine inches in height, and producing spikes of small whitish flowers, whose petals are fringed on their edges. They are easily propagated by parting their roots; and should be planted in a shady situation, and in a soft loamy soil.

MITHRA, feasts of, in antiquity, were feasts celebrated among the Romans in honour of Mithras or the sun. The most ancient instance of this Mithras among the Romans occurs in an inscription dated in the third consulate of Trajan, or about the year of Christ 101. This is the dedication of an altar to the sun under the above name, thus inscribed, *Deo Soli Mithræ*. But the worship of Mithras was not known in Egypt and Syria in the time of Origen, who died about the year of Christ 263; though it was common at Rome for more than a century before this time. The worship of Mithras was proscribed at Rome in the year 378, by order of Gracchus, prefect of the prætorium. According to M. Freret, the feasts of Mithras were derived from Chaldæa, where they had been instituted for celebrating the entrance of the sun into the sign Taurus.

MITHRAS, or MITHRA, a god of Persia and Chaldæa, supposed to be the sun. His worship was introduced at Rome. He is generally represented as a young man, whose head is covered with a turban after the manner of the Persians. He supports his knee upon a bull that lies on the ground, and one of whose horns he holds in one hand, while with the other he plunges a dagger in his neck.

MITHRIDATE, in pharmacy; an antidote, or composition, in form of an electuary, supposed to serve either as a remedy or a preservative against poisons. (See PHARMACY.) It takes its name from the inventor, Mithridates king of Pontus; who is said to have so fortified his body against poisons with antidotes and preservatives, that when he had a mind to dispatch himself, he could not find any poison that would take effect. The receipt of it was found in his cabinet, written with his own hand, and was carried to Rome by Pompey. It was translated into verse by Damocratus, a famous physician; and was afterwards translated by Galen, from whom we have it: though there is room to imagine it has undergone considerable alterations since the time of its royal prescriber.

MITHRIDATES, the name of several kings of Pontus. See PONTUS.

MITHRIDATES VII. surnamed *Eupator* and *the Great*, succeeded to the throne at the age of 11 years, about 123 years before the Christian era. The beginning of his reign was marked by ambition, cruelty, and artifice. He murdered his own mother, who had been left by his father coheiress of the kingdom; and he fortified his constitution by drinking antidotes against the poison with which his enemies at court attempted to destroy him. He early inured his body to hardship, and employed himself in the most manly exercises, often remaining whole months in the country, and making frozen snow and the earth the place of his repose. Naturally ambitious and cruel, he spared no pains to acquire to himself power and dominion. He murdered the two sons whom his sister Laodice had had by Ariarathes King of Cappadocia, and placed one of his own children, only eight years old, on the vacant throne. These violent proceedings alarmed Nicomedes king of Bithynia, who had married Laodice the widow of Ariarathes. He suborned a youth to be king of Cappadocia, as the third son of Ariarathes; and Laodice was sent to Rome to impose upon the senate, and assure them that her third son was now alive, and that his pretensions to the kingdom of Cappadocia were just and well founded. Mithridates, on his part, sent to Rome Gordius the governor of his son; who solemnly declared before the Roman people, that the youth who sat on the throne of Cappadocia was the third son and lawful heir of Ariarathes, and that he was supported as such by Mithridates. This intricate affair displeased the Roman senate: and finally to settle the dispute they took away the kingdom of Cappadocia from Mithridates, and Paphlagonia from Nicomedes. These two kingdoms being thus separated from their original possessors, were presented with their freedom and independence; but the Cappadocians refused it, and received Ariobarzanes for king. Such were the first seeds of enmity between Rome and the king of Pontus. Mithridates never lost an opportunity by which he might lessen the influence of his adversaries; and the more effectually to destroy their power in Asia, he ordered all the Romans that were in his dominions to be massacred. This was done in one night, and no less than 150,000, according to Plutarch, or 80,000 Romans, as Appian mentions, were made the victims of his cruelty. This called aloud for vengeance. Aquilius, and soon after Sylla, marched against Mithridates with a large army. The former was made prisoner; but Sylla obtained a victory over the king's generals; and another decisive engagement rendered him master of all Greece, Macedonia, Ionia, and Asia Minor. This ill fortune was aggravated by the loss of about 200,000 men, who were killed in the several engagements that had been fought; and Mithridates, weakened by repeated ill success by sea and land, sued for peace from the conqueror, which he obtained on condition of defraying the expences which the Romans had incurred by the war, and of remaining satisfied with the possessions which he had received from his ancestors. While these negociations of peace were carried on, Mithridates was not unmindful of his real interest. His poverty, and not his inclinations, obliged him to wish for peace. He immediately took the field with an army of 140,000 infantry and 16,000 horse, which consisted of his own forces and those of his son-in-law Tigranes king of Armenia. With such a numerous army, he soon made himself master of the Roman provinces in Asia; none dared to oppose his conquests; and the Romans, relying on his fidelity, had withdrawn the greatest part of their armies from the country. The news of his warlike preparations was no sooner heard, than Lucullus the consul marched into Asia; and without delay he blocked up the camp of Mithridates, who was then besieging Cyzicus. The Asiatic monarch escaped from him, and fled into the heart of his kingdom. Lucullus pursued him with the utmost celerity; and would have taken him prisoner after a battle, had not the avidity of his soldiers preferred the plundering of a mule loaded with gold to the taking of a monarch who had exercised such cruelties against their countrymen, and shown himself so faithless to the most solemn engagements. After this escape Mithridates was more careful about the safety of his person; and he even ordered his wives and sisters to destroy themselves, fearful of their falling into the enemy's hands. The appointment of Glabrio to the command of the Roman forces, instead of Lucullus, was favourable to Mithridates, who recovered the greatest part of his dominions. The sudden arrival of Pompey, however, soon put an end to his victories. A battle in the night was fought near the Euphrates, in which the troops of Pontus laboured under every disadvantage. The engagement was by moon-light, and as the moon then shone in the face of the enemy, the lengthened shadows of the arms of the Romans having induced Mithridates to believe that the two armies were close together, the arrows of his soldiers were darted from a great distance, and their efforts rendered ineffectual. An universal overthrow ensued, and Mithridates, bold in his misfortunes, rushed through the thick ranks of the enemy at the head of 800 horsemen, 500 of whom perished in the attempt to follow him. He fled to Tigranes; but that monarch refused an asylum to his father-in-law, whom he had before supported with all the collected forces of his kingdom. Mithridates found a safe retreat among the Scythians; and though destitute of power, friends, and resources, yet he meditated the overthrow of the Roman empire, by penetrating into the heart of Italy by land. These wild projects were rejected by his followers, and he sued for peace. It was denied to his ambassadors; and the victorious Pompey declared, that to obtain it, Mithridates must ask it in person. He scorned to trust himself in the hands of his enemy, and resolved to conquer or to die. His subjects refused to follow him any longer; and revolting from him, made his son Pharnaces king. The son showed himself ungrateful to his father; and even, according to some writers, he ordered him to be put to death. This unnatural treatment broke the heart of Mithridates; he obliged his wife to poison herself, and attempted to do the same himself. It was in vain: the frequent antidotes he had taken in the

the early part of his life, strengthened his constitution against the poison; and when this was unavailing, he attempted to stab himself. The blow was not mortal; and a Gaul who was then present, at his own request gave him the fatal stroke, about 64 years before the Christian era. Such were the misfortunes, abilities, and miserable end, of a man, who supported himself so long against the power of Rome, and who according to the declarations of the Roman authors, proved a more powerful and indefatigable adversary to the capital of Italy than the great Annibal, Pyrrhus, Perseus, or Antiochus. Mithridates has been commended for his eminent virtues, and censured for his vices. As a commander, he deserves the most unbounded applause; and it may create admiration to see him waging war, with such success, during so many years, against the most powerful people on earth, led to the field by a Sylla, a Lucullus, and a Pompey. He was the greatest monarch that ever sat on a throne, according to the opinion of Cicero; and indeed no greater proof of his military character can be brought, than the mention of the great rejoicings which happened in the Roman armies and in the capital at the news of his death. No less than 12 weeks were appointed for public thanksgivings to the immortal gods; and Pompey, who had sent the first intelligence of his death to Rome, and who had partly hastened his fall, was rewarded with the most uncommon honours. It is said that Mithridates conquered 24 nations, whose different languages he knew, and spoke with the same ease and fluency as his own. As a man of letters he also deserves attention. He was acquainted with the Greek language, and even wrote in that dialect a treatise on botany. His skill in physic is well known; and even now there is a celebrated antidote which bears his name, and is called *mithridate.* Superstition as well as nature had united to render him great; and if we rely upon the authority of Justin, his birth was accompanied by the appearance of two large comets, which were seen for 70 days successively, and whose splendor eclipsed the mid-day sun, and covered the fourth part of the heavens.

MITHRIDATICUM BELLUM, the *Mithridatic War*, one of the longest and most celebrated wars ever carried on by the Romans against a foreign power. See PONTUS.

MITRA, was a cap or covering for the head, worn by the Roman ladies, and sometimes by the men; but it was looked upon as a mark of effeminacy in the last, especially when it was tied upon their heads.

MITRE, a sacerdotal ornament worn on the head, by bishops and certain abbots on solemn occasions: being a sort of cap, pointed and cleft at top. The high-priest among the Jews wore a mitre or bonnet on his head. The inferior priests of the same nation had likewise their mitres; but in what respect they differed from that of the high-priest, is uncertain. Some contend that the ancient bishops wore mitres; but this is by no means certain.

MITRE, in architecture, is the workmens term for an angle that is just 45 degrees, or half a right one. If the angle be a quarter of a right angle, they call it a *half-mitre*.

To describe such angles, they have an instrument called the *mitre-square*; with this they strike mitre-lines on their quarters or battens; and for dispatch, they have a *mitre-box*, as they call it, which is made of two pieces of wood, each about an inch thick, one nailed upright on the edge of the other; the upper piece hath the mitre-lines struck upon it on both sides, and a kerf to direct the saw in cutting the mitre-joints readily, by only applying the piece into this box.

MITRE is used by the writers of the Irish history for a sort of base money, which was very common there about the year 1270, and for 30 years before and as many after.

There were beside the mitre several other pieces called according to the figures impressed upon them, rosaries, lionades, eagles, and by the like names. They were imported from France and other countries, and were so much below the proper currency of the kingdom, that they were not worth so much as a halfpenny each. They were at length decryed in the year 1300, and good coins struck in their place. These were the first Irish coins in which the sceptre was left out. They were struck in the reign of Edward, the son of Henry III. and are still found among the other antiquities of that country. They have the king's head in a triangle full-faced. The penny when well preserved, weighs 22 grains; the halfpenny $10\frac{1}{2}$ grains.

MITTAU, the capital of the Duchy of Courland. It is strongly fortified; but was taken by the Swedes in 1701, and by the Muscovites in 1706. E. Long. 23. 51. N. Lat. 56. 44.

MITTIMUS, as generally used, hath two significations. 1. It signifies a writ for removing or transferring of records from one court to another. 2. It signifies a precept, or command in writing, under the hand and seal of a justice of the peace, directed to the gaoler or keeper of some prison, for the receiving and safe keeping of an offender charged with any crime, until he be delivered by due course of law.

MITYLENE, or MYTELENE (anc. geog.), a celebrated, powerful, and affluent city, capital of the island of Lesbos. It receives its name from *Mitylene*, the daughter of Macareus, a king of the country. It is greatly commended by the ancients for the stateliness of its buildings and the fruitfulness of its soil, but more particularly for the great men it produced: Pittacus, Alcæus, Sappho, Terpander, Theophanes, Hellanicus, &c. were all natives of Mitylene. It was long a seat of learning; and with Rhodes and Athens, it had the honour of having educated many of the great men of Rome and Greece. In the Peloponnesian war, the Mityleneans suffered greatly for their revolt from the power of Athens; and in the Mithridatic wars, they had the boldness to resist the Romans, and disdain the treaties which had been made between Mithridates, and Sylla. See METELIN.

MIXT, or MIXT BODY, in chemistry, that which is compounded of different elements or principles.

MIXTURE, a compound or assemblage of several different bodies in the same mass. Simple mixture, consists only in the simple apposition of parts of different bodies to each other. Thus, when powders of different kinds are rubbed together, the mixture is only simple, and each of the powders retains its particular characters. In like manner, when oil and water are mixed together, though the parts of both are confounded, so that the liquor may appear to be homogeneous, we cannot say that there is any more than a simple

ſimple appoſition of the parts, as the oil and water may very eaſily be again ſeparated from each other. But the caſe is very different when bodies are *chemically* mixed; for then one or both bodies aſſume new properties, and can by no means be diſcovered in their proper form without a particular chemical proceſs adapted to this purpoſe. Hence chemical mixture is attended with many phenomena which are never obſerved in ſimple mixtures; ſuch as heat, effervefcence, &c. To chemical mixture belongs the union of acids and alkalies, the amalgamation of metals, ſolution of gums, &c. and upon it depend many of the principal operations of CHEMISTRY. See the article *paſſim*.

MIXTURE, in pharmacy, a medicine which differs from a julep in this reſpect, that it receives into its compoſition not only ſalts, extracts, and other ſubſtances diſſoluble in water; but alſo earths, powders, and ſuch ſubſtances as cannot be diſſolved.

MIZEN, in the ſea-language, is a particular maſt or ſail. The mizen-maſt ſtands in the ſternmoſt part of the ſhip. In ſome great ſhips there are two of theſe; when that next the main-maſt is called the *main-mizen*, and that next the poop the *bonaventure mizen*.

MIZRAIM, or MISRAIM, the dual name of Egypt, uſed in ſcripture to denote the Higher and Lower Egypt, which ſee. It ſometimes occurs ſingular, *Mazor*: 2 Kings xix. Iſaiah xix. Micah vii.

MNEMOSYNE (fab. hiſt.), a daughter of Cœlus and Terra. She maried Jupiter, by whom ſhe had the nine muſes. The word *mnemoſyne* ſignifies "memory;" and therefore the poets have rightly called Memory the mother of the muſes, becauſe it is to that mental endowment that mankind are indebted for their progreſs in ſcience.

MNIUM, MARSHMOSS; a genus of the natural order of muſci, belonging to the cryptogamia claſs of plants. The anthera is operculated; the calyptra ſmooth; the female capitulum naked and powdery, remote. There are 18 ſpecies, of which ſeven are natives of Britain; but none have any remarkable property except the two following. 1. The fontanum is an elegant moſs, frequent in bogs, and on the borders of cold ſprings. It is from two to four inches high: the ſtalks are ſimple at the baſe, and covered with a ruſty down; but higher up are red, and divided into ſeveral round, ſingle, taper branches, which proceed nearly from the ſame point. The leaves are not more than $\frac{1}{10}$th of an inch long, lanceolate and acute, of a whitiſh green colour; and ſo thinly ſet, that the red ſtalk appears between them. This moſs, as it may be ſeen at a conſiderable diſtance, is a good mark to lead to the diſcovery of clear and cold ſprings. Linnæus informs us, that the Laplanders are well acquainted with this ſign. Dr Withering informs us, that wherever this moſs grows, a ſpring of freſh water may be found without much digging. 2. The hygrometricum grows in woods, heaths, garden-walks, walls, old trees, decayed wood, and where coals or cinders have been laid. It is ſtemleſs, hath tips inverſely egg-ſhaped, nodding, and bright yellow. If the fruit-ſtalk is moiſtened at the baſe with a little water or ſteam, the head makes three or four revolutions: if the head is moiſtened, it turns back again.

MOAB (anc. geog.), a country of Arabia Petræa; ſo called from Moab the ſon of Lot, to whoſe poſterity this country was allotted by divine appointment, Deut. xi. 9. It was originally occupied by the Emim, a race of giants extirpated by the Moabites, *ibid.* Moab anciently lay to the ſouth of Ammon, before Sihon the Amorite ſtripped both nations of a part of their territory, afterwards occupied by the Iſraelites, Numb. xxi.; and then Moab was bounded by the river Arnon to the north, the Lacus Aſphaltites to the weſt, the brook Zared to the ſouth, and the mountains Abarim to the eaſt.

MOAT, or DITCH, in fortification, a deep trench dug round the rampart of a fortified place, to prevent ſurpriſes.

The brink of the moat, next the rampart, is called the *ſcarpe*; and the oppoſite one, the *counterſcarpe*.

A dry moat round a large place, with a ſtrong garriſon, is preferable to one full of water; becauſe the paſſage may be diſputed inch by inch, and the beſiegers, when lodged in it, are continually expoſed to the bombs, granades, and other fire-works, which are thrown inceſſantly from the rampart into their works. In the middle of dry moats, there is ſometimes another ſmall one, called *cunette*; which is generally dug ſo deep till they find water to fill it.

The deepeſt and broadeſt moats are accounted the beſt; but a deep one is preferable to a broad one: the ordinary breadth is about 20 fathoms, and the depth about 16.

To drain a moat that is full of water, they dig a trench deeper than the level of the water, to let it run off; and then throw hurdles upon the mud and ſlime, covering them with earth or bundles of ruſhes, to make a ſure and firm paſſage.

MOATAZALITES, or SEPARATISTS, a religious ſect among the Turks, who deny all forms and qualities in the Divine Being; or who diveſt God of his attributes.

There are two opinions among the Turkiſh divines concerning God. The firſt admits metaphyſical forms or attributes; as, that God has wiſdom, by which he is wiſe; power, by which he is powerful; eternity, by which he is eternal, &c. The ſecond allows God to be wiſe, powerful, eternal; but will not allow any form or quality in God, for fear of admitting a multiplicity. Thoſe who follow this latter opinion are called *Moatazalites*; they who follow the former, *Sephalites*.

The Moatazalites alſo believed that the word of God was created *in ſubjecto*, as the ſchoolmen term it; and to conſiſt of letters and ſounds; copies thereof being written in books to expreſs or imitate the original; they denied abſolute prediſtination, and affirmed that man is a free agent. This ſect is ſaid to have firſt invented the ſcholaſtic divinity, and is ſubdivided into no leſs than 20 inferior ſects, which mutually brand one another with infidelity.

MOBILE, MOVEABLE, any thing ſuſceptible of motion, or that is diſpoſed to be moved either by itſelf or by ſome other prior *mobile* or mover.

Primum MOBILE, in the ancient aſtronomy, was a ninth heaven or ſphere, imagined above thoſe of the planets and fixed ſtars. This was ſuppoſed to be the first mover, and to carry all the lower spheres round along with it; by its rapidity communicating to them a motion whereby they revolved in 24 hours. But the diurnal revolution of the planets is now accounted for without the assistance of any such *primum mobile*.

Perpetuum MOBILE. See *Perpetual* MOTION.

MOCHO, Moco, or *Mokha*; by some supposed to be the Musa or Muza of Ptolemy, is a port and town on the Red Sea, of considerable trade; contains about 10,000 inhabitants, Jews, Armenians, and Mohammedans; is surrounded with walls after the ancient manner; and has four gates and four towers, the last mounted with cannon; but there is no ditch. It gives name to a kingdom extending along the most southern coast of Arabia; of which that part which lies next the sea is a dry barren desart, in some places 10 or 12 leagues over; but bounded by mountains, which being well watered, enjoy an almost perpetual spring; and besides coffee, the peculiar produce of this country, yields corn, grapes, myrrh, frankincense, cassia, balm, gums of several sorts, mangos, dates, pomegranates, &c. The weather here is so hot and sultry in summer, especially when the south wind blows, that it would be insupportable, if it was not mitigated by the cool breezes that generally blow from the mountains on the north, or the Red and Arabic Seas on the west and east. The heat in winter is equal to that of the warmest summers of England; and it is very seldom that either clouds or rain are seen. The city of Mocho is now the emporium for the trade of all India to the Red Sea. The trade was removed hither from Aden, in consequence of the prophecy of a sheik, much revered by the people, who foretold that it would soon become a place of extensive commerce notwithstanding its disadvantageous situation. It stands close to the sea, in a large, dry, and sandy plain, that affords no good water within 20 miles of the city; what they drink comes from Mosa, and costs as dear as small-beer in England. The water near the town, as it is thought, produces a worm, which the naturalists call the *dracunculus*, which is about two feet and a half long, very slender, and breeds in the fleshy parts of the body: in extracting it great care must be used, the consequence being dangerous if any part of it remains in the body. The buildings here are lofty, and tolerably regular, having a pleasant aspect from Mecca. The steeples of several mosques are very high, presenting themselves to view at a great distance. Their markets are well stored with beef, mutton, lamb, kid, camels, and antelopes flesh, common fowls, Guinea hens, partridges, and pigeons. The sea affords plenty of fish, but not savoury; which some think proceeds from the extreme saltness of the water, and the nature of their aliment. The markets are also stocked with fruit, such as grapes, peaches, apricots, quinces, and nectarines; although neither shrub nor tree is to be seen near the town, except a few date-trees. Frequently no rain falls here in two or three years, and seldom more than a shower or two in a year; but in the mountains, at the distance of about 20 miles from Mokha, the earth is watered with a gentle shower every morning, which makes the valleys fertile in corn and the fruits natural to the climate. The Arab inhabitants, though remarkably grave and superstitious, are said to be extremely covetous and hypocritical; robbing, thieving, and committing piracy, without the least scruple or remorse. The English and Dutch companies have handsome houses here, and carry on a great trade in coffee, olibanum, myrrh, aloes, liquid storax, white and yellow arsenic, gum-arabic, mummy, balm of Gilead, and other drugs. One inconvenience, however, they sustain from the violence and exactions of the Arabian princes; but the king's customs are easy, being fixed at three *per cent.* to Europeans. Of the coins at Mocho, the most current is the camassie, which rises and falls in value at the banker's discretion: they are from 50 to 80 for a current dollar, which is but an imaginary species, being always reckoned one and a half *per cent.* lower than Spanish dollars. As to their weights, they are almost infinite, according to the nature of the thing to be weighed: they have the banian weight, the magnet, the ambergris, the agala, the gold and silver weights, &c.

MOCK-ORE, or *Mock-Lead*. See BLENDE.

MOCKING-BIRD, in ornithology. See TURDUS.

MOCOCO. See LEMUR.

MODE, which is a word of the same general import with MANNER, is used as a technical term in grammar, metaphysics, and music. For its import in GRAMMAR, see that article, n° 80.

MODE, in metaphysics, seems properly to denote the manner of a thing's existence: but Locke, whose language in that science is generally adopted, uses the word in a sense somewhat different from its ordinary and proper signification. "Such complex ideas, which, however compounded, contain not in them the supposition of subsisting by themselves, but are considered as dependencies on, or affections of, substances," he calls *modes*. Of these *modes*, there are, according to him, two sorts, which deserve distinct consideration. First, there are some "which are only variations, or different combinations of the same simple idea, without the mixture of any other, as *a dozen* or *a score*; which are nothing but the ideas of so many distinct units added together:" and these he calls *simple modes*. Secondly, "there are others compounded of simple ideas of several kinds put together to make one complex one; *e. g. beauty*, consisting of a certain composition of colour and figure, causing delight in the beholder; *theft*, which being the concealed change of the possession of any thing without the consent of the proprietor, contains, as is visible, a combination of several ideas of several kinds;" and these he calls *mixed modes*. For the just distinction between *ideas* and *notions*, as well as between *ideas* and the *qualities* of external objects, which in this account of modes are all confounded together, see METAPHYSICS.

MODE, in music; a regular disposition of the air and accompaniments relative to certain principal sounds upon which a piece of music is formed, and which are called the *essential sounds of the mode*.

There is this difference between the mode and the tone, that the latter only determines the principal sound, and indicates the place which is most proper to be occupied by that system which ought to constitute the bass of the air, whereas the former regulates the thirds, and modifies the whole scale agreeably to its fundamental sounds.

Our *modes* are not, like those of the ancients, cha-

racterised

racterised by any sentiment which they tend to excite, but result from our system of harmony alone. The sounds essential to the mode are in number three, and form together one perfect chord. 1. The tonic or key, which is the fundamental note both of the tone and of the mode: (See TONE and TONIC). 2. The dominant, which is a fifth from the tonic: (See DOMINANT). 3. The mediant, which properly constitutes the *mode*, and which is a third from the same tonic. As this third may be of two kinds, there are of consequence two different modes. When the mediant forms a greater third with the tonic, the mode is major; when the third is lesser, it is minor.

The major mode is immediately generated by the resonance of sounding bodies, which exhibit the third major of the fundamental sound: but the minor mode is not the product of nature; it is only found by analogy and inversion. This is equally true upon the system of Sig. Tartini as upon that of M. Rameau.

This last author, in his various and successive publications, has explained the origin of this minor mode in different ways, of which his interpreter M. d'Alembert was satisfied with none. It is for this reason that he has founded this origin on a different principle, which cannot be better explained than in the words of that eminent geometrician. See MUSIC, Art. 28, 29, 30, and 31.

When the mode is once determined, every note in the scale assumes a name expressive of its relation to the fundamental sound, and peculiar to the place which it occupies in that particular mode. We subjoin the names of all the notes significant of their relative values and places in each particular *mode*, taking the octave of *ut* as an example of the major *mode*, and of *la* as an example of the minor.

Major,	*ut*	*re*	*mi*	*fa*	*sol*	*la*	*si*	*ut*
Minor,	*la*	*si*	*ut*	*re*	*mi*	*fa*	*sol*	*la*
	Tonic	Second note.	Mediant.	Fourth note, or Sub-dominant.	Dominant.	Sixth note, or Sub-dominant.	Seventh note.	Octave.

It is necessary to remark, that when the seventh note is only a semitone distant from the highest in the octave, that is to say, when it forms a third major with the dominant, as *si* natural in the major *mode*, or *sol* sharp in the minor, that seventh sound is then called a *sensible note*, because it discovers the tonic and renders the tone apreciable.

Nor does each gradation only assume that name which is suitable to it; but the nature of each interval is determined according to its relation to the *mode*. The rules established for this are as follow:

1. The second note must form a second major above the tonic, the fourth note and the dominant should form a fourth and fifth exactly true; and this equally in both modes.

2. In the major mode, the mediant or third, the sixth and the seventh from the tonic, should always be major; for by this the mode is characterised. For the same reason these three intervals ought always to be minor in the minor mode: nevertheless, as it is necessary that the sensible note should likewise there be perceived, which cannot be effectuated without a false relation whilst the sixth note still remains minor; this occasions exceptions, of which in the course of the air or harmony care must be taken. But it is always necessary that the cleff, with its transpositions, should preserve all the intervals, as determined with relation to the tonic, according to the species of the *mode*. For this a general rule will be found at the word *Cleff*, in Rousseau's Musical Dictionary.

As all the natural chords in the octave of *ut* give, with relation to that tonic, all the intervals prescribed for the major *mode*, and as the case is the same with the octave of *la* for the minor mode, the preceding example, which was only given that we might have an opportunity of naming the notes, may likewise serve as a formula for the rule of the intervals in each *mode*.

This rule is not, as one might imagine, established upon principles that are merely arbitrary: it has its source in the generation of harmony, at least in a certain degree. If you give a perfect major chord to the tonic, to the dominant, and the sub-dominant, you will have all the sounds of the diatonic scale for the major *mode*: to obtain that of the minor, leaving still its third major to the dominant, give a third minor to the two other chords. Such is the analogy of the mode.

As this mixture of major and minor chords introduces into the minor mode a false relation between the sixth and the sensible note, to avoid this false relation, they sometimes give the third major to the fourth note in ascent, or the third minor to the dominant in descending, chiefly by inverting the chords; but these in this case are licences.

There are properly no more than two *modes*, as we have seen: but there are twelve different sounds in the octave which may be made fundamental sounds, and of consequence form as many keys or tones; and as each of these tones are susceptible of the major or minor mode, music may be composed in twenty-four modes or manners. Nay, in the manner of writing music, there are even thirty-four passable modes: but in practice ten are excluded; which when thoroughly examined are nothing else but a repetition of the other ten, under relations much more difficult, in which all the chords must change their names, and where it must cost any one some trouble to know what he is about. Such is the major mode upon a note raised above its natural pitch by a semitone, and the minor mode upon a note depressed by a semitone. Thus, instead of composing upon *sol* sharp with a third major, it is much more eligible to operate upon *la* flat, which will give you an opportunity to employ the same tones; and instead of composing upon *re* flat with a third minor, you will find it more convenient to choose *ut* sharp for the same reason; viz. on one hand to avoid a *fa* with a double sharp, which would be equivalent to a *sol* natural; and on the other hand a *si* with a double flat, which would become a *la* natural.

The composer does not always continue in the same *mode*, nor in the same *key*, in which he has begun an air; but, whether to alter the expression or introduce variety, *modes* and *keys* are frequently changed, according to the analogy of harmony; yet always returning to those which have been first heard: this is called *modulation*.

From

Mode.

From thence arifes a new divifion of *modes* into fuch as are *principal* and fuch as are *relative*: the principal is that in which the piece begins and ends; the relative modes are fuch as the compofer interweaves with the principal in the flow of the harmony. (See MODULATION).

Others have propofed a third fpecies, which they call a *mixed mode*, becaufe it participates the modulation of both the others, or rather becaufe it is compofed of them; a mixture which they did not reckon an inconveniency, but rather an advantage, as it increafes the variety, and gives the compofer a greater latitude both in air and harmony.

This new mode, not being found by the analyfis of the three chords like the two former, is not determined, like them, by harmonics effential to the mode, but by an entire fcale which is peculiar to itfelf, as well in rifing as defcending; fo that in the two modes abovementioned the fcale is inveftigated by the chords; and in this mixed mode the chords are inveftigated by the fcale. The following notes exhibit the form of this fcale in fucceffion, as well rifing as defcending:

mi fa fol la fi ut re mi.

Of which the effential difference is, as to the *melody*, in the pofition of the two femitones; of which the firft is found between the firft and the fecond note, and the laft between the fifth and fixth; and, with refpect to the *harmony*, the difference confifts in this, that upon its tonic it carries a third minor in the beginning, and major in ending, in the accompaniment of this fcale, as well in rifing as defcending, fuch as it has been given by thofe who propofed it, and executed at a fpiritual concert, May 30, 1751.

They object to its inventor, That his mode has neither chords nor harmony effential to itfelf, nor cadencies which are peculiar to it, and which fufficiently diftinguifh it from the major or minor mode. He anfwers to this, That the diftinction of his mode is lefs in harmony than in melody, and lefs even in the mode itfelf than in the modulation; that in its beginning it is diftinguifhed from the major mode by its third minor, and in its end from the minor mode by its plagal cadence. To which his opponents reply, That a modulation which is not exclufive cannot be fufficient to eftablifh a mode; and that his muft inevitably occur in the two other modes, and above all in the minor; and, as to his plagal cadence, that it neceffarily takes place in the minor mode as often as tranfition is made from the chord of the tonic to that of the dominant, as has long been the cafe in practice, even upon final notes, in plagal modes, and in the tone proper to the fourth. From whence it is concluded, that his mixed mode is not fo much a particular fpecies, as a new denomination for the manner of interweaving and combining the major and minor modes, as ancient as harmony, practifed at all periods; and this appears to be fo true, that, even when he begins his fcale, its author will neither venture to give the fifth nor the fixth to his tonic, for fear left by the firft the tonic fhould be determined in the minor mode, or the mediant in the major mode by the fecond. He leaves the harmony equivocal by not filling up his chord.

But whatever objections may be made againft the mixed mode, whofe name is rather rejected than its practice, this will not prevent the author from appearing as a man of genius, and a mufician profoundly learned in the principles of his art, by the manner in which he treats it, and the arguments which he ufes to eftablifh it.

Mode, Model.

MODE *Major.* } See INTERVAL.
MODE *Minor.* }

MODEL, in a general fenfe, an original pattern, propofed for any one to copy or imitate.

1 Different kinds of models.

This word is particularly ufed in building, for an artificial pattern made in wood, ftone, plafter, or other matter, with all its parts and proportions, in order for the better conducting and executing fome great work, and to give an idea of the effect it will have in large. In all great buildings, it is much the fureft way to make a model in relievo, and not to truft to a bare defign or draught. There are alfo models for the building of fhips, &c. and for extraordinary ftaircafes, &c.

They alfo ufe models in painting and fculpture; whence, in the academies, they give the term *model* to a naked man or woman, difpofed in feveral poftures, to afford an opportunity to the fcholars to defign him in various views and attitudes.

2 General method of making models.

Models in imitation of any natural or artificial fubftance, are moft ufually made by means of moulds compofed of plafter of Paris. For the purpofe of making thefe moulds, this kind of plafter is much more fit than any other fubftance, on account of the power it has of abforbing water, and foon condenfing into an hard fubftance, even after it has been rendered fo thin as to be of the confiftence of cream. This happens in a fhorter or longer time as the plafter is of a better or worfe quality; and its good or bad properties depend very much upon its age, to which, therefore, particular regard ought to be had. It is fold in the fhops at very different prices; the fineft being made ufe of for cafts, and the midling fort for moulds. It may be very eafily coloured by means of almoft any kind of powder excepting what contains an alkaline falt; for this would chemically decompofe the fubftance of it, and render it unfit for ufe. A very confiderable quantity of chalk would alfo render it foft and ufelefs, but lime hardens it to a great degree. The addition of common fize will likewife render it much harder than if mere water is made ufe of. In making either moulds or models, however, we muft be careful not to make the mixture too thick at firft; for if this is done, and more water added to thin it, the compofition muft always prove brittle and of a bad quality.

The particular manner of making models (or *cafts*, as they are alfo called) depends on the form of the fubject to be taken. The procefs is eafy, where the parts are elevated only in a flight degree, or where they form only a right or obtufe angle with the principal furface from which they project; but where the parts project in fmaller angles or form curves inclined towards the principal furface, the work is more difficult. This obfervation, however, holds good only with regard to hard and inflexible bodies; for fuch as are foft may often be freed from the mould, even though they have the fhape laft mentioned. But though this be the cafe with the foft original fubftance, it is not fo with the inflexible model when once it is caft.

The moulds are to be made of various degrees of thicknefs, according to the fize of the model to be caft; and may be from half an inch to an inch, or, if very large, an inch and an half. Where a number of models are to be taken from one mould, it will likewife be neceffary to have it of a ftronger contexture than where only a few are required, for very obvious reafons.

3 Anatomical models.

It is much more eafy to make a mould for any foft fubftance than a rigid one, as in any of the vifcera of the animal body: for the fluidity of the mixture makes it eafily accommodate itfelf to the projective parts of the fubftance; and as it is neceffary to inflate thefe fubftances, they may be very readily extracted again by letting out the air which diftended them.

When a model is to be taken, the furface of the original is firft to be greafed, in order to prevent the plafter from fticking to it; but if the fubftance itfelf is flippery, as is the cafe with the internal parts of the human body, this need not be done: when neceffary, it may be laid over with linfeed oil by means of a painter's brufh. The original is then to be laid on a fmooth table, previoufly greafed or covered with a cloth, to prevent the plafter fticking to it; then furround the original with a frame or ridge of glazier's putty, at fuch a diftance from it as will admit the plafter to reft upon the table on all fides of the fubject for about an inch, or as much as is fufficient to give the proper degree of ftrength to the mould. A fufficient quantity of plafter is then to be poured as uniformly as poffible over the whole fubftance, until it be every where covered to fuch a thicknefs as to give a proper fubftance to the mould, which may vary in proportion to the fize. The whole muft then be fuffered to remain in this condition till the plafter has attained its hardnefs; when the frame is taken away, the mould may be inverted, and the fubject removed from it; and when the plafter is thoroughly dry let it be well feafoned.

Pole's Anatomical Inftructor.

Having formed and feafoned the moulds, they muft next be prepared for the cafts by greafing the infide of them with a mixture of olive oil and lard in equal parts, and then filled with fine fluid plafter, and the plain of the mould formed by its refting on the furface of the table covered to a fufficient thicknefs with coarfe plafter, to form a ftrong bafis or fupport for the caft where this fupport is requifite, as is particularly the cafe where the thin and membranous parts of the body are to be reprefented. After the plafter is poured into the mould, it muft be fuffered to ftand until it has acquired the greateft degree of hardnefs it will receive: after which the mould muft be removed: but this will be attended with fome difficulty when the fhape of the fubject is unfavourable; and in fome cafes the mould muft be feparated by means of a fmall mallet and chiffel. If by thefe inftruments any parts of the model fhould be broken off, they may be cemented by making the two furfaces to be applied to each other quite wet; then interpofing betwixt them a little liquid plafter; and laftly, the joint fmoothed after being thoroughly dry. Any fmall holes that may be made in the mould can be filled up with liquid plafter, after the fides of them have been thoroughly wetted, and fmoothed over with the edge of a knife.

In many cafes it is altogether impracticable to prepare a mould of one piece for a whole fubject; and therefore it muft be confidered how this can be done in fuch a manner as to divide the mould into the feweft pieces. This may be effected by making every piece cover as much of the pattern as poffible, without furrounding fuch projecting parts, or running into fuch hollows as would not admit a feparation of the mould. It is impoffible, however, to give any particular directions in this matter which can hold good in every inftance, the number of pieces of which the mould is to confift being always determined from the fhape of the pattern. Thus the mould of the human calculus will require no more than three pieces, but that of an *os femoris* could fcarce have fewer than ten or twelve.—Where any internal pieces are required, they are firft to be made, and then the outer pieces after the former have become hard.

To make a mould upon an hard and dry fubftance, we muft, in the firft place, rub the furface of it fmoothly over with the mixture of oil and lard abovementioned. Such hollows as require internal pieces are then to be filled up with fluid plafter; and while it continues in this ftate, a wire loop muft be introduced into it, by which, when hardened, it can be pulled off. The plafter fhould be fomewhat raifed in a pyramidal form round this wire, and afterwards cut fmooth with a knife while yet in its foft ftate; preferving two or three angular ridges from the loop to the outer edge, that it may fix the more fteadily in the outer piece of the mould to be afterwards made upon it. Let the outer piece then be well greafed, to prevent the fecond piece from adhering; the loop being inclofed with fome glazier's putty, both to prevent the fecond piece from adhering and to preferve an hollow place for the cord.

To form the fecond or outfide piece, mix a quantity of plafter proportioned to the extent of furface it is to cover and the intended thicknefs of the mould: when it is juft beginning to thicken, or affumes fuch a confiftence as not to run off very eafily, fpread it over the internal piece or pieces as well as the pattern, taking care at the fame time not to go too far left it fhould not deliver fafely; and as the plafter becomes more tenacious, add more upon the pattern until it has become fufficiently thick, keeping the edges fquare and fmooth like the edge of a board. The plafter fhould be fpread equally upon all parts, which is beft done by a painter's pallet-knife or apothecary's bolus-knife: but for this the inftrument fhould be fomewhat lefs pliable than it is commonly made.

When the outfide piece is hardened, the edges are to be pared fmooth, and nearly made fquare with a fmall pointed knife. Little holes of a conical fhape are to be made with the point of a knife about an inch diftant from one another, according to the fize of the piece. Thefe are defigned to receive the fluid plafter in forming the adjacent parts of the mould, and occafion points correfponding to the hollows; and are intended to preferve the edges of the different pieces fteadily in their proper relative fituations. The third piece is then to be formed in a manner fimilar to the

fecond;

second; greasing the edges of the former plentifully with hog's lard and oil, to prevent the pieces from adhering to each other. Thus the pattern is to be wholly inclosed, only leaving a proper orifice for pouring in the plaster to form the model; small holes being also bored in the mould opposite to the wire-loops fixed in the inside pieces, through which a cord is to be conveyed from the loop to confine such pieces during the time of casting. In some cases, however, it is not necessary that the mould should totally inclose the pattern; for instance, where a model is to be made of a pedestal, or a bust of any part of the human body. The bottom of such moulds being left open, there is accordingly ample room for pouring in the plaster.

After the mould is completely formed, it is next to be dried either naturally or by a gentle artificial heat, and then seasoned in the following manner:—Having been made thoroughly dry, which, if the mould is large, will require two or three weeks, it is to be brushed over plentifully with linseed oil boiled with sugar of lead, finely levigated litharge or oil of vitriol. The inside and joints of the mould should be particularly well supplied with it. If the mould be large, it is needless to attend to the outside: but when the moulds are small, it will not be improper to boil them in the oil; by which means their pores are more exactly filled than could otherwise be done. After the moulds have undergone this operation, they are again set by to dry, when, being greased with olive-oil and hog's lard, they are fit for use. If linseed oil be used for greasing the moulds, it will in a short time impart a disagreeable yellow colour to the casts.

The mould being properly prepared and seasoned, nothing more is requisite to form the model than to pour the finest liquid plaster of Paris into it. After a layer of this, about half an inch in thickness, has been formed all round the mould, we may use the coarser kind to fill it up entirely, or to give to the model what thickness we please.

4
Models from living subjects.

Besides the models which are taken from inanimate bodies, it has been frequently attempted to take the exact resemblance of people while living, by using their face as the original of a model, from whence to take a mould; and the operation, however disagreeable, has been submitted to by persons of the highest ranks in life. A considerable difficulty occurs in this, however, by reason of the person's being apt to shrink and distort his features when the liquid is poured upon him; neither is he altogether without danger of suffocation, unless the operator well understands his business.

To avoid the former inconvenience, it will be proper to mix the plaster with warm instead of cold water, by which means the person will be under no temptation to shrink; and to prevent any danger of a fatal accident, the following method is to be practised: Having laid the person horizontally on his back, the head must first be raised by means of a pillow to the exact position in which it is naturally carried when the body is erect; then the parts to be represented must be very thinly covered over with fine oil of almonds by means of a painter's brush: the face is then to be first covered with fine fluid plaster, beginning at the upper part of the fore-head, and spreading it over the eyes, which are to be kept close, that the plaster may not come in contact with the globe; yet not closed so strongly as to cause any unnatural wrinkles. Cover then the nose and ears, plugging first up the *meatus auditorii* with cotton, and the nostrils with a small quantity of tow rolled up, of a proper size, to exclude the plaster. During the time that the nose is thus stopped, the person is to breathe through the mouth: in this state the fluid plaster is to be brought down low enough to cover the upper lip, observing to leave the rolls of tow projecting out of the plaster. When the operation is thus far carried on, the plaster must be suffered to harden; after which the tow may be withdrawn, and the nostrils left free and open for breathing. The mouth is then to be closed in its natural position, and the plaster brought down to the extremity of the chin. Begin then to cover that part of the breast which is to be represented, and spread the plaster to the outsides of the arms and upwards, in such a manner as to meet and join that which is previously laid on the face: when the whole of the mass has acquired its due hardness, it is to be cautiously lifted, without breaking or giving pain to the person. After the mould is constructed, it must be seasoned in the manner already directed; and when the mould is cast, it is to be seperated from the model by means of a small mallet and chissel. The eyes, which are necessarily shown closed, are to be carved, so that the eye-lids may be represented in an elevated posture; the nostrils hollowed out, and the back part of the head, from which, on account of the hair, no mould can be taken, must be finished according to the skill of the artist. The edges of the model are then to be neatly smoothed off and the bust fixed on its pedestal.

5
Topographical models.

The method of making models in the plaster of Paris is undoubtedly the most easy way of obtaining them. When models, however, are made of such large objects that the model itself must be of considerable size, it is vain to attempt making it in the way above described. Such models must be constructed by the hand with some soft substance, as wax, clay, putty, &c. and it being necessary to keep all the proportions with mathematical exactness, the construction of a single model of this kind must be a work of great labour and expence as well as of time. Of all those which have been undertaken by human industry, however, perhaps the most remarkable is that constructed by General Pfiffer, to represent the mountainous parts of Switzerland. It is composed of 142 compartments, of different sizes and forms, respectively numbered, and so artfully put together, that they can be separated and replaced with the greatest ease. The model itself is $20\frac{1}{2}$ feet long and 12 broad, and formed on a scale which represents two English miles and a quarter by an English foot; comprehending part of the cantons of Zug, Zurich, Schweitz, Underwalden, Lucerne, Berne, and a small part of the mountains of Glarus; in all, an extent of country of $18\frac{1}{2}$ leagues in length and 12 in breadth. The highest point of the model, from the level of the centre (which is the lake of Lucerne), is about ten inches; and as the most elevated mountain represented therein rises 1475 toises

toises or 9440 feet above the lake of Lucerne, at a gross calculation, the height of an inch in the model is about 900 feet. The whole is painted of different colours, in such a manner as to represent objects as they exist in nature; and so exactly is this done, that not only the woods of oak, beech, pine, and other trees, are distinguished, but even the strata of the several rocks are marked, each being shaped upon the spot, and formed of granite, gravel, or such other substances as compose the natural mountain. So minute also is the accuracy of the plan, that it comprises not only all the mountains, lakes, rivers, towns, villages, and forests, but every cottage, bridge, torrent, road, and even every path is distinctly marked.

The principal material employed in the construction of this extraordinary model, is a mixture of charcoal, lime, clay, a little pitch, with a thin coat of wax; and is so hard that it may be trod upon without any damage. It was begun in the year 1766, at which time the general was about 50 years of age, and it employed him till the month of August 1785; during all which long space of time he was employed in the most laborious and even dangerous tasks.—He raised the plans with his own hands on the spot, took the elevation of mountains, and laid them down in their several proportions. In the prosecution of this laborious employment he was twice arrested for a spy; and in the popular cantons was frequently forced to work by moon-light, in order to avoid the jealousy of the peasants, who imagined that their liberty would be endangered should a plan of their country be taken with such minute exactness. Being obliged frequently to remain on the tops of some of the Alps, where no provisions could be procured; he took along with him a few milk-goats, who supplied him with nourishment. When any part was finished, he sent for the people residing near the spot, and desired them to examine each mountain with accuracy, whether it corresponded, as far as the smallness of the scale would admit, with its natural appearance; and then, by frequently retouching, corrected the deficiencies. Even after the model was finished, he continued his Alpine expeditions with the same ardour as ever, and with a degree of vigour that would fatigue a much younger person. All his elevations were taken from the level of the lake of Lucerne; which, according to M. Saussure, is 1408 feet above the level of the Mediterranean.

MODENA, a duchy of Italy, bounded on the south by Tuscany and the republic of Lucca, on the north by the duchy of Mantua, on the east by the Bolognese and the territories of the church, and on the west by the duchy of Parma; extending in length from south to north about 56 English miles, and in breadth between 24 and 36, and yielding plenty of corn, wine, and fruits, with mineral waters. In some places also petroleum is skimmed off the surface of the water of deep wells made on purpose; and in others is found a kind of earth or tophus, which, when pulverised, is said to be an excellent remedy against poison, fevers, dysenteries, and hypochondriac disorders. The country of La Salsa affords several kinds of petrifactions. The principal rivers are the Crostolo, Secchia, and Panaro. The family of Esté, dukes of Modena, is very ancient. They had their name from Esté, a small city in the district of Padua. In 1753, the duke was appointed imperial vicar-general, field-marshal, and governor, of the Milanese during the minority of the archduke Peter Leopold, who was declared governor-general of the Austrian Lombardy. The duke, though a vassal of the empire, hath an unlimited power within his own dominions.

MODENA, an ancient city, in Latin *Mutina*, which gives name to a duchy of Italy, and is its capital. It stands 28 miles east of Parma, 44 almost south of Mantua, and 20 west of Bologna; and is a pretty large and populous, but not a handsome city. It is much celebrated by Roman authors for its grandeur and opulence; but was a great sufferer by the siege it underwent during the troubles of the triumvirate. It hath long been the usual residence of the dukes; and is also the see of a bishop, who is suffragan to the archbishop of Bologna. Mr Keysler says, that when Decius Brutus was besieged here by Mark Antony, Hirtius the consul made use of carrier-pigeons; and that, even at this day, pigeons are trained up at Modena to carry letters and bring back answers. This city hath given birth to several celebrated persons, particularly Tasso the poet, Correggio the great painter, Sigonius the civilian and historian, da Vignola the architect, and Montecuculi the imperial general. The tutelary saint of it is named *Geminianus*. The ducal palace is a very noble edifice, in which, among the other fine pictures, the birth of Christ by Correggio, called *la Natte Felice*, is much celebrated. The only manufacture for which this city is noted, is that of masks, of which great numbers are exported. The churches of the Jesuits, of the Theatines, and of St Dominic, are well worth viewing. In the college of St Carlo Boromeo between 70 and 80 young noblemen are continually maintained, and instructed both in the sciences and genteel exercises. St Beatrix, who was of the family of Esté, is said to knock always at the gate of the palace three days before any of the family dies. Before most of the houses are covered walks or porticos, as at Bologna. The city is fortified, and on its south side stands the citadel.

MODERATION, in ethics, is a virtue consisting in the proper government of our appetites, passions, and pursuits, with respect to honours, riches, and pleasures; and in this sense it is synonymous with *temperance*: it is also often used to denote *candour*.

MODERATOR, in the schools, the person who presides at a dispute, or in a public assembly: thus the president of the annual assembly of the church of Scotland is styled *moderator*.

MODERN, something new, or of our time; in opposition to what is antique or *ancient*.

Modern Authors, according to Naude, are all those who have wrote since Boethius. The modern philosophy commences with Galileo; the modern astronomy with Copernicus.

MODESTY, in ethics, is sometimes used to denote humility; and sometimes to express chastity, or purity of sentiments and manners.—Modesty, in this last sense, and as particularly applied to women, is defined by the authors of the *Encyclopédie Methodique*, as a natural, chary, and honest shame; a secret fear; a

feeling

feeling on account of what may be accompanied with disgrace. Women who possess only the remains of a suspicious modesty, make but feeble efforts to resist: those who have obliterated every trace of modesty from their countenance, soon extinguish it completely in their soul, and throw aside for ever the veil of decency. She, on the contrary, who truly possesses modesty, passes over in silence attempts against her honour, and forbears speaking of those from whom she has received an outrage, when in doing so she must reveal actions and expressions that might give alarm to virtue.

The idea of modesty is not a chimera, a popular prejudice, or an illusion arising from laws and education. Nature, which speaks the same language to all men, has, with the unanimous consent of nations, annexed contempt to female incontinence. To resist and to attack are laws of her appointment: and while she bestows desires on both parties, they are in the one accompanied with boldness, in the other with shame. To individuals she has allotted long spaces of time for the purposes of self-preservation, and but moments for the propagation of their species. What arms more gentle than *Modesty* could she have put into the hands of that sex which she designed to make resistance!

If it were the custom for both sexes to make and receive advances indiscriminately, vain importunity would not be prevented: the fire of passion would never be stirred up, but languish in tedious liberty; the most amiable of all feelings would scarcely warm the human breast; its object would with difficulty be attained. That obstacle which seems to remove this object to a distance, in fact brings it nearer. The veil of shame only makes the desires more attractive. Modesty kindles that flame which it endeavours to suppress: its fears, its evasions, its caution, its timid avowals, its pleasing and affecting finesses, speak more plainly what it wishes to conceal, than passion can do without it: it is Modesty, in short, which enhances the value of a favour, and mitigates the pain of a refusal.

Since modesty is the secret fear of ignominy; and since all nations, ancient or modern, have confessed the obligation of its laws; it must be absurd to violate them in the punishment of crimes, which should always have for its object the re-establishment of order. Was it the intention of those oriental nations, who exposed women to elephants, trained for an abominable species of punishment, to violate one law by the observance of another? By an ancient practice among the Romans, a girl could not be put to death before she was marriageable. Tiberius found means to evade this law by ordering them to be violated by the executioner previous to the infliction of punishment; the refinement of a cruel tyrant, who sacrificed the morals to the customs of his people! When the legislature of Japan caused women to be exposed naked in the market-places, and obliged them to walk on all-fours like brutes, modesty was shocked: but when it wanted to force a mother—when it wanted to compel a son—nature received an outrage.

Such is the influence of climate in other countries, that the physical part of love possesses an almost irresistible force. The resistance is feeble; the attack is accompanied with a certainty of success. This is the case at Patana, at Bantam, and in the small kingdoms on the coast of Guinea. When the women in these countries (says Mr Smith) meet with a man, they lay hold of him, and threaten to inform their husbands if he despises their favours. But here the sexes seem to have abolished the laws peculiar to each. It is fortunate to live in a temperate climate like ours, where that sex which possesses the most powerful charms exerts them to embellish society; and where modest women, while they reserve themselves for the pleasures of one, contribute to the amusement of all.

MODIFICATION, in philosophy, that which modifies a thing, or gives it this or that manner of being. Quantity and quality are accidents which modify all bodies.

Decree of Modification, in Scots law, a decree ascertaining the extent of a minister's stipend, without proportioning it among the persons liable in payment.

MODILLIONS, in architecture, ornaments in the corniche of the Ionic, Corinthian, and Composite columns.

MODIUS, a Roman dry measure for all sorts of grain, containing 32 heminæ, or 16 sextarii, or one-third of the amphora, amounting to an English peck. See Measure.

MODREVIUS (Andreas Frichius), secretary to Sigismund Augustus king of Poland, acquired considerable reputation by his learning and works. He broke off from the Romish church, favoured the Lutherans and Anti-trinitarians, and took great pains in order to unite all Christian societies under the same communion. Grotius has placed him in the class of the reconcilers of the different schemes of religion. His principal work is intitled, *De republica emendanda*.

MODULATION, the art of forming any thing to certain proportion.

Modulation, in reading, or speaking. See Reading.

Modulation, in music, derived from the Latin *modulari*. This word in our language is susceptible of several different significations. It frequently means no more than an air, or a number of musical sounds properly connected and arranged. Thus it answers to what Mr Malcolm understands by the word *tune*, when he does not expressly treat concerning the tuning of instruments. Thus likewise it expresses the French word *chant;* for which reason, in the article Music, we have frequently expressed the one word by the other, But the precise and technical acceptation to which it ought to be confined, is the art of composing melody or harmony agreeably to the laws prescribed by any particular key, that of changing the key, or of regularly and legitimately passing from one key to another. In what remains to be said upon the subject we follow Rousseau.

Modulation (says he) is properly the manner of ascertaining and managing the modes; but at this time the word most frequently signifies the art of conducting the harmony and the air successively through several modes, in a manner agreeable to the ear and conformed to rules.

If the different modes be produced by harmony, from thence likewise must spring the laws of modulation.

Modulation.

tion. These laws are simple in conception, but difficult in practice. We proceed therefore to show in what they consist.

To modulate properly in the same tone, it is necessary, 1. To run through all the sounds of it in an agreeable air, frequently repeating the sounds which are most essential to it, and dwelling upon these sounds with the most remarkable emphasis; that is to say, that the chord containing the sensible notes, and that of the tonic, should frequently be heard in it, but under different appearances, and obtained by different procedures to prevent monotony. 2. That reposes or cadences should only be established upon these two chords: the greatest liberty, however, which ought to be taken with the rule is, that a cadence or repose may be established on the chord of the subdominant. 3. In short, that none of the sounds of the mode ought ever to be altered; for without quitting it we cannot introduce a sharp or a flat which does not belong to it, nor abstract any one which in reality does belong to it.

But passing from one mode to another, we must consult analogy, we must consider the relations which a key bears to the other notes in the series, and to the number of sounds common to both the modes, that from whence we pass, and that into which we enter.

If we pass from a mode major, whether we consider the fifth from the key as having the most simple relation with it except that of the octave, or whether we consider it as the first sound which enters into the harmonics of the same key, we shall always find, that this fifth, which is the dominant of the mode, is the chord upon which we may establish the modulation most analogous to that of the principal key.

This dominant, which constituted one of the harmonics of the first key, makes also one of its own peculiar key, of which it is the fundamental sound. There is then a connection between these two chords. Besides, that same dominant carrying, as well as the tonic, a perfect chord major upon the principle of resonance, these two chords are only different one from the other by the dissonance, which passing from the key to the dominant is the sixth superadded, and when reascending from the dominant to the key is the seventh. Now these two chords, thus distinguished by the dissonance which is suitable to each, by the sounds which compose them when ranged in order, form precisely the octave, or the diatonic scale, which we call a *gammut*, which determines the mode.

This same series of the key, altered only by a sharp, forms the scale belonging to the mode of the dominant; which shows how striking the analogy is between these two tones, and gives the easiest opportunity of passing from one to the other by means of one single alteration alone. The mode then of the dominant is the first which presents itself after that of the key in the order of modulations.

The same simplicity of relations which we find between a tonic and its dominant, is likewise found between the same tonic and its sub-dominant: for that fifth, in ascending, which is formed by the dominant with the tonic, is likewise formed by the sub-dominant in descending: but that sub-dominant does not form a fifth with the tonic, except by inversion; it is directly a fourth, if we take that tonic below, as it ought to be; and which fixes the degreee of their relations: for in this sense the fourth, whose ratio is as 3 to 4, immediately follows the fifth, whose ratio is as 2 to 3. So that, if that sub-dominant does not enter into the chord of the tonic, in return the tonic enters into its perfect chord. For let *ut mi sol* be the chord of the tonic, that of the sub-dominant shall be *fa la ut:* thus it is the *ut* which here forms the connection, and the two other sounds of this new chord, are exactly the two dissonances of the preceding. Besides, we need not alter more sounds for this new mode than for that of the dominant; they are both in the one and the other quite the same chords of the principal mode, except one. And a flat to the sensible note *si* or B, and all the notes in the mode of *ut* or C will serve for that of *fa* or F. The mode of the sub-dominant then is scarcely less analogous to the principal mode than that of the dominant.

It ought likewise to be remarked, that after having made use of the first modulation in order to pass from a principal mode *ut* or C, to that of the dominant *sol* or G, we are obliged to make use of the second to return to the principal mode: for if *sol* or G be the dominant in the mode of *ut* or C, *ut* is the sub-dominant in the mode of *sol:* thus one of these modulations is no less necessary than the other.

The third sound which enters into the chord of the tonic is that of a third formed by its mediant; and after the preceding, it is likewise the most simple of relations $\frac{2}{3}\frac{3}{4}\frac{4}{5}$. Here then is a new modulation which presents itself, and which is so much the more analogous, because, two of the sounds of the principal tonic enter likewise into the minor chord of its mediant: for the former chord being *ut mi sol*, the latter must be *mi sol si*, where it may be perceived that *mi* and *sol* are common. But what renders this modulation a little more remote, is the number of sounds which are necessary to be altered, even for the minor mode, which is most suitable to this *mi*. In the article MUSIC (234.) will be found a table for all the modes; and Rousseau, in his Musical Dictionary, has given the formula of a scale both for the major and minor: now, by applying this formula to the minor mode, we find nothing in reality, but the fourth sound *fa* heightened by a sharp in ascending; but in rising, we find two others which are altered, *viz.* the principal tonic *ut*, and its second *re*, which here becomes a sensible note: it is certain that the alteration of so many sounds, and particularly of the tonic, must remove the mode and weaken the analogy.

If we should invert the third as we have inverted the fifth, and take that third below the tonic on the sixth note *la*, which ought here to be called a *sub-mediant*, or the *mediant below*, we shall form upon this note *la* a modulation more analagous to the principal tone than that of *mi;* for as the perfect chord of this sub-mediant is *la ut mi*, there once more we find, as in that of the mediant, two of the sounds which enter into the chord of the tonic, viz. *ut* and *mi:* and moreover, since the scale of this new key is composed, at least in descending, of the same sounds with that of the principal key; and since it has only two sounds altered in ascending, that is to say, one fewer than the series of the

the mediant; it follows that the modulation of this sixth note is preferable to that of the mediant; and by so much the more, that there the principal tonic forms one of the sounds essential to the mode; which is more proper for approximating the idea of the modulation. The *mi* may afterwards follow.

Here then are four sounds, *mi fa sol la*, upon each of which we may modulate in passing from the major mode of *ut*. *Re* and *si* remain, which are the two harmonics of the dominant. This last as being a sensible note, cannot become a tonic by any proper modulation, at least it cannot immediately become one: this would be an abrupt application of ideas too much opposed to the same sounds, and would likewise be to give it a harmony too remote from the principal sound, As to the second note *re*, we may likewise, by favour of a consonant procedure in the fundamental base, modulate upon it in a third minor; but this must be only continued for an instant, that the audience may not have time to forget the modulation of *ut*, which is itself altered in that place; otherwise, instead of returning immediately to *ut*, we must pass through intermediate modes, where we must run great hazard of deviation.

By following the same analogies, we may modulate in the following order, to make our exit from a minor mode; first upon the mediant, afterwards the dominant, next the sub-dominant, then the sub-mediant, or sixth note. The mode of each of these accessory keys is determined by its mediant taken from the principal sound. For instance, issuing from the major mode of *ut*, to modulate upon its mediant, we render the mode of that mediant minor; because *sol*, the dominant of the principal sound, forms a third minor with that mediant, which is *mi*. On the contrary, in our egress from the minor mode of *la*, we modulate upon its mediant *ut* in the major mode; because *mi*, the dominant of the tone from whence we issue, forms a third major with the key of that into which we enter, &c.

These rules, comprehended in one general formula, import, that the modes of the dominant and of the sub-dominant are like that of the tonic, and that the mediant and the sixth note require a mode opposed. We must, however, remark, that, by the right which we have of passing from the major to the minor, and *vice versa*, upon the same key, we may likewise change the order of modes from one key to another; but while we thus remove ourselves from the natural modulation, we must presently think of our return: for it is a general rule, that every piece of music ought to terminate in that key with which it began.

In his ~~Medical~~ Dictionary, plate B, fig. 6, and 7, Rousseau has collected in two examples which are very short, all the modes to which we may immediately pass; the first, in passing from the major mode; and the second, from the minor. Each note indicates a particular modulation: and the value of the notes in each example likewise shows the relative duration suitable to each of these modes, according to its relation with the principal mode.

These immediate transitions from one mode to another, furnish us with the means of passing by the same rules to modes still more remote, and from thence to return to the principal mode, of which we never should lose sight. But it is not sufficient to know what course we ought to pursue; we must likewise be acquainted with the method of entering into it. A summary therefore of the precepts which are given in this department shall immediately follow.

In melody, in order to discover and introduce the modulation which we have chosen, nothing is necessary but to render perceptible the alterations which it causes in the sounds of that mode from whence we issue, to make them proper for the mode into which we enter. Are we now in the major mode of *ut?* there needs no more than to sound the note *fa* sharp, that we may discover the mode of the dominant; or a *si* flat, that we may show the mode of the sub-dominant. Afterwards you may run over the sounds essential to the mode in which we enter: if it is well chosen, your modulation will always be just and regular.

In harmony, the difficulty is a little increased: for as it is necessary that the change of modes should be made at the same time through all the parts, care must be taken of the harmony, and of the air, that we may avoid pursuing different modulations at the same time. Huygens has happily remarked, that the prohibition of two fifths in immediate succession proceeds upon this rule as its principle; in reality, between two parts it is scarcely possible to form a number of just fifths in uninterrupted succession without operating in two different modes.

To introduce a mode, a great many pretend that it is sufficient to form the perfect chord of its principal sound, and this is indispensable in order to produce the mode. But it is certain, that the mode cannot be exactly determined but by the chord containing the sensible note, or the dominant: we must then cause this chord to be heard when we enter into a new modulation. The most eligible rule would be, That in it the seventh, or minor dissonance, should always be prepared, at least the first time in which it is heard; but this method is not practicable in every admissible modulation: and provided that the fundamental basis proceeds by consonant intervals, that the connection of harmony be observed, the analogy of the mode pursued, and false relations avoided, the modulation will always be approved. Composers prescribe as another rule, That a mode should not be changed except after a perfect cadence; but this interdict is useless, and no person observes it.

All the possible methods of passing from one mode to another, are reducible to five with respect to the major mode, and to four with respect to the minor; which, in the Musical Dictionary, plate B, fig. 8. will be found implied in a fundamental basis intended for each modulation. If there be any other modulation which cannot be resolved into some one of these nine, unless that modulation be enharmonic, it must infallibly be illegitimate, See Enharmonic.

MODULE, in architecture, a certain measure, or bigness, taken at pleasure, for regulating the proportions of columns, and the symmetry or disposition of the whole building. Architects generally choose the semidiameter of the bottom of the collumn for their module, and this they subdivide into parts or minutes.

MOEBIUS (Godfrey), professor of physic at Iena, was

was born at Lauch in Thuringia in 1611. He became first physician to Frederic William elector of Brandenburg, to Augustus duke of Saxony, and to William duke of Saxe-Weimar. He wrote several medical works, which are esteemed; and died at Halle, in Saxony, in 1664.

MOENIUS (Caius), a celebrated Roman consul, conqueror of the ancient Latins, 358 B. C. He was the first who hung up the prows, &c. of the galleys he had taken at the naval engagement of Actium, upon the place where the tribunes harangued the people; from whence it was called the *rostra*.

MŒONIA, or Mæonia. See Mæonia and Lydia.

MŒSIA, or Mysia, (anc. geog.) a country of Europe, extending from the confluence of the Savus and the Danube to the shores of the Euxine. It was divided into Upper and Lower Mœsia. Lower Mœsia was on the borders of the Euxine, and comprehended that tract of country which received the name of *Pontus* from its vicinity to the sea. Upper Mœsia lay beyond the other, in the inland country.

MOFFAT, a village of Scotland, in the shire of Annandale, 50 miles south-west of Edinburgh; famous for its sulphureous well, which has been in just estimation for near 150 years as a remedy in all cutaneous and scrophulous complaints; and for its chalybeate spring, perhaps the strongest in Britain, which was discovered about 45 years ago, and is of a very bracing quality.—The place is chiefly supported by the company who resort thither for the benefit of its waters and air; but it has also a manufacture of coarse woollen stuffs. It is a well-built clean village; and contains many good and even elegant lodgings, a tolerable assembly-room, a bowling-green and walks, and one of the best inns between London and Edinburgh.

MOFFETTA. See Ampsancti.

MOGODORE, or Mogadore, a large, uniform, and well-built town in the kingdom of Morocco, situated about 350 miles from Tangier on the Atlantic ocean, and surrounded on the land-side by deep and heavy sands. The European factory here consists of about a dozen mercantile houses of different nations, whose owners, from the protection granted them by the emperor, live in full security from the Moors, whom indeed they keep at a rigid distance. They export, to America, mules; to Europe, Morocco leather, hides, gum arabic, gum sandarac, ostrich feathers, copper, wax, wool, elephant's teeth, fine mats, beautiful carpeting, dates, figs, raisins, olives, almonds, oil, &c. In return, they import timber, artillery of all kinds, gunpowder, woollen cloths, linens, lead, iron in bars, all kinds of hardware and trinkets, such as looking-glasses, snuff-boxes, watches, small knives, &c. tea, sugar, spices, and most of the useful articles which are not otherwise to be procured in this empire, The town is regularly fortified on the sea-side; and on the land, batteries are so placed as to prevent any incursion from the southern Arabs, who are of a turbulent disposition, and who, from the great wealth which is known to be always in Mogodore, would gladly avail themselves of any opportunity that offered to pillage the town. The entrance, both by sea and land, consists of elegant stone arch-ways, with double gates. The market-place is handsomely built, with piazzas of the same materials; and at the water-port there is a custom house and powder magazine, both of which are neat stone buildings. Besides these public edifices, the emperor has a small but handsome palace for his occasional residence. The streets of the town, though very narrow, are all in straight lines; and the houses, contrary to what we meet with in the other towns of the empire, are lofty and regular. The bay, which is little better than a road, and is very much exposed when the wind is at north-west, is formed by a curve in the land, and a small island about a quarter of a mile from the shore.—Its entrance is defended by a fort well furnished with guns.

MOGULS, a celebrated nation of Asia, whose conquests formerly were the most rapid and extensive of any people recorded in history. They themselves deduce their origin from Japhet, or, as they call him, *Japhis*, the son of Noah. His son Turk, they say, was the first king, or khan, of those nations who are now known by the separate names of *Turks Tartars*, and *Moguls;* and the tartars especially, assert that their proper designation is *Turks*. To this prince is attributed many of those inventions which barbarous nations commonly ascribe to their first sovereigns. He was succeeded by Taunak; in whose reign the whole posterity of Turk were divided into four large tribes, denominated the *orda's* of Erlat, Gialair, Kaugin, Berlas or Perlas; of which last came the famous Timur Beg, or Tamerlane.—From this time to that of Alanza Khan, we meet with nothing remarkable. In his reign the Turks being immersed in all kinds of luxury, universally apostatized into idolatry. Having two sons, Tartar and Mogul, he divided his dominions among them, and thus gave rise to the two empires of the Tartars and Moguls.

1 Moguls descended from Japhet.

The two nations had not long existed before they began to make war upon each other, and after long contention, the event at last was, that Il Khan, emperor of the Moguls, was totally overthrown by Siuntz Khan, emperor of the Tartars: and so great was the defeat, that the Mogul nation seems to have been almost exterminated. Only two of Il Khan's family survived this disaster. These were Kajan his youngest son, and Nagos his nephew, who were both of an age, and had both been married the same year. These two princes, with their wives, had been taken prisoners by Siuntz Khan, but found means to make their escape to their own country. Here they seized upon all the cattle which had not been carried off by the Tartars; which was easily done, as having none to dispute about the property with them; then stripping some of the slain, they took their clothes, and retired into the mountains. They passed several mountains without much difficulty; but at last advanced to the foot of one exceedingly high, which had no way over it but a very small path made by certain animals, called in the Tartar language, *archara*. This path they found themselves obliged to make use of, though it was so strait, that only one could pass at a time, and he was in the most imminent danger of breaking his neck at the least false step.

2 Almost exterminated

Having

Moguls.

3 They arrive in a delightful valley.

Having ascended the mountain on one side by this path, they descended by the same on the other side; and were agreeably surprised to find themselves in a most delightful track, interspersed with rivulets and charming meadows, abounding with a vast variety of delicious fruits, and inclosed on all sides by inaccessible mountains, in such a manner as to shelter them from all future pursuits of the Tartars. Here they lived some time, and gave this beautiful country the name of *Irgana-kon,* in allusion to its situation; *Irgana* signifying, in the old language of the Moguls, a "valley," and *Kon* a "steep height."

In process of time these two families very much increased. Kajan, whose posterity was the most numerous, called his descendants *Kajath:* but the people springing from Nagos were divided into two tribes; one of which received the appellation of *Nagoster,* and the other that of *Durlagan.*

These two Mogul princes and their descendants lived in this place for more than 400 years; but the latter then finding it too narrow for them, meditated a return to the country from which their forefathers had been driven. For some time, however, they found this impracticable, as the path that conducted their ancestors had been long since destroyed. At last they discovered, that one part of the high mountain abovementioned was not very thick in a certain place; and also, that it consisted entirely of iron-ore. To this, having before set fire to a layer of wood, and another of charcoal, laid along the foot of the mountain, they applied 70 large bellows, and at last melted the mountain in such a manner, that an opening was made large enough for a loaded camel to pass; and through this passage they all marched out with great joy.

4 From whence they at last issue, and defeat the Tartars.

The moguls having thus issued as it were from a new world, overthrew the Tartars in their turn; and continued to be a very considerable nation till the time of their great hero Temujin, afterwards called *Jenghiz Khan,* whom they extol in the most extravagant manner. It is difficult, however, to say, at the time Temujin made his appearance, how far the dominions of the Moguls extended, or in what estimation they were held by their neighbours. It seems to be pretty certain, that great part of the vast region now known by the name of *Tartary,* was then in a state of considerable civilization, and likewise extremely populous, as we find mention made of many cities which the Moguls destroyed; and the incredible multitudes whom they slaughtered, abundantly show the populousness of the country. On the east, the country of the Moguls and Tartars had the great desart which divides Tartary from China; on the west, it had the empire of Karazm, founded by Mahmud Gazni; and on the south were the countries now known by the name of *Indostan, Siam, Pegu, Tonquin,* and *Cochin-China.* Thus it comprehended the eastern part of modern Tartary, and all Siberia. This whole region was divided among a great number of *Amacks,* or *tribes;* who had each, one or more khans, according as it was more or less numerous, or divided into branches. Among these, that of the *Kara-its* was the most powerful; their prince assumed the title of *Grand Khan,* and among the rest, the Moguls were tributary to him; but, according to the Chinese historians, both the one and the other were tributary to the emperor of Kitay or Katay. China was divided into two parts; the nine southern provinces were in the hands of the Chinese emperors of the Song dynasty, who kept their court at Hang-chew, the capital of the province of Check-yang; the five northern provinces, excepting part of Shensi, were possessed by the Kin, a people of Eastern Tartary, from whom are descended the Manchew Tartars, at present masters of China. This vast dominion was named *Kitay* or *Katay,* and was divided into two parts: that which belonged to China, was properly called *Kitay;* and the part which belonged to Tartary was called *Karakitay,* in which some even include the territories of the Moguls, Karaits, and other tribes, which are the subject of the present history. The western part of the empire of Kitay was possessed by a Turkish prince, who had lately founded a new kingdom there, called *Hya;* whose capital city was Hyachew, now Ninghya in Shensi, from whence the kingdom took its name. To the west of Hya lay Tangut; a country of great extent, and formerly very powerful; but at that time reduced to a low state, and divided among many princes some of whom were subject to the emperor of Hya, and others to the emperor of China. All Tartary to the westward, as far as the Caspian sea, with the greater part of Little Buckharia, which then passed under the general name of *Turkeston,* was subject to Ghurkhan, Khurkhan, or Kavar Khan; to whom even the Gazni monarchs are said to have been tributary. This Ghurkhan had been prince of the Western Kitan or Lyau; who, driven out of Kitay by the king, settled in Little Buckharia and the country to the north, where they founded a powerful state about the year 1124.

5 State of Asia at the time of Jenghiz Khan.

6 Descent and birth of Temujin.

Thus the Moguls, properly so called, had but a very small extent of empire which could be called their own, if indeed they had any, when Temujin made his appearance. This hero is said by the Tartars to have been of Divine origin, since his family could be traced no farther back than ten generations, the mother of whom was got with child by a spirit. The names and transactions of his predecessors are equally uncertain and unimportant: he himself however was born in the year 1163, and is said to have come into the world with congealed blood in his hands; from whence it was prognosticated that he would be a great warrior, and obtain the victory over all his enemies.

This prediction, if any such there was, Temujin most literally fulfilled. At the time of his father's decease, his subjects amounted to between 30,000 and 40,000 families; but of these two thirds quickly deserted, and Temujin was left almost without subjects. When only 13 years of age he fought a bloody battle against these revolters; but either was defeated, or gained an indecisive victory; so that he remaind in obscurity for 27 years longer. His good fortune at last he owed to the friendship of Vang Khan, who ruled over a great number of Tartar tribes to the north of Kitay, and has been heard of under the name of *Prester John* among the Europeans. This prince took Temujin under his protection; and a rebellion being afterwards raised aganst himself, Temujin was made his general, and the khan was kept in possession of his throne; soon after which, Temujin subdued the tribes which had revolted from himself, treating them at the same time with the utmost barbarity.

7 Subdues his revolted subjects by means of Vang Khan.

Bb 2 This

This happened in the year 1201; but Vang Khan, instead of continuing the friend of Temujin, now became jealous, and resolved to destroy him by treachery. With this view he proposed a marriage between Temujin's son Juji and his own daughter, and another between Temujin's daughter and his own son. Temujin was invited to the camp of Vang Khan, in order to celebrate this double marriage; but, receiving intelligence of some evil intention against him, he excused himself to Vang Khan's messengers, and desired that the ceremony might be put off to some other time.

8 Who becomes jealous, and contrives his destruction.

A few days after the departure of these messengers, Badu and Kishlik, two brothers, who kept the horses of one of Vang Khan's chief domestics, came and informed Temujin, that the grand Khan finding he had missed his aim, was resolved to set out instantly, and surprise him next morning, before he could suspect any danger. Temujin, alarmed at this intelligence, quitted his camp in the night-time, and retired with all his people to some distance. He was scarce gone when Vang Khan's troops arrived, and discharged an incredible number of arrows among the empty tents; but finding nobody there, they pursued Temujin in such haste that they fell into great disorder. In this condition they were suddenly attacked and routed by Temujin; after which an open war with Vang Khan took place.

By this quarrel almost all the princes of Tartary were put in motion, some siding with Temujin, and others with Vang Khan. But at last fortune declared in favour of the former: Vang Khan was overthrown in a battle, where he lost 40,000 men; and obliged to fly for refuge to a prince named *Tayyan Khan*, who was Temujin's father-in-law, and his own enemy, and by whom he was ungenerously put to death. Temujin immediately began to seize on his dominions, great part of which voluntarily submitted: but a confederacy was formed against him by a number of Vang Khan's tributaries, at the head of whom was Jamuka, a prince who had already distinguished himself by his enmity to Temujin; and even Tayyan Khan himself was drawn into the plot, through jealousy of his son-in-law's good fortune. But Temujin was well prepared; and in the year 1204 attacked Tayyan Khan, entirely routed his army, killed himself, and took Jemuka prisoner, whose head he caused instantly to be struck off; after which he marched against the other tribes who had conspired against him. Them he quickly reduced; took a city called *Kashin*, where he put all to the sword who had borne arms against him; and reduced all the Mogul tribes in 1205.

9 Temujin overcomes all his enemies.

Temujin now, having none to oppose him, called a general diet, which he appointed to be held on the first day of the spring 1206; that is, on the day in which the sun entered Aries. To this diet were summoned all the great lords both Moguls and Tartars; and in the mean time to establish good order in the army, he divided his soldiers into bodies of 10,000, 1000, 100, and 10 men, with their respective officers, all subordinate to the generals, or those who commanded the bodies of 10,000; and these were to act under his own sons. On the day of holding the diet, the princes of the blood and great lords appeared dressed in white. Temujin, dressed in the same manner, with his crown on his head, sat down on his throne, and was complimented by the whole assembly, who wished him the continuance of his health and prosperity. After this they confirmed the Mogul empire to him and his successors, adding all those kingdoms which he had subdued, the descendants of whose vanquished khans were deprived of all right or title to them; and after this he was proclaimed emperor with much ceremony. During this inauguration, a pretended prophet declared that he came from God to tell the assembly, that from thenceforth Temujin should assume the name of *Jenghiz Khan*, or *the Most Great Khan of khans*; prophecying also, that all his posterity should be khans from generation to generation. This prophecy, which was no doubt owing to Temujin himself, had a surprising effect on his subjects, who from that time concluded that all the world belonged of right to them, and even thought it a crime against heaven for any body to attempt to resist them.

10 Assumes the title of Jenghis Khan.

Jenghiz Khan having now reduced under his subjection all the wandering tribes of Moguls and Tartars, began to think of reducing those countries to the south and south west of his own, where the inhabitants were much more civilized than his own subjects; and the countries being full of fortified cities, he must of course expect to meet with more resistance. He began with the emperor of Hya, whose dominions he invaded in 1209, who at last submitted to become his tributary. But in the mean time Jenghis Khan himself was supposed to be tributary to the emperor of Kitay; who, in 1210, sent him an officer, demanding the customary tribute. This was refused with the utmost indignation, and a war commenced, which ended not but with the dissolution of the empire of Kitay, as mentioned under the article CHINA.

11 Invades Hya, China, &c.

In the year 1216, Jenghis Khan resolved to carry his arms westward, and therefore left his general Muchuli to pursue his conquests in Kitay. In his journey westward he overthrew an army of 300,000 Tartars who had revolted against him; and, in 1218, sent ambassadors desiring an alliance with Mohammed Karazm Shah, emperor of Gazna. His ambassador was haughtily treated: however, the alliance was concluded; but soon after broken through the treachery, as it is said, of the Karazmian monarch's subjects. This brought on a war attended with the most dreadful devastations, and which ended with the entire destruction of the empire of Karazm or Gazna, as related under the article GAZNA.

After the reduction of Karazm, part of the Moguls broke into Iran or Persia, where also they made large conquests, while others of their armies invaded Georgia and the countries to the west; all this time committing such enormities, that the Chinese historians say both men and spirits burst with indignation. In 1225, Jenghiz Khan returned to Hya, where he made war on the emperor for having sheltered some of his enemies. The event was, that the emperor was slain, and his kingdom conquered, or rather destroyed; which, however, was the last exploit of this most cruel conqueror, who died in 1227, as he marched to complete the destruction of the Chinese.

The Mogul empire, at the death of Jenghiz Khan, extended over a prodigious tract of country; being more than 1800 leagues in length from east to west, and upwards of 1000 in breadth from north to south.

12 Vast extent of his empire.

Its

Moguls. Its princes, however, were ſtill inſatiable, and puſhed on their conqueſts on all ſides. Oktay was acknowledged emperor after Jenghiz Khan and had under his immediate government Moguleſtan (the country of the Moguls properly ſo called), Kitay, and the countries eaſtward to the Tartarian ſea. Jagaty his brother governed under him a great part of the weſtern conqueſts. The country of the Kipjacks, and others to the eaſt and north-eaſt, north and north-weſt, were governed by Batu or Patu the ſon of Juji, who had been killed in the wars; while Tuli or Toley, another ſon of Jenghiz Khan, had Khoraſſan, Perſia, and what part of India was conquered. On the eaſt ſide the Mogul arms were ſtill attended with ſucceſs; not only the empire of Kitay, but the ſouthern part of CHINA, was conquered, as already related under that article n° 24—42. On the weſt ſide matters continued much in the ſame way till the year 1254, when Magu, or Menkho, the fourth khan of the Moguls, (the ſame who was afterwards killed at a ſiege in China*), raiſed a great army, which he gave to his brother Hulaku, or Hulagu, to extend his dominions weſtward. In 1255 he entered Iran, where he ſuppreſſed the Iſmaelians or Aſſaſſins, of whom an account is given under the article ASSASSINS; and two years afterwards he advanced to Bagdad, which he took, and

13 Bagdad reduced.

cruelly put the khalif to death, treating the city with no more lenity than the Moguls uſually treated thoſe which fell into their hands. Every thing was put to fire and ſword; and in the city and its neighbourhood the number of ſlain, it is ſaid, amounted to 1,600,000. The next year he invaded Syria; the city of Damaſcus was delivered up, and, as it made no reſiſtance, the inhabitants were ſpared; but Aleppo being taken by ſtorm, a greater ſlaughter enſued there than had taken place at Bagdad, not even the children in their cradles being ſpared. Some cities of this country revolted the next year, or the year after; but falling again into the hands of the Moguls, they were plundered, and the inhabitants butchered without mercy, or carried into ſlavery.

* See China, n° 38.

Hulaku died in 1264, and at his death we may fix the greateſt extent of the Mogul empire. It now comprehended the whole of the continent of Aſia excepting part of Indoſtan, Siam, Pegu, Cochinchina and a few of the countries of Leſſer Aſia, which had not been attacked by them; and during all theſe vaſt conqueſts no Mogul army had ever been conquered, except one by Jalolodin, as mentioned under the ar-

14 It begins to decline.

ticle GAZNA.—From this period, however, the empire began to decline. The ambition of the khans having prompted them to invade the kingdoms of Japan and Cochinchina, they were miſerably diſappointed in their attempts, and loſt a great number of men. The ſame bad ſucceſs attended them in Indoſtan; and in a ſhort time this mighty empire broke into ſeveral ſmaller ones. The governors of Perſia being of the family of Jenghiz Khan, owned no allegiance to any ſuperior; thoſe of Tartary did the ſame. The Chineſe threw off the yoke: and thus the continent of Aſia wore much the ſame face that it had done before Jenghiz Khan began his conqueſts.

The ſucceſſors of Hulaku reigned in Perſia till the year 1335; but that year Abuſaid Khan, the eighth from Hulaku, dying, the affairs of that country fell into confuſion for want of a prince of the race of Jenghiz Khan to ſucceed to the throne. The empire, therefore was divided among a great number of petty princes, who fought againſt each other almoſt without intermiſſion, till, in the year 1369, Timur Bek, or Tamerlane, one of theſe princes, having conquered a number of others, was crowned at Balkh, with the pompous title of *Saheb Karan*; that is, "the emperor of the age, and conqueror of the world." As he had juſt before taken that city, and deſtroyed one of his moſt formidable rivals who had ſhut himſelf up in it, the new emperor began his reign with beheading ſome of the inhabitants, impriſoning others, burning their houſes, and ſelling the women and children for ſlaves. In 1370 he croſſed the Sihun, made war on the Getes, and attacked Karazm. Next year he granted a peace to his enemies; but two years after, he again invaded the country of the Getes, and by the year 1379 had fully conquered the country as well as Korazan; and from that time he continued to extend his conqueſts in much the ſame manner as Jenghiz Khan had done, though with leſs cruelty.—In 1387 he had reduced Armenia, Georgia, and all Perſia; the conqueſt of which laſt was completed by the reduction of Iſpahan, 70,000 of the inhabitants of which were ſlaughtered on account of a ſedition raiſed by ſome raſh or evil diſpoſed perſons.

15 Tamerlane crowned emperor of Balkh.

16 Becomes a great conqueror.

After the reduction of Perſia, Timur turned his arms northward and weſtward, ſubduing all the countries to the Euphrates. He took the city of Bagdad; ſubdued Syria; and having ravaged great part of Ruſſia, returned to Perſia in 1396, where he ſplendidly feaſted his whole army. In 1398 he invaded Indoſtan, croſſed the Indus on the 17th of September, reduced ſeveral fortreſſes, and made a vaſt number of captives. However, as he was afraid that, in caſe of any emergency, theſe priſoners might take part with the enemy, he gave orders to his ſoldiers to put all their Indian ſlaves to death; and, in conſequence of this inhuman order. more than 100,000 of theſe poor wretches were ſlaughtered in leſs than an hour.

17 Invades and conquers Indoſtan.

In the beginning of the year 1399, Timur was met by the Indian army; whom, after a deſperate battle, he defeated with great ſlaughter, and ſoon after took the city of Delhi, the capital of the country. Here he ſeated himſelf on the throne of the Indian emperors, and here the ſharifs, kadis, and principal inhabitans of the city, came to make their ſubmiſſion, and begged for mercy. The tame elephants and rhinoceroſes likewiſe were brought to kneel before him as they had been accuſtomed to do to the Indian emperors, and made a great cry as if they implored his clemency. Theſe war elephants, 120 in number, were, at his return, ſent to Samarcand, and to the province where his ſons reſided. After this, at the requeſt of the lords of the court, Timur made a great feaſt, at which he diſtributed preſents to the princes and principal officers.

18 The city of Delhi deſtroyed, and the inhabitants ſlaughtered.

Delhi at this time conſiſted of three cities, called *Seyri*, *Old Delhi*, and *Jehan Penah*. Seyri was ſurrounded with a wall in form of a circle. Old Delhi was the ſame, but much larger, lying ſouth-weſt of the other. Theſe two parts were joined on each ſide by a wall; and the third, lying between them, was called *Jehan Penah*, which was larger than Old Delhi. Pe-

nah

nah had ten gates; Seyri had ſeven, three of which looked towards Jehan Penah; this laſt had thirteen gates, ſix to the north-weſt, and ſeven to the ſouth eaſt. Every thing ſeemed to be in a quiet poſture, when on the 12th of January 1399, the ſoldiers of Timur being aſſembled at one of the gates of Dehli, inſulted the inhabitants of the ſuburbs. The great emirs were ordered to put a ſtop to theſe diſorders; but their endeavours were not effectual. The ſoltanas having a curioſity to ſee the rarities of Dehli, and particularly a famous palace adorned with 1000 pillars, built by an ancient king of India, went in with all the court; and the gate being on that occaſion left open for every body, above 15,000 ſoldiers got in unperceived. But there was a far greater number of troops in a large place between Dehli, Seyri, and Jehan Penah, who committed great diſorders in the two laſt cities. This made the inhabitants in deſpair fall on them; and many, ſetting fire to their houſes, burnt their wives and children. The ſoldiers ſeeing this confuſion did nothing but pillage the houſes; while the diſorder was increaſed by the admiſſion of more troops, who ſeized the inhabitants of the neighbouring places who had fled thither for ſhelter. The emirs, to put a ſtop to this miſchief, cauſed the gates to be ſhut: but they were quickly opened by the ſoldiers within, who roſe in arms againſt their officers; ſo that by the morning of the 13th the whole army was entered, and this great city was totally deſtroyed. Some ſoldiers carried out 150 ſlaves, men, women, and children, nay, ſome of their boys had 20 ſlaves a-piece to their ſhare. The other ſpoils, in jewels, plate and manufactures, were immenſe; for the Indian women and girls were adorned with precious ſtones, and had bracelets and rings on their hands, feet and even toes, ſo that the ſoldiers were loaded with them. On the 15th, in old Dehli, the Indians retired into the great moſque to defend themſelves; but being attacked by the Tartars, they were all ſlaughtered, and towers erected with their heads. A dreadful carnage now enſued throughout the whole city, and ſeveral days were employed before the inhabitants could be made to quit it entirely; and as they went, the emirs took a number of them for their ſervice. The artiſans were alſo diſtributed among the princes and commanders; all but the maſons, who were reſerved for the emperor, in order to build him a ſpacious ſtone-moſque at Samarcand.

After this terrible devaſtation, Timur marched into the different provinces of Indoſtan, every where defeating the Indians who oppoſed him, and ſlaughtering the Ghebrs or worſhippers of fire. On the 25th of March he ſet out on his return, and on the 9th of May arrived at Samarcand. In a few months after his arrival, he was obliged to undertake an expedition into Perſia, where affairs were in the utmoſt diſorder on account of the miſconduct of his ſon, whom he had appointed ſovereign of that empire Here Timur ſoon ſettled matters; after which he again ſet out on

19 Timur quarrels with Bajazet the Turkiſh ſultan.

an expedition weſtward, reduced many places in Georgia which had not ſubmitted before, and invaded and conquered Syria. At the ſame time he quarrelled with Bajazet the Turkiſh ſultan, then buſied in an enterpriſe againſt Conſtantinople, in which he would probably have ſucceeded had not Timur interpoſed. The cauſe of this quarrel at firſt was, that Bajazet had demanded tribute from a prince who was under Timur's protection, and is ſaid to have returned an inſulting anſwer to the Tartar ambaſſadors who were ſent to him on that account. Timur, however, who was an enthuſiaſt in the cauſe of Mahometaniſm, and conſidered Bajazet as engaged in the cauſe of heaven when beſieging a Chriſtian city, was very unwilling to diſturb him in ſo pious a work; and therefore undertook ſeveral expeditions againſt the princes of Syria and Georgia, in order to give the Turkiſh monarch time to cool and return to reaſon. Among other places, he again inveſted the city of Bagdad which had caſt off its allegiance to him; and having taken it by ſtorm, made ſuch a dreadful maſſacre of the inhabitants, that 120 towers were erected with the heads of the ſlain. In the mean time Bajazet continued to give freſh provocation, by protecting one Kara Yuſef a robber, who had even inſulted the caravan of Mecca; ſo that Timur at length reſolved to make war upon him. The ſultan, however, foreſeeing the danger of bringing ſuch a formidable enemy againſt himſelf, thought proper to aſk pardon, by a letter, for what was paſt, and promiſe obedience to Timur's will for the future. This embaſſy was graciouſly received; and Timur returned for anſwer, that he would forbear hoſtilities, provided Bajazet would either put Kara Yuſef to death, ſend him to the Tartar camp, or expel him out of his dominions. Along with the Turkiſh ambaſſadors he ſent one of his own; telling Bajazet that he would march into the confines of Anatolia, and there wait his final anſwer.

Though Bajazet had ſeemed at firſt willing to come to an agreement with Timur, and to dread his ſuperior power; yet he now behaved in ſuch an unſatisfactory manner, that the Tartar monarch deſired him to prepare for war; upon which he raiſed the ſiege of Conſtantinople, and having met Timur with an army greatly inferior to the Tartars, was utterly defeated and taken priſoner. According to ſome accounts, he was treated with great humanity and honour; while others inform us, that he was ſhut up in an iron cage, againſt which he daſhed out his brains the following year. At any rate, it is certain that he was not reſtored to liberty, but died in confinement. 20 Bajazet defeated and taken priſoner.

This victory was followed by the ſubmiſſion of many places of the Leſſer Aſia to Timur; the Greek emperor owned himſelf his tributary, as did alſo the ſultan of Egypt. After this Timur once more returned to Georgia, which he cruelly ravaged; after which he marched to Samarcand, where he arrived in the year 1405. Here, being now an old man, this mighty conqueror began to look forward to that ſtate which at one time or other is the dread of all living creatures; and Timur, in order to quiet the remorſes of his own conſcience, came to the following curious reſolution, which he communicated to his intimate friends namely, that "as the vaſt conqueſts he had made were not obtained without *ſome violence*, which had occaſioned the deſtruction of a great number of God's creatures, he was reſolved, by way of atonement for his paſt crimes, to perform ſome good action; namely, to make war on the infidels, and exterminate the idolaters of China." This atonement however, he did not live to accompliſh; for he died the ſame 21 Death of Tamerlane, and diſſolution of his empire.

year

Moguls. year of a burning fever, in the 71st year of his age and 36th of his reign.

On the death of Timur, his empire fell immediately into great disorder, and the civil wars continued for five or six years; but at last peace was restored, by the settlement of Shah Rukh, Timur's son, on the throne. He did not, however, enjoy the empire in its full extent, or indeed much above one half of it; having only Karazm, Khorassan, Kandahar, Persia, and part of Indostan. Neither was he able, though a brave and warlike prince, to extend his dominions, though he transmitted them to his son Ulug Beg. He proved a wise and learned monarch; and is famous for the astronomical tables which he caused to be composed, and which are well known at this day. He was killed in 1448 by his son Abdollatif, who six months after was put to death by his own soldiers. After the death of Abdollatif, Abdollah, a grandson of Shah Rukh, seized the throne; but, after reigning one year, was expelled by Abusaid Mirza, the grandson of Miran Shah the son of Timur. His reign was one continued scene of wars and tumults; till at last he was defeated and taken prisoner by one Hassan Beg, who put him to death in 1468. From this time we may look upon the empire of Timur as entirely dissolved, though his descendants still reigned in Persia and Indostan, the latter of which is still known by the name of the *Mogul's empire*.

22 History of Indostan.

On the death of the abovementioned monarch, his son Babr or Babor succeeded him, but was soon driven out by the Usbeck Tartars; after which he resided some time in Gazna, whence he made incursions into Hindostan, and at length became master of the whole empire, excepting the kingdoms of Dekan, Guzerat, and Bengal. For the transactions subsequent to this period, see the articles HINDOSTAN and INDIA. What remains to be supplied here is an account of the revolution that has lately happened at Delhi the capital of the Mogul empire.

Gholam Khadur, author of the revolution, was the son of Zabda Khan. His father disinherited him, and drove him from his presence on account of his vices and his crimes. Shah Allum, the king of Delhi, took him under his protection, treated him as his own son, and conferred on him the first title in the kingdom, Amere ul Omraow. He lived with the king, and raised a body of about 8000 troops of his own countrymen the Moguls, which he commanded. Gholam Khadur was of a passionate temper, haughty, cruel, ungrateful, and debauched. In the latter end of the year 1788, the king had formed suspicions that some of the neighbouring rajahs (princes) would make an attempt to plunder and destroy his territories. These suspicions were verified by the approach of a considerable army towards his capital, commanded by Ismael Beg Khan, and assisted by Scindia. Gholam Khadur told the king on this, that he had nothing to fear; for that he had an army sufficiently strong to oppose the enemy: that all the king had to do was to march out with his troops, give them a supply of cash, and he would lay his head on the enemy's being overcome. The king on this replied, that he had no money to carry on a contest. Gholam Khadur said, that this objection would soon be obviated, as he (Gholam Khadur) would advance the necessary supply of cash, and that all his majesty had to do was to head the army. "This (said he) will animate them and give them confidence; the presence of a monarch is above half the battle." The king agreed in appearance, and requested Gholam Khadur to assemble the army, pay their arrears, and inform them of his intentions. Gholam Khadur retired contented: but great was his astonishment, when he intercepted the next day a letter from the king to Scindia, desiring him to make as much haste as possible, and destroy Gholam Khadur; for, says he, Khadur wishes me to act contrary to my wishes, and oppose you. On this discovery, Gholam Khadur marched out with his Moguls, crossed the Jumna, and encamped on the other side opposite the fort of Delhi. He sent to the king the intercepted letter, and asked him if his conduct did not deserve to be punished by the loss of his throne? He began to besiege the fort, and carried it in a few days. He entered the palace in arms; flew to the king's chamber; insulted the old man in the most barbarous manner; knocked him down, and, kneeling on his breast, with his knife took out one of his eyes, and he ordered a servant of the king's to take out the other.

After this he gave up the palace to pillage, and went to the king's zazana (the residence of his women); where he insulted the ladies, and tore their jewels from their noses and ears, and off their arms and legs. As he had lived with the king, he was well acquainted with the different places where the king's treasures were hid; he dug up the floor of the king's own bed-room, and found there two chests, containing in specie 120,000 gold mohurs, or L. 192,000 sterling; this he took, and vast sums more. To get at the hidden jewels of the women, he practised one of the most villainous schemes that ever was thought of. The third day after these horrid cruelties, he ordered that all the king's ladies and daughters should come and pay their respects to him, and promised to set those free who could please him by their appearance and dress. The innocent, unthinking women, brought out their jewels, and adorned themselves in their richest attire to please this savage. Gholam Khadur commanded them to be conveyed into a hall, where he had prepared common dresses for them; these dresses he made them put on by the assistance of eunuchs; and taking possession of their rich dresses and jewels, sent the women home to the palace to lament their loss and curse his treachery. Gholam Khadur did not even stop here; but insulted the princesses, by making them dance and sing. The most beautiful of the king's daughters, Mobaruck ul Moulk, was brought to this tyrant to gratify his lust: but she resisted, and is said to have stabbed herself in order to avoid force.

Scindia soon after this came to the assistance of the king, rather to make him his prey. Gholam Khadur fled and took refuge in the fort of Agra, a large city about 150 miles from Delhi. Scindia's troops besieged him there. Perceiving at last that he must be taken if he continued in the fort, he took the advantage of a dark night, stuffed his saddle with a large stock of precious stones, took a few followers, and fled from the fort towards Persia. Unluckily for him, he fell off his horse the second night after his flight; by this

this means a party of horse which had been sent in pursuit of him came up with him, and took him prisoner. He was brought to Scindia; who, after exposing him for some time in irons, and some time in a cage, ordered his ears, his nose, his hands, and his feet, to be cut off, and his eyes taken out; in which state he was allowed to expire.

Scindia has rewarded himself by seizing upon the kingdom which he came to guard: And all that now belongs to Shah Allum, the nominal emperor, is the city of Delhi, with a small district around it, where, even deprived of sight, he remains an empty shadow of royalty; an instance of the instability of human greatness, and of the precarious state of despotic governments.

MOHAIR, in commerce, the hair of a kind of goat frequent about Angria in Turkey; the inhabitants of which city are all employed in the manufacture of camblets made of this hair.

Some give the name *mohair* to the camblets or stuffs made of this hair: of these there are two kinds; the one smooth and plain, the other watered like tabbies: the difference between the two only consists in this, that the latter is calendered, the other not. There are also mohairs both plain and watered, whose woof is of wool, cotton, or thread.

Mohair-Shell, in conchyliology, a name given to a peculiar species of voluta, which seems of a closely and finely reticulated texture, and resembles on the surface a piece of mohair or a very close silk-worm's web.

MOHAWKS. See Muck.

Mohawk-Country, a part of North America, inhabited by one of the five nations of the Iroquois, situated between the state of New York and the lake Ontario or Frontignac.

MOHILA, or Moelia, one of the Comorra islands in the Indian sea, between the north end of the island of Madagascar and the continent of Africa. The inland parts are mountainous and woody; but the lands adjoining to the sea are watered by several fine streams which descend from the mountains; and the grass is green all the year, so that it affords a most delightful habitation. There are plenty of provisions of all kinds; and the East India ships of different nations sometimes touch here for refreshment.

MOHILOF, a large and strong city of Poland, in the province of Lithuania, and palatinate of Mscislau. It is well built, populous, and has a considerable trade. Near this place the Swedes obtained a great victory over the Russians in 1707.

MOIDORE, a Portuguese gold coin, value 1l. 7s. Sterling.

MOIETY *(Medietas)*, the half of any thing.

MOINE (Peter le), was born at Chaumont in Bassigni, A. D. 1602, and died at Paris August 22, 1672, aged 70. He joined the society of Jesuits, and enjoyed several offices among them. He is chiefly known by his verses, which were collected into one volume folio in 1671. Father le Moine is the first of the French poets belonging to that famous society, who acquired reputation by this species of writing. It cannot be denied that this poet possessed genius and fancy; but his imagination was ungoverned, which is particularly the case in his poem of *Saint Louis*. Despreaux, when asked his opinion of this poet, replied, That "he was too extravagant for praise, and too much a poet for censure." To give his character in one word, he was a pedant who had a lively imagination without taste, and who, far from restraining his impetuous genius, abandoned himself without reserve to its direction. Hence his gigantic figures, his crowd of metaphors, his ridiculous antitheses, his hyperbolical expressions, &c. This Jesuit somewhere says, "that the water of the river on the banks of which he had composed his verses, was so admirably qualified to make poets, that though it were converted into holy water, it would not protect a man against the dæmon of poetry." The prose of Father le Moine is in the same briliant and bombastic style. Senault, a father of the oratory, used to say of him, that he was "Balzac in a theatrical dress." Among his prose works are, 1. *La Devotion aisée*, Paris, 1652, 8vo; an extraordinary book which produced more mirth than devotion. 2. *Pensées Morales*. On these two books the reader may consult Paschal's ninth and tenth provincial letters. 3. A short treatise on History, in 12mo; in which we find many pleasant and curious thoughts mixed with a good deal of common-place.

Moine, (Stephen le), a very learned French minister of the Protestant religion, was born at Caen in 1624. He became extremely skilled in the Greek, Latin, and Oriental tongues, and professed divinity with high reputation at Leyden, in which city he died in 1689. Several Dissertations of his are printed together, and intituled *Varia Sacra*, in 2 vols. 4to; Besides which, he wrote other works.

Moine (Francis le), an excellent French painter, was born at Paris in 1688, and trained up under Galloche professor of the academy of painting; which office he himself afterwards filled. Le Moine painted the grand saloon which is at the entrance into the apartments of Versailles, and which represents the apotheosis of Hercules. He was four years about it; and the king, to show how well pleased he was with it, made him his first painter in 1736, and gave him a pension of 4000 livres. A fit of lunacy seized this painter the year after; during which he run himself through with his sword, and died June 4, 1737, aged 49.

MOIRA (sometimes written *Moyra)*, a town of Ireland, situated in the county of Down and province of Ulster, 69 miles from Dublin; noted for its linen manufacture, and a monthly market for vending the same. It gives title of earl to the family of Rawdon. Lord Moira has here a very beautiful seat; and here is a handsome church, a charity school, and two dissenting-meeting-houses.

MOISTURE. See Humidity.

The moisture of the air has considerable effects on the human body. For the quantity and quality of the food, and the proportion of the meat to the drink, being given, the weight of a human body is less, and consequently its discharges greater in dry weather than in wet weather; which may be thus accounted for: the moisture of the air moistens the fibres of the skin and lessens perspiration by lessening their vibratory motion. When perspiration is thus lessened by the moisture of the air, urine indeed is by degrees increased,

increased, but not equally. Hence, according to Dr Bryan Robinson, we learn, that to keep a body of the same weight in wet weather as in dry, either the quantity of food must be lessened, or the proportion of the meat to the drink increased; and both these may be done by lessening the drink without making any change in the meat.

The instrument used for determining the degree of moisture in the air, is called an *hygrometer*. See HYGROMETER.

MOIVRE (Abraham), was born at Vitri in Champagne, A. D. 1667. His father was a surgeon. At the revocation of the edict of Nantes, he determined to fly into England rather than abandon the religion of his fathers. Before he left France, he had begun the study of Mathematics; and having perfected himself in that science in London, he was obliged, by the meanness of his circumstances, to teach it. Newton's *principia*, which accidentally fell into his hands, showed him how little progress he had made in a science of which he thought himself master. From this work he acquired a knowledge of the geometry of infinites with as great facility as he had learned the elementary geometry; and in a short time he was fit to be ranked with the most celebrated mathematicians. His success in these studies procured him a seat in the Royal Society of London and in the Academy of Sciences at Paris. His merit was so well understood in the former, that he was thought capable of deciding in the famous dispute between Leibnitz and Newton concerning the differential calculus. —He published a Treatise on Chances in 1738, and another on annuities in 1732; both extremely accurate. The Philosophical Transactions contain many interesting memoirs of his composition.— Some of them treat of the method of fluxions; others are on the lunula of Hippocrates; others on physical astronomy, in which he resolved many important problems; and others, in short, on the analysis of the games of chance, in which he followed a different course from that of Montmort. Towards the close of his life he lost his sight and hearing; and the demand for sleep became so great that he required 20 hours of it in a day. He died at London, 1754, aged 87. His knowledge was not confined to mathematics; but he retained to the last a taste for polite literature. He was intimately acquainted with the best authors of antiquity; and he was frequently consulted about difficult passages in their works. Rabelais and Moliere were his favourite French authors; he had them by heart: and he one day observed to one of his acquaintance, "that he would rather have been Moliere than Newton." He recited whole scenes of the *Misanthrope* with that delicacy and force with which he remembered to have heard them recited at Paris 70 years before, by Moliere's own company. The character indeed was somewhat similar to his own. He judged severely of mankind; and could never conceal his disgust at the conversation of a fool, nor his aversion to cunning and dissimulation. He was free from the affectation of science; and no one could know him to be a mathematician but from the accuracy of his thoughts. His conversation was general and instructive. Whatever he said was well digested and clearly expressed. His style possessed more strength and solidity than ornament and animation; but he was always correct, as he bestowed as much pains on his sentences as on his calculations. He could never endure any bold assertions or indecent witticisms against religion. "I show you that I am a Christian (said he one day to a person who thought to pay him a compliment by observing that mathematicians were attached to no religion), by forgiving the speech you have now made." The practice of giving vails to servants was not laid aside in his time; and, on this account, when a nobleman asked him why he did not dine oftener with him? "You must excuse me, my lord (replied he), I cannot afford it."

MOLA (Pietro Francisco), an eminent painter, was born, according to most authors, at Lugano, a city belonging to the Switzers, in the year 1609. Others affirm, that the place of his birth was Coldra, in the district of Como. He was at first the disciple of Giuseppe d'Arpino, and afterwards of Albano. When he quitted the school of the latter, he went to Venice, and studied assiduously the pictures of Titian. Tintoretto, Basan, and Paolo Veronese. He painted historical subjects and landscapes with great success; but his genius seemed more particularly adapted to the latter. His pictures, in both styles, are spoken of with the warmest commendations. He died in 1665.—He had a brother, *Giovanna Batista*, who was also a painter, and of some merit, but very inferior to that of the older.

MOLA, an ancient town of Italy, in the kingdom of Naples, and in the Terra di Lavoro, where they pretend to show the ruins of Cicero's house. It is seated on the gulph of Venice, in E. Long. 17. 50. N. Lat. 41. 5.

MOLA Salsa (*Salt Cake*), in antiquity, was barley parched, and afterwards ground to meal or flour, then mixed with salt and frankincense, with the addition of a little water. Thus prepared, it was sprinkled between the horns of the victim before it was killed in sacrifice. This act was called *immolatio*, and was common to the Greeks as well as Romans; with this difference, that the *mola* of the Romans was of wheat. The Greeks called it ουλη or ουλοχυτη.

MOLARES, or DENTES MOLARES, in anatomy, the large teeth, called in English the *grinders*. See ANATOMY, n° 27.

MOLASSES, or MOLOSSES. See MOLOSSES.

MOLDAVIA, a province of Turkey in Europe, bounded on the north-east by the river Niester, which divides it from Poland; on the east, by Bessarabia; on the south by the Danube, which parts it from Bulgaria; and on the west, by Walachia and Transylvania: it being 240 miles in length and 150 in breadth. It lies in a good air and fruitful soil, producing corn, wine, rich pastures, a good breed of horses, oxen, sheep, plenty of game, fish, fowl, honey, wax, and all European fruits. Its principal rivers are the Danube, Niester, Pruth, Bardalach, and Ceret. The inhabitants are Christians of the Greek church, and Jassy is the principal town. It has been tributary to the Turks ever since the year 1574; who appoint a prince who is a native of the country, but have no regard to his being of the principal families. They pay a large yearly tribute, besides which, they are obliged to raise a great body of horse at their own expence.

Mole.

MOLE, a river in Surry, which has taken its name from running under ground. It first disappears at Box-hill, near Darking, in the county of Surry, and emerges again near Leatherhead.

MOLE, in zoology. See TALPA.

Moles in the fields may be destroyed by taking a head or two of garlic, onion or leek, and putting it into their holes; on which they will run out as if frighted, and you may kill them with a spear or dog. Or pounded hellebore, white or black, with wheat-flour, the white of an egg, milk, and sweet-wine, or metheglin, may be made into a paste, and pellets as big as a small nut may be put into their holes: the moles will eat this with pleasure, and will be killed by it. In places where you would not dig nor break much, the fuming their holes with brimstone, garlic or other unsavoury things, drives them away; and if you put a dead mole into a common haunt, it will make them absolutely forsake it.

Or take a mole-spear or staff, and where you see them cast, go lightly but not on the side betwixt them and the wind, lest they perceive you; and at the first or second putting up of the earth, strike them with your mole-staff downright, and mark which way the earth falls most: if she casts towards the left hand, strike somewhat on the right hand; and so on the contrary, to the casting up of the plain ground, strike down, and there let it remain; then take out the tongue in the staff, and with the spattle, or flat edge, dig round about your grain to the end thereof, to see if you have killed her; and if you have missed her, leave open the hole and step aside a little, and perhaps she will come to stop the hole again, for they love but very little air; and then strike her again; but if you miss her, pour into the hole two gallons of water, and that will make her to come out for fear of drowning: mind them going out of a morning to feed or coming home when fed, and you may take a great many.

MOLE, in midwifery, a mass of fleshy matter, of a spherical figure generated in the uterus, and sometimes mistaken for a child. See MIDWIFERY.

MOLE, or *Mark*. See NÆVUS.

MOLE, in architecture, a massive work formed of large stones laid in the sea by means of coffer dams, extended either in a right line or an arch of a circle, before a port, which it serves to close; to defend the vessels in it from the impetuosity of the waves, and to prevent the passage of ships without leave. Thus we say the mole of the harbour of Messina, &c.

MOLE is sometimes also used to signify the harbour itself.

MOLE, (*moles*,) among the Romans, was also used for a kind of mausoleum, built in manner of a round tower on a square base, insulate, encompassed with columns, and covered with a dome.—The mole of the emperor Adrian, now the castle of St Angelo, was the greatest and most stately of all the moles. It was crowned with a brazen pine apple, wherein was a golden urn containing the ashes of the emperor.

Mole-cricket, in zoology. See GRILLOTALPA.

Mole-Hills, These little hillocks of earth are a very great prejudice to the pasture lands, not only in wasting so much of the land as they cover, but in hindering the scythe in mowing. In the west of England they use a peculiar instrument for the breaking up of these; it is a flat board, very thick, and of about eight inches in diameter, into which there is fastened a perpendicular handle of three or four feet long. It has four broad and sharp iron teeth at the front, which readily cut through the hill, and spread the earth it consists of; and behind there is a large knob proper for breaking the clods with, if there are any. Some use a spade, or other common instrument in the place of this, but not so well. There is however, a much better instrument even than this, for destroying these hills where they are in very great numbers. This is a kind of horse-machine; it has a sharp-iron about three feet over, and with a strong back.—It is about four or five inches broad, and has two long handles for a horse to be harnessed to, and a cross bar of iron to strengthen it at the bottom of the handles, reaching from the one handle to the other. The middle of this cross-bar is furnished with one, two, or more sharp pieces of iron like small plough-shares, to cut the mole-hills into two, three or more parts. The iron behind is of a semicircular figure. A single horse is harnessed to this machine, and a boy must be employed to drive it, and a man to hold and guide it; the sharp irons or shares are the first things that meet the hill, they run through it, break its texture, and cut it into several parts; and the circular iron following immediately behind them, cuts up the whole by the roots, and leaves the land level. This instrument will destroy as many mole-hills in one day as a common labourer can in eight, and would be of very great advantage to the kingdom if brought into general use. It is to be observed, that this leaving a naked space in the place of every hill, it will be necessary to go over the land. and sow them with hay seed, otherwise these spots will want the produce of grass the first years. The farmers in some parts of England are not willing to destroy the mole-hills, but let them stand from year to year, suppposing that they get some ground by them; but the advantage by this means is so little, that it does not balance the unsightliness and damage to the mowing.

Mole, Molesworth.

MOLESWORTH (Robert), Viscount Molesworth, an eminent statesman and polite writer, born at Dublin in 1656, where his father was a merchant. He was attainted by King James for his activity on the prince of Orange's invasion; but the latter, when he was settled on the throne, called up Mr Molseworth into the privy-council, and sent him envoy-extraordinary to the court of Denmark. Here he resided above three years, and then returned upon some disgust, without an audience of leave. Upon his return, he drew up his Account of Denmark, a work well known, in which he represented that government as arbitrary; and hence gave great offence to George prince of Denmark. The Danish envoy presented a Memorial to King William concerning it, and then furnished materials for an answer, which was executed by Dr William King. Mr Molesworth was member of the houses of commons in both kingdoms; King George I. made him a commissioner of trade and plantations, and advanced him to the peerage of Ireland, by the title of *Baron Philipstown*, and *Viscount Molesworth of Swords*.

Swords. He died in 1725. Besides his Account of Denmark, he wrote an address to the house of commons, for the encouragement of agriculture; and translated Franco Gallia, a Latin treatise of the civilian Hottoman, giving an account of the free state of France, and other parts of Europe, before the encroachments made on their liberties.

MOLIERE (John Baptist), a famous French comedian, whose true name was *Pocquelin*, which for some reason or other he sunk for that of Moliere. He was the son of a valet de chambre, and was born at Paris about the year 1620. He went through the study of the classics under the Jesuits in the college of Clermont, and was designed for the bar; but at his quitting the law-schools, he made choice of the actor's profession. From the prodigious fondness he had for the drama, his whole study and application being directed to the stage, he continued till his death to exhibit plays, which were greatly applauded. It is said the first motive of his going upon the stage was to enjoy the company of an actress for whom he had contracted a violent fondness. His comedies are highly esteemed. And it is no wonder he so justly represented domestic feuds, and the torments of jealous husbands, or of those who have reason to be so, it being asserted that no man ever experienced all this more than Moliere, who was very unhappy in his wife. His last comedy was *La Malade imaginaire*, which was brought on the stage in 1673; and Moliere died on the fourth night of its representation; some say in acting the very part of the pretended dead man, which gave some excercise for the wits of the time; but according to others he died in his bed that night, from the bursting of a vein in his lungs by coughing. The king, as a last mark of his favour, prevailed with the archbishop of Paris to suffer him to be buried in consecrated ground; though he had irritated the clergy by his *Tartuff*. The most esteemed editions of his works are that of Amsterdam, 5 vols 12mo, 1692; and that of Paris, 6 vols 4to, 1734.

MOLINA (Lewis), a Spanish lawyer, who was employed by Philip II. king of Spain in the councils of the Indies and of Castile. He is the author of a learned treatise concerning the entails of the ancient estates of the Spanish nobility, entitled, *De Hispanorum Primogenitorum Origine et Natura*, published in 1603, in folio. This book is likewise applicable to several provinces in France. Lewis Molina must not be confounded with John Molina, a Spanish historian, author of *Cronica antiqua d' Arragon*, published in 1524, in folio; and also of *De las Casas memorables d'Espagna*, in folio. The first work appeared at Valencia, and the second at Alcala.

MOLINÆUS. See Moulin.

MOLINISTS, in ecclesiastical history, a sect in the Romish church, who follow the doctrine and sentiments of the Jesuit Molina, relating to sufficient and efficacious grace. He taught that the operations of divine grace were entirely consistent with the freedom of human will; and he introduced a new kind of hypothesis to remove the difficulties attending the doctrines of predestination and liberty, and to reconcile the jarring opinions of Augustines, Thomists, Semi-Pelagians, and other contentious divines. He affirmed, that the decree of predestination to eternal glory was founded upon a previous knowledge and consideration of the merits of the elect; that the grace from whose operation these merits are derived, is not efficacious by its own intrinsic power only, but also by the consent of our own will, and because it is administered in those circumstances, in which the Deity, by that branch of his knowledge which is called *scientia media*, foresees that it will be efficacious. The kind of prescience, denominated in the schools *scientia media*, is that foreknowledge of future contingents that arises from an acquaintance with the nature and faculties of rational beings, of the circumstances in which they shall be placed, of the objects that shall be presented to them, and of the influence which their circumstances and objects must have on their actions.

MOLINOS (Michael,) a Spanish priest, who endeavoured to spread new doctrines in Italy. He was born in the diocese of Saragossa in 1627; and entered into priest's orders, though he never held any ecclesiastical benefice. He was a man of good sense and learning, and his life was exemplary; though instead of practising austerities, he gave himself up to contemplation and mystical devotion. He wrote a book intitled, *Il Guida Spirituale*, containing his peculiar notions, which was greedily read both in Italy and Spain. His followers are called *Quietists*; because his chief principle was, that men ought to annihilate themselves in order to be united to God, and afterwards remain in quietness of mind, without being troubled for what shall happen to the body. He was taken up in 1687; and his 68 propositions were examined by the pope and inquisitors, who decreed that his doctrine was false and pernicious, and that his books should be burned. He was forced to recant his errors publicly in the Dominicans church, and was condemned to perpetual imprisonment. He was 60 years old when he was taken, and had been spreading his doctrine 22 years before. He died in prison in 1692.

MOLINOSISTS, a sect among the Romanists. who adhere to the doctrine of Molinos. These are the same with what are otherwise called *Quietists*.

MOLLOY (Charles. Esq;), descended from a good family in the kingdom of Ireland, was born in the city of Dublin, and received part of his education at Trinity college there, of which he afterwards became a fellow. At his first coming to England he entered himself of the Middle Temple, and was supposed to have had a very considerable hand in the writing of a periodical paper called "Fogs's Journal;" as also since that time to have been almost the sole author of another well-known paper, intitled "Common Sense." All these papers give testimony of strong abilities, great depth of understanding, and clearness of reasoning. Dr King was a considerable writer in the latter, as were lords Chesterfield and Lyttleton. Our author had large offers made him to write in defence of Sir Richard Walpole, but these he rejected; notwithstanding which, at the great change in the ministry in 1742, he was entirely neglected, as well as his fellow labourer Amherst, who conducted "The Craftsman." Mr Molloy, however, having married a lady of fortune, was in circumstances which enabled him to treat the ingratitude of his patriotic friends with the contempt it deserved. He lived many years after this period, dying so lately as July 16. 1767.

He alſo wrote three dramatic pieces, viz. The perplexed Couple; The Coquet; and, The Half-pay Officers; none of which met with much ſucceſs.

MOLLUGO, African chickweed: A genus of the trigynia order, belonging to the triandria claſs of plants; and in the natural method ranking under the 22d order, *Caryophyllei.* The calyx is pentaphyllous; there is no corolla; the capſule is trilocular, and trivalved. Its characters are theſe: The empalement of the flower is compoſed of five oblong ſmall leaves, coloured on their inſides, and permanent; the flower has five oval petals ſhorter than the empalement; and three briſtly ſtamina, which ſtand near the ſtyle, terminated by ſingle ſummits; it has an oval germen, having three furrows, ſupporting three very ſhort ſtyles: the germen becomes an oval capſule with three cells, filled with ſmall kidney-ſhaped ſeeds. There are ſeveral ſpecies, few of which are admitted into gardens. Miller reckons two and Linnæus five ſpecies. This plant is ſaid to have an aperitive virtue.

MOLUSCA, in the Linnæan ſyſtem, is the denomination of the ſecond genus of vermes or worms. Theſe are ſimple naked animals, not included in a ſhell, but furniſhed with limbs, and comprehend eighteen ſubordinate genera, and one hundred and ten ſpecies.

MOLO, a philoſopher of Rhodes, called alſo Apollonius. Some are of opinion that Apollonius and Molo are two different perſons, who were both natives of Alabanda, and diſciples of Menecles of the ſame place. They both viſited Rhodes, and there opened a ſchool; but Molo came ſome time after Apollonius. Molo had Cicero and J. Cæſar among his pupils.

MOLOCH, a falſe god of the Ammonites who dedicated their children to him, by making them "paſs through the fire," as the ſcriptures expreſs it. There are various opinions concerning this method of conſecration. Some think, the children leaped over a fire ſacred to Moloch; others that they paſſed between two fires; and others, that they were really burnt in the fire, by way of ſacrifice to this god. There is foundation for each of theſe opinions. For, firſt, it was uſeful among the pagans to luſtrate or purify with fire; and in the next place, it is expreſsly ſaid, that the inhabitants of Sepharvaim burnt their children in the fire to Anamelech and Adramelech; much ſuch deities as Moloch of the Ammonites.

Moſes, in ſeveral places, forbids the Iſraelites to dedicate their children to this god as the Ammonites did, and threatens death and utter extirpation to ſuch perſons as were guilty of this abominable idolatry. And there is great probability that the Hebrews were much addicted to the worſhip of this deity; ſince Amos, and after him St Stephen, reproaches them with having carried along with them into the wilderneſs the tabernacle of their god Moloch.

Solomon built a temple to Moloch upon the mount of Olives; and Manaſſeh, a long time after, imitated his impiety, by making his ſon paſs through the fire in honour of Moloch. It was chiefly in the valley of Tophet and Hinnom, to the eaſt of Jeruſalem, that the Iſraelites paid their idolatrous worſhip to this falſe god of the Ammonites.

There are various ſentiments concerning the relation which Moloch had to the other pagan divinities. Some believe he was the ſame with Saturn, to whom it is well known that human ſacrifices were offered. Others ſuppoſe him to be Mercury; others, Mars; others, Mithras; and others, Venus. Laſtly, others take Moloch to be the ſun, or the king of heaven. Moloch was likewiſe called *Milkom;* as appears from what is ſaid of Solomon, that he went after Aſhtaroth the abomination of the Zidonians, and Milkom the abomination of the Ammonites.

MOLOSSES, Molasses, or *Melaſſes,* that groſs fluid matter remaining of ſugar after refining, and which no boiling will bring to a conſiſtence more ſolid than that of ſyrup: hence alſo called *ſyrup of ſugar.*

Properly, molaſſes are only the ſediment of one kind of ſugar called *chypre,* or brown ſugar, which is the refuſe of other ſugars not to be whitened or reduced into loaves.

Moloſſes are much uſed in Holland for the preparation of tobacco, and alſo among poor people inſtead of ſugar. There is a kind of brandy or ſpirit made of moloſſes; but by ſome held exceedingly unwholeſome. See below.

Artificial Molosses. There has been found a method of making moloſſes from apples without the addition of ſugar. The apple that ſucceeds beſt in this operation is a ſummer ſweeting of a middle ſize, pleaſant to the taſte, and ſo full of juice that ſeven buſhels will yield a barrel of cyder.

The manner of making it is this: the apples are to be ground and preſſed, then the juice is to be boiled in a large copper, till three quarters of it be evaporated: this will be done with a moderate fire in about ſix hours, with the quantity of juice abovementioned; by this time it will be of the conſiſtence and taſte as well as of the colour of moloſſes.

This new moloſſes ſerves to all the purpoſes of the common kind, and it is of great uſe in preſerving cyder. Two quarts of it, put into a barrel of racked cyder, will preſerve it, and give it an agreeable colour.

The invention of this kind of moloſſes was owing to Mr Chandler of Woodſtock in New England, who living at a diſtance from the ſea, and where the common moloſſes was very dear and ſcarce, provided this for the ſupply of his own family, and ſoon made the practice among people of the neighbourhood. It is to be obſerved, that this ſort of apple, the ſweeting, is of great uſe in making cyder, one of the very beſt kinds we know being made of it. The people in New-England alſo feed their hogs with the fallings of the orchards of theſe apples; and the conſequences of this is, that their pork is the fineſt in the world.

Moloſſes Spirit; a very clean and pure ſpirit, much uſed in England, and made from moloſſes or common treacle diſſolved in water, and fermented in the ſame manner as malt or the common malt-ſpirit. See Distillation, n° 10.

Moloſſes ſpirit coming dearer than that of malt, it is frequently met with baſely adulterated with a mixture of that ſpirit, and indeed ſeldom is to be bought without ſome daſh of it. Many have a way of mixing malt in the fermenting liquor; by this the yield of the whole is greatly increaſed, and the maker may aſſure the buyer that the ſpirit is pure as it ran from the worm.

In moſt of the nice caſes in our compound diſtillery,

lery, the molosses-spirit supplies the place of a pure and clean spirit. Our cinnamon, citron, and other fine cordial waters, are made with it; for the malt spirit would impart to these a very disagreeable flavour.

Molosses spirit gives a yellow stain to the hands or other substances dipped into it; and may therefore be of use in dyeing. It is possible also that the vinegar-makers may find use for it in their way; but the most advantageous of all its uses is to the distiller himself; a quantity of it added to new treacle intended for fermentation will be of great use in the process, and increase very considerably the quantity of spirit; but the proportion in regard to the new matter must not be too great.

MOLOSSI, a people of Epirus, who inhabited that part of the country which was called *Molossia* or *Molossus*, from king Molosses, a son of Pyrrhus and Andromache. This country had the bay of Ambracia on the south, and the country of the Perrhæbeans on the east. The dogs of the place were famous, and received the name of *Molossi* among the Romans. Dodona was the capital of the country, according to some writers. Others, however, reckon it as the chief city of Thesprotia.

MOLOSSUS, in the Greek and Latin poetry, a foot consisting of three long syllables. As *audiri*, *cantabant*, *virtutem*.

It takes its name either from a dance in use among the people called *Molossi* or *Epirotæ*; or from the temple of Jupiter Molossus, where odes were sung, in which this foot had a great share; or else because the march of the Molossi, when they went to the combat, was composed of these feet, or had the cadence thereof. The same foot was also called among the ancients, *Vertumnus*, *extensipes*, *hippius*, & *canius*.

MOLSA (Francis Maria), an eminent poet of the 16th century, was born at Modena. He gained so prodigious a reputation by his Latin and Italian poetry, that, as Paul Jovius tells us, "for 30 years together the patrons of wit at Rome strove to promote him." If he had behaved with the least prudence, he might easily have raised himself to considerable preferments and fortunes in the world; but he managed so ill that it was not possible to serve him.—He was entirely debauched, and at the same time devoid of all prudence and decency in the management of his pleasures. Hence he destroyed his reputation, and put an absolute stop to the progress of his fortunes. He died, in 1544, of the French disease. Molsa was a great orator as well as a great poet. He met once with a favourable opportunity of displaying his talent this way; for having seen the people of Rome highly incensed against Lorenzo de Medicis, who had struck off the heads of a great number of ancient statues, he accused him of that action, and (according to Paul Jovius) made so lively an oration upon it, that he perfectly overwhelmed him with confusion and despair: and it was generally believed that Lorenzo de Medicis was so confounded at the infamy with which he was branded in that oration, that, in order to efface it, he resolved to restore the city of Florence to its liberty, by assassinating Alexander de Medicis his near relation, which he did in 1537.

Molsa (Tarquinia), daughter of Camillo Molsa, knight of the order of St James of Spain, and granddaughter of Francis Maria Molsa, was one of the most accomplished ladies that ever appeared in the world; wit, learning, beauty, and virtue, all uniting, in her in a most extraordinary degree. Her father observing, while she was yet very young, the goodness and excellence of her genius, procured her the best masters in every branch of literature and science. Lazaro Labadini, a celebrated grammarian of those times, taught her polite literature; and her Latin compositions in prose and verse show that she attained the art of writing well, and composing correctly. She became learned in Aristotle under Camillo Corcapani; Anthony Guarini the mathematician taught her the doctrine of the sphere; she learned poetry under Francis Patricius the famous philosopher; and logic and philosophy under P. Latoni, who also instructed her thoroughly in the Greek tongue. The rabbi Abraham taught her the principles of the Hebrew language; and John Marier Barbier formed her in the politeness of the Tuscan tongue; in which she has not only written a great number of easy and elegant verses, but likewise several letters and other pieces which are in high esteem with the polite and learned in Italy. Besides her original works, she has translated several things from Greek and Latin in a manner which shows her to have understood those languages as well as her own. Afterwards she learned music, as a relaxation and diversion from her more serious studies; and in this art she attained the highest degree of perfection. She used to play upon the violin as well as upon the lute, and sing to it at the same time in so exquisite a taste as charmed every hearer; and she instituted at length a choir of ladies, over which she herself used to preside. This lady was in high reputation at the court of Alphonsus II. duke of Farrara, a prince of great judgment, and a passionate lover of every thing that was elegant; and we are told, that he stood ravished with admiration upon finding so many more accomplishments than he had been taught to expect in her. But the most authentic testimony and declaration of her high merit and character, was that which she received from the city of Rome; which, by a decree of the senate, in which all her excellencies and qualifications are set forth, honoured her with the title of *Singular*, and bestowed the rights of a Roman citizen upon her and the whole family of Molsa. Molsa was married; but losing her husband without having any children, would never consent to be married again, although she was very young. She gave such lively tokens of her grief, that Patricius compares her to another Artemisia.

MOLUCILLA, in botany: A genus of the gymnospermia order, belonging to the didynamia class of plants; and in the natural method ranking under the 42d order, *Verticillatæ*. The calyx is campanulated, gradually widening larger than the corolla, and spinous.

MOLTEN-grease, in farriery. See there § xxii.

MOLUCCA islands, lie in the East Indian sea under the line; of which there are five principal, namely, Ternate, Tydor, Machian, Motyr, and Bachian. The largest of them is hardly 30 miles in circumference. They produce neither corn, rice, nor cattle, except

except goats: but they have oranges, lemons, and other fruits; and are most remarkable for spices, especially cloves. They have large snakes, which are not venomous, and very dangerous land crocodiles. At present they have three kings; and the Dutch, who are very strong there, keep out all other European nations, being jealous of their spice-trade. The religion is idolatry; but there are many Mahometans. They were discovered by the Portuguese in 1511, who settled upon the coast; but the Dutch drove them away, and are now masters of all these islands.

MOLWITZ, a town of Silesia, in the province of Grotska, remarkable for a battle gained by the Prussians over the Austrians in 1741. E. Long, 16. 45. N. Lat. 50. 26.

MOLY. The name of this plant is rendered famous by Homer; and hence has been much inquired into, as to its true sense, by the botanists of almost all times The old interpreters of Homer explain this word by the "wild rue;" and the only reason for this is, that at some time, probably long after the days of Homer, the people of Cappadocia called the wild rue *moly*. But this plant is wholly different from the moly of Homer, which Theophrastus affirms grew in his time in Arcadia in great plenty, and had a round bulbous root like an onion, and long and grassy leaves like the squill. On the whole, the moly of Homer seems to have been a species of allium or garlic.

MOLYBDENA, in chemistry, a mineral often confounded with plumbago or black lead, but possessed of different properties. It is composed of scaly laminæ of various magnitudes, scarcely adhering to each other; somewhat greasy to the touch, soiling the fingers, and leaving traces on paper of a blackish grey colour. In powder it is of a bluish colour.

"Perfect molybdena (says Mr Fourcroy) slightly detonates with nitre; the residue contains molybdena, tartar, and calx of iron. From the experiments of Mr Scheele, molybdena appears to consist of a peculiar combustible matter and iron. The nature of the combustible matter is not yet perfectly known. Mr Hielm, a disciple of the celebrated Bergman, appears to have succeeded in converting it into a regulus. Mr Pelletier affirms, that he has had the same success; but the properties of this new metal have not yet been examined. The molybdenic acid appears to be a metallic one. Its weight, its styptic, and austere taste, its dry and pulverulent form, its fusibility, insolubility, the colour it assumes by action of flame and combustible matters, its precipitation by nut-galls and the acid of Prussian blue, show that it is somewhat similar to the arsenical acid. This substance is so rare in France, that no chemist except M. Pelletier has had an opportunity of making a regular series of experiments upon it. It is greatly to be wished that they should be continued, especially with a view of deciding whether the Molybdenic acid be truly different from all others; for I cannot avoid thinking, notwithstanding its peculiar characters, that a substance which does not become acid but by the assistance of 30 parts of weak nitrous acid, and is with so much difficulty brought to assume the saline state, ought not to be considered as an acid truly peculiar." See CHEMISTRY-*Index*; and MINERALOGY, p. 134.

Molybdena is found sometimes along with tin-ores and iron-ores, that are attracted by the magnet, among copperish pyrites; and also with wolfram, in Saxony, Iceland, Sweden, France, Spain, &c.

MOLYBDIA, in natural history, the name of a genus of crystals of a cubic form, or composed of six sides, at right angles, like a dye.

MOLYN (Peter), called *Tempesta* and *Pietro Mulier*, an eminent painter, was born at Haerlem in 1637. According to some authors, he was the disciple of Snyders, whose manner of painting he at first imitated. But his genius led him to the study of dismal subjects; and he so far excelled in painting tempests, storms at sea, and shipwrecks, that he was called by way of distinction *Tempesta*. His pictures are very rare, and held in the greatest estimation. The name of *Pietro Mulier*, or *du Mulieribus*, was given him on account of having caused his wife to be assassinated, in order to marry a young lady of Genoa with whom he was in love. But this villanous transaction being discovered, he was seized, imprisoned, and capitally condemned. However, the greatness of his merit as an artist occasioned a mitigation of the sentence; but he was still detained in prison, where he diligently followed his profession, and would have continued there in all probability for life, had he not met with an opportunity of escaping to Placentia, at the time Louis XIV. bombarded the city of Genoa, after he had been in confinement 16 years. To this artist are attributed several very neat prints, executed with the graver only, in a style greatly resembling that of John Vander Velde. They consist chiefly of candle-light pieces and dark subjects. M. Heinekin mentions *Peter Molyn* the elder, who was a native of Holland, and a painter; but not so eminent as Tempesta. Some suppose the prints abovementioned ought to be ascribed to the latter; as, though very neatly executed, they are laboured heavy performances, and not equal in any degree to what one might expect from the hand of an artist of so much repute as Tempesta.

MOLYNEUX (William), an excellent mathematician and astronomer, was born at Dublin in 1656, and admitted into the university of that city; which when he left, he carried with him a testimonial drawn up in an uncommon form, and in the strongest terms, signifying the high opinion conceived of his genius, the probity of his manners, and the remarkable progress he had made in letters. In 1675, he entered in the middle-temple, where he spent three years in the study of the laws of his country; but the bent of his genius lay strongly toward mathematics and philosophical studies; and even at the university he conceived a dislike to scholastic learning, and fell into the methods of Lord Bacon. Returning to Ireland in June 1678, he shortly after married Lucy the daughter of Sir William Domvile the king's attorney-general. Being master of an easy fortune, he continued to indulge himself in prosecuting such branches of natural and experimental philosophy as were most agreeable to his fancy; wherein astronomy having the greatest share, he began, about 1681, a literary correspondence with Flamstead the king's astronomer, which he kept up for several years. In 1683, he formed a design of erecting a philosophical society at Dublin, in imitation

tion of the Royal Society at London; and, by the countenance and encouragement of Sir Willam Petty, who accepted the office of president, they began a weekly meeting that year, when our author was appointed their first secretary.

Mr Molyneux's reputation for learning recommended him, in 1684, to the notice and favour of the first and great duke of Ormond, then lord-lieutenant of Ireland; and chiefly by his grace's influence he was appointed, that year, with Sir William Robinson, surveyor general of his majesty's buildings and works, and chief engineer. In 1686 he was sent abroad by the government to view the most considerable fortresses in Flanders. He travelled, in company with Lord Mountjoy, through that country, Holland, part of Germany, and France. Upon his return from Paris to London, in April 1680, he published his *Sciothericum Telescopium*, containing a description of the structure and use of a telescopial dial invented by him. The severities of Tyrconnel's government forced him, with many others, into England, where he spent two years with his family, his place of residence being at Chester. In this retirement he wrote his Dioptrics, dedicated to the Royal Society. Here he lost his lady, who died soon after she had brought him a son. Illness had deprived her of her eye-sight 12 years before, that is, soon after she was married; from which time she had been very sickly, and afflicted with extreme pains of the head. As soon as the public tranquillity was settled in his native country, he returned home; and, upon the convening of a new parliament in 1692, was chosen one of the representatives for the city of Dublin. In the next parliament, in 1695, he was chosen to represent the university there, and continued to do so to the end of his life; that learned body having, before the end of the first session of the former conferred on him the degree of doctor of laws. He was likewise nominated by the lord-lieutenant one of the commissioners for the forfeited estates, to which employment was annexed a salary of 500l. a-year; but looking upon it as an invidious office, he declined it. In 1698, he published "The Case of Ireland stated, in relation to its being bound by Acts of Parliament made in England:" in which he is supposed to have delivered all, or most that can be said upon this subject, with great clearness and strength of reasoning. Among many persons with whom he maintained correspondence and friendship, Mr Locke was in a particular degree dear to him, as appears from their letters. In the above year, which was the last of his life, he made a journey to England, on purpose to pay a visit to that great man; and not long after his return to Ireland was seized with a fit of the stone, of which he died. Besides the works already mentioned, he published several pieces in the Philosophical Transactions.

MOLYNEUX (Samuel) son of the former, was born at Chester in July 1689; and educated with great care by his father, according to the plan laid down by Locke upon that subject. When his father died, he fell under the management of his uncle, Dr Thomas Molyneux, an excellent scholar and physician at Dublin, and also an intimate friend of Mr Locke; who executed his trust so well, that Mr Molyneux became afterwards a most polite and accomplished gentleman, and was made secretary to his late majesty when he was prince of Wales. Astronomy being his favourite study, as it had been his father's, he projected many schemes for the advancement of it, and was particularly employed in in the years 1723, 1724, and 1725, in perfecting the method of making telescopes; one of which, of his own making, he had presented to John V. king of Portugal. In the midst of these thoughts being appointed a commissioner of the admiralty, he became so engaged in public affairs, that he had not leisure to pursue these enquiries any farther; and gave his papers to Dr Robert Smith, professor of astronomy at Cambridge, whom he invited to make use of his house and apparatus of instruments, in order to finish what he had left imperfect. Mr Molyneux dying soon after, Dr Smith lost the opportunity, yet, supplying what was wanting from Mr Huygens and others, he published the whole in his "Complete Treatise of Optics."

MOMBAZA, or MONBAZA, a town of Africa, in an island of the same name, with a castle and fort: seated on the eastern coast, opposite to the country of Mombaza in Zanguebar, 70 miles south of Melinda, and subject to Portugal. E. Long. 48. 0. N. Lat. 44. 0.

MOMBAZA, a country of Africa in Zanguebar, subject to the Portuguese, from whence they export slaves, gold, ivory, rice, flesh, and other provisions, with which they supply the settlements in Brasil. The king of this country being a Christian, had a quarrel with the Portuguese governor, took the castle by assault, turned Mahometan, and murdered all the Christians, in 1631: but in 1729 they became masters of the territory again.

MOMENT, in the doctrine of time, an instant, or the most minute and indivisible part of duration

MOMENTUM, in mechanics, signifies the same with impetus, or the quantity of motion in a moving body; which is always equal to the quantity of matter multiplied into the velocity; or, which is the same thing, it may be considered as a rectangle under the quantity of matter and velocity. See MECHANICS.

MOMORDICA, MALE BALSAM APPLE: A genus of the syngenesia order, belonging to the monoecia class of plants; and in the natural method ranking under the 34th order, *Cucurbitaceæ*. The male calyx is quinquefid; the corolla sexpartite; the filaments are three in number. The female calyx is trifid; the corolla quinquepartite; the style trifid; the fruit is an apple parting asunder with a spring. The most remarkable species are, 1. The balsamina, or male balsam apple. This is a native of Asia; and has a trailing stalk like those of the cucumber or melon, with smooth leaves, cut into several segments, and spread open like a hand. The fruit is oval, ending in acute points, having several deep angles, with sharp tubercles placed on their edges. It changes to a red or purplish colour when ripe, opening with an elasticity, and throwing out its seeds. 2. The elaterium, wild or spurting cucumber, has a large fleshy root, somewhat like briony, from whence come forth every spring several thick, rough, trailing stalks, dividing into many branches, and extending every way two or three feet; these are garnished with thick, rough, almost heart-shaped leaves, of a grey colour,

colour, ſtanding upon long foot-ſtalks. The flowers come out from the wings of the ſtalks: theſe are male and female, growing at different places on the ſame plant like thoſe of the common cucumber: but they are much leſs, of a pale yellow colour, with a greeniſh bottom; the male flowers ſtand upon thick, ſhort, foot-ſtalks, but the female flowers ſit upon the young fruit; which, after the flower is faded, grows of an oval form, an inch and a half long, ſwelling like a cucumber, of a grey colour like the leaves, and covered over with ſhort prickles. This ſpecies has one of its names from the property of caſting out its ſeeds, together with the viſcid juice in which the ſeeds are lodged, with a violent force, if touched when ripe.

Uſes. The firſt ſpecies is famous in Syria for curing wounds. The natives cut open the unripe fruit, and infuſe it in ſweet oil, which they expoſe to the ſun for ſome days, until it becomes red; and then preſerve it for uſe. Dropped on cotton, and applied to a freſh wound, the Syrians reckon this oil the beſt vulnerary next to balſam of Mecca, having found by experience that it often cures large wounds in three days. The leaves and ſtems of this plant are uſed for arbours or bowers. The elaterium of the ſhops is the fruit, or rather the inſpiſſated fæcula, of the juice of the unripe fruit of the wild cucumber. It is uſually brought to Britain from Spain and the ſouthern parts of France, where the plant is common. It is brought to Britain in ſmall, flat, whitiſh lumps, or cakes, that are dry, and break eaſily between the fingers. It is of an acrid, nauſeous, bitter taſte, and has a ſtrong offenſive ſmell when newly made; but theſe, as well as its other properties, it loſes after being kept for ſome time. It is a very violent purge and vomit, and is now but ſeldom uſed. From the property which the plant has of throwing out its ſeeds, it has ſometimes been called *Noli me tangere*.

MOMUS, in fabulous hiſtory, the god of raillery, or the jeſter of the celeſtial aſſembly, and who ridiculed both gods and men. Being choſen by Vulcan, Neptune, and Minerva, to give his judgment concerning their works, he blamed them all: Neptune for not making his bull with horns before his eyes, in order that he might give a ſurer blow; Minerva for building a houſe that could not be removed in caſe of bad neighbours; and Vulcan, for making a man without a window in his breaſt, that his treacheries might be ſeen. For his free reflections upon the gods, Momus was driven from heaven. He is generally repreſented raiſing a maſk from his face, and holding a ſmall figure in his hand.

MONA, two iſlands of this name in the ſea lying between Britain and Ireland. The one deſcribed by Cæſar, as ſituated in the mid-paſſage between both iſlands, and ſtretching out in length from ſouth to north. Called *Monaæda* (Ptolemy); *Monopia*, or *Monabia* (Pliny). Suppoſed to be the Iſle of Man.—Another Mona, (Tacitus); an iſland more to the ſouth, and of greater breadth; ſituated on the coaſt of the Ordovices, from which it is ſeparated by a narrow ſtrait. The ancient ſeat of the Druids. Now called *Angleſey*, the iſland of the Angles or Engliſh.

Mona, an iſland of the Baltic Sea, ſouth-weſt of the iſland of Zealand, ſubject to Denmark. E. Long. 12. 30. N. Lat. 55. 20.

Mona. See Inchcolm.

MONACO, a ſmall but handſome and ſtrong town of Italy, in the territory of Genoa, with a caſtle, citadel, and a good harbour. It is ſeated on a craggy rock, and has its own prince, under the protection of France. E. Long. 7. 33. N. Lat. 43. 48.

MONAD, ſee *Leibnitzian Philoſophy*.

MONADELPHIA, (from μονος *alone*, and αδελφια *a brotherhood*;) a "ſingle brotherhood:" The name of the 16th claſs in Linnæus's ſexual ſyſtem, conſiſting of plants with hermaphrodite flowers; in which all the ſtamina or male organs of generation are united below into one body or cylinder, through which paſſes the pointal or female organ. See Botany, p. 437.

MONAGHAN, a county of Ireland, ſituated in the province of Ulſter, is bounded by Tyrone on the north, Armagh on the eaſt, Cavan and Louth on the ſouth, and Fermanagh on the weſt. It is a boggy and mountainous tract, but in ſome places is well improved. It contains 170,090 Iriſh plantation acres, 24 pariſhes, five baronies, and one borough, and ſends four members to parliament. It is about 30 miles long and 22 broad. The linen trade of this county is averaged at L. 104,000 yearly.

Monaghan, a poſt, fair, and market town, and chief of the county of that name, is diſtant 62 miles from Dublin; it is a borough, and returns two members to parliament; patron Lord Clermont. It gives title of baron to the family of Blayney, and has ſix fairs. It was anciently called *Muinechan*. An abbey was founded here in a very early age, of which Moelodius, the ſon of Aodh was abbot. In 1462, a monaſtery for conventual Franciſcans was erected on the ſite of this abbey, which was granted on the general ſuppreſſion of monaſteries to Edward Withe, and a caſtle has been ſince erected on the ſite by Edward Lord Blayney.

MONAMY (P.), a good painter of ſea-pieces, was born in Jerſey; and certainly (ſays Mr Walpole), from his circumſtances or the views of his family he had little reaſon to expect the fame he afterwards acquired, having received his firſt rudiments of drawing from a ſign and houſe painter on London bridge. But when nature gives real talents they break forth in the homelieſt ſchool. The ſhallow waves that rolled under his window taught young Monamy what his maſter could not teach him, and fitted him to imitate the turbulence of the ocean. In painter's hall is a large piece by him, painted in 1726. He died at his houſe in Weſtminſter the beginning of 1749.

MONANDRIA, (from μονος *alone*, and ανηρ *a man* or *huſband*:) the name of the firſt claſs in Linnæus's ſexual ſyſtem; conſiſting of plants with hermaphrodite flowers, which have only one ſtamen or male organ.

MONARCHY, a large ſtate governed by one; or a ſtate where the ſupreme power is lodged in the hands of a ſingle perſon. The word comes from the Greek μοναρχης, "one who governs alone; formed of μονος, *ſolus*, and αρχη *imperium*, "government." Of the three forms of government, viz. democracy, ariſtocracy, and monarchy, the laſt is the moſt powerful, all the ſinews of government being knit together, and united in the hand of the prince; but then there is imminent danger of his employing that strength to improvident or oppressive purposes. As a democracy is the best calculated to direct the end of a law, and an aristocracy to invent the means by which that end shall be obtained, a monarchy is most fit for carrying those means into execution.

The most ancient monarchy was that of the Assyrians, which was founded soon after the deluge. We usually reckon four grand or universal monarchies; the Assyrian, Persian, Grecian, and Roman; though St Augustine makes them but two, viz. those of Babylon and Rome. Belus is placed at the head of the series of Assyrian kings who reigned at Babylon, and is by profane authors esteemed the founder of it, and by some the same whom the scriptures call Nimrod. The principal Assyrian kings after Belus were Ninus, who built Nineveh, and removed the seat of empire to it; Semiramis, who, disguising her sex, took possession of the kingdom instead of her son, and was killed and succeeded by her son Ninyas; and Sardanapalus, the last of the Assyrian monarchs, and more effeminate than a woman. After his death the Assyrian empire was split into three separate kingdoms, viz. the Median, Assyrian, and Babylonian. The first king of the Median kingdom was Arbaces; and this kingdom lasted till the time of Astyages, who was subdued and divested of his kingdom by Cyrus.

In the time of Cyrus there arose a new and second monarchy called the Persian, which stood upwards of 200 years from Cyrus, whose reign began A. M. 3468, to Darius Codomannus, who was conquered by Alexander, and the empire translated to the Greeks, A. M. 3674.—The first monarch was Cyrus, founder of the empire. 2. Cambyses, the son of Cyrus. 3. Smerdis. 4. Darius, the son of Hystaspis, who reigned 521 years before Christ. 5. Xerxes, who reigned 485 years before Christ. 6. Artaxerxes Longimanus, who reigned 464 years before Christ. 7. Xerxes the second. 8. Ochus, or Darius, called Nothus, 424 years before Christ. 9. Artaxerxes Mnemon, 405 years before Christ. 10. Artaxerxes Ochus, 359 years before Christ. 11. Arses, 338 years before Christ. 12. Darius Codomannus, 336 years before Christ, who was defeated by Alexander the Great, and deprived of his kingdom and life about 331 years before Christ: the dominion of Persia after his death was translated to the Greeks.

The third monarchy was the Grecian. As Alexander, when he died, did not declare who should succeed him, there started up as many kings as there were commanders. At first they governed the provinces that were divided among them under the title of viceroys; but when the family of Alexander the Great was extinct, they took upon them the name of kings. Hence, in process of time, the whole empire of Alexander produced four distinct kingdoms, viz. 1. The Macedonian; the kings of which, after Alexander, were Antipater, Cassander, Demetrius Poliorcetes, Seleucus Nicanor, Meleager, Antigonus Doson, Philip, and Perseus, under whom the Macedonian kingdom was reduced to the form of a Roman province. 2. The Asiatic kingdom, which upon the death of Alexander fell to Antigonus, comprehending that country now called Natolia, together with some other regions beyond Mount Taurus. From this kingdom proceeded two lesser ones, viz. that of Pergamus, whose last king, Attalus, apointed the Roman people to be his heir; and Pontus, reduced by the Romans into the form of a province, when they had subdued the last king, Mithridates. 3. The Syrian of whose twenty-two kings the most celebrated were, Seleucus Nicanor, founder of the kingdom; Antiochus Deus; Antiochus the Great; Antiochus Epiphanes; and Tigranes, who was conquered by the Romans under Pompey; and Syria reduced into the form of a Roman province. 4. The Egyptian which formed by the Greeks in Egypt, and flourished near 240 years under 12 kings, the principal of whom were, Ptolemy Lagus, its founder; Ptolemy Philadelphus, founder of the Alexandrian library; and queen Cleopatra, who was overcome by Augustus, in consequence of which Egypt was added to the dominion of the Romans.

The fourth monarchy was the Roman, which lasted 244 years, from the building of the city until the time when the royal power was abrogated. The kings of Rome were. Romulus, its founder; Numa Pompilius; Tullus Hostilius; Ancus Martius; Tarquinius Priscus; Servius Tullius; and Tarquin the Proud, who was banished, and with whom terminated the regal power.

There seems in reality no necessity to make the Medes, Persians, and Greeks, succeed to the whole power of the Assyrians, to multiply the number of the monarchies. It was the same empire still; and the several changes that happened in it did not constitute different monarchies. Thus the Babylonian empire was successively governed by princes of different nations, yet without any new monarchy being formed thereby. Rome, therefore, may be said to have immediately succeeded Babylon in the empire of the world. See Empire.

Of monarchies some are absolute and despotic, where the will of the monarch is uncontroulable; others are limited, where the prince's authority is restrained by laws, and part of the supreme power lodged in other hands, as in Britain. See Government.

Some monarchies again are hereditary, where the succession devolves immediately from father to son; and others are elective, where, on the death of the monarch, his successor is appointed by election, as in Poland.

Fifth-Monarchy Men, in the ecclesiastical history of England, were a set of wrong-headed and turbulent enthusiasts who arose in the time of Cromwell, and who expected Christ's sudden appearance upon earth to establish a new kingdom; and, acting in consequence of this allusion, aimed at the subversion of all human government.

MONARDA, Indian horehound, in botany: A genus of the monogynia order, belonging to the diandria class of plants; and in the natural method ranking under the 42d order, *Verticillatæ*. The corolla is unequal, with the upper lip lineal, involving the filaments; there are four seeds. The most remarkable species is the zeylanica, a native of the East Indies. It rises with an herbaceous, four-cornered, hoary stalk, and bears leaves that are entire, nearly heart-shaped, woolly, deep notched on the edges, and having footstalks. The flowers, which are purplish and fragrant, surround the stalk in whorls, each whorl containing about 14 flowers: and are succeeded by four small kidney-shaped shining seeds, lodged in the bottom of the permanent flower-cup. The Indians superstitiously believe that a fumigation of this plant is effectual for driving away the devil; and from this imaginary property its name in the Ceylonese language is derived. Grimmius relates, in his *Laboratorium Ceylonicum*, that for taste and smell this species of horehound stands remarkably distinguished. A water and subtile oil are obtained from it, both of which are greatly commended in obstructions of the matrix. A syrup is likewise prepared from this plant, which is useful in the abovementioned disorders as well as in diseases of the stomach.

MONARDES (Nicholas), an excellent Spanish physician of Seville, who lived in the 16th century: and deservedly acquired great reputation by his practical skill and the books which he wrote. His Spanish works have been translated into Latin by Clusius, into Italian by Annibal Brigantus, and those upon American drugs have appeared in English. He died about the year 1578.

MONASTEREVAN, a post town of Ireland, in the country of Kildare and province of Leinster, 36 miles from Dublin. This town takes its name from a magnificent abbey which was founded here, in which St Evan in the beginning of the 7th century placed a number of monks from south Munster, and which had the privilege of being a sanctuary, St Evan's festival is held on the 22d of December. The consecrated bell, which belonged to this saint, was on solemn trials sworn upon by the whole tribe of the Eoganachts, and was always committed to the care of the Mac Evans, hereditary chief justices of Munster; the abbot of this house sat as a baron in parliament.— At the general suppression of monasteries, this abbey was granted to George Lord Audley, who assigned it to Adam Loftus, viscount Ely. It afterwards came into the family of Moor, earls of Drogheda, and has been beautifully repaired by the present Lord Drogheda, still wearing the venerable appearance of an abbey. There is a nursery at Monasterevan for the charter schools of the province of Leinster; and the grand canal has been carried up to this town from Dublin, since which it has been much improved and enlarged with several new buildings. It is a market-town, and also holds four fairs in the year.

MONASTERY, a convent or house built for the reception of religious; whether it be abbey, priory, nunnery, or the like.

MONASTERY is only properly applied to the houses of monks, mendicant friars, and nuns. The rest are more properly called *religious houses*. For the origin of monasteries, see MONASTIC and MONK.

The houses belonging to the several religious orders which obtained in England and Wales were, cathedrals, colleges, abbeys, priories, preceptories, commandries, hospitals, friaries, hermitages, chantries, and free chapels. These were under the direction and management of various officers. The dissolution of houses of this kind began so early as 1312, when the Templars were suppressed; and in 1323 their lands, churches, advowsons, and liberties, in England, were given by 17 Ed. II. st. 3. to the prior and brethren of the hospital of St John at Jerusalem. In the years 1390, 1437, 1441, 1459, 1497, 1505, 1508, and 1515, several other houses were dissolved, and their revenues settled on different colleges in Oxford and Cambridge. Soon after the last period, Cardinal Wolsey, by licence of the king and pope, obtained a dissolution of above 30 religious houses for the founding and endowing his colleges at Oxford and Ipswich. About the same time a bull was granted by the same pope to Cardinal Wolsey to suppress monasteries, where there were not above six monks, to the value of 8000 ducats a-year, for endowing Windsor and King's College in Cambridge; and two other bulls were granted to Cardinals Wolsey and Campeius, where there were less than twelve monks, and to annex them to the greater monasteries; and another bull to the same cardinals to inquire about abbeys to be suppressed in order to be made cathedrals. Although nothing appears to have been done in consequence of these bulls, the motive which induced Wolsey and many others to suppress these houses was the desire of promoting learning; and Archbishop Cranmer engaged in it with a view of carrying on the Reformation. There were other causes that concurred to bring on their ruin: many of the religious were loose and vicious; the monks were generally thought to be in their hearts attached to the pope's supremacy; their revenues were not employed according to the intent of the donors; many cheats in images, feigned miracles, and counterfeit relics, had been discovered, which brought the monks into disgrace; the Observant friars had opposed the king's divorce from Queen Catherine; and these circumstances operated, in concurrence with the king's want of a supply and the people's desire to save their money, to forward a motion in parliament, that in order to support the king's state and supply his wants, all the religious houses might be conferred upon the crown which were not able to spend above L. 200 a-year; and an act was passed for that purpose 27 Hen. VIII. c. 28. By this act about 380 houses were dissolved, and a revenue of L. 30,000 or L. 32,000 a-year came to the crown; besides about L. 100,000 in plate and jewels. The suppression of these houses occasioned discontent, and at length an open rebellion: when this was appeased, the king resolved to suppress the rest of the monasteries, and appointed a new visitation; which caused the greater abbeys to be surrendered apace; and it was enacted by 31 Hen. VIII. c. 13. that all monasteries, &c. which have been surrendered since the 4th of February, in the 27th year of his majesty's reign, and which hereafter shall be rendered, shall be vested in the king. The knights of St John of Jerusalem were also suppressed by the 32 Hen. VIII. c. 24. The suppression of these greater houses by these two acts produced a revenue to the king of above L. 100,000 a-year besides a large sum in plate and jewels. The last act of dissolution in this king's reign was the act of 37 Hen. VIII. c. 4. for dissolving colleges, free chapels, chantries, &c. which act was farther enforced by 1 Edward. VI. c. 14. By this act were suppressed 90 colleges, 110 hospitals, and 2374 chantries and free chapels. The number of houses and places suppressed from first to last, so far as any calculations appear to have been made, seems to be as follow:

Of lesser monasteries, of which we have the valuation, - - -	374
Of greater monasteries, - -	186
Belonging to the hospitallers, -	48
Colleges, - - - -	90
Hospitals, - - - -	110
Chantries and free chapels, -	2374
Total	3182

Besides the friars houses and those suppressed by Wolsey, and many small houses of which we have no particular account.

The sum total of the clear yearly revenue of the several houses at the time of their dissolution, of which we have any account, seems to be as follows:

Of the greater monasteries,	L.104,919	13	3½
Of all those of the lesser monasteries of which we have the valuation,	29,702	1	10½
Knights hospitallers head house in London, - -	2385	12	8
We have the valuation of only 28 of their houses in the country,	3026	9	5
Friars houses of which we have the valuation, - -	751	2	0¼
Total	L.140,784	19	3¼

If proper allowances are made for the lesser monasteries and houses not included in this estimate, and for the plate, &c. which came into the hands of the king by the dissolution, and for the value of money at that time, which was at least six times as much as at present, and also consider that the estimate of the lands was generally supposed to be much under the real worth, we must conclude their whole revenues to have been immense.

It does not appear that any computation hath been made of the number of persons contained in the religious houses.

Those of the lesser monasteries dissolved by 27 Hen. VIII. were reckoned at about	10,000
If we suppose the colleges and hospitals to have contained a proportionable number, these will make about - -	5347
If we reckon the number in the greater monasteries, according to the proportion of their revenues, they will be about 35,000; but as probably they had larger allowances in proportion to their number than those of the lesser monasteries, if we abate upon that account 5000, they will then be	30,000
One for each chantry and free chapel,	2374
Total	47,721

But as there were probably more than one person to officiate in several of the free chapels, and there were other houses which are not included within this calculation, perhaps they may be computed in one general estimate at about 50,000. As there were pensions paid to almost all those of the greater monasteries, the king did not immediately come into the full enjoyment of their whole revenues: however, by means of what he did receive, he founded six new bishoprics, viz. those of Westminster (which was changed by Queen Elisabeth into a deanery, with twelve prebends and a school), Peterborough, Chester, Gloucester, Bristol, and Oxford. And in eight other sees he founded deaneries and chapters, by converting the priors and monks into deans and prebendaries, viz. Canterbury, Winchester, Durham, Worcester, Rochester, Norwich, Ely, and Carlisle. He founded also the colleges of Christ-church in Oxford and Trinity in Cambridge, and finished King's college there. He likewise founded professorships of divinity, law, physic, and of the Hebrew and Greek tongues, in both the said universities. He gave the house of Grey-friars and St Bartholomew's hospital to the city of London, and a perpetual pension to the poor knights of Windsor, and laid out great sums in building and fortifying many ports in the channel. It is observable, upon the whole, that the dissolution of these houses was an act, not of the church, but of the state; in the period preceding the Reformation, by a king and parliament of the Roman catholic communion in all points except the king's supremacy; to which the pope himself, by his bulls and licences, had led the way.

MONASTIC, something belonging to monks, or the monkish life. The monastic profession is a kind of civil death, which in all worldly matters has the same effect with the natural death. The council of Trent, &c. fix sixteen years for the age at which a person may be admitted into the monastical state.

St Anthony is the person who, in the fourth century, first instituted the monastic life; as St Pachomius, in the same century, is said to have first set on foot the cœnobitic life, *i. e.* regular communities of religious. In a short time the desarts of Egypt became inhabited with a set of solitaries, who took upon them the monastic profession. St Basil carried the monkish humour into the east, where he composed a rule which afterwards obtained through a great part of the west.

In the 11th century the monastic discipline was grown very remiss. St Odo first began to retrieve it in the monastery of Cluny: that monastery, by the conditions of its erection, was put under the immediate protection of the holy see; with a prohibition to all powers, both secular and ecclesiastical, to disturb the monks in the possession of their effects or the election of their abbot. In virtue hereof they pleaded an exemption from the jurisdiction of the bishop, and extended this privilege to all the houses dependent on Cluny. This made the first congregation of several houses under one chief immediately subject to the pope, so as to constitute one body, or, as they now call it, one *religious order*. Till then, each monastery was independent and subject to the bishop. See Monk.

MONCAON, or Monzon, a town of Portugal, in the province of Entre-Douro-de-Minho, with a strong castle. The Spaniards have several times attempted to take it, but in vain. W. Long. 8. 2. N. Lat. 41. 52.

MONCON, or Monzon, a strong town of Spain, in the kingdom of Arragon. It was taken by the French in 1642, but the Spaniards retook it the following year. It is seated at the confluence of the rivers Sosa and Cinca E. Long. 0. 19. N. Lat. 41. 43.

MONCRIF (François Augustin Paradis de), secretary

cretary to M. le comte de Clermont, reader to the queen, one of the 40 of the French academy, and a member of the academies of Nanci and Berlin, was born at Paris of respectable parents, A. D. 1687, and died there, Nov. 12. 1770, aged 83.

Avec des mœurs dignes de l'age d'or,
Il fut un ami sur, un auteur agréable ;
Il mourut vieux comme Nestor,
Mais il fut moins bavard et beaucoup plus amaible.

Such was Moncrif. He possessed an elegant mind, an engaging person, an unceasing desire to please, and a gentle, equable, and obliging temper. The advantage of reading in a very superior and interesting manner, of singing tender airs, and of composing agreeable couplets, soon procured him a great number of friends, and many of these of the first rank. He asked permission to accompany a celebrated minister who was banished in 1757; but though such disinterested attachment was highly admired, he was only allowed to go every year to express his gratitude to him in his retreat. He was never ashamed of the poverty of his relations, but assisted them and brought them forward by his influence at corut. He had been at first a fencing-master; and it is said that he foresaw he would be obliged to employ his sword in defence of his works. Most of them needed not this precaution. The principal are, 1. *Essai sur la necessité et sur les moyens de plaire*, in 12mo. This production is written in a lively ingenious manner, is full of excellent maxims, and has gone through many editions. In the present age, a greater share of argument would be expected; but the chief merit of the work is, that, unlike the productions of many moralists, it contains nothing which the author himself did not reduce to practice. He had made it his study to contribute to the delight and amusement of those respectable societies into which he was admitted. 2. *Les Ames rivales*, an agreeable little romance, in which there occur several ingenious observations on French manners; the *Abderites*, a comedy of but ordinary merit: *Poesies diverses*, full of delicacy (his *Romances* and his *Rajeunissement inutile* are particularly distinguished for smooth versification, elegant reflections, and pleasing narration); and some dissertations which display considerable wit and information. These pieces are to be found in the miscellaneous works of the author, published at Paris 1743, in 12mo. 3. Some little pieces of one act; which make part of different operas, called the *Fragmens*, *Zelindor*, *Ismene Almasis*, the *Genius tutelaires*, and the *Sibylle*. He was devoted to lyric poetry, and cultivated it with success. In this species of writing we have from his pen the *Empire de l'Amour*, a ballet; the *Tropheé ;* the *Ames reunis*, a ballet which was never acted; and *Erosine*, a heroic pastoral. 4. *L'Histoire des Chats*, a trifling performance, too severely censured at the time, and now almost wholly fallen into oblivion. This work gave the Comte d'Argenson an opportunity of being witty at the author's expence. When Voltaire retired into Prussia, Moncrif applied to the minister for the vacant place of historiographer: "*Historgraphe!* (said the Comte d'Argenson), vous voulez sans doute dire historiogriphe." His works were collected, in 1761, into 4 vols, 12mo.

MONDA, or Munda (anc. geog.), a river of Lusitania, running midway from east to west into the Atlantic, between the Durius and Tagus, and washing Conimbrica. Now the *Mondego*, a river of Portugal, which running by Coimbra, falls into the Atlantic, 30 miles below it.

MONDAY, the second day of the week, so called as being anciently sacred to the moon; *q. d.* moon-day.

MONDOVI, a considerable town of Italy, in Piedmont; with a citadel, university, and bishop's see. It is the largest and most populous town of Piedmont, and is seated in E. Long. 8. 15. N. Lat. 44. 23.

MONEMUGI, an empire in the south of Africa, has Zanguebar on the east, Monomotapa on the south, Motamba and Makoko on the west, and Abyssinia on the north and partly to the east, though its boundaries that way cannot be ascertained. It is divided into the kingdoms of Mujaco, Makoko or Anko, Gingiro, Cambate, Alaba, and Monemugi Proper. This last lies in the middle of the torrid zone, and about the equinoctial line south of Makoko, west of Zanguebar, north of Monomotopa, and east of Congo and of the northern parts of Monomotopa. To ascertain its extent, is too difficult a task, being a country so little frequented. The country known, abounds with gold, silver, copper mines, and elephants. The natives clothe themselves in silks and cottons, which they buy of strangers and wear collars of transparent amber-beads, brought them from Cambaya: which beads serve also instead of money; gold and silver being too common, and of little value among them.

Their monarch always endeavours to be at peace with the princes round about him, and to keep an open trade with Quitoa, Melinda, and Mombaza, on the east, and with Congo on the west; from all which places the black merchants resort thither for gold. The Portuguese merchants' report, that on the east side of Monemugi there is a great lake full of small islands, abounding with all sorts of fowl and cattle, and inhabited by negroes. They relate also, that on the main-land eastward they heard sometimes the ringing of bells, and that one could observe buildings very much like churches; and that from these parts came men of a brown and tawny complexion, who traded with those islanders, and with the people of Monemugi.

This country of Monemugi affords also abundance of palm-wine and oil, and such great plenty of honey, that above half of it is lost, the blacks not being able to consume it. The air is generally very unwholesome, and excessively hot, which is the reason why no Christians undertake to travel in this empire. De Lisle gives the division of this country as follows: The Maracates, the Messeguaries, the kingdom of the Buengas, the kingdom of Masti, and that of Maravi. But we are not acquainted with any particulars relating to these nations or kingdoms.

MONETARIUS, or Moneyer, a name which antiquaries and medalists give to those who struck the ancient coins or monies.

Many of the old Roman, &c. coins have the name of the *monetarius*, either written at length or at least the initial letters of it. See Medal.

MONEY, a piece of matter, commonly metal, to which public authority has affixed a certain value and weight to ſerve as a medium in commerce. See Coin, Commerce, and Medals; alſo the article Bank.

Money is uſually divided into *real* or *effective*, and *imaginary*, or *money of account*.

I. *Real Money*.

1. *Hiſtory of real Money*. Real money includes all coins, or ſpecies of gold, ſilver, copper, and the like; which have courſe in common, and do really exiſt. Such are guineas, piſtoles, pieces of eight, ducats, &c.

Real money, civilians obſerve, has three eſſential qualities, *viz.* matter, form, and weight or value.

For the matter, copper is that thought to have been firſt coined; afterwards ſilver; and laſtly gold, as being the moſt beautiful, ſcarce, cleanly, diviſible, and pure of all metals.

The degrees of goodneſs are expreſſed in gold by carats; and in ſilver by pennyweights, &c. For there are ſeveral reaſons for not coining them pure and without alloy, *viz.* the great loſs and expence in refining them, the neceſſity of hardening them to make them more durable, and the ſcarcity of gold and ſilver in moſt countries. See Alloy.

Among the ancient Britons, iron rings, or as ſome ſay, iron plates were uſed for money; among the Lacedemonians, iron bars quenched with vinegar, that they might not ſerve for any other uſe. Seneca obſerves, that there was anciently ſtamped money of leather, *corium forma publica impreſſum*. And the ſame thing was put in practice by Frederic II. at the ſiege of Milan; to ſay nothing of an old tradition among ourſelves, that in the confuſed times of the barons wars the like was done in England: but the Hollanders, we know, coined great quantities of paſteboard in the year 1574.

As to the form of money, it had been more various than the matter. Under this are comprehended the weight, figure, impreſſion, and value.

For the impreſſion, the Jews, though they deteſted images, yet ſtamped on the one ſide of their ſhekel the golden pot which had the manna, and on the other Aaron's rod. The Dardans ſtamped two cocks fighting. The Athenians ſtamped their coins with an owl, or an ox; whence the proverb on bribed lawyers, *Bos in lingua*. They of Ægina, with a tortoiſe; whence that other ſaying, *Virtutem et ſapientiam vincunt teſtudines*. Among the Romans, the monetarii ſometimes impreſſed the images of men that had been eminent in their families on the coins: but no living man's head was ever ſtamped on a Roman coin till after the fall of the commonwealth. From that time they bore the emperor's head on one ſide. From this time the practice of ſtamping the prince's image on coins has obtained among all civilized nations; the Turks and other Mahometans alone excepted, who, in deteſtation of images, inſcribe only the prince's name, with the year of the tranſmigration of their prophet.

As to the figure it is either round, as in Britain; multangular or irregular, as in Spain; ſquare, as in ſome parts of the Indies; or nearly globular, as in moſt of the reſt.

After the arrival of the Romans in Britain, the Britons imitated them, coining both gold and ſilver with the images of their kings ſtamped on them. When the Romans had ſubdued the kings of the Britons, they alſo ſuppreſſed their coins, and brought in their own; which were current there from the time of Claudius to that of Valentinian the younger, about the ſpace of 500 years.

Mr Camden obſerves, that the moſt ancient Engliſh coin he had known was that of Ethelbert king of Kent, the firſt Chriſtian king in the iſland: in whoſe time all money-accounts begin to paſs by the names of *pounds*, *ſhillings*, *pence*, and *mancuſes*. Pence ſeems borrowed from the Latin *pecunia*, or rather from *pendo*, on account of its juſt weight, which was about threepence Sterling. Theſe were coarſely ſtamped with the king's image on the one ſide, and either the mint-maſter's, or the city's where it was coined, on the other. Five of theſe pence made their ſhilling, probably ſo called from *ſcilingus*, which the Romans uſed for the fourth part of an ounce. Forty of theſe ſcillings made their pound: and 400 of theſe pounds were a legacy, or a portion for a king's daughter, as appears by the laſt will of king Alfred. By theſe names they tranſlated all ſums of money in their old Engliſh teſtament; talents by *pundes;* Judas's thirty pieces of ſilver by *thirtig ſcillinga;* tribute-money, by *penining;* the mite by *feorthling*.

But it muſt be obſerved, that they had no other real money, but pence only; the reſt being imaginary moneys, *i. e.* names of numbers or weights. Thirty of theſe pence made a mancus, which ſome take to be the ſame with a mark; manca, as appears by an old MS. was *quinta pars unciæ*. Theſe mancas or mancuſes were reckoned both in gold and ſilver. For in the year 680 we read that Ina king of the Weſt Saxons obliged the Kentiſhmen to buy their peace at the price of 30,000 mancas of gold. In the notes on King Canute's laws, we find this diſtinction, that *mancuſa* was as much as a mark of ſilver; and *manca* a ſquare piece of gold, valued at 30 pence.

The Danes introduced a way of reckoning money by ores, *per oras;* mentioned in Domeſday-book; but whether they were a ſeveral coin, or a certain ſum, does not plainly appear. This however, may be gathered from the Abbey-book of Burton, that 20 ores were equivalent to two marks. They had alſo a gold coin called *byzantine*, or *bezant*, as being coined at Conſtantinople, then called *Byzantium*. The value of which coin is not only now loſt, but was ſo entirely forgot even in the time of King Edward III. that whereas the biſhop of Norwich was fined a byzantine of gold to be paid the abbot of St Edmund's Bury for infringing his liberties (as it had been enacted by parliament in the time of the conqueror), no man then living could tell how much it was: ſo it was referred to the king to rate how much he ſhould pay. Which is the more unaccountable, becauſe but 100 years before, 200,000 bezants were exacted by the ſoldan for the ranſom of St Louis of France; which were then valued at 100,000 livres.

Though the coining of money be a ſpecial prerogative of the king, yet the ancient Saxon princes communicated it to their ſubjects; inſomuch that in every good town there was at leaſt one mint; but at London

Money.

don eight; at Canterbury four for the king, two for the archbishop, one for the abbot at Winchester, six at Rochester, at Hastings two, &c.

The Norman kings continued the same custom of coining only pence, with the prince's image on one side, and on the other the name of the city where it was coined, with a cross so deeply impressed, that it might be easily parted and broke into two halves, which, so broken, they called *halfpence;* or into four parts, which they called *fourthings* or *farthings*.

In the time of King Richard I. money coined in the east parts of Germany came in special request in England on account of its purity, and was called *easterling money*, as all the inhabitants of those parts were called *Easterlings*. And shortly after some of those people skilled in coining were sent for hither to bring the coin to perfection; which since has been called *sterling* for *Easterling*. See STERLING.

King Edward I. who first adjusted the measure of an ell by the length of his arm, herein imitating Charles the Great, was the first also who established a certain standard for the coin, which is expressed to this effect by Greg. Rockley, mayor of London, and mint-master.—"A pound of money containeth twelve ounces: in a pound there ought to be eleven ounces, two easterlings, and one farthing; the rest alloy. The said pound ought to weigh twenty shillings and three pence in account and weight. The ounce ought to weigh twenty pence, and a penny twenty-four grains and a half. Note, that eleven ounces two-pence Sterling ought to be of pure silver, called *leaf-silver;* and the minter must add of other weight seventeen-pence half-penny farthing, if the silver be so pure."

About the year 1320, the States of Europe first began to coin gold; and among the rest, King Edward III. The first pieces he coined were called *florences*, as being coined by Florentines; afterwards he coined nobles; then rose-nobles, current at 6s. and 8d. half-nobles called *half-pennies*, at 3 s. and 4d. of gold; and quarters at 20 d. called *farthings of gold*. The succeeding kings coined rose-nobles, and double rose-nobles, great sovereigns, and half Henry nobles, angels, and shillings.

King James I. coined units, double crowns, Britain crowns; then crowns, half-crowns, &c.

2. *Comparative value of Money and Commodities at different periods*. The English money, though the same names do by no means correspond with the same quantity of precious metal as formerly, has not changed so much as the money of most other countries. From the time of William the Conqueror, the proportion between the pound, the shilling, and the penny, seems to have been uniformly the same as at present.

Edward III. as already mentioned, was the first of the English Kings that coined any gold; and no copper was coined by authority before James I. These pieces were not called farthings, but *farthing tokens*, and all people were at liberty or take or refuse them. Before the time of Edward III. gold was exchanged, like any other commodity, by its weight; and before the time of James I. copper was stamped by any one person who chose to do it.

In the year 612 and 727, an ewe and lamb were rated at 1 s. Saxon money till a fortnight after Easter. Between the years 900 and 1000, two hydes of land, each containing about 120 acres, were sold for 100 shillings. In 1000, by King Ethelred's laws, a horse was rated at 30s. a mare, or a colt of a year old, at 20 s. a mule, or young ass, at 12 s. an ox at 30 s. a cow at 24 s. a swine at 8 d. a sheep at 1 s. In 1043, a quarter of wheat was sold for 60 d. Hence it is computed, that in the Saxon times there was ten times less money in proportion to commodities, than at present. Their nominal specie, therefore being about three times higher than ours, the price of every thing, according to our present language, must be reckoned thirty times cheaper than it is now.

In the reign of William the Conqueror, commodities were ten times cheaper than they are at present; from which we cannot help forming a very high idea of the wealth and power of that king: for his revenue was L. 400,000 per annum, every pound being equal to that weight of silver, consequently the whole may be estimated at L. 1,200,000 of the present computation; a sum which, considering the different value of money between that period and the present, was equivalent to L. 12,000,000 of modern estimation.

The most necessary commodities do not seem to have advanced their price from William the Conqueror to Richard I.

The price of corn in the reign of Henry III. was near half the mean prince in our times. Bishop Fleetwood has shown, that in the year 1240, which was in this reign, L. 4 : 13 : 9, was worth about L. 50 of our present money. About the latter end of this reign, Robert de Hay, rector of Souldern, agreed to receive 100 s. to purchase to himself and successor the annual rent of 5 s. in full compensation of an acre of corn.

Butchers meat, in the time of the great scarcity in the reign of Edward II. was, by a parliamentary ordinace, sold three times cheaper than our mean price at present; poultry somewhat lower, because being now considered as a delicacy, it has risen beyond its proportion. The mean price of corn at this period was half the present value, and the mean price of cattle one-eight.

In the next reign, which was that of Edward III. the most necessary commodities were in general about three or four times cheaper than they are at present. In those times, knights, who served on horseback in the army, had 2 s. a day, and a foot archer 6 d. which last would now be equal to a crown a day. This pay has continued nearly the same nominally (only that in the time of the commonwealth the pay of the horse was advanced to 2 s. 6d. and that of the foot to 1 s. though it was reduced again at the Restoration), but soldiers were proportionably of a better rank formerly.

In the time of Henry VI. corn was about half its present value, other commodities much cheaper. Bishop Fleetwood has determined, from a most accurate consideration of every circumstance, that L. 3 in this reign was equivalent to L. 28 or L. 30 now.

In the time of Henry VII. many commodities were three times as cheap here, and in all Europe, as they are at present, there having been a great increase of gold and silver in Europe since his time, occasioned by the discovery of America.

The

The commodities whose price has risen the most since before the time of Henry VII. are butchers meat, fowls, and fish, especially the latter. And the reason why corn was always much dearer in proportion to other eatables, according to their prices at present, is, that in early times agriculture was little understood. It required more labour and expence, and was more precarious, than it is at present. Indeed notwithstanding the high price of corn in the times we are speaking of, the raising of it so little answered the expence, that agriculture was almost universally quitted for grasing; which was more profitable, notwithstanding the low price of butchers meat. So that there was constant occasion for statutes to restrain grasing, and to promote agriculture; and no effectual remedy was found till the bounty upon the exportation of corn; since which, about ten times more corn has been raised in this country than before.

The price of corn in the time of James I. and consequently that of other necessaries of life, was not lower, but rather higher, than at present; wool is now two thirds of the value it was then; the finer manufactures having sunk in price by the progress of art and industry, notwithstanding the increase of money. Butchers meat was higher than at present. Prince Henry made an allowance of near 4d. per pound for all the beef and mutton used in his family. This may be true with respect to London; but the price of butchers meat in the country, which does not even now much exceed this price at a medium, has certainly greatly increased of late years, and particularly in the northern counties.

The prices of commodities are higher in England than in France; besides that the poor people of France live upon much less than the poor in England, and their armies are maintained at less expence. It is computed by Mr Hume, that a British army of 20,000 men is maintained at near as great an expence as 60,000 in France, and that the English fleet, in the war of 1741, required as much money to support it as all the Roman legions in the time of the emperors. However, all that we can conclude from this is, that money is much more plentiful in Europe at present than it was in the Roman empire.

In the 13th century the common interest which the Jews had for their money, Voltaire says, was 20 per cent. But with regard to this, we must consider the great contempt that nation was always held in, the large contributions they were frequently obliged to pay, the risk they run of never receiving the principal, the frequent confiscations of all their effects, and the violent persecutions to which they were exposed; in which circumstances it was impossible for them to lend money at all unless for most extravagant interest, and much disproportioned to its real value. Before the discovery of America and the plantation of the colonies, the interest of money was generally 12 per cent. all over Europe; and it has been growing gradually less since that time, till it is now generally about four or five.

When sums of money are said to be raised by a whole people, in order to form a just estimate of it we must take into consideration not only the quantity of the precious metal according to the standard of the coin, and the proportion of the quantity of coin to the commodities, but also the number and riches of the people who raise it; for populous and rich countries will much more easily raise any certain sum of money than one that is thinly inhabited, and chiefly by poor people. This circumstance greatly adds to our surprise at the vast sums of money raised by William the Conqueror, who had a revenue nearly in value equal to L.12,000,000 of our money (allowance being made for the standard of coin and the proportion it bore to commodities), from a country not near so populous or rich as England is at present. Indeed, the accounts historians give us of the revenues of this prince, and the treasure he left behind him, are barely credible.

II. *Imaginary Money* or *Money of account*, is that which has never existed, or at least which does not exist in real specie, but is a denomination invented or retained to facilitate the stating of accounts, by keeping them still on a fixed footing, not to be changed, like current coins, which the authority of the sovereign raises or lowers according to the exigencies of the state. Of which kind are pounds, livres, marks, maravedies, &c. See the annexed Table, where the fictitious money is distinguished by a dagger (†).

Moneys of Account among the Ancients.— 1. The Grecians reckoned their sums of money by *drachma*, *minæ*, and *talenta*. The drachma was equal to $7\frac{3}{4}$ d. Sterling; 100 drachmæ made the mina, equal to 3*l.* 4*s.* 7*d.* Sterling; 60 minæ made the talent, equal to 193*l.* 15*s.* Sterling; hence 100 talents mounted to 19,375*l.* Sterling. The mina and talentum, indeed, were different in different provinces: their proportions in Attic drachms are as follow. The Syrian mina contained 25 Attic drachms; the Ptolemaic $33\frac{1}{3}$; the Antiochic and Eubæan 100; the Babylonic 116; the greater Attic and Tyrian $133\frac{1}{3}$; the Æginean and Rhodian $166\frac{2}{3}$. The Syrian talent contained 15 Attic minæ; the Ptolemaic 20; the Antiochic 60; the Eubæan 60; the Babylonic 70; the greater Attic and Tyrian 80; the Æginean and Rhodian 100.

2. Roman moneys of account were the *sestertius* and *sestertium*. The sestertius was equal to 1*d.* $3\frac{3}{4}$*q.* Sterling. One thousand of these made the sestertium, equal to 8*l.* 1*s.* 5*d.* 2*q.* Sterling. One thousand of these sestertia made the decies sestertium (the adverb. *centies* being always understood) equal to 8072*l.* 18*s.* 4*d.* Sterling. The decies sestertium, they also called *decies centena millia nummum*. Centies sestertium, or centies HS, were equal to 80,729*l.* 3*s.* 4*d.* Millies HS to 807,291*l.* 13*s.* 4*d.* Millies centies HS to 888,020*l.* 16*s.* 8*d.*

Theory of Money.

1. *Of Artificial or Material Money.*

I. As far back as our accounts of the transactions of mankind reach, we find they had adopted the precious metals, that is, silver and gold, as the common measure of value, and as the adequate equivalent for every thing alienable.

The metals are admirably adapted for this purpose: they are perfectly homogeneous? when pure, their masses,

 masses, or bulks, are exactly in proportion to their weights: no physical difference can be found between two pounds of gold, or silver, let them be the production of the mines of Europe; Asia, Africa, or America; they are perfectly malleable, fusible, and suffer the most exact division which human art is capable to give them; they are capable of being mixed with one another, as well as with metals of a baser, that is, of a less homogeneous nature, such as copper; by this mixture they spread themselves uniformly through the whole mass of the composed lump, so that every atom of it becomes proportionally possessed of a share of this noble mixture; by which means the subdivision of the precious metals is rendered very extensive.

Their physical qualities are invariable; they lose nothing by keeping; they are solid and durable; and though their parts are separated by friction, like every other thing, yet still they are of the number of those which suffer least by it.

If money, therefore, can be made of any thing, that is, if the proportional value of things vendible can be measured by any thing material, it may be measured by the metals.

II. The two metals being pitched upon as the most proper substances for realising the ideal scale of money, those who undertake the operation of adjusting a standard, must constantly keep in their eye the nature and qualities of a scale, as well as the principles upon which it is formed.

The unit of the scale must constantly be the same, although realised in the metals, or the whole operation fails in the most essential part. This realising the unit is like adjusting a pair of compasses to a geometrical scale, where the smallest deviation from the exact opening once given must occasion an incorrect measure. The metals, therefore, are to money what a pair of compasses is to a geometrical scale.

This operation of adjusting the metals to the money of account implies an exact and determinate proportion of both metals to the money-unit, realised in all the species and denominations of coin, adjusted to that standard.

The smallest particle of either metal added to, or taken away from, any coins, which represent certain determinate parts of the scale, overturns the whole system of material money. And if, notwithstanding such variation, these coins continue to bear the same denominations as before, this will as effectually destroy their usefulness in measuring the value of things, as it would overturn the usefulness of a pair of compasses, to suffer the opening to vary, after it is adjusted to the scale representing feet, toises, miles or leagues, by which the distances upon the plan are to be measured.

III. Debasing the standard is a good term; because it conveys a clear and distinct idea. It is diminishing the weight of the pure metal contained in that denomination by which a nation reckons, and which we have called the *money unit*. Raising the standard requires no farther definition, being the direct contrary.

IV. Altering the standard (that is, raising or debasing the value of the money-unit) is like altering the national measures of weights. This is best discovered by comparing the thing altered with things of the same nature which have suffered no alteration. Thus, if the foot of measure was altered at once over all England, by adding to it, or taking from it, any proportional part, of its standard length, the alteration would be best discovered by comparing the new foot with that of Paris, or of any other country, which had suffered no alteration. Just so, if the pound Sterling, which is the English unit, shall be found any how changed, and if the variation it has met with be difficult to ascertain because of a complication of circumstances, the best way to discover it, will be to compare the former and the present value of it with the money of other nations which has suffered no variation. This the course of exchange will perform with the greatest exactness.

V. Artists pretend, that the precious metals, when absolutely pure from any mixture, are not of sufficient hardness to constitute a solid and lasting coin. They are found also in the mints mixed with other metals of a baser nature; and the bringing them to a state of perfect purity occasions an unnecessary expence. To avoid, therefore, the inconvenience of employing them in all their purity, people have adopted the expedient of mixing them with a determinate proportion of other metals, which hurts neither their fusibility, malleability, beauty, or lustre. This metal is called *alloy*; and, being considered only as a support to the principal metal, is accounted of no value in itself. So that eleven ounces of gold, when mixed with one ounce of silver acquires, by that addition no augmentation of value whatever.

This being the case, we shall, as much as possible, overlook the existence of alloy, in speaking of money in order to render language less subject to ambiguity.

2. *Incapacities of the Metals to perform the office of an invariable Measure of Value.*

I. Were there but one species of such a substance as we have represented gold and silver to be; were there but one metal possessing the qualities of purity, divisibility, and durability; the inconveniences in the use of it for money would be fewer by far than they are found to be as matters stand.

Such a metal might then, by an unlimited division into parts exactly equal, be made to serve as a tolerably steady and universal measure. But the rivalship between the metals, and the perfect equality which is found between all their physical qualities, so far as regards purity and divisibility, render them so equally well adapted to serve as the common measure of value, that they are universally admitted to pass current as money.

What is the consequence of this? that the one measures the value of the other, as well as that of every other thing. Now the moment any measure begins to be measured by another, whose proportion to it is not physically, perpetually, and invariably the same, all the usefulness of such a measure is lost. An example will make this plain.

A foot of measure is a determinate length. An English foot may be compared with the Paris foot, or with that of the Rhine; that is to say, it may be measured by them; and the proportion between their lengths

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lengths may be expressed in numbers; which proportion will be the same perpetually. The measuring the one by the other will occasion no uncertainty; and we may speak of length by Paris feet, and be perfectly well understood by others who are used to measure by the English foot, or by the foot of the Rhine.

But suppose that a youth of 12 years old takes it into his head to measure from time to time, as he advances in age, by the length of his own foot, and that he divides this growing foot into inches and decimals: what can be learned from his account of measures? As he increases in years, his foot, inches, and subdivisions, will be gradually lengthening; and were every man to follow his example, and measure by his own foot, then the foot of a measure now established would totally cease to be of any utility.

This is just the case with the two metals. There is no determinate invariable proportion between their value; and the consequence of this is, that when they are both taken for measuring the value of other things, the things to be measured, like lengths to be measured by the young man's foot, without changing their relative proportion between themselves, change, however, with respect to the denominations of both their measures. An example will make this plain.

Let us suppose an ox to be worth 3000 pounds weight of wheat, and the one and the other to be worth an ounce of gold, and an ounce of gold to be worth exactly 15 ounces of silver: if the case should happen, that the proportional value between gold and silver should come to be as 14 is to one, would not the ox, and consequently the wheat, be estimated at less in silver, and more in gold, than formerly? Farther, would it be in the power of any state to prevent this variation in the measure of the value of oxen and wheat, without putting into the unit of their money less silver and more gold than formerly?

If therefore any particular state should fix the standard of the unit of their money to one species of the metals, while in fact both the one and the other are actually employed in measuring value; does not such a state resemble the young man who measures all by his growing foot? For if silver, for example, be retained as the standard, while it is gaining upon gold one fifteenth additional value; and if gold continue all the while to determine the value of things as well as silver; it is plain, that, to all intents and purposes, this silver measure is lengthening daily like the young man's foot, since the same weight of it must become every day equivalent to more and more of the same commodity; notwithstanding that we suppose the same proportion to subsist, without the least variation, between that commodity and every other species of things alienable.

Buying and selling are purely conventional, and no man is obliged to give his merchandise at what may be supposed to be the proportion of its worth. The use, therefore, of an universal measure, is to mark, not only the relative value of the things to which it is applied as a measure, but to discover in an instant the proportion between the value of those, and of every other commodity valued by a determinate measure in all the countries of the world.

Were pounds Sterling, livres, florins, piastres, &c. which are all money of account, invariable in their values, what a facility would it produce in all conversions, what an assistance to trade! But as they are all limited or fixed to coins, and consequently vary from time to time, this example shows the utility of the invariable measure which we have described

There is another circumstance which incapacitates the metals from performing the office of money; the substance of which the coin is made, is a commodity which rises and sinks in its value with respect to other commodities, according to the wants, competition, and caprices of mankind. The advantage, therefore, found in putting an intrinsic value into that substance which performs the function of money of account, is compensated by the instability of that intrinsic value; and the advantage obtained by the stability of paper, or symbolical money, is compensated by the defect it commonly has of not being at all times susceptible of realization into solid property or intrinsic value.

In order, therefore, to render material money more perfect, this quality of metal, that is, of a commodity, should be taken from it; and in order to render paper-money more perfect, it ought to be made to circulate upon metallic or land-security.

II. There are several smaller inconveniences accompanying the use of the metals, which we shall here shortly enumerate.

1mo, No money made of gold or silver can circulate long, without losing its weight, although it all along preserves the same denomination. This represents the contracting a pair of compasses which had been rightly adjusted to the scale.

2do, Another inconvenience proceeds from the fabrication of money. Supposing the faith of princes who coin money to be inviolable, and the probity as well as capacity of those to whom they commit the inspection of the business of the metals to be sufficient, it is hardly possible for workmen to render every piece exactly of a proper weight, or to preserve the due proportion betweeen pieces of different denominations; that is to say, to make every ten sixpences exactly of the same weight with every crown-piece and every five shillings struck in a coinage. In proportion to such inaccuracies, the parts of the scale become unequal.

3tio, Another inconvenience, and far from being inconsiderable, flows from the expence requisite for the coining of money. This expence adds to its value as a manufacture, without adding any thing to its weight.

4to, The last inconvenience is, that by fixing the money of account entirely to the coin, without having any independent common measure, to mark and control these deviations from mathematical exactness, (which are either inseparable from the metals themselves, or from the fabrication of them), the whole measure of value, and all the relative interests of debtors and creditors, become at the disposal not only of workmen in the mint, of Jews who deal in money, of clippers and washers in coin; but they are also entirely at the mercy of princes, who have the right of coinage, and who have frequently also the right of

raising

raising or debasing the standard of the coin, according as they find it most for their present and temporary interest.

3. *Methods which may be proposed for lessening the several Inconveniences to which material money is liable.*

The inconveniences from the variation in the relative value of the metals to one another, may in some measure be obviated by the following expedients.

1mo, By considering one only as the standard, and leaving the other to seek its own value like any other commodity.

2do, By considering one only as the standard, and fixing the value of the other from time to time by authority, according as the market-price of the metals shall vary.

3tio, By fixing the standard of the unit according to the mean proportion of the metals, attaching it to neither; regulating the coin accordingly; and upon every considerable variation in the proportion between them, either to make a new coinage, or to raise the denomination of one of the species, and lower it in the other, in order to preserve the unit exactly in the mean proportion between the gold and silver.

4to, To have two units and two standards, one of gold and one of silver, and to allow every body to stipulate in either.

5to, Or last of all, to oblige all debtors to pay one half in gold, and one half in the silver standard.

4. *Variations to which the Value of the Money-unit is exposed from every Disorder in the Coin.*

Let us suppose, at present, the only disorder to consist in a want of the due proportion between the gold and silver in the coin.

This proportion can only be established by the market-price of the metals; because an augmentation and rise in the demand for gold or silver has the effect of augmenting the value of the metal demanded. Let us suppose, that to-day one pound of gold may buy fifteen pounds of silver: If to-morrow there be a high demand for silver, a competition among merchants to have silver for gold will ensue: they will contend who shall get the silver at the rate of 15 pounds for one of gold: this will raise the price of it; and in proportion to their views of profit, some will accept of less than the 15 pounds. This is plainly a rise in the silver more properly than a fall in the gold; because it is the competition for the silver which has occasioned the variation in the former proportion between the metals.

Let us now suppose, that a state, having with great exactness examined the proportion of the metals in the market, and having determined the precise quantity of each for realising or representing the money-unit, shall execute a most exact coinage of gold and silver coin. As long as that proportion continues unvaried in the market, no inconvenience can result from that quarter in making use of metals for money of account.

But let us suppose the proportion to change; that the silver, for example, shall rise in its value with regard to gold: will it not follow, from that moment, that the unit realized in the silver, will become of more value than the unit realized in the gold-coin?

But as the law has ordered them to pass as equivalents for one another, and as debtors have always the option of paying in what legal coin they think fit, will they not choose to pay in gold? and will not then the silver coin be melted down or exported, in order to be sold as bullion, above the value it bears when it circulates in coin? Will not this paying in gold also really diminish the value of the money-unit, since upon this variation every thing must sell for more gold than before, as we have already observed.

Consequently, merchandise, which have not varied in their relative value to any other thing but to gold and silver, must be measured by the mean proportion of the metals; and the application of any other measure to them is altering the standard. If they are measured by the gold, the standard is debased; if by silver, it is raised.

If, to prevent the inconvenience of melting down the silver, the state shall give up affixing the value of their unit to both species at once, and shall fix it to one, leaving the other to seek its price as any other commodity; in that case, no doubt, the melting down of the coin will be prevented; but will this ever restore the value of the money-unit to its former standard? Would it, for example, in the foregoing supposition, raise the debased value of the money-unit in the gold coin, if that species were declared to be the standard? It would indeed render silver coin purely a merchandise, and, by allowing it to seek its value, would certainly prevent it from being melted down as before; because the pieces would rise conventionally in their denomination; or an *agio*, as it is called, would be taken in payments made in silver: but the gold would not, on that account, rise in its value, or begin to purchase any more merchandise than before. Were therefore the standard fixed to the gold, would not this be an arbitrary and a violent revolution in the value of the money-unit, and a debasement of the standard?

If, on the other hand, the state should fix the standard to the silver, which we suppose to have risen in its value, would that ever sink the advanced value which the silver coin had gained above the worth of the former standard unit? and would not this be a violent and an arbitrary revolution in the value of the money-unit, and a raising of the standard?

The only expedient, therefore, is, in such a case, to fix the numerary unit to neither of the metals, but to contrive a way to make it fluctuate in a mean proportion between them; which is in effect the introduction of a pure ideal money of account.

The regulation of fixing the unit by the mean proportion, ought to take place at the instant the standard unit is fixed with exactness both to the gold and silver. If it be introduced long after the market-proportion between the metals has deviated from the proportion established in the coin; and if the new regulation is made to have a retrospect, with regard to the acquitting of permanent contracts entered into while the value of the money-unit had attached itself to the lowest currency in consequence of the principle above laid

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This is clear from the former reafoning. The moment the market price of the metals differs from that in the coin, every one who has payments to make, pays in that fpecies which is the higheft rated in the coin; confequently, he who lends, lends in that fpecies. If after the contract, therefore, the unit is carried up to the mean proportion, this muft be a lofs to him who had borrowed.

From this we may perceive, why there is lefs inconvenience from the varying of the proportion of the metals, where the ftandard is fixed to one of them, than when it is fixed to both. In the firft cafe, it is at leaft uncertain whether the ftandard or the merchandife fpecies is to rife; confequently is is uncertain whether the debtors or the creditors are to gain by a variation. If the ftandard fpecies fhould rife, the creditors will gain; if the merchandife fpecies rifes, the debtors will gain; but when the unit is attached to both fpecies, then the creditors never can gain, let the metals vary as they will; if filver rifes, then debtors will pay in gold; if gold rifes, the debtors will pay in filver. But whether the unit be attached to one or to both fpecies, the infallible confequence of a variation is, that one half of the difference is either gained or loft by debtors and creditors. The invariable unit is conftantly the mean proportional between the two meafures.

5. *How the Variations of the intrinfic Value of the Unit of Money muft affect all the domeftic Intereft of a Nation.*

If the changing the content of the bufhel by which grain is meafured, would affect the intereft of thofe who are obliged to pay, or who are entitled to receive a certain number of bufhels of grain for the rent of lands; in the fame manner muft every variation in the value of the unit of account affect all perfons who, in permanent contracts, are obliged to make payments, or who are obliged to receive fums of money ftipulated in multiples or in fractions of that money-unit.

Every variation, therefore, upon the intrinfic value of the money-unit, has the effect of benefiting the clafs of creditors at the expence of debtors, or *vice verfa*.

This confequence is deduced from an obvious principle. Money is more or lefs valuable in proportion as it can purchafe more or lefs of every kind of merchandife. Now, without entering anew into the caufes of the rife and fall of prices, it is agreed upon all hands, that whether an augmentation of the general mafs of money in circulation has the effect of raifing prices in general, or not, any augmentation of the quantity of the metals appointed to be put into the money-unit, muft at leaft affect the value of that money-unit, and make it purchafe more of any commodity than before: that is to fay, 113 grains of fine gold, the prefent weight of a pound Sterling in gold, can buy 113 pounds of flour; were the pound Sterling raifed to 114 grains of the fame metal, it would buy 114 pounds of flour; confequently, were the pound Sterling augmented by one grain of gold, every miller who paid a rent of ten pounds a-year, would be obliged to fell 1140 pounds of his flour, in order to procure ten pounds to pay his rent, in place of 1130 pounds of flour, which he fold formerly to procure the fame fum; confequently, by this innovation, the miller muft lofe yearly ten pounds of flour, which his mafter confequently muft gain. From this example, it is plain that every augmentation of metals put into the pound Sterling, either of filver or gold, muft imply an advantage to the whole clafs of creditors who are paid in pounds Sterling, and confequently muft be a proportional lofs to all debtors who muft pay by the fame denomination.

6. *Of the Diforder in the Britifh Coin, fo far as it occafions the melting down or the exporting of the Specie.*

The defects in the Britifh coin are three.

1mo, The proportion between the gold and filver is found to be as 1 to 15 $\frac{2}{10}$, whereas the market price may be fuppofed to be nearly as 1 to 14$\frac{1}{2}$.

2do, Great part of the current money is worn and light.

3tio, from the fecond defect proceeds the third, to wit, that there are feveral currencies in circulation which pafs for the fame value, without being of the fame weight.

4to, From all thefe defects refults the laft and greateft inconvenience, to wit, that fome innovation muft be made, in order to fet matters on a right footing.

The Englifh, befides the unit of their money which they call the pound Sterling, have alfo the unit of their weight for weighing the precious metals.

This is called the *pound troy*, and confifts of 12 ounces, every ounce of 20 penny-weights, and every penny-weight of 24 grains. The pound troy, therefore, confifts of 240 penny-weights and 5760 grains.

The finenefs of the filver is reckoned by the number of ounces and penny-weights of the pure metal in the pound troy of the compofed mafs; or, in other words, the pound troy, which contains 5760 grains of ftandard filver, contains 5328 grains of fine filver, and 432 grains of copper, called *alloy*.

Thus ftandard filver is 11 ounces 2 penny-weights of fine filver in the pound troy to 18 penny-weights copper, or 111 parts fine filver to 9 parts alloy.

Standard gold is 11 ounces fine to 1 ounce filver or copper employed for alloy, which together make the pound troy; confequently, the pound troy of ftandard gold contains 5280 grains fine, and 480 grains alloy, which alloy is reckoned of no value.

This pound of ftandard filver is ordered, by ftatute of the 43d of Elizabeth, to be coined into 62 fhillings, 20 of which make the pound fterling; confequently the 20 fhillings contain 1718.7 grains of fine filver, and 1858.06 ftandard filver.

The pound troy of ftandard gold, $\frac{11}{12}$ fine, is ordered, by an act of king Charles II. to be cut into 44$\frac{1}{2}$ guineas; that is to fay, every guinea contains 129.43 grains of ftandard gold, and 118.644 of fine gold; and

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and the pound Sterling, which is $\frac{20}{21}$ of the guinea, contains 112.994, which we may state at 113 grains of fine gold.

The coinage in England is entirely defrayed at the expence of the state. The mint price for the metals is the very same with the price of the coin. Whoever carries to the mint an ounce of standard silver, receives for it in silver coin 5 *s.* 2 d, or 62 *d.*: whoever carries an ounce of standard gold receives in gold coin 3*l.* 17*s.* 10$\frac{1}{2}$*d.* the one and the other making exactly an ounce of the same fineness with the bullion. Coin, therefore, can have no value in the market above bullion; consequently, no loss can be incurred by those who melt it down.

When the guinea was first struck, the government (not inclining to fix the pound Sterling to the gold coin of the nation) fixed the guinea at 20 shillings, (which was then below its proportion to the silver), leaving it to seek its own price above that value, according to the course of the market.

By this regulation no harm was done to the English silver standard; because the guinea, or 118.644 grains fine gold being worth more, at that time, than 20 shillings, or 1718.7 grains fine silver, no debtor would pay with gold at its standard value; and whatever it was received for above that price was purely conventional.

Accordingly guineas sought their own price until the year 1728, then they were fixed a new, not below their value as at first, but at what was then reckoned their exact value, according to the proportion of the metals, *viz.* at 21 shillings; and at this they were ordered to pass current in all payments.

This operation had the effect of making the gold a standard as well as the silver. Debtors then paid indifferently in gold as well as in silver, because both were supposed to be of the same intrinsic as well as current value; in which case no inconvenience could follow upon this regulation. But in time silver came to be more demanded: the making of plate began to prevail more than formerly, and the exportation of silver to the East Indies increasing yearly, made the demand for it greater, or perhaps brought its quantity to be proportionably less than before. This changed the proportion of the metals; and by slow degrees they have come from that of 1 to 15.2 (the proportion they were supposed to have when the guineas were fixed and made a lawful money at 21 shillings) to that of 14.5, the present *supposed* proportion.

The consequence of this has been, that the same guinea which was worth 1804.6 grains fine silver, at the time it was fixed at 21 s. is now worth no more than 1719.9 grains of fine silver according to the proportion of 14$\frac{1}{2}$ to 1.

Consequently debtors, who have always the option of the legal species in paying their debts, will pay pounds sterling no more in silver but in gold; and as the gold pounds they pay in are not intrinsically worth the silver pounds they paid in formerly according to the statute of Elisabeth, it follows that the pound Sterling in silver is really no more the standard, since nobody will pay at that rate, and since nobody can be compelled to do it.

Besides this want of proportion between the metals, the silver coined before the reign of George I. is now become light by circulation; and the guineas coined by all the princes since Charles II. pass by tale, though many of them are considerably diminished in their weight.

Let us now examine what profit the want of proportion and the want of weight in the coin can afford to the money-jobbers in melting it down or exporting it.

Did every body consider coin only as the measure for reckoning value, without attending to its value as a metal, the deviations of gold and silver coin from perfect exactness, either as to proportion or weight, would occasion little inconvenience.

Great numbers, indeed, in every modern society, consider coin in no other light than that of money of account; and have great difficulty to comprehend what difference any one can find between a light shilling and a heavy one, or what inconvenience there can possibly result from a guinea's being some grains of fine gold too light to be worth 21 shillings standard weight. And did every one think in the same way, there would be no occasion for coin of the precious metals at all; leather, copper, iron, or paper, would keep the reckoning as well as gold and silver.

But although there be many who look no farther than at the stamp on the coin, there are others whose sole business it is to examine its intrinsic worth as a commodity, and to profit of every irregularity in the weight and proportion of metals.

By the very institution of coinage, it is implied, that every piece of the same metal, and same denomination with regard to the money-unit, shall pass current for the same value.

It is, therefore, the employment of money-jobbers, to examine, with a scrupulous exactness, the precise weight of every piece of coin which comes into their hands.

The first object of their attention is, the price of the metals in the market: a jobber finds, at present, that with 14.5 pounds of fine silver bullion, he can buy one pound of fine gold bullion.

He therefore buys up with gold coin all the new silver as fast as it is coined, of which he can get at the rate of 15.2 pounds for one in gold; these 15.2 pounds silver coin he melts down into bullion, and converts that back into gold bullion, giving at the rate of only 14.5 pounds for one.

By this operation he remains with the value of $\frac{7}{10}$ of one pound weight of silver bullion clear profit upon the 15$\frac{1}{5}$ pounds he bought; which $\frac{7}{10}$ is really lost by the man who inadvertently coined silver at the mint, and gave it to the money-jobber for his gold. Thus the state loses the expence of the coinage, and the public the convenience of change for their guineas.

But here it may be asked, Why should the money-jobber melt down the silver coin? can he not buy gold with it as well without melting it down? He cannot; because when it is in coin he cannot avail himself of its being new and weighty. Coin goes by tale, not by weight; therefore, were he to come to market with his new silver coin, gold bullion being sold at the mint price, we shall suppose, viz. at 3*l.* 17*s.* 10$\frac{1}{2}$*d.* Sterling money *per* ounce, he would be obliged to pay the price of what he brought with heavy money, which he can equally do with light.

He therefore melts down the new silver coin, and sells

ſells it for bullion, at ſo many pence an ounce; the price of which bullion is, in the Engliſh market, always above the price of ſilver at the mint, for the reaſons now to be given.

When you ſell ſtandard-ſilver bullion at the mint, you are to be paid in weighty money: that is, you receive for your bullion the very ſame weight in ſtandard coin; the coinage coſt nothing; but when you ſell bullion in the market, you are paid in worn out ſilver, in gold, in bank-notes, in ſhort, in every ſpecies of lawful current money. Now all theſe payments have ſome defect: the ſilver you are paid with is worn and light; the gold you are paid with is overrated, and perhaps alſo light; and the bank-notes muſt have the ſame value with the ſpecie with which the bank pays them; that is, with light ſilver or overrated gold.

It is for theſe reaſons, that ſilver bullion, which is bought by the mint at *5s. 2d. per* ounce of heavy ſilver money, may be bought at market at 65 pence the ounce in light ſilver, over-rated gold, or bank-notes, which is the ſame thing.

Further, we have ſeen how the impoſition of coinage has the effect of raiſing coin above the value of bullion, by adding a value to it which it had not as a metal.

Juſt ſo, when the unit is once affixed to certain determined quantities of both metals, if one of the metals ſhould afterwards riſe in value in the market, the coin made of that metal muſt loſe a part of its value as coin, although it retains it as a metal. Conſequently, as in the firſt caſe it acquired an additional value by being coined, it muſt now acquire an additional value by being melted down. From this we may conclude, that when the ſtandard is affixed to both the metals in the coin, and when the proportion of that value is not made to follow the price of the market, that ſpecies which riſes in the market is melted down, and the bullion is ſold for a price as much exceeding the mint price as the metal has riſen in its value.

If, therefore, in England, the price of ſilver bullion is found to be at 65 pence the ounce, while at the mint it is rated at 62; this proves that ſilver has riſen $\frac{3}{65}$ above the proportion obſerved in the coin, and that all coin of ſtandard weight may conſequently be melted down with a profit of $\frac{3}{65}$. But as there are ſeveral other circumſtances to be attended to which regulate and influence the price of bullion, we ſhall here paſs them in review, the better to diſcover the nature of this diſorder in the Engliſh coin, and the advantages which money-jobbers may draw from it.

The price of bullion, like that of every other merchandiſe, is regulated by the value of the money it is paid with.

If bullion, therefore, ſells in England for 65 pence an ounce, paid in ſilver coin, it muſt ſell for 65 ſhillings the pound troy: that is to ſay, the ſhillings it is commonly paid with do not exceed the weight of $\frac{1}{65}$ of a pound troy; for if the 65 ſhillings with which the pound of bullion is paid weighed more than a pound troy, it would be a ſhorter and better way for him who wants bullion to melt down the ſhillings and make uſe of the metal, than to go to market with them in order to get leſs.

We may, therefore, be very certain, that no man will buy ſilver bullion at 65 pence an ounce, with any ſhilling which weighs above $\frac{1}{65}$ of a pound troy.

We have gone upon the ſuppoſition that the ordinary price of bullion in the Engliſh market is 65 pence *per* ounce. This has been done upon the authority of ſome late writers on this ſubject: it is now proper to point out the cauſes which may make it deviate from that value.

I. It may vary, and certainly will vary, in the price, according as the currency is better or worſe, When the expences of a war, or a wrong balance of trade, have carried off a great many heavy guineas, it is natural that bullion ſhould riſe; becauſe then it will be paid for more commonly in light gold and ſilver; that is to ſay, with pounds Sterling, below the value of 113 grains fine gold, the worth of the pound Sterling in new guineas.

II. This wrong balance of trade, or a demand for bullion abroad, becoming very great, may occaſion a ſcarcity of the metals in the market, as well as a ſcarcity of the coin; conſequently, an advanced price muſt be given for it in proportion to the greatneſs and height of the demand. In this caſe, both the ſpecie and the bullion muſt be bought with paper. But the riſe in the price of bullion proceeds from the demand for the metals and the competition between merchants to procure them, and not becauſe the paper given as the price is at all of inferior value to the ſpecie. The leaſt diſcredit of this kind would not tend to diminiſh the value of the paper: it would annihilate it at once. Therefore, ſince the metals muſt be had, and that the paper cannot ſupply the want of them when they are to be exported, the price riſes in proportion to the difficulties in finding metals elſewhere than in the Engliſh market.

III. A ſudden call for bullion, for the making of plate. A goldſmith can well afford to give 67 pence for an ounce of ſilver, that is to ſay, he can afford to give one pound of gold for 14 pounds of ſilver, and perhaps for leſs, notwithſtanding that what he gives be more than the ordinary proportion between the metals, becauſe he indemnifies himſelf amply by the price of his workmanſhip; juſt as a tavern-keeper will pay any price for a fine fiſh, becauſe, like the goldſmith, he buys for other people.

IV. The mint price has as great an effect in bringing down the price of bullion, as exchange has in raiſing it. In countries where the metals in the coin are juſtly proportioned, where all the currencies are of legal weight, and where coinage is impoſed, the operations of trade make the price of bullion conſtantly to fluctuate between the value of the coin and the mint price of the metals.

Now let us ſuppoſe that the current price of ſilver bullion in the market is 65 pence the ounce, paid in lawful money, no matter of what weight or of what metal. Upon this the money-jobber falls to work. All ſhillings which are above $\frac{1}{65}$ of a pound troy, he throws into his melting-pot, and ſells them as bullion for 65d. per ounce; all thoſe which are below that weight he carries to market, and buys bullion with them at 65d. per ounce.

What is the conſequence of this?

That thoſe who ſell the bullion, finding the ſhillings which the money-jobber pays with perhaps not above

$\frac{1}{66}$ of

$\frac{1}{66}$ of a pound troy, they on their ſide raiſe the price of their bullion to 66d. the ounce.

This makes new work for the money-jobber; for he muſt always gain. He now weighs all ſhillings as they come to hand; and as formerly he threw into his melting-pot thoſe only which were worth more than $\frac{1}{65}$ of a pound troy, he now throws in all that are in value above $\frac{1}{66}$. He then ſells the melted ſhillings at 66d. the ounce, and buys bullion with the light ones at the ſame price.

This is the conſequence of ever permitting any ſpecies of coin to paſs by the authority of the ſtamp, without controlling it at the ſame time by the weight: and this is the manner in which money jobbers gain by the currency of light money.

It is no argument againſt this expoſition of the matter to ſay, that ſilver bullion is ſeldom bought with ſilver coin; becauſe the pence in new guineas are worth no more than the pence of ſhillings of 65 in the pound troy: that is to ſay, that 240 pence contained in $\frac{20}{21}$ of a new guinea, and 240 pence contained in 28 ſhillings of 65 to the pound troy, differ no more on the intrinſic value than 0.83 of a grain of fine ſilver upon the whole, which is a mere trifle.

Whenever, therefore, ſhillings come below the weight of $\frac{1}{65}$ of a pound troy, then there is an advantage in changing them for new guineas; and when that is the caſe, the new guineas will be melted down, and profit will be found in ſelling them for bullion, upon the principles we have juſt been explaining.

We have already given a ſpecimen of the domeſtic operations of the money-jobbers; but theſe are not the moſt prejudicial to national concerns. The jobbers may be ſuppoſed to be Engliſhmen; and in that caſe the profit they make remains at home: but whenever there is a call for bullion to pay the balance of trade, it is evident that this will be paid in ſilver coin; never in gold, if heavy ſilver can be got; and this again carries away the ſilver coin, and renders it at home ſo rare, that great inconveniences are found for want of the leſſer denominations of it. The loſs however here is confined to an inconvenience; becauſe the balance of trade being a debt which muſt be paid, we do not conſider the exportation of the ſilver for that purpoſe as any conſequence of the diſorder of the coin. But beſides this exportation which is neceſſary, there are others which are arbitrary, and which are made only with a view to profit of the wrong proportion.

When the money-jobbers find difficulty in carrying on the traffic we have deſcribed, in the Engliſh market, becauſe of the competition among themſelves, they carry the ſilver coin of the country, and ſell it abroad for gold, upon the ſame principles that the Eaſt India company ſend ſilver to China in order to purchaſe gold.

It may be demanded, What hurt this trade can do to Britain, ſince thoſe who export ſilver bring back the ſame value in gold? Were this trade carried on by natives, there would be no loſs; becauſe they would bring home gold for the whole intrinſic value of the ſilver. But if we ſuppoſe foreigners ſending over gold to be coined at the Engliſh mint, and changing the gold into Engliſh ſilver coin, and then carrying off this coin, it is plain that they muſt gain the difference, as well as the money-jobbers. But it may be anſwered, That having given gold for ſilver at the rate of the mint, they have given value for what they have received. Very right; but ſo did Sir Hans Sloane, when he paid five guineas for an overgrown toad: he got value for his money: but it was value only to himſelf. Juſt ſo, whenever the Engliſh government ſhall be obliged to reſtore the proportion of the metals (as they muſt do), this operation will annihilate that imaginary value which they have hitherto ſet upon gold; which imagination is the only thing which renders the exchange of their ſilver againſt the foreign gold equal.

But it is farther objected, that foreigners cannot carry off the heavy ſilver; becauſe there is none to carry off. Very true; but then they have carried off a great quantity already; or if the Engliſh Jews have been too ſharp to allow ſuch a profit to fall to ſtrangers, (which may or may not have been the caſe), then this diſorder is an effectual ſtop to any more coinage of ſilver for circulation.

7. *Of the diſorder in the Britiſh Coin, ſo far as it affects the Value of the Pound Sterling Currency.*

From what has been ſaid, it is evident, that there muſt be found in England two legal pounds Sterling of different values; the one worth 113 grains of fine gold, the other worth 1718.7 grains of fine ſilver. We call them different; becauſe theſe two portions of the precious metals are of different values all over Europe.

But beſides theſe two different pounds Sterling, which the change in the proportion of the metals have created, the other defects of the circulating coin produce ſimilar effects. The guineas coined by all the princes ſince king Charles II. have been of the ſame ſtandard weight and fineneſs, 44½ in a pound troy of ſtandard gold $\frac{11}{12}$ fine; theſe have been conſtantly wearing ever ſince they have heen coined; and in proportion to their wearing they are of leſs value.

If therefore, the new guineas are below the value of a pound Sterling in ſilver, ſtandard weight, the old muſt be of leſs value ſtill. Here then is another currency, that is, another pound Sterling: or indeed more properly ſpeakiug, there are as many different pounds Sterling as there are guineas of different weights. This is not all; the money-jobbers having carried off all the weighty ſilver, that which is worn with uſe and reduced even below the ſtandard of gold, forms one currency more, and totally deſtroys all determinate proportion between the money-unit and the currencies which are ſuppoſed to repreſent it.

It may be aſked, how, at this rate, any ſilver has remained in England? It is anſwered, that the few weighty ſhillings which ſtill remain in circulation, have marvellouſly eſcaped the hands of the money-jobbers: and as to the reſt, the rubbing and wearing of theſe pieces has done what the ſtate might have done; that is to ſay, it has reduced them to their due proportion with the lighteſt gold.

The diſorder, therefore, of the Engliſh coin has rendered the ſtandard of a pound Sterling quite uncertain. To ſay that it is 1718.7 grains of fine ſilver, is quite ideal. Who are paid in ſuch pounds? To ſay that it is 113 grains of pure gold, may alſo not be true; becauſe there are many currencies worſe than the new guineas.

What then is the consequence of all this disorder? What effect has it upon the current value of a pound Sterling? And which way can the value of that be determined?

The operations of trade bring value to an equation, notwithstanding the greatest irregularities possible; and so in fact a pound Sterling has acquired a determinate value over all the world by the means of foreign exchange. This is a kind of ideal scale for measuring the British coin, although it has not all the properties of that described above.

Exchange considers the pound Sterling as a value determined according to the combination of the values of all the different currencies, in proportion as payments are made in the one or the other; and as debtors generally take care to pay in the worst species they can, it consequently follows, that the value of the pound Sterling should fall to that of the lowest currency.

Were there a sufficient quantity of worn gold and silver to acquit all bills of exchange, the pound Sterling would come down to the value of them; but if the new gold be also necessary for that purpose, the value of it must be proportionally greater.

All these combinations are liquidated and compensated with one another, by the operations of trade and exchange: and the pound Sterling, which is so different in itself, becomes thereby, in the eyes of commerce a determinate unit; subject, however to variations, from which it never can be exempted.

Exchange therefore, is one of the best measures for valuing a pound Sterling, present currency. Here occurs a question:

Does the great quantity of paper-money in England tend to diminish the value of the pound Sterling?

We answer in the negative. Paper money is just as good as gold or silver money, and no better. The variation of the standard, as we have already said, must influence the interests of debtors and creditors proportionably every where. From this it follows that all augmentation of the value of the money-unit in the specie must hurt the debtors in the paper money; and all diminutions, on the other hand, must hurt the creditors in the paper money as well as every where else. The payments, therefore, made in paper money, never can contribute to the regulation of the standard of the pound Sterling; it is the specie received in liquidation of that paper money which alone can contribute to mark the value of the British unit; because it is affixed to nothing else.

From this we may draw a principle, "That in countries where the money-unit is entirely affixed to the coin, the actual value of it is not according to the legal standard of that coin, but according to the mean proportion of the actual worth of these currencies in which debts are paid.

From this we see the reason why the exchange between England and all other trading towns in Europe has long appeared so unfavourable. People calculate the real par, upon the supposition that a pound Sterling is worth 1718.7 grains troy of fine silver, when in fact the currency is not perhaps worth 1638, the value of a new guinea in silver, at the market proportion of 1 to 14.5; that is to say, the currency is but 95.3 *per cent.* of the silver standard of the 43d of Elizabeth. No wonder then if the exchange be thought unfavourable.

From the principle we have just laid down, we may gather a confirmation of what we advanced concerning the cause of the advanced price of bullion in the English market.

When people buy bullion with current money at a determinate price, that operation, in conjunction with the course of exchange, ought naturally to mark the actual value of the pound Sterling with great exactness.

If therefore the price of standard bullion in the English market, when no demand is found for the exportation of the metals, that is to say, when paper is found for paper upon exchange, and when merchants versed in these matters judge exchange (that is, remittances) to be at par, if then silver bullion cannot be bought at a lower price than 65 pence the ounce, it is evident that this bullion might be bought with 65 pence in shillings, of which 65 might be coined out of the pound troy English standard silver; since 65 per ounce implies 65 shillings for the 12 ounces or pound troy.

This plainly shows how standard silver bullion should sell for 65 pence the ounce, in a country where the ounce of standard silver in the coin is worth no more than 62; and were the market-price of bullion to stand uniformly at 65 pence per ounce, that would show the value of the pound Sterling to be tolerably fixed. All the heavy silver coin is now carried off; because it was intrinsically worth more than the gold it passed for in currency. The silver therefore which remains is worn down to the market proportion of the metals, as has been said; that is to say, 20 shillings in silver currency are worth 113 grains of fine gold, at the proportion of 1 to 14.5 between gold and silver. Now,

as 1 is to 14.5 so is 113 to 1638:

so the 20 shillings current weigh but 1638 grains fine silver, instead of 178.7, which they ought to do according to the standard.

Now let us speak of standard silver, since we are examining how far the English coin must be worn by use.

The pound troy contains 5760 grains. This according to the standard, is coined into 62 shillings: consequently, every shilling ought to weigh 92.9 grains. Of such shillings it is impossible that ever standard bullion should sell at above 62 pence per ounce. If therefore such bullion sells for 65 pence, the shillings with which it is bought must weigh no more than 88.64 grains standard silver; that is, they must lose 4.29 grains, and are reduced to $\frac{1}{65}$ of a pound troy.

But it is not necessary that bullion be bought with shillings; no stipulation of price is ever made farther than as so many pence Sterling per ounce. Does not this virtually determine the value of such currency with regard to all the currencies in Europe? Did a Spaniard, a Frenchman, or a Dutchman, know the exact quantity of silver bullion which can be bought in the London-market for a pound Sterling, would he inform himself any farther as to the intrinsic value of that money unit; would he not understand the value of it far better from that circumstance than by the

course

Money. course of any exchange, since exchange does not mark the intrinsic value of money but only the value of that money transported from one place to another?

The price of bullion, therefore when it is not influenced by extraordinary demand, (such as for the payment of a balance of trade, or for making an extraordinary provision of plate), but when it stands at what every body knows to be meant by the common market price, is a very tolerable measure of the value of the actual money-standard in any country.

If it be therefore true, that a pound sterling cannot purchase above 1638, grains of fine silver bullion, it will require not a little logic to prove that it is really, or has been for these many years, worth any more; notwithstanding that the standard weight of it in England is regulated by the laws of the kingdom at 1718.7 grains of fine silver.

If to this valuation of the pound Sterling drawn from the price of bullion, we add the other drawn from the course of exchange; and by this we find, that when paper is found for paper upon exchange, a pound Sterling cannot purchase above 1638 grains of fine silver in any country of Europe; upon these two authorities we may very safely conclude (as to the matter of fact at least that the pound Sterling is not worth more, either in London or in any other trading city; and if this be the case, it is just worth 20 shillings of 65 to the pound troy.

If therefore the mint were to coin shillings at that rate, and pay for silver bullion at the market price, that is, at the rate of 65 pence per ounce in those new coined shillings, they would be in proportion to the gold; silver would be carried to the mint equally with gold; and would be as little subject to be exported or melted down.

It may be inquired in this place, how far the coining the pound troy into 65 shillings is contrary to the laws of England?

The moment a state pronounces a certain quantity of gold to be worth a certain quantity of silver, and orders these respective quantities of each metal to be received as equivalents of each other, and as lawful money in payments, that moment gold is made a standard as much as silver. If therefore too small a quantity of gold be ordered or permitted to be considered as an equivalent for the unit, the silver standard is from that moment debased; or indeed more properly speaking, all silver money is from that moment proscribed; for who, from that time, will ever pay in silver, when he can pay cheaper in gold? Gold, therefore, by such a law, is made the standard, and all declarations to the contrary are against the matter of fact.

Were the king, therefore, to coin silver at 65 shillings in the pound, it is demonstration, that by such an act he would commit no adulteration upon the standard: the adulteration is already committed. The standard has descended to where it is by slow degrees, and by the operation of political causes only; and nothing prevents it from falling lower but the standard of the gold coin. Let guineas be now left to seek their value as they did formerly, and let light silver continue to go by tale, we shall see the guineas up at 30 shillings in 20 years time, as was the case in 1695.

It is as absurd to say that the standard of Queen Elisabeth has not been debased by enacting that the English unit shall be acquitted with 113 grains of fine gold, as it would be to affirm that it would not be debased from what it is at present by enacting that a pound of butter should every where be received in payment for a pound Sterling; although the pound Sterling should continue to consist of 3 ounces, 17 penny-weights, and 10 grains of standard silver, according to the statute of the 43 of Elisabeth. In that case, most debtors would pay in butter; and silver would, as at present, acquire a conventional value as a metal, but would be looked upon no longer as a standard, or as money.

If therefore by the law of England, a pound Sterling must consist of 1718.7 grains troy of fine silver; by the law of England also, 113 grains of gold must be of the same value: but no law can establish that proportion; consequently; in which ever way a reformation be brought about, some law must be reversed; consequently, expediency, and not compliance with law, must be the motive in reforming the abuse.

From what has been said, it is not at all surprising that the pound Sterling should in fact be reduced nearly to the value of the gold. Whether it ought to be kept at that value is another question. All that we here decide is, that coining the pound troy into 65 shillings would restore the proportion of the metals, and render both species common in circulation. But restoring the weight and proportion of the coin is not the difficulty which prevents a reformation of the English coinage.

8. *Circumstances to be attended to in a new Regulation of the British Coin.*

To people who do not understand the nature of such operations it may have an air of justice to support the unit at what is commonly believed to be the standard of Queen Elizabeth, *viz.* at 1718.7 grains of fine silver.

The regulating the standard of both silver and gold to $\frac{11}{12}$ fine, and the pound Sterling to four ounces standard silver, as it stood during the reign of Queen Mary I. has also its advantages, as Mr Harris has observed. It makes the crown-piece to weigh just one ounce, the shilling four penny-weight, and the penny eight grains; consequently, were the new statute to bear, that the weight of the coin should regulate its currency upon certain occasions, the having the pieces adjusted to certain aliquot parts of weight would make weighing easy, and would accustom the common people to judge of the value of money by its weight, and not by the stamp.

In that case there might be a conveniency in striking the gold coins of the same weight with the silver; because the proportion of their values would then constantly be the same with the proportion of the metals. The gold crowns would be worth at present 3 l. 12 s. 6d. the half crowns 1l. 16s. 3d. the gold shillings 14s. and 6d. and the half 7s. and 3d. This was anciently the practice in the Spanish mints.

The interests within the state can be nowise perfectly protected but by permitting conversions of value from the old to the new standard, whatever it be, and by

Money. by regulating the footing of such conversions by act of parliament, according to circumstances.

For this purpose, we shall examine those interests which will chiefly merit the attention of government, when they form a regulation for the future of acquitting permanent contracts already entered into. Such as may be contracted afterwards will naturally follow the new standard.

The landed interest is no doubt the most considerable in the nation. Let us therefore examine, in the first place, what regulations it may be proper to make, in order to do justice to this great class, with respect to the land-tax on one hand, and with respect to their lessees on the other.

The valuation of the lands of England was made many years ago, and reasonably ought to be supported at the real value of the pound Sterling at that time, according to the principles already laid down. The general valuation, therefore, of the whole kingdom will rise according to this scheme. This will be considered as an injustice; and no doubt it would be so, if, for the future, the land-tax be imposed as heretofore, without attending to this circumstance; but as that imposition is annual, as it is laid on by the landed interest itself, who compose the parliament, it is to be supposed that this great class will at least take care of their own interest.

Were the valuation of the lands to be stated according to the valuation of the pound Sterling of 1718.7 grains of silver, which is commonly supposed to be the standard of Elisabeth, there would be no great injury done: this would raise the valuation only 5 per cent. and the land-tax in proportion.

There is no class of inhabitants in all England so much at their ease, and so free from taxes, as the class of farmers. By living in the country, and by consuming the fruits of the earth without their suffering any alienation, they avoid the effect of many excises, which, by those who live in corporations, are felt upon many articles of their consumption, as well as on those which are immediately loaded with these impositions. For this reason it will not, perhaps, appear unreasonable, if the additional 5 *per cent.* on the land-tax were thrown upon this class, and not upon the landlords.

With respect to leases, it may be observed, that we have gone upon the supposition that the pound Sterling in the year 1728 was worth 1718.7 grains of fine silver, and 113 grains of fine gold.

There would be no injustice done the lessees of all the lands in the kingdom, were their rents to be fixed at the mean proportion of these values. We have observed how the pound Sterling has been gradually diminishing in its worth from that time by the gradual rise of the silver. This mean proportion, therefore, will nearly answer to what the value of the pound Sterling was in 1743; supposing the rise of the silver to have been uniform.

It may be farther alleged in favour of the landlords, that the gradual debasement of the standard has been more prejudicial to their interest in letting their lands, than to the farmers in disposing of the fruits of them. Proprietors cannot so easily raise their rents upon new leases, as farmers can raise the prices of their grain according to the debasement of the value of the currency.

The pound Sterling, thus regulated at the mean proportion of its worth, as it stands at present, and as it stood in 1728, may be realised in 1678.6 grains of fine silver, and 115.76 grains fine gold; which is 2.4 *per cent.* above the value of the present currency. No injury, therefore, would be done to lessees, and no unreasonable gain would accrue to the landed interest, in appointing conversions of all land-rents at $2\frac{1}{2}$ *per cent.* above the value of the present currency.

Without a thorough knowledge of every circumstance relating to Great Britain, it is impossible to lay down any plan. It is sufficient here briefly to point out the principles upon which it must be regulated.

The next interest to be considered is that of the nation's creditors. The right regulation of their concerns will have a considerable influence in establishing public credit upon a solid basis, by making it appear to all the world, that no political operation upon the money of Great Britain can in any respect either benefit or prejudice the interest of those who lend their money upon the faith of the nation. The regulating also the interest of so great a body, will serve as a rule for all creditors who are in the same circumstances, and will upon other accounts be productive of greater advantages to the nation in time coming.

In 1749, a new regulation was made with the public creditors, when the interest of the whole redeemable national debt was reduced to 3 *per cent.* This circumstance infinitely facilitates the matter with respect to this class, since, by this innovation of all former contracts, the whole national debt may be considered as contracted at, or posterior to, the 25th of December 1749.

Were the state, by any arbitrary operation upon money (which every reformation must be), to diminish the value of the pound Sterling in which the parliament at that time bound the nation to acquit those capitals and the interest upon them, would not all Europe say, That the British parliament had defrauded their creditors? If therefore the operation proposed to be performed should have a contrary tendency, *viz.* to augment the value of the pound Sterling with which the parliament at that time bound the nation to acquit those capitals and interests, must not all Europe also agree, That the British parliament had defrauded the nation?

This convention with the ancient creditors of the state, who, in consequence of the debasement of the standard, might have justly claimed an indemnification for the loss upon their capitals, lent at a time when the pound Sterling was at the value of the heavy silver, removes all causes of complaint from that quarter. There was in the year 1749 an innovation in all their contracts; and they are now to be considered as creditors only from the 25th of December of that year.

Let the value of the pound Sterling be inquired into during one year preceding and one posterior to the transactions of the month of December 1749. The great sums borrowed and paid back by the nation during that period, will furnish data sufficient for that calculation. Let this value of the pound be specified in in troy grains of fine filver and fine gold bullion, without mentioning any denomination of money according to the exact proportion of the metals at that time. And let this pound be called *the pound of national credit*.

This firft operation being determined, let it be enacted that the pound Sterling, by which the ftate is to borrow for the future, and that in which the creditors are to be paid, fhall be the exact mean proportion between the quantities of gold and filver above fpecified, according to the actual proportion of the metals at the time fuch payments fhall be made: or that the fums fhall be borrowed or acquitted, one half in gold and one half in filver, at the refpective requifitions of the creditors or of the ftate, when borrowing. All debts contracted pofterior to 1749 may be made liable to converfions.

The confequence of this regulation will be the infenfible eftablifhment of a bank-money. Nothing would be more difficult to eftablifh, by a pofitive revolution, than fuch an invariable meafure; and nothing will be found fo eafy as to let it eftablifh itfelf by its own advantages. This bank-money will be liable to much fewer inconveniences than that of Amfterdam. There the perfons tranfacting muft be upon the fpot; here, the Sterling currency may, every quarter of a year, be adjufted by the exchequer to this invariable ftandard, for the benefit of all debtors and creditors who incline to profit of the ftability of this meafure of value.

This fcheme is liable to no inconvenience from the variation of the metals, let them be ever fo frequent or hard to be determined; becaufe upon every occafion where there is the fmalleft doubt as to the actual proportion, the option competent to creditors to be paid half in filver and half in gold will remove.

Such a regulation will alfo have this good effect, that it will give the nation more juft ideas of the nature of money, and confequently of the influence it ought to have upon prices.

If the value of the pound Sterling fhall be found to have been by accident lefs in December 1749 than it is a prefent; or if at prefent the currency be found below what it has commonly been fince 1749; in juftice to the creditors, and to prevent all complaints, the nation may grant them the mean proportion of the value of the pound Sterling from 1749 to 1760, or any other which may to parliament appear reafonable.

This regulation muft appear equitable in the eyes of all Europe; and the ftrongeft proof of it will be, that it will not produce the fmalleft effect prejudicial to the intereft of the foreign creditors. The courfe of exchange with regard to them will ftand precifely as before.

A Dutch, French, or German creditor, will receive the fame value for his intereft in the Englifh ftocks as heretofore. This muft filence all clamours at home, being the moft convincing proof, that the new regulation of the coin will have made no alteration upon the real value of any man's property, let him be debtor or creditor.

The intereft of every other denomination of creditors, whofe contracts are of a frefh date, may be regulated upon the fame principles. But where debts are of an old ftanding, juftice demands, that attention be had to the value of money at the time of contracting. Nothing but the ftability of the Englifh coin, when compared with that of other nations, can make fuch a propofal appear extraordinary. Nothing is better known in France than this ftipulation added to obligations, *Argent au cours de ce jour*; that is to fay, That the fum fhall be repaid in coin of the fame intrinfic value with what has been lent. Why fhould fuch a claufe be thought reafonable for guarding people againft arbitrary operations upon the numerary value of the coin, and not be found juft upon every occafion where the numerary value of it is found to be changed, let the caufe be what it will?

The next intereft we fhall examine is that of trade. When men have attained the age of 21, they have no more occafion for guardians. This may be applied to traders; they can parry with their pen every inconvenience which may refult to other people from the changes upon money, provided only the laws permit them to do themfelves juftice with refpect to their engagements. This clafs demands no more than a right to convert all reciprocal obligations into denominations of coin of the fame intrinfic value with thofe they have contracted in.

The next intereft is that of buyers and fellers; that is, of manufacturers with regard to confumers, and of fervants with refpect to thofe who hire their perfonal fervice.

The intereft of this clafs requires a moft particular attention. They muft, literally fpeaking, be put to fchool, and taught the firft principles of their trade, which is buying and felling. They muft learn to judge of price by the grains of filver and gold they receive: they are children of a mercantile mother, however warlike the father's difpofition. If it be the intereft of the ftate that their bodies be rendered robuft and active, it is no lefs the intereft of the ftate that their minds be inftructed in the firft principles of the trade they exercife.

For this purpofe, tables of converfion from the old ftandard to the new muft be made, and ordered to be put up in every market, in every fhop. All duties, all excifes, muft be converted in the fame manner. Uniformity muft be made to appear every where. The fmalleft deviation from this will be a ftumbling-block to the multitude.

Not only the intereft of the individuals of the clafs we are at prefent confidering, demands the nation's care and attention in this particular; but the profperity of trade, and the well-being of the nation, are alfo deeply interefted in the execution.

The whole delicacy of the intricate combinations of commerce depends upon a juft and equable vibration of prices, according as circumftances demand it. The more, therefore, the induftrious claffes are inftructed in the principles which influence prices, the more eafily will the machine move. A workman then learns to fink his price without regret, and can raife it without avidity. When principles are not underftood, prices cannot gently fall, they muft be pulled down; and merchants dare not fuffer them to rife, for fear of abufe, Money. even although the perfection of an infant manufacture should require it.

The last interest is that of the bank of England, which naturally must regulate that of every other.

Had this great company followed the example of other banks, and established a bank-money of an invariable standard as the measure of all their debts and credits, they would not have been liable to any inconvenience upon a variation of the standard.

The bank of England was projected about the year 1694, at a time when the current money of the nation was in the greatest disorder, and government in the greatest distress both for money and for credit. Commerce was then at a very low ebb; and the only, or at least the most profitable, trade of any, was jobbing in coin, and carrying backwards and forwards the precious metals from Holland to England. Merchants profited also greatly from the effects which the utter disorder of the coin produced upon the price of merchandise.

At such a juncture the resolution was taken to make a new coinage; and upon the prospect of this, a company was found, who, for an exclusive charter to hold a bank for 13 years, willingly lent the government upwards of a million Sterling at 8 *per cent.* (in light money we suppose), with a prospect of being repaid both interest and capital in heavy. This was not all: part of the money lent was to be applied for the establishment of the bank; and no less than 4000l. a-year was allowed to the company, above the full interest, for defraying the charge of the management.

Under such circumstances the introduction of bank-money was very superfluous, and would have been very impolitic. That invention is calculated against the raising of the standard: but here the bank profited of that rise in its quality of creditor for money lent; and took care not to commence debtor by circulating their paper until the effect of the new regulation took place in 1695; that is, after the general re-coinage of all the clipped silver.

From that time till now, the bank of England has been the basis of the nation's credit, and with great reason has been constantly under the most intimate protection of every minister.

The value of the pound Sterling, as we have seen, has been declining ever since the year 1601, the standard being fixed to silver during all that century, while the gold was constantly rising. No sooner had the proportion taken another turn, and silver begun to rise, than the government of England threw the standard virtually upon the gold, by regulating the value of the guineas at the exact proportion of the market. By these operations, however, the bank has constantly been a gainer (in its quality of debtor) upon all the paper in circulation; and therefore has lost nothing by not having established a bank-money.

The interest of this great company being established upon the principles we have endeavoured to explain, it is very evident, that the government of England never will take any step in the reformation of the coin which in its consequences can prove hurtful to the bank. Such a step would be contrary both to justice and to common sense. To make a regulation which, by raising the standard, will prove beneficial to the public creditors, to the prejudice of the bank (which we may call the *public debtor*), would be an operation upon public credit like that of a person who is at great pains to support his house by props upon all sides, and who at the same time blows up the foundation of it with gunpowder. Money.

We may therefore conclude, that with regard to the bank of England, as well as every other private banker, the notes which are constantly payable upon demand must be made liable to a conversion at the actual value of the pound Sterling at the time of the new regulation.

That the bank will gain by this, is very certain; but the circulation of their notes is so swift, that it would be absurd to allow to the then possessors of them that indemnification which naturally should be shared by all those through whose hands they have passed, in proportion to the debasement of the standard during the time of their respective possession.

Besides these considerations, which are in common to all states, the government of Great Britain has one peculiar to itself. The interest of the bank, and that of the creditors, are diametrically opposite: every thing which raises the standard hurts the bank; every thing which can sink it hurts the creditors: and upon the right management of the one and the other, depends the solidity of public credit. For these reasons, without the most certain prospect of conducting a restitution of the standard to the general advantage as well as approbation of the nation, no minister will probably ever undertake so dangerous an operation.

We shall now propose an expedient which may remove at least some of the inconveniences which would result from so extensive an undertaking as that of regulating the respective interests in Great Britain by a positive law, upon a change in the value of their money of account.

Suppose then, that, before any change is made in the coin, government should enter into a transaction with the public creditors, and ascertain a permanent value for the pound sterling for the future, specified in a determined proportion of the fine metals in common bullion, without any regard to money of account, or to any coin whatever.

This preliminary step being taken, let the intended alteration of the standard be proclaimed a certain time before it is to commence. Let the nature of the change be clearly explained, and let all such as are engaged in contracts which are dissolvable at will upon the prestations stipulated, be acquitted between the parties, or innovated as they shall think proper; with certification, that, posterior to a certain day, the stipulations formerly entered into shall be binding according to the denominations of the money of account in the new standard.

As to permanent contracts, which cannot at once be fulfilled and dissolved, such as leases, the parliament may either prescribe the methods and terms of conversion; or a liberty may be given to the parties to annul the contract, upon the debtor's refusing to perform his agreement according to the new standard. Contracts, on the other hand, might remain stable, with respect to creditors who would be satisfied with payments made on the footing of the old standard. If the rise intended should not be very considerable, no great injustice can follow such a regulation.

Annuities are now thoroughly underſtood, and the value of them is brought to ſo nice a calculation, that nothing will be eaſier than to regulate theſe upon the footing of the value paid for them, or of the ſubject effected by them. If by the regulation, land-rents are made to riſe in denomination, the annuities charged upon them ought to riſe in proportion; if in intrinſic value, the annuity ſhould remain as it was.

9. *Regulations which the Principles of this Inquiry point out as expedient to be made by a new Statute for regulating the Britiſh Coin.*

LET us now examine what regulations it may be proper to make by a new ſtatute concerning the coin of Great Britain, in order to preſerve always the ſame exact value of the pound Sterling realized in gold and in ſilver, in ſpite of all the incapacities inherent in the metals to perform the functions of an invariable ſcale or meaſure of value.

1. The firſt point is to determine the exact number of grains of fine gold and fine ſilver which are to compoſe it, according to the then proportion of the metals in the London market.

2. To determine the proportion of theſe metals with the pound troy: and in regard that the ſtandard of gold and ſilver is different, let the mint price of both metals be regulated according to the pound troy fine.

3. To fix the mint-price within certain limits; that is to ſay, to leave to the king and council, by proclamation, to carry the mint price of bullion up to the value of the coin, as is the preſent regulation, or to ſink it to *per cent.* below that price, according as government ſhall incline to impoſe a duty upon coinage.

4. To order, that ſilver and gold coin ſhall be ſtruck of ſuch denominations as the king ſhall think fit to appoint; in which the proportion of the metals above determined ſhall be conſtantly obſerved through every denomination of the coin, until neceſſity ſhall make a new general coinage unavoidable.

5. To have the number of grains of the fine metal in every piece marked upon the exergue, or upon the legend of the coin, in place of ſome initial letters of titles, which not one perſon in a thouſand can decypher; and to make the coin of as compact a form as poſſible, diminiſhing the ſurface of it as much as is conſiſtent with beauty.

6. That it ſhall be lawful for all contracting parties to ſtipulate their payments either in gold or ſilver coin, or to leave the option of the ſpecies to one of the parties.

7. That where no particular ſtipulation is made, creditors ſhall have power to demand payment, half in one ſpecies, half in the other; and when the ſum cannot fall equally into gold and ſilver coins, the fractions to be paid in ſilver.

8. That in buying and ſelling, when no particular ſpecies has been ſtipulated, and when no act in writing has intervened, the option of the ſpecies ſhall be competent to the buyer.

9. That all ſums paid or received by the king's receivers, or by bankers, ſhall be delivered by weight, if demanded.

10. That all money which ſhall be found under the legal weight, from whatever cauſe it may proceed, may be rejected in every payment whatſoever; or if offered in payment of a debt above a certain ſum, may be taken according to its weight, at the then mint price, in the option of the creditor.

11. That no penalty ſhall be incurred by thoſe who melt down or export the nation's coin; but that waſhing, clipping, or diminiſhing the weight of any part of it ſhall be deemed felony, as much as any other theft, if the perſon ſo degrading the coin ſhall afterwards make it circulate for lawful money.

To prevent the inconveniences proceeding from the variation in the proportion between the metals, it may be provided,

12. That upon every variation of proportion in the market-price of the metals, the price of both ſhall be changed, according to the following rule:

Let the price of the pound troy fine gold in the coin be called *G*.

Let the price of ditto in the ſilver be called *S*.

Let the new proportion between the market-price of the metals be called *P*.

Then ſtate this formula:

$$\frac{G}{2P}+\frac{S}{2}=$$ to a pound troy fine ſilver, in Sterling currency.

$$\frac{S}{2}+P+\frac{G}{2}=$$ to a pound troy fine gold, in Ster. currency.

This will be a rule for the mint to keep the price of the metals conſtantly at par with the price of the market; and coinage may be impoſed, as has been deſcribed, by fixing the mint price of them at a certain rate below the value of the fine metals in the coin.

14. As long as the variation of the market-price of the metals ſhall not carry the price of the riſing metal ſo high as the advanced price of the coin above the bullion, no alteration need be made on the denomination of either ſpecies.

14. So ſoon as the variation of the market price of the metals ſhall give a value to the riſing ſpecies, above the difference between the coin and the bullion; then the king ſhall alter the denominations of all the coin, ſilver and gold, adding to the coins of the riſing metal exactly what is taken from thoſe of the other. An example will make this plain:

Let us ſuppoſe that the coinage has been made according to the proportion of 14.5 to 1; that 20 ſhillings, or 4 crown-pieces, ſhall contain, in fine ſilver, 14.5 times as many grains as the guinea, or the gold pound, ſhall contain grains of fine gold. Let the new proportion of the metals be ſuppoſed to be 14 to 1. In that caſe, the 20 ſhillings, or the 4 crowns, will contain $\frac{1}{26}$ more value than the guinea. Now ſince there is no queſtion of making a new general coinage upon every variation, in order to adjuſt the proportion of the metals in the weight of the coins, that proportion might be adjuſted by changing their reſpective denominations according to this formula:

Let the 20 ſhillings, or 4 crowns, in coin, be called *S*. Let the guinea be called *G*. Let the difference between the old proportion and the new, which is $\frac{1}{29}$, be called *P*. Then ſay,

$$S-\frac{P}{2}=$$ a pound ſterling, and $$G+\frac{P}{2}=$$ a pound ſterl.

By this it appears that all the ſilver coin muſt be raiſed

raised in its denomination $\frac{1}{78}$, and all the gold coin must be lowered in its denomination $\frac{1}{78}$; yet still S + G will be equal to two pounds Sterling, as before, whether they be considered according to the old or according to the new denominations.

But it may be observed, that the imposition of coinage rendering the value of the coin greater than the value of the bullion, that circumstance gives a certain latitude in fixing the new denominations of the coin, so as to avoid minute fractions. For, providing the deviation from the exact proportion shall fall within the advanced price of the coin, no advantage can be taken by melting down one species preferably to another; since, in either case, the loss incurred by melting the coin must be greater than the profit made upon selling the bullion. The mint price of the metals, however, may be fixed exactly, that is, within the value of a farthing upon a pound of fine silver or gold. This is easily reckoned at the mint; although upon every piece in common circulation the fractions of farthings would be inconvenient.

15. That notwithstanding of the temporary variations made upon the denomination of the gold and silver coins, all contracts formerly entered into, and all stipulations in pounds shillings and pence, may continue to be acquitted according to the old denominations of the coins, paying one-half in gold and one-half in silver: unless in the case where a particular species has been stipulated; in which case, the sums must be paid according to the new regulation made upon the denomination of that species, to the end that neither profit nor loss may result to any of the parties.

16. That notwithstanding the alterations on the mint price of the metals, and in the denomination of the coins, no change shall be made upon the weight of the particular pieces of the latter, except in the case of a general re-coinage of one denomination at least: that is to say, the mint must not coin new guineas, crowns, &c. of a different weight from those already in currency, although by so doing the fractions might be avoided. This would occasion confusion, and the remedy would cease to be of any use upon a new change in the proportion of the metals. But it may be found convenient, for removing the small fractions in shillings and sixpences, to recoin such denominations altogether, and to put them to their integer numbers, of twelve and of six pence, without changing in any respect their proportion of value to all other denominations of the coin: this will be no great expence, when the bulk of the silver coin is put into 5 shilling pieces.

By this method of changing the denominations of the coin, there never can result any alteration in the value of the pound Sterling; and although fractions of value may now and then be introduced, in order to prevent the abuses to which the coin would otherwise be exposed by the artifice of those who melt it down, yet still the inconvenience of such fractions may be avoided in paying, according to the old denominations, in both species, by equal parts. This will also prove demonstratively, that no change is thereby made in the true value of the national unit of money.

17. That it be ordered, that shillings and sixpences shall only be current for 20 years; and all other coins, both gold and silver, for 40 years, or more. For ascertaining which term, there may be marked, upon the exergue of the coin, the last year of their currency, in place of the date of their fabrication. This term elapsed, or the date effaced, that they shall have no more currency whatsoever; and, when offered in payment, may be received as bullion at the actual price of the mint, or refused, at the option of the creditor.

18. That no foreign coin shall have any *legal* currency, except as bullion at the mint price.

By these and the like regulations may be prevented, *1mo*, The melting or exporting of the coin in general. *2do*, The melting or exporting one species, in order to sell it as bullion at the advanced price. *3tio*, The profit in acquitting obligations preferably in one species to another. *4to*, The degradation of the standard, by the wearing of the coin, or by a change in the proportion between the metals. *5to*, The circulation of the coin below the legal weight. *6to*, The profit that other nations reap by paying their debts more cheaply to Great Britain than Great Britain can pay her's to them.

And the great advantage of it is, that it is an uniform plan, and may serve as a perpetual regulation, compatible with all kinds of denominations of coins, variations in the proportion of the metals, and with the imposition of a duty upon coinage, or with the preserving it free; and further, that it may in time be adopted by other nations, who will find the advantage of having their money of account preserved perpetually at the same value, with respect to the denominations of all foreign money of account established on the same principles.

A TABLE

A TABLE OF COINS.

Showing the Quantity of Fine Metal contained in them.

The number of grains of fine metal in every coin is fought for in the regulations of the mint of the country where it is coined, and is expreffed in the grains in ufe in that mint. From that weight it is converted into thofe of other countries according to the following proportions:

3840 Troy grains, 4676.35 Paris grains, 5192.8 Holland aces or grains, and 4649.06 Colonia grains, are fuppofed to be equal weights; and the coins in the Table are converted according to thofe proportions.

Table of Coins, reduced to Grains of fine Metal, according to the Troy, Paris, Colonia, and Holland weights.	Gold Coins.				Silver Coins.			
	Troy.	Paris.	Colonia.	Holland.	Troy.	Paris.	Colonia.	Holland.
English Coins.								
1 A Guinea by ftatute — — — —	118.651	144.46	143.65	160.45				
2 A Crown by ftatute — — —	— —	— —	— —	— —	429.68	523.2	520.2	581.
3 A fhilling by ftatute — — —	— —	— —	— —	— —	85.935	104.65	104.	116.2
4 A filver Pound Sterling by ftatute 1601 — —	— —	— —	— —	— —	1718.7	2093.	2080.8	2324.1
5 A Gold Pound Sterling by ftatute 1728 — —	113.	137.61	136.8	152.8				
6 A filver Pound Sterling in currency = $\frac{20}{62}$ lb. Troy —	— —	— —	— —	— —	1639.38	1996.4	1984.7	2216.
7 A Silver Pound Sterl. at the proportion of gold to filver as 1 to 14½	113.	137.61	136.8	152.8	1638.5	1995.3	1983.7	2215.7
8 A Gold Pound Sterling at the fame proportion of 1 to 14½	118.4	144.18	143.34	160.11	1718.7	2093.	2080.8	2324.1
9 A Pound Sterling at the mean proportion in gold and in filver	115.769	140.98	140.16	156.55	1678.6	2044.2	2032.2	2269.9
10 A Shilling current = $\frac{1}{62}$ of a pound Troy — —	— —	— —	— —	— —	81.961	99.8	99.	110.82
11 A Guinea in Silver, or 21 Shillings ftandard weight —	— —	— —	— —	— —	1804.6	2197.6	2184.8	2440.3
12 A Guinea at the proportion of 1 to 14½, worth in Silver	— —	— —	— —	— —	1720.4	2095.1	2082.8	2326.4
13 A Pound Troy, or 12 ounces Englifh weight — —	5760.	7019.2	6973.5	7789.2				
French Coins.								
1 A Louis d'or — — —	113.27	137.94	137.13	153.17				
2 A Crown of fix livres — — —	— —	— —	— —	— —	409.94	499.22	496.3	554.3
3 A Crown of three ditto — — —	— —	— —	— —	— —	204.97	249.61	248.15	277.1
4 A livre — — — —	— —	— —	— —	— —	68.34	83.23	82.74	92.42
5 A Louis d'or, or 24 livres in filver — —	— —	— —	— —	— —	1639.7	1996.9	1985.2	2217.4
6 A Marc of Paris weight, fine gold or filver — —	3783.87	4608.	4581.1	5116.9	3783.87	4608.	4581.1	5116.9
7 A Marc of gold coin effective weight, in fine —	3398.3	4138.5	4114.3	4593.4				
8 A Mark of filver coin effective weight, in fine —	— —	— —	— —	— —	3402.3	4143.4	4119.2	4600.9
German Coins.								
1 A Carolin legal weight — —	115.45	140.6	139.78	156.12				
2 A Ducat of the Empire ditto — —	52.8	64.37	64.	71.48				
3 A Florin of Convention — —	— —	— —	— —	— —	179.73	218.87	217.6	243.
4 A Dollar of Convention — —	— —	— —	— —	— —	269.59	328.31	326.4	364.5
5 A Dollar of Exchange, the Carolin = 9 flor. 42 kreutzers	17.85	21.74	21.615	24.14				
6 a Florin current = $\frac{1}{11}$ of a Carolin —	10.54	12.84	12.77	14.26				
7 A Carolin in filver, at the proportion of 1 to 14½ —	— —	— —	— —	— —	1674.	2038.6	2026.8	2263.8
Dutch Coins.								
1 A Dutch Ducat — — —	51.76	6.3	62.67	70.				
2 A Florin in Silver — — —	— —	— —	— —	— —	148.	180.3	179.2	200.21

UNIVERSAL TABLE

Of the present State of the REAL and IMAGINARY MONIES of the World.

† This mark is prefixed to the Imaginary Money, or Money of Account.

All Fractions in the Value English are Parts of a PENNY.

= This mark signifies *is*, *make*, or *equal to*.

EUROPE, Northern Parts.

ENGLAND AND SCOTLAND.

London, Bristol, Liverpool, &c.
Edinburgh, Glasgow, Aberdeen, &c.

			£.	s.	d.
A Farthing		- - -	0	0	$0\frac{1}{4}$
2 Farthings	=	a Halfpenny -	0	0	$0\frac{1}{2}$
2 Halfpence		a Penny -	0	0	1
4 Pence		a Groat -	0	0	4
6 Pence		a Half Shilling	0	0	6
12 Pence		a Shilling -	0	1	0
5 Shillings		a Crown -	0	5	0
20 Shillings		†a Pound Sterling	1	0	0
21 Shillings		a Guinea -	1	1	0

IRELAND.

Dublin, Cork, Londonderry, &c.

			£.	s.	d.
A farthing		- -	0	0	$0\frac{3}{13}$
2 Farthings	=	a Halfpenny -	0	0	$0\frac{6}{13}$
2 Halfpence		†a Penny -	0	0	$0\frac{12}{13}$
$6\frac{1}{2}$ Pence		a Half Shilling -	0	0	6
12 Pence		†a Shilling Irish -	0	0	$11\frac{3}{40}$
13 Pence		a shilling -	0	1	0
65 Pence		a Crown -	0	5	0
20 Shillings		†a Pound Irish	0	18	$5\frac{1}{2}$
$22\frac{3}{4}$ Shillings		a Guinea -	1	1	0

FLANDERS AND BRABANT.

Ghent, Ostend, &c. Antwerp, Brussels, &c.

			£.	s.	d.
†A Pening		- - -	0	0	$0\frac{9}{160}$
4 Peningens	=	an Urch - -	0	0	$0\frac{9}{40}$
8 Peningens		†a Grote -	0	0	$0\frac{9}{20}$
2 Grotes		a Petard -	0	0	$0\frac{9}{10}$
6 Petards		†a Scalin -	0	0	$5\frac{2}{5}$
7 Petards		a Scalin -	0	0	$6\frac{3}{10}$
40 Grotes		†a Florin -	0	1	6
$17\frac{1}{2}$ Scalins		a Ducat -	0	9	3
240 Grotes		†a Pound Flem. -	0	9	0

HOLLAND AND ZEALAND.

Amsterdam, Rotterdam, Middleburg, Flushing, &c.

			£.	s.	d.
† Pening		- - -	0	0	$0\frac{21}{320}$
8 Peningens	=	†a Grote - -	0	0	$0\frac{21}{40}$
2 Grotes		a Stiver -	0	0	$1\frac{1}{20}$
6 Stivers		a Scalin -	0	0	$6\frac{3}{10}$
20 Stivers		a Guilder -	0	1	9
50 Stivers		a Rix-dollar -	0	4	$4\frac{1}{4}$

HOLLAND, &c.

			£.	s.	d.
60 Stivers		a Dry Guilder -	0	5	3
105 Stivers		a Ducat - -	0	9	3
6 Guilders		†a Pound Flem. -	0	10	6

EUROPE, Northern Parts. GERMANY.

HAMBURG. *Altena, Lubec, Bremen, &c.*

			£.	s.	d.
†A Tryling	=	- - -	0	0	$0\frac{3}{128}$
2 Trylings		†a Sexling -	0	0	$0\frac{3}{64}$
2 Sexlings		a Fening -	0	0	$0\frac{3}{32}$
12 Fenings		a Shilling Lub.	0	0	$1\frac{1}{8}$
16 Shillings		†a Marc -	0	1	6
2 Marcs		a Slet dollar -	0	3	0
3 Marcs		a Rix-dollar -	0	4	6
$6\frac{1}{4}$ Marcs		a Ducat -	0	9	$4\frac{1}{2}$
120 Shillings		†a Pound Flem.	0	11	3

HANOVER. *Lunenburgh, Zell, &c.*

			£.	s.	d.
†A Fening	=	- -	0	0	$0\frac{7}{48}$
3 Fenings		a Dreyer -	0	0	$0\frac{7}{16}$
8 Fenings		a Marien - -	0	0	$1\frac{1}{6}$
12 Fenings		a Grosh -	0	0	$1\frac{3}{4}$
8 Groshen		a Half Gulden -	0	1	2
16 Groshen		a Gulden -	0	2	4
24 Groshen		†a Rix-dollar -	0	3	6
32 Groshen		a Double Gulden	0	4	8
4 Guldens		a Ducat -	0	9	2

SAXONY AND HOLSTEIN.

Dresden, Leipsic, &c. Wismar, Keil, &c.

			£.	s.	d.
†An Heller	=	- -	0	0	$0\frac{7}{96}$
2 Hellers		a Fening -	0	0	$0\frac{7}{48}$
6 Hellers		a Dreyer -	0	0	$0\frac{7}{16}$
16 Hellers		a Marien - -	0	0	$1\frac{1}{6}$
12 Fenings		a Grosh -	0	0	$1\frac{3}{4}$
16 Groshen		a Gould - -	0	2	4
24 Groshen		†a Rix-dollar -	0	3	6
32 Groshen		a Specie-dollar .	0	4	8
4 Goulds		a Ducat . .	0	9	4

BRANDENBURGH AND POMERANIA.

Berlin, Potsdam, &c. Stetin, &c.

			£.	s.	d.
†A Denier	=	. .	0	0	$0\frac{7}{216}$
9 Deniers		a Polchen .	0	0	$0\frac{7}{24}$
18 Deniers		a Grosh . .	0	0	$0\frac{7}{12}$
3 Polchens		an Abrass .	0	0	$0\frac{7}{8}$
20 Groshen		†a Marc .	0	0	$9\frac{1}{3}$

30 Groshen

EUROPE, Northern Parts. GERMANY.

BRANDENBURGH, &c.

		£.	s.	d.
30 Groshen	a Florin	0	1	2
90 Groshen	†a Rix-dollar	0	3	6
108 Groshen	an Albertus	0	4	2
8 Florins	a Ducat	0	9	4

COLOGN, *Mentz, Triers, Liege, Munich, Munster, Paderbourn, &c.*

		£.	s.	d.
A Dute		0	0	$0\frac{7}{80}$
3 Dutes =	a Cruitzer	0	0	$0\frac{21}{80}$
2 Cruitzers	an Albus	0	0	$0\frac{21}{40}$
8 Dutes	a Stiver	0	0	$0\frac{7}{10}$
3 Stivers	a Plapert	0	0	$2\frac{1}{10}$
4 Platperts	a Copstuck	0	0	$8\frac{2}{5}$
40 Stivers	a Guilder	0	2	4
2 Guilders	a Hard Dollar	0	4	8
4 Guilders	a Ducat	0	9	4

BOHEMIA, SILESIA, and HUNGARY.

Prague, Breslaw, Presburg, &c.

		£.	s.	d.
A Fening		0	0	$0\frac{7}{60}$
2 Fenings =	a Dreyer	0	0	$0\frac{7}{30}$
3 Fenings	a Grosh	0	0	$0\frac{7}{20}$
4 Fenings	a Cruitzer	0	0	$0\frac{7}{15}$
2 Cruitzers	a White Grosh	0	0	$0\frac{14}{15}$
60 Cruitzers	a Gould	0	2	4
90 Cruitzers	†a Rix-dollar	0	3	6
2 Goulds	a Hard dollar	0	4	8
4 Goulds	a Ducat	0	9	4

AUSTRIA and SWABIA.

Vienna, Tiest, &c. Ausburg, Blenheim, &c.

		£.	s.	d.
A Fening		0	0	$0\frac{7}{60}$
2 Fenings =	a Dreyer	0	0	$0\frac{7}{30}$
4 Fenings	a Cruitzer	0	0	$0\frac{7}{15}$
14 Fenings	a Grosh	0	0	$1\frac{19}{30}$
4 Cruitzers	a Batzen	0	0	$1\frac{13}{15}$
15 Batzen	a Gould	0	2	4
90 Cruitzers	†a Rix-dollar	0	3	6
30 Batzen	a Specie-dollar	0	4	8
60 Batzen	a Ducat	0	9	4

FRANCONIA, *Francfort, Nuremburg, Dettingen, &c.*

		£.	s.	d.
A Fening		0	0	$0\frac{7}{60}$
4 Fenings =	a Cruitzer	0	0	$0\frac{7}{15}$
3 Cruitzers	a Keyser Grosh	0	0	$1\frac{2}{5}$
4 Cruitzers	a Batzen	0	0	$1\frac{13}{15}$
15 Cruitzers	an Ort Gould	0	0	7
60 Cruitzers	a Gould	0	2	4
90 Cruitzers	†a Rix-dollar	0	3	6
2 Goulds	a Hard Dollar	0	4	8
240 Cruitzers	a Ducat	0	9	4

POLAND and PRUSSIA.

Cracow, Warsaw, &c. Dantzic, Koningsberg, &c.

		£.	s.	d.
A Schelon		0	0	$0\frac{7}{45}$
3 Schelons =	a Grosh	0	0	$0\frac{7}{15}$
5 Groshens	a Coustic	0	0	$2\frac{1}{3}$
3 Coustics	a Tinse	0	0	7

EUROPE, Northern Parts.

POLAND, &c.

		£.	s.	d.
18 Groshen =	an Ort	0	0	$8\frac{2}{5}$
30 Groshen	a Florin	0	1	2
90 Groshen	†a Rix dollar	0	3	6
8 Florins	a Ducat	0	9	4
5 Rix-dollars	a Frederic d'Or	0	17	6

LIVONIA.

Riga, Revel, Narva, &c.

		£.	s.	d.
A Blacken		0	0	$0\frac{7}{90}$
6 Blackens =	a Grosh	0	0	$0\frac{7}{15}$
9 Blackens	a Vording	0	0	$0\frac{7}{10}$
2 Groshen	a Whiten	0	0	$0\frac{14}{15}$
6 Groshen	a Marc	0	0	$2\frac{4}{5}$
30 Groshen	a Florin	0	1	2
90 Groshen	†a Rix dollar	0	3	6
108 Groshen	an Albertus	0	4	$2\frac{6}{15}$
64 Whitens	a Copper-plate Dollar	0	5	0

DENMARK, ZEALAND, and NORWAY.

Copenhagen, Sound, &c. Bergen, Drontheim, &c.

		£.	s.	d.
A Skilling		0	0	$0\frac{9}{16}$
6 Skillings =	a Duggen	0	0	$3\frac{3}{8}$
16 Skillings	†a Marc	0	0	9
20 Skillings	a Rix-marc	0	0	$11\frac{1}{4}$
24 Skillings	a Rix ort	0	1	$1\frac{1}{2}$
4 Marcs	a Crown	0	3	0
6 Marcs	a Rix dollar	0	4	6
11 Marcs	a Ducat	0	8	3
14 Marcs	a Hatt Ducat	0	10	6

SWEDEN and LAPLAND.

Stockholm, Upsal, &c. Thorn, &c.

		£.	s.	d.
† A Runstick		0	0	$0\frac{7}{36}$
2 Runsticks =	a Stiver	0	0	$0\frac{7}{18}$
8 Runsticks	a Copper Marc	0	0	$1\frac{5}{9}$
3 Copper Marcs	a Silver Marc	0	0	$4\frac{2}{3}$
4 Copper Marcs	a Copper Dollar	0	0	$6\frac{2}{9}$
9 Copper Marcs	a Caroline	0	1	2
3 Copper Dollars	a Silver Dollar	0	1	$6\frac{2}{3}$
3 Silver Dollars	a Rix dollar	0	4	8
2 Rix dollars	a Ducat	0	9	4

RUSSIA and MUSCOVY.

Petersburg, Archangel, &c. Moscow, &c.

		£.	s.	d.
A Polusca		0	0	$0\frac{27}{200}$
2 Poluscas =	a Denusca	0	0	$0\frac{27}{100}$
2 Denuscas	†a Copec	0	0	$0\frac{27}{50}$
3 Copecs	an Altin	0	0	$1\frac{31}{50}$
10 Copecs	a Grievener	0	0	$5\frac{2}{5}$
25 Copecs	a Polpotin	0	1	$1\frac{1}{2}$
50 Copecs	a Poltin	0	2	3
100 Copecs	a Ruble	0	4	6
2 Rubles	a Xervonitz	0	9	0

BASIL. *Zurich, Zug, &c.*

		£.	s.	d.
A Rap		0	0	$0\frac{1}{24}$
3 Rapen =	a Fening	0	0	$0\frac{1}{8}$
4 Fenings	a Cruitzer	0	0	$0\frac{1}{2}$
12 Fenings	†a Sol	0	0	$1\frac{1}{2}$

EUROPE, Southern Parts.

SWITZERLAND.

BASIL, &c.

			£.	s.	d.
15 Fenings	=	a Coarſe Batzen	0	0	1 $\frac{7}{8}$
18 Fenings		a Good Batzen	0	0	2 $\frac{1}{4}$
20 Sols		†a Livre -	0	2	6
60 Cruitzers		a Gulden -	0	2	6
108 Cruitzers		a Rix dollar	0	4	6

St GALL. *Apenſal*, &c.

An Heller		- -	0	0	0 $\frac{1}{16}$
2 Hellers	=	a Fening -	0	0	0 $\frac{1}{8}$
4 Fenings		a Cruitzer -	0	0	0 $\frac{1}{2}$
12 Fenings		†a Sol -	0	0	1 $\frac{1}{2}$
4 Cruitzers		a Coarſe Batzen	0	0	2
5 Cruitzers		a Good Batzen	0	0	2 $\frac{1}{2}$
20 Sols		†a Livre -	0	2	6
60 Cruitzers		a Gould -	0	2	6
102 Cruitzers		a Rix-dollar	0	4	3

BERN. *Lucern, Neufchatel, &c.*

A Denier		- -	0	0	0 $\frac{1}{10}$
4 Deniers	=	a Cruitzer -	0	0	0 $\frac{2}{5}$
3 Cruitzers		†a Sol -	0	0	1 $\frac{1}{5}$
4 Cruitzers		a Plapert -	0	0	1 $\frac{3}{5}$
5 Cruitzers		a Gros -	0	0	2
6 Cruitzers		a Batzen -	0	0	2 $\frac{2}{5}$
20 Sols		†a Livre -	0	2	0
75 Cruitzers		a Gulden -	0	2	6
135 Cruitzers		a Crown -	0	4	6

GENEVA. *Pekay, Bonne*, &c.

A Denier		. -	0	0	0 $\frac{1}{32}$
2 Deniers	=	a Denier current	0	0	0 $\frac{1}{16}$
12 Deniers		a Small Sol	0	0	0 $\frac{3}{8}$
12 Deniers current		a Sol current	0	0	0 $\frac{3}{4}$
12 Small Sols		†a Florin -	0	0	4 $\frac{1}{2}$
20 Sols current		†a Livre current	0	1	3
$10\frac{1}{2}$ Florins		a Patacon -	0	3	11 $\frac{1}{4}$
$15\frac{3}{4}$ Florins		a Croiſade -	0	5	10 $\frac{7}{8}$
24 Florins		a Ducat -	0	9	0

FRANCE and NAVARRE.

Liſle, Cambray, Valenciennes, &c.

A Denier		- -	0	0	0 $\frac{1}{24}$
12 Deniers	=	a Sol -	0	0	0 $\frac{1}{2}$
15 Deniers		†a Patard -	0	0	0 $\frac{5}{8}$
15 Patards		†a Piette -	0	0	9 $\frac{3}{4}$
20 Sols		a Livre Tournois	0	0	10
20 Patards		†a Florin -	0	1	0 $\frac{1}{2}$
60 Sols		an Ecu of Ex.	0	2	6
$10\frac{1}{2}$ Livres		a Ducat -	0	9	3
24 Livres		a Louis d'Or	1	0	0

Dunkirk, St Omers, St Quintin, &c.

A Denier		- -	0	0	0 $\frac{1}{24}$
12 Deniers	=	a Sol -	0	0	0 $\frac{1}{2}$
15 Deniers		†a Patard -	0	0	0 $\frac{5}{8}$
15 Sols		†a Piette -	0	0	7 $\frac{1}{2}$
20 Sols		†a Livre Tournois	0	0	10
3 Livres		an Ecu of Ex.	0	2	6
24 Livres		a Louis d'Or	1	0	0
$25\frac{1}{2}$ Livres		a Guinea -	1	1	0
$32\frac{2}{5}$ Livres		a Moeda -	1	7	0

Paris, Lyons, Marſeilles, &c. Bourdeaux, Bayonne, &c.

			£.	s.	d.
A Denier		- -	0	0	0 $\frac{1}{[illegible]}$
3 Deniers	=	a Liard -	0	0	0 $\frac{1}{[illegible]}$
2 Liards		a Dardene -	0	0	0 $\frac{1}{4}$
12 Deniers		a Sol -	0	0	0 $\frac{1}{2}$
20 Sols		†a Livre Tournois	0	0	10
60 Sols		an Ecu of Ex.	0	2	6
6 Livres		an Ecu	0	5	0
10 Livres		†a Piſtole -	0	8	4
24 Livres		a Louis d'Or	1	0	0

PORTUGAL. *Liſbon, Oporto, &c.*

† A Re		- - -	0	0	0 $\frac{27}{400}$
10 Rez	=	a Half Vintin -	0	0	0 $\frac{27}{40}$
20 Rez		a Vintin -	0	0	1 $\frac{7}{20}$
5 Vintins		a Teſtoon -	0	0	6 $\frac{3}{4}$
4 Teſtoons		a Cruſade of Ex.	0	2	3
24 Vintins		a New Cruſade -	0	2	8 $\frac{2}{5}$
10 Teſtoons		†a Milre - -	0	5	7 $\frac{1}{2}$
48 Teſtoons		a Moeda -	1	7	0
64 Teſtoons		a Joaneſe -	1	16	0

SPAIN and CATALONIA.

Madrid, Cadiz, Seville, &c. New Plate.

A Maravedie		- -	0	0	0 $\frac{43}{272}$
2 Maravedies	=	a Quartil -	0	0	0 $\frac{43}{136}$
34 Maravedies		a Rial -	0	0	5 $\frac{3}{8}$
2 Rials		a Piſtarine	0	0	10 $\frac{3}{4}$
8 Rials		†a Piaſtre of Ex.	0	3	7
10 Rials		a Dollar -	0	4	6
375 Maravedies		†a Ducat of Ex.	0	4	11 $\frac{1}{2}$
32 Rials		†a Piſtole of Ex.	0	14	4
36 Rials		a Piſtole -	0	16	9

Gibraltar, Malaga, Denia, &c. Velon.

† A Maravedie		- -	0	0	0 $\frac{23}{272}$
2 Maravedies	=	a Ochavo	0	0	0 $\frac{23}{136}$
4 Maravedies		a Quartil	0	0	0 $\frac{23}{68}$
34 Maravedies		†a Rial Velon	0	0	2 $\frac{7}{8}$
15 Rials		†a Piaſtre of Ex.	0	3	7
512 Maravedies		a Piaſtre	0	3	7
60 Rials		†a Piſtole of Ex.	0	14	4
2048 Maravedies		a Piſtole of Ex.	0	16	9
78 Rials		a Piſtole -	0	16	9

Barcelona, Saragoſſa, Valencia, &c. Old Plate.

A Maravedie		- -	0	0	0 $\frac{27}{128}$
16 Maravedies	=	a Soldo -	0	0	3 $\frac{3}{8}$
2 Soldos		a Rial Old Plate	0	0	6 $\frac{3}{4}$
20 Soldos		†a Libra -	0	5	7 $\frac{1}{2}$
24 Soldos		†a Ducat -	0	6	9
16 Soldos		†a Dollar -	0	4	6
22 Soldos		†a Ducat -	0	6	2 $\frac{1}{4}$
21 Soldos		†a Ducat -	0	5	10 $\frac{7}{8}$
60 Soldos		a Piſtole -	0	16	9

ITALY

GENOA. *Novi*, &c. CORSICA. *Baſtia*, &c.

A Denari		- - - -	0	0	0 $\frac{43}{1200}$
12 Denari	=	a Soldi -	0	0	0 $\frac{43}{100}$
4 Soldi		a Chevalet	0	0	1 $\frac{18}{25}$
20 Soldi		†a Lire -	0	0	8 $\frac{2}{5}$
30 Soldi		a Teſtoon	0	1	0 $\frac{9}{10}$

EUROPE, Southern Parts. ITALY.

GENOA, &c.

			£.	s.	d.
5 Lires	=	a Croisade	0	3	7
115 Soldi		†a Pezzo of Ex.	0	4	2
6 Testoons		a Genouine	0	6	2
20 Lires		a Pistole -	0	14	4

PIEDMONT, SAVOY, AND SARDINIA.

Turin, Chamberry, Cagliari, &c.

			£.	s.	d.
A Denari	-	- -	0	0	0 1/16
3 Denari	=	a Quatrini	0	0	0 3/16
12 Denari		a Soldi -	0	0	0 3/4
12 Soldi		†a Florin -	0	0	9
20 Soldi		†a Lire -	0	1	3
6 Florins		a Scudi -	0	4	6
7 Florins		a Ducatoon	0	5	3
13 Lires		a Pistole -	0	16	3
16 Lires		a Louis d'Or	1	0	0

Milan, Modena, Parma, Pavia, &c.

			£.	s.	d.
A Denari	-	- -	0	0	0 3/82
3 Denari	=	a Quatrini -	0	0	0 9/82
12 Denari		a Soldi -	0	0	0 18/41
20 Soldi		†a Lire -	0	0	8 32/41
115 Soldi		a Scudi current	0	4	2 1/2
117 Soldi		†a Scudi of Ex.	0	4	3
6 Lires		a Philip -	0	4	4 1/2
22 Lires		a Pistole	0	16	0
23 Lires		a Spanish Pistole	0	16	9

Leghorn, Florence, &c.

			£.	s.	d.
A Denari	-	- -	0	0	0 5/144
4 Denari	=	a Quatrini	0	0	0 5/36
12 Denari		a Soldi -	0	0	0 5/12
5 Quatrini		a Craca -	0	0	0 25/36
8 Cracas		a Quilo -	0	0	5 5/9
20 Soldi		†a Lire -	0	0	8 1/3
6 Lires		a Piastre of Ex.	0	4	2
7½ Lires		a Ducat -	0	5	2 1/2
22 Lires		a Pistole -	0	15	6

ROME, *Civita Vecchia, Ancona.*

			£.	s.	d.
A Quatrini	-	- -	0	0	0 3/20
5 Quatrini	=	a Bayoc -	0	0	0 3/4
8 Bayocs		a Julio -	0	0	6
10 Bayocs		a Stampt Julia	0	0	7 1/2
24 Bayocs		a Testoon	0	1	6
10 Julios		a Crown current	0	5	0
12 Julios		†a Crown stampt	0	6	0
18 Julios		a Chequin	0	9	0
31 Julios		a Pistole -	0	15	6

NAPLES. *Gaieta, Capua, &c.*

			£.	s.	d.
A Quatrini	-	- .	0	0	0 2/15
3 Quatrini	=	a Grain -	0	0	0 2/5
10 Grains		a Carlin -	0	0	4
40 Quatrini		a Paulo -	0	0	5 1/3
20 Grains		a Tarin -	0	0	8
40 Grains		a Testoon -	0	1	4
100 Grains		a Ducat of Ex.	0	3	4
23 Tarins		a Pistole -	0	15	4
25 Tarins		a Spanish Pistole	1	16	9

SICILY and MALTA. *Palermo, Messina, &c.*

			£.	s.	d.
A Pichila	-	-	0	0	0 1/39
6 Pichili	=	a Grain -	0	0	0 2/13
8 Pichili		a Ponti -	0	0	0 8/39
10 Grains		a Carlin -	0	0	1 7/13
20 Grains		a Tarin -	0	0	3 1/13
6 Tarins		†a Florin of Ex.	0	1	6 6/13
13 Tarins		a Ducat of Ex.	0	3	4
60 Carlins		†an Ounce	0	7	8 4/13
2 Ounces		a Pistole	0	15	4

Bologna, Ravenna, &c.

			£.	s.	d.
A Quatrini	-	-	0	0	0 1/16
6 Quatrini	=	a Bayoc -	0	0	0 3/8
10 Bayocs		†a Julio -	0	0	6
20 Bayocs		a Lire -	0	1	0
3 Julios		a Testoon -	0	1	6
80 Bayocs		a Schudi of Ex.	0	4	3
105 Bayocs		a Ducatoon	0	5	3
100 Bayocs		a Crown -	0	5	0
31 Julios		a Pistole -	0	15	6

VENICE. *Bergham, &c.*

			£.	s.	d.
A Picoli	-	- -	0	0	0 1/36
12 Picoli	=	a Soldi -	0	0	0 1/3
6½ Soldi		†a Gros	0	0	2 1/6
18 Soldi		a Jule -	0	0	6
20 Soldi		†a Lire -	0	0	6 2/3
3 Jules		a Testoon	0	1	6
124 Soldi		a Ducat Current	0	3	5 1/3
24 Gros		†a Ducat of Ex.	0	4	4
17 Lires		a Chequin -	0	9	2

TURKY. *Morea, Candia, Cyprus, &c.*

			£.	s.	d.
A Mangar		- -	0	0	0 3/20
4 Mangars	=	†an Asper -	0	0	0 3/5
3 Aspers		a Parac -	0	0	1 4/5
5 Aspers		a Bestic -	0	0	3
10 Aspers		an Ostic -	0	0	6
20 Aspers		a Solota -	0	1	0
80 Aspers		†a Piastre -	0	4	0
100 Aspers		a Caragrouch	0	5	0
10 Solotas		a Xeriff -	0	10	0

ASIA.

ARABIA. *Medina, Mecca, Mocha, &c.*

			£.	s.	d.
A Carret	-	- -	0	0	0 1/8
5¼ Carrets	=	a Caveer -	0	0	0 21/32
7 Carrets		a Comashee	0	0	0 9/16
80 Carrets		a Larin -	0	0	10 1/8
18 Comashees		an Abyss	0	1	4 1/2
60 Comashees		†a Piastre -	0	4	6
80 Caveers		a Dollar -	0	4	6
100 Comashees		a Sequin -	0	7	6
80 Larins		†a Tomond	3	7	6

PERSIA. *Ispahan, Ormus, Gombroon, &c.*

			£.	s.	d.
A Coz	-	- .	0	0	0 2/5
4 Coz	=	a Bisti -	0	0	1 3/5
10 Coz		a Shahee -	0	0	4
20 Coz		a Mamooda	0	0	8
25 Coz		a Larin -	0	0	10
4 Shahees		an Abashee	0	1	4

5 Abashees

			£.	s.	d.
5 Abashees	=	an Or -	0	8	6
12 Abashees		a Bovello -	0	16	0
50 Abashees		†a Tomond	3	6	8

ASIA. MOGUL.

GUZZURAT. *Surat, Cambay, &c.*

			£.	s.	d.
A Pecka			0	0	0$\frac{15}{64}$
2 Peckas	=	a Pice -	0	0	0$\frac{15}{32}$
4 Pices		a Fanam -	0	0	1$\frac{7}{8}$
5 Pices		a Viz -	0	0	2$\frac{11}{32}$
10 Pices		an Ana -	0	0	7$\frac{1}{2}$
4 Anas		a Rupee -	0	2	6
2 Rupees		an English Crown	0	5	0
14 Anas		a Pagoda -	0	8	9
4 Pagodas		a Gold Rupee	1	15	0

MALABAR.

Bombay, Dabul, &c.

			£.	s.	d.
†A Budgrook		- -	0	0	0$\frac{27}{800}$
2 Budgrooks	=	†a Re -	0	0	0$\frac{27}{400}$
5 Rez		a Pice	0	0	0$\frac{27}{80}$
16 Pices		a Laree	0	0	5$\frac{2}{5}$
20 Pices		a Quarter	0	0	6$\frac{3}{4}$
240 Rez		a Xeraphim	0	1	4$\frac{1}{5}$
4 Quarters		a Rupee	0	2	3
14 Quarters		a Pagoda	0	8	0
60 Quarters		a Gold Rupee	1	15	0

Goa, Visapour, &c.

			£.	s.	d.
†A Re		- -	0	0	0$\frac{27}{400}$
2 Rez	=	a Bazaraco	0	0	0$\frac{27}{200}$
2 Bazaracos		a Pecka -	0	0	0$\frac{27}{100}$
20 Rez		a Vintin	0	0	1$\frac{7}{20}$
4 Vintins		a Laree	0	0	5$\frac{2}{5}$
3 Larees		a Xeraphim	0	1	4$\frac{1}{5}$
42 Vintins		a Tangu	0	4	6
4 Tangus		a Paru	0	18	0
8 Tangus		a Gold Rupee	1	15	0

COROMANDEL. *Madrass, Pondicherry, &c.*

			£.	s.	d.
A cash	-	- -	0	0	0$\frac{5}{32}$
5 Cash	=	a Viz -	0	0	0$\frac{3}{16}$
2 Viz		a Pice -	0	0	0$\frac{3}{8}$
6 Pices		a Pical -	0	0	2$\frac{1}{4}$
8 Pices		a Fanam -	0	0	3
10 Fanams		a Rupee -	0	2	6
2 Rupees		an English Crown	0	5	0
36 Fanams		a Pagoda -	0	8	9
4 Pagodas		a Gold Rupee	1	15	0

BENGAL. *Callicut, Calcutta, &c.*

			£.	s.	d.
A Pice	-	- -	0	0	0$\frac{5}{32}$
4 Pices	=	a Fanam -	0	0	0$\frac{5}{8}$
6 Pices		a Viz -	0	0	0$\frac{15}{16}$
12 Pices		an Ana -	0	0	1$\frac{7}{8}$
10 Anas		a Fiano -	0	1	6$\frac{3}{4}$
16 Anas		a Rupee -	0	2	6
2 Rupees		a French Ecu	0	5	0
2 Rupees		an English Crown	0	5	0
56 Anas		a Pagoda -	0	8	9

ASIA.

SIAM. *Pegu, Malacca, Cambodia, Sumatra, Java, Borneo, &c.*

			£.	s.	d.
A Cori	-	- - - -	0	0	0$\frac{3}{40000}$
800 Cori	=	a Fettee	0	0	0$\frac{3}{50}$
125 Fettees		a Sataleer -	0	0	7$\frac{1}{2}$
250 Fettees		a Sooco -	0	1	3
500 Fettees		a Tutal -	0	2	6
900 Fettees		a Dollar -	0	4	6
2 Ticals		a Rial -	0	5	0
4 Soocos		an Ecu -	0	5	0
8 Sateleers		a Crown -	0	5	0

CHINA. *Pekin, Canton, &c.*

			£.	s.	d.
A Caxa	-	- -	0	0	0$\frac{2}{25}$
10 Caxa	=	a Candereen -	0	0	0$\frac{4}{5}$
10 Candereens		a Mace -	0	0	8
35 Candereens		a Rupee -	0	2	6
2 Rupees		a Dollar -	0	4	6
70 Candereens		a Rix-dollar -	0	4	4$\frac{1}{2}$
7 Maces		an Ecu -	0	5	0
2 Rupees		a Crown -	0	5	0
10 Maces		†a Tale -	0	6	8

JAPAN. *Jedda, Meaco, &c.*

			£.	s.	d.
A Piti	-	- - -	0	0	0$\frac{1}{5}$
20 Pitis	=	a Mace -	0	0	4
15 Maces		an Ounce Silver	0	4	10$\frac{1}{5}$
20 Maces		a Tale -	0	6	8
30 Maces		an Ingot -	0	9	8$\frac{2}{5}$
13 Ounces Silver		an Ounce Gold	3	3	0
2 Ounces Gold		a Japanese -	6	6	0
2 Japaneses		a Double -	12	12	0
21 Ounces Gold		†a Cattee -	66	3	0

AFRICA.

EGYPT. *Old and New Cairo, Alexandria, Sayde, &c.*

			£.	s.	d.
An Asper	-	- -	0	0	0$\frac{5}{9}$
3 Aspers	=	a Medin -	0	0	1$\frac{2}{3}$
24 Medins		an Italian Ducat	0	3	4
80 Aspers		†a Piastre -	0	4	0
30 Medins		a Dollar -	0	4	6
96 Aspers		an Ecu - -	0	5	0
32 Medins		a Crown -	0	5	0
200 Aspers		a Sultanin -	0	10	0
70 Medins		a Pargo Dollar -	0	10	0

BARBARY *Algiers, Tunis, Tripoli, Una, &c.*

			£.	s.	d.
An Asper	-	- - -	0	0	0$\frac{5}{9}$
3 Aspers	=	a Medin -	0	0	1$\frac{2}{3}$
10 Aspers		a Rial old Plate	0	0	6$\frac{3}{4}$
2 Rials		a Double -	0	1	1$\frac{1}{2}$
4 Doubles		a Dollar -	0	4	6
24 Medins		a Silver Chequin	0	3	4
30 Medins		a Dollar -	0	4	6
150 Aspers		a Zequin -	0	8	10
15 Doubles		a Pistole -	0	16	9

MOROCCO. *Santa Cruz, Mequinez, Fez, Tangiers, Sallee, &c.*

			£.	s.	d.
A Fluce		- -	0	0	0$\frac{1}{12}$
24 Fluces	=	a Blanquil -	0	0	2

AFRICA.

MOROCCO, &c.

				£.	s.	d.
4 Blanquils	=	an Ounce	-	0	0	8
7 Blanquils		an octavo	-	0	1	2
14 Blanquils		a Quarto	-	0	2	4
2 Quartos		a Medio	-	0	4	8
28 Blanquils		a Dollar	-	0	4	6
54 Blanquils		a Xequin	-	0	9	0
100 Blanquils		a Pistole	-	0	16	9

AMERICA. WEST-INDIES.

ENGLISH. *Jamaica, Barbadoes, &c.*

				£.	s.	d.
† Halfpenny		-	-	0	0	0 ,$\frac{5}{16}$ $\frac{7}{0}$
2 Halfpence	=	†a Penny		0	0	0 $\frac{5}{8}$ $\frac{7}{0}$
$7\frac{1}{2}$ Pence		a Bit	-	0	0	5 $\frac{3}{8}$
12 Pence		†a Shilling		0	0	8 $\frac{1}{2}$ $\frac{1}{6}$
75 Pence		a Dollar		0	4	6
7 Shillings		a Crown		0	5	0
20 Shillings		†a pound	-	0	14	3
24 Shillings		a Pistole	-	0	16	9
30 Shillings		a Guinea		1	1	0

FRENCH. *St Domingo, Martinico, &c.*

				£.	s.	d.
† A Half Sol		-	-	0	0	0 $\frac{1}{6}$ $\frac{1}{4}$ $\frac{7}{0}$
2 Half Sols	=	†a Sol	-	0	0	0 $\frac{1}{3}$ $\frac{1}{2}$ $\frac{7}{0}$
$7\frac{1}{2}$ Sols		a Half Scalin		0	0	2 $\frac{1}{1}$ $\frac{1}{6}$
15 Sols		a Scalin		0	0	5 $\frac{3}{8}$
20 Sols		†a livre	-	0	0	7 $\frac{5}{16}$
7 Livres		a Dollar		0	4	6
8 Livres		an Ecu	-	0	4	10 $\frac{1}{2}$
26 Livres		a Pistole	-	0	16	9
32 Livres		a Louis d'Or		1	0	0

AMERICA. CONTINENT.

ENGLISH. *Nova Scotia, Virginia, New England, &c.*

				£.	s.	d.
† A Penny		-	-	0	0	1
12 Pence	=	†a shilling	-	0	1	0
20 Shillings		†a Pound	-	1	0	0
2 Pounds						
3 Pounds						
4 Pounds						
5 Pounds						
6 Pounds						
7 Pounds						
8 Pounds						
9 Pounds						
10 Pounds						

The value of the Currency alters according to the Plenty or Scarcity of Gold and Silver Coins that are imported.

Canada, Florida, Cayena, &c.

† A Denier		
12 Deniers	=	†a Sol.
20 Sols		†a Livre.
2 Livres		
3 Livres		
4 Livres		
5 Livres		
6 Livres		
7 Livres		
8 Livres		
9 Livres		
10 Livres		

The value of the Currency alters according to the Plenty or Scarcity of Gold and Silver Coins that are imported.

Note. For all the *Spanish*, *Portuguese*, *Dutch*, and *Danish* Dominions, either on the Continent or in the West Indies, see the Moneys of the respective nations.

Ancient Money. See Coins and Medals.

Paper Money. See the article Bank.

Mongault.

MONGAULT (Nicholas Hubert), an ingenious and learned Frenchman, and one of the best writers of his time, was born at Paris in 1674. At 16 he entered into the congregation of the fathers of the oratory, and was afterwards sent to Mans to learn philosophy. That of Aristotle then obtained in the schools, and was the only one which was permitted to be taught: nevertheless Mongault, with some of that original spirit which usually distinguishes men of uncommon abilites from the vulgar, ventured in a public thesis which he read at the end of the course of lectures, to oppose the opinions of Aristotle, and to maintain those of Des Cartes. Having studied theology with the same success, he quitted the oratory in 1699; and soon after went to Thoulouse, and lived with Colbert archbishop of that place, who had procured him a priory in 1698. In 1710 the duke of Orleans, regent of the kingdom, committed to him the education of his son the duke of Chartres; which important office he discharged so well, that he acquired an universal esteem. In 1714, he had the abbey of Chartreuve given him, and that of Villeneuve in 1719. The duke of Chartres, becoming colonel-general of the French infantry, chose the Abbé Mongault to fill the place of secretary-general; made him also secretary of the province of Dauphiny; and, after the death of the regent his father, raised him to other considerable employments. All this while he was as assiduous as his engagements would permit in cultivating polite literature; and, in 1714, published at Paris, in 6 vols. 12mo. an edition of Tulley's Letters to Atticus, with an excellent French translation, and judicious comment upon them. This work has been often reprinted and is justly reckoned admirable; for, as Middleton has observed, in the preface to his Life of Cicero, the Abbé Mongault "did not content himself with retailing the remarks of other commentators, or out of the rubbish of their volumes with selecting the best, but entered upon his task with the spirit of a true critic, and by the force of his own genius has happily illustrated many passages which all the interpreters before him had given up as inexplicable." He published also a very good translation of Herodian from the Greek; the best edition of which is that of 1745, in 12mo. He died at Paris in 1746, He was a member of the French academy, and of the academy of inscriptions and belles lettres; and was fitted to do honour to any society.

Mongooz Monk.

MONGOOZ, in zoology. See Lemur.

MONK anciently denoted, "a person who retired from

from the world to give himself up wholly to God, and to live in solitude and abstinence." The word is derived from the Latin *monachus*, and that from the Greek μοναχος, "solitary;" of μονος *solus*, "alone."

The original of monks seems to have been this: The persecutions which attended the first ages of the Gospel forced some Christians to retire from the world, and live in desarts and places most private and unfrequented in hopes of finding that peace and comfort among beasts which were denied them among men. And this being the case of some very extraordinary persons, their example gave so much reputation to retirement, that the practice was continued when the reason of its commencement ceased. After the empire became Christian, instances of this kind were numerous; and those whose security had obliged them to live separately and apart, became afterwards united into societies. We may also add, that the mystic theology, which gained ground towards the close of the third century, contributed to produce the same effect, and to drive men into solitude for the purposes of enthusiastic devotion.

The monks, at least the ancient ones, were distinguished into *solitaires*, *cœnobites*, and *sarabaites*.

The *solitary* are those who live alone, in places remote from all towns and habitations of men, as do still some of the hermits.—The *cœnobites* are those who live in community with several others in the same house, and under the same superiors.—The *sarabaites* were strolling monks, having no fixed rule or residence.

The houses of monks again were of two kinds, viz. *monasteries* and *lauræ*. See MONASTERY and LAURA.

Those we call monks now-a-days are cœnobites, who live together in a convent or monastery, who make vows of living according to a certain rule established by the founder, and wear a habit which distinguishes their order.

Those that are endowed, or have a fixed revenue, are most properly called monks, *monachi;* as the Chartreux, Benedictines, Bernardines, &c. The Mendicants, or those that beg, as the Capuchins and Franciscans, are more properly called *religious* and *friars;* though the names are frequently confounded.

The first monks were those of St Antony; who, towards the close of the fourth century, formed them into a regular body, engaged them to live in society with each other, and prescribed to them fixed rules for the direction of their conduct. These regulations, which Antony had made in Egypt, were soon introduced into Palestine and Syria by his disciple Hilarion. Almost about the same time, Aones or Eugenius, with their companions Gaddanas and Azyzas, instituted the monastic order in Mesopotamia and the adjacent countries; and their example was followed with such rapid success, that in a short time the whole east was filled with a lazy set of mortals, who, abandoning all human connections, advantages, pleasures, and concerns, wore out a languishing and miserable life amidst the hardships of want, and various kinds of suffering, in order to arrive at a more close and rapturous communication with God and angels.

From the east this gloomy institution passed into the west, and first into Italy and its neighbouring islands; though it is uncertain who transplanted it thither. St Martin, the celebrated bishop of Tours, erected the first monasteries in Gaul, and recommended this religious solitude with such power and efficacy, both by his instructions and his example, that his funeral is said to have been attended by no less than 2000 monks. From hence the monastic discipline extended gradually its progress through the other provinces and countries of Europe. There were besides the monks of St Basil (called in the east *Calogeri*, from καλος γερων "good old man") and those of St Jerom, the hermits of St Augustine, and afterwards those of St Benedict and St Bernard; at length came those of St Francis and St Dominic, with a legion of others; all which see under their proper heads, BENEDICTINES, &c.

Towards the close of the 5th century, the monks, who had formerly lived only for themselves in solitary retreats, and had never thought of assuming any rank among the sacerdotal order, were now gradually distinguished from the populace, and endowed with such opulence and honourable privileges, that they found themselves in a condition to claim an eminent station among the supports and pillars of the Christian community. The fame of their piety and sanctity was so great, that bishops and presbyters were often chosen out of their order; and the passion of erecting edifices and convents, in which the monks and holy virgins might serve God in the most commodious manner, was at this time carried beyond all bounds. However, their licentiousness, even in this century, was become a proverb; and they are said to have excited the most dreadful tumults and seditions in various places. The monastic orders were at first under the immediate jurisdiction of the bishops, from which they were exempted by the Roman pontiff about the end of the 7th century; and the monks, in return, devoted themselves wholly to advance the interests and to maintain the dignity of the bishop of Rome. This immunity which they obtained was a fruitful source of licentiousness and disorder, and occasioned the greatest part of the vices with which they were afterwards so justly charged. In the 8th century the monastic discipline was extremely relaxed both in the eastern and western provinces, and all efforts to restore it were ineffectual. Nevertheless, this kind of institution was in the highest esteem, and nothing could equal the veneration that was paid about the close of the 9th century to such as devoted themselves to the sacred gloom and indolence of a convent. This veneration induced several kings and emperors to call them to their courts, and to employ them in civil affairs of the greatest moment. Their reformation was attempted by Louis the Meek, but the effect was of short duration. In the 11th century they were exempted by the popes from the authority of their sovereigns, and new orders of monks were continually established; insomuch that in the council of Lateran that was held in the year 1215, a decree was passed, by the advice of Innocent III. to prevent any new monastic institutions; and several were entirely suppressed. In the 15th and 16th centuries, it appears, from the testimonies of the best writers, that the monks were generally lazy, illiterate, profligate, and licentious Epicureans, whose views in life were confined to opulence, idleness, and pleasure. However, the Reformation had a manifest

influence

influence in restraining their excesses, and rendering them more circumspect and cautious in their external conduct.

Monks are distinguished by the colour of their habits into *black*, *white*, *grey*, &c. Among the monks, some are called *monks of the choir*, others *professed monks*, and others *lay monks*; which last are destined for the service of the convent, and have neither clericate nor literature

Cloistered MONKS, are those who actually reside in the house; in opposition to *extra*-monks, who have benefices depending on the monastery.

Monks are also distinguished into *reformed*, whom the civil and ecclesiastical authority have made masters of ancient convents, and put in their power to retrieve the ancient discipline, which had been relaxed; and *ancient*, who remain in the convent, to live in it according to its establishment at the time when they made their vows, without obliging themselves to any new reform.

Anciently the monks were all laymen, and were only distinguished from the rest of the people by a particular habit and an extraordinary devotion. Not only the monks were prohibited the priesthood, but even priests were expresly prohibited from becoming monks, as appears from the letters of St Gregory. Pope Syricius was the first who called them to the clericate, on occasion of some great scarcity of priests, that the church was then supposed to labour under: and since that time, the priesthood has been usually united to the monastical profession.

MONK (George), a personage memorable for having been the principal agent in restoring Charles II. to his crown, was descended from a very ancient family, and born in Devonshire in 1608. Being an unprovided younger son, he dedicated himself to arms from his youth, and obtained a pair of colours in the expedition to the Isle of Rhée: he served afterwards in the Low Countries with reputation in both King Charles's northern expeditions; and did such service in quelling the Irish rebellion, that he was appointed governor of Dublin, but was superseded by parliamentary authority. Being made major-general of the Irish brigade employed in the siege of Nantwich in Cheshire, he was taken prisoner by Sir Thomas Fairfax, and remained confined in the Tower of London until the year 1646; when, as the means of liberty, he took the covenant, and accepted a command in the Irish service under the parliament. He obtained the command in chief of all the parliamentary forces in the north of Ireland, where he did signal services, until he was called to account for a treaty made with the Irish rebels; a circumstance which was only obliterated by his future good fortune. He served in Scotland under Oliver Cromwell with such success, that he was left there as commander in chief; and he was one of the commissioners for uniting that kingdom with the new-erected commonwealth. He served at sea also against the Dutch; and was treated so kindly on his return, that Oliver is said to have grown jealous of him. He was, however, again sent to Scotland as commander in chief, and continued there five years; when he dissembled so well, and improved circumstances so dextrously, that he aided the desires of a wearied people, and restored the king without any disturbance; for which he was immediately rewarded both with honours and profit: (See BRITAIN, n° 194, &c.)—He was created duke of Albemarle, with a grant of 7000 l. *per annum* estate, beside other emoluments; and enjoyed the confidence of his master without forfeiting that of the people. After his death in 1670, there was published a treatise composed by him while he remained prisoner in the Tower, intitled, "Observations on Military and Political Affairs," a small folio.

MONK-*fish*. See SQUALUS.

MONKS-*Head*, or *Wolf's bane*. See ACONITUM.

MONKEY, in zoology. See APE and SIMIA.

MONMOUTH (James, duke of), son to Charles II. by Mrs Lucy Walters, was born at Rotterdam in 1649. Upon the Restoration, he was called over to England, where the king received him with all imaginable joy, created him earl of Orkney (which was changed into that of Monmouth), and he took his seat in the house of peers in the ensuing session of parliament. He married Anne, the heiress of Francis earl of Buccleugh; and hence it came to pass that he had also the title of *Buccleugh*, and took the surname of *Scot*, according to the custom of Scotland. In 1668 his father made him captain of his life-guard of horse; and in 1672 he attended the French king in the Netherlands, and gave proofs of bravery and conduct. In 1673 the king of France made him lieutenant general of his army, with which he came before Maestricht, and behaved himself with incredible gallantry, being the first who entered it himself. He returned to England, was received with all possible respect, and was received chancellor of the university of Cambridge. After this he went to assist the prince of Orange to raise the siege of Mons, and did not a little contribute towards it. He returned to England; and was sent, in quality of his father's general, to quell an insurrection in Scotland, which he effected: but soon after he fell into disgrace; for, being a protestant, he was deluded into ambitious schemes, upon the hopes of the exclusion of the duke of York: he conspired against his father and the duke: and when the latter came to the throne by the title of *James II.* he openly appeared in arms, encouraged by the Protestant army; but coming to a decisive battle before he had sufficient forces to oppose the royal army, he was defeated, taken soon after concealed in a ditch, tried for high treason, condemned, and beheaded in 1685, aged 36. See BRITAIN, n° 242. 249—265.

MONMOUTH, the capital of the county of Monmouthshire in England, 129 miles from London.—It has its name from its situation at the conflux of the Monow or Mynwy, and the Wye, over each of which it has a bridge, and a third over the Frothy.—Here was a castle in William the Conqueror's time, which Henry III. took from John Baron of Monmouth. It afterwards came to the house of Lancaster, who bestowed many privileges upon the town. Here Henry V. surnamed *of Monmouth*, was born. The famous historian Geoffrey was also born at this place. Formerly it gave the title of *earl* to the family of Carey, and of *duke* to king Charles the Second's eldest natural son; but now of *earl* to the Mordaunts, who are also earls of Peterborough. It is a populous and well built place, and carries on a con-

considerable trade with Bristol by means of the Wye. It has a weekly market, and three fairs.

Monmouthshire, a county of England; anciently reckoned a part of Wales, but in Charles the Second's time taken into the Oxford circuit, and made an English county. It is bounded on the north by Herefordshire, on the east by Gloucestershire, on the south by the river Severn, and on the west by the Welch counties of Brecknock and Glamorgan. Its extent from north to south is about 30 miles, from east to west 26, and in circumference 110. It is subdivided into six hundreds; and contains seven market-towns, 127 parishes, about 6494 houses, 38,900 inhabitants; but sends only three members to parliament, that is, one for Monmouth, and two for the county. The air is temperate and healthy; and the soil fruitful, though mountainous and woody. The hills feed sheep, goats, and horned cattle; and the valleys produce plenty of grass and corn. This county is extremely well watered by several fine rivers; for, besides the Wye, which parts it from Gloucestershire, the Mynow, which runs between it and Herefordshire, and the Rumney, which divides it from Glamorganshire, it has, peculiar to itself, the Usk, which enters this county a little above Abergavenny, runs mostly southward, and falls into the Severn by the mouth of the Ebwith; which last river runs from north to south, in the western side of the county. All these rivers, especially the Wye and Usk, abound with fish, particularly salmon and trout.

MONNOYE (Bernard de la), born at Dijon in 1641, was a man of fine parts and great learning. He was admirably formed for poetry; and used to win the first prizes instituted by the members of the French academy, till he discontinued to write for them (it is said) at the solicitation of the academy; a circumstance which, if true, would reflect higher honour on him than a thousand prizes. All his pieces are in a most exquisite taste; and he was no less skilful in Latin poetry than in the French. Menage and Bayle have both bestowed the highest encomiums on his Latin poetry. His Greek poems are likewise looked upon as very good; and so are his Italian, which are written with great spirit. But poetry was not La Monnoye's only province: to a perfect skill in poetry, he joined a very accurate and extensive knowledge of the languages. He had great skill in criticism; and no man applied himself with greater assiduity to the study of history, ancient and modern. He was perfectly acquainted with all the scarce books that had any thing curious in them; very well versed in the history of the learned; and what completes all, is the wonderful clearness with which he possessed these various kinds of knowledge. He wrote Remarks on the Menagiana; in the last edition of which, in 4 vols 12mo, printed in 1715, are included several pieces of his poetry, and a curious dissertation on the famous book *De tribus Impostoribus*. His Dissertation on *Pomponius Lætus*, at least an extract of it, is inserted in the new edition of Baillet's *Jugemens des sçavans*, published in 1722, with a great number of remarks and corrections by La Monnoye. He also embellished the Anti-Baillet of Menage with a multitude of corrections and notes. It would employ several pages to enumerate the varions services this ingenious and learned man did to the republic of letters; as well by enriching it with productions of his own, as by the assistance which he communicated very freely upon all occasions to the learned of his times. Thus, among others, he favoured Bayle with a great number of curious particulars for his Dictionary, and was highly applauded by him on that account. He died at Paris, October 15th, 1728, in his 88th year. —Mr de Sallinger published at the Hague A Collection of Poems by La Monnoye, with his elogium, from whence many of the above particulars are taken. He also left behind him a Collection of Letters, mostly critical; several curious Dissertations; 300 Select Epigrams from Martial, and other poets ancient and modern, in French verse; several other works in prose and verse, in French, Latin, and Greek, all ready for the press.

MONNOYER (John Baptist), "one of the greatest masters (according to Mr Walpole) that has appeared for painting flowers. They are not so exquisitely finished as Van Huysum's, but his colouring and composition are in bolder style." He was born at Lisle in 1635; and educated at Antwerp as a painter of history, which he soon changed for flowers. Going to Paris in 1663, he was received into the academy with applause; and employed at Versailles, Trianon, Marly, and Meudon; and painted in the hotel de Bretonvilliers at Paris, and other houses. The duke of Montague brought him to England; where much of his hand is to be seen, at Montague-house, Hampton-court, the duke of St Alban's at Windsor, Kensington, Lord Carlisle's, Burlington-house, &c. But his most curious work is said to be a looking glass at Kensington palace, which he adorned with flowers for Queen Mary, who held him in such high esteem, that she honoured him with her presence nearly the whole time he was busied in the performance.—Baptist passed and repassed several times between France and England; but having married his daughter to a French painter who was suffered to alter and touch upon his pictures, Baptist was offended and returned to France no more. He died in Pall-mall in 1699.—His son Antony, called *young Baptist*, painted in his father's manner, and had merit.

MONOCEROS, unicorn, in astronomy, a southern constellation formed by Hevelius, containing in his catalogue 19 stars, and in the Britannic Catalogue 31.

MONOCEROS, in zoology. See Monodon.

MONOCHORD; an instrument by which we are enabled to try the several proportions of musical sounds and intervals, as well in the natural as in tempered scales. Originally it had, as its name implies, only one string; but it is better constructed with two, as we have by means of this additional string an opportunity of judging of the harmony of two tempered notes in every possible variety of temperament (see Temperament and tuning). It consists of a brass rule placed upon a sound-board, and accurately divided into different scales according to the purposes for which it is chiefly intended. Above this rule the strings are to be stretched over two fixed bridges, between which there is a moveable fret, so contrived as to divide at pleasure one of the strings into the same proportional parts as are engraved upon the scales beneath. The figure of the instrument, the manner of

striking

Monochord.

ſtriking the ſtrings ſo as to produce the ſound, as likewiſe the conſtruction of the moveable bridge, may be varied at pleaſure according to the wiſh and ingenuity of the artiſt: But with the aſſiſtance of ſuch an inſtrument accurately conſtructed, any perſon with a good ear may be enabled to tune a keyed inſtrument with ſufficient preciſion to anſwer every practical purpoſe.

The following table contains the chief ſcales that have hitherto been computed. In column 1ſt is given the natural ſcale, or ſcale of perfect intervals. The ſecond column contains a new tempered ſcale, which ſeems better adapted than any other to keyed inſtruments, when chiefly deſigned for leſſon-playing, or playing without accompanyments. The third is a ſcale propoſed by Mr Emerſon in his Mechanics, and ſince recommended by Mr Jones in his Phyſiological Diſquiſitions, and by Mr Cavallo in the Philoſophical Tranſactions for 1788. The fourth and fifth exhibit the ſyſtems of mean tones, and of equal harmony, calculated by Dr Smith for inſtruments of a more perfect conſtruction than thoſe now in uſe.

Note.	Natural Scale.	Tempered Scale.	Emerſon, Jones, &c.	Mean Tones.	Equal harmony
C		1000			
C✻	937.5	952.9	943.8	957	959.3
D♭				934.5	933
D	888.9	893.3	890.9	894.4	895
D✻	833.3	837.5	840.8	856	858.6
E♭				836	835
E	800	798	793.7*	800	801
F♭				781	779
E✻				765.6	768.5
F	750	748.1	749.1	747.6	747.4
F✻	711.1	712.9	707.1	715.5	717
G♭				698.7	697.3
G	666.7	668.3	667.4	668.7	669
G✻	625	632	629.9	640	641.7
A♭				625	624
A	600	597	594.6	598	598.7
A✻	562.5	559.7	561.2	572.4	574.4
B♭				559	558.6
B	533.3	533.3	529.7*	535	536
C♭				522.4	521
B✻				512	514
C	500	500	500	500	500

N. B. Mr Jones propoſes to have the two numbers which are denoted by ſtars reſpectively altered to the numbers 796 and 531.

The method of tuning any inſtrument by means of the monochord is as follows: Firſt, you muſt tune the C of the monochord to the concert pitch by means of a tuning-fork; next, you are to put the middle C of your inſtrument in perfect uniſon with the C of the monochord: Then move the ſliding fret to the next diviſion on the ſcale, and proceed in the ſame manner with all the ſeveral notes and half notes within the compaſs of an octave. When this is done with accuracy, the other keys are all to be tuned, by comparing them with the octave which is already tempered. [The monochord is here ſuppoſed to be made to the pitch of C; but this may be varied at the will of the conſtructor.]

The curious reader who may wiſh for further information reſpecting the conſtruction and uſe of monochords, will be highly gratified in peruſing the appendix of Mr Atwood's Treatiſe on Rectilinear Motion, and Mr Jones's ingenious and entertaining obſervations on the ſcale of muſic, monochord, &c. in his Phyſiological Diſquiſitions.

Monochord is alſo uſed for any muſical inſtrument that conſiſts of only one ſtring or chord; in this ſenſe the trumpet marine may properly be called a *monochord.*

MONOCULUS, in zoology; the name of a genus of inſects of the order of *aptera*, in the Linnæan ſyſtem. Its body is ſhort, of a roundiſh figure, and covered with a firm cruſtaceous ſkin; the fore-legs are ramoſe, and ſerve for leaping and ſwimming; it has but one eye, which is large, and compoſed of three ſmaller ones.

Of this genus, many of which have been reckoned among the microſcopic animals, authors enumerate a great number of ſpecies. The figure in Plate CCCXV. repreſents the quadricornis, or four-horned monoculus, a very ſmall ſpecies about half a line in length, and of an aſhen grey colour. From the head ariſe four antennæ, two forwards and two backwards; all four furniſhed with a few hairs, which give them the figure of a branch. Between the antennæ, on the fore part of the head, is ſituated a ſingle eye. From the head to the tail the body goes down, decreaſing in ſhape like a pear; and is compoſed of ſeven or eight rings, which grow continually more ſtraitened. The tail is long, divided into two; each diviſion giving riſe outwardly to three or four briſtly hairs. The animal carries its eggs on the two ſides of its tail in the form of two yellowiſh parcels filled with ſmall grains, and which taken together, nearly equal the inſect in bigneſs. This minute inſect is found in ſtanding pools. A number of them being kept in a bottle of water, ſome will be ſeen loaded with their eggs, and after a while depoſiting the two parcels, either jointly or ſeparately.

The name *monoculus* has been given to this genus, as conſiſting of individuals which apparently have but one eye: and from the manner in which they proceed forward in the water by leaping, they have alſo been called *water-fleas*. The branching antennæ ſerve them inſtead of oars, the legs being ſeldom uſed for ſwimming. "The tail, forked in ſome ſpecies, in others ſimple, ſerves them for a rudder. Their colour varies from white to green, and to red, more or leſs deep, doubtleſs in a ratio to the fragments of the vegetables on which they feed. The red tincture they ſometimes give to the water, has made ſome ignorant men think that the water had turned to blood. Too weak to be carnivorous, they on the contrary fall a prey to other aquatic inſects, even to polypi. Their body, compact and hard, is ſo tranſparent that in ſome the eggs with which the abdomen is filled are diſcernable. The water-parrot and the ſhell-monoculus, are remarkable. This latter is provided with a bivalvular ſhell, within which he ſhuts himſelf

Barbut's Genera of Inſects, p. 360.

Monodon.

himſelf up, if drawn out of the water. The ſhell opens underneath, the inſect puts forth its antennæ, by means of which it ſwims very expeditiouſly in various directions, ſeeking a ſolid body to adhere to, and then it is that it uſes its feet in walking, by ſtretching them out through the aperture of its ſhell.

"I preſerved a pair of theſe inſects (ſays our author), laſt year, in a ſmall glaſs tumbler, the one male the other female, having a bag filled with eggs affixed on each ſide the abdomen. In the ſpace of 14 days the increaſe was aſtoniſhing: it would have been impoſſible to have taken a ſingle drop of water out of the glaſs without taking with it either the larva or a young monoculus. I again repeated the experiment by ſelecting another pair; and at the expiration of the laſt 14 days my ſurpriſe was increaſed beyond meaſure. The contents of the glaſs appeared a maſs of quick-moving, animated matter; and being diverſified by colours of red, green, aſh-colour, white, &c. afforded with the aſſiſtance of the magnifier, conſiderable entertainment."

MONODON, in ichthyology, a genus of fiſhes belonging to the order of *cete;* the characters of which are: There are two very long, ſtraight, and ſpirally twiſted teeth, which ſtick out from the upper jaw; and the ſpiracle or breathing hole, is ſituated on the anterior part of the ſkull. There is but one ſpecies, the monoceros, or horned narwhal, which ſometimes grows to 25 feet in length, excluſive of the horn; but the uſual ſize is from 16 to 20. It is particularly noted for its horn or horns, as they are called; but which are real teeth. Of theſe there are always two in young animals; though the old ones have generally but one, ſometimes none. From the circumſtance of only one tooth being uſually found, the animal has acquired the name of *Unicorn Fiſh*, or *Sea Unicorn*. They inhabit the northern ſeas, from Norway to within the arctic circle: they are plentiful in Davis's ſtraits and the north of Greenland; where the natives, for want of wood, make rafters of the teeth. From the tooth or horn may be diſtilled a very ſtrong *ſal volatile:* the ſcrapings are eſteemed *alexipharmic*, and were uſed of old in malignant fevers and againſt the bites of ſerpents. The uſe of it to the animal ſeems to be chiefly as a weapon of offence, and a very powerful one it appears to be: there are many inſtances of its having been found in the bottoms of ſhips which returned from the northern ſeas, probably owing to the animal's having miſtaken the ſhip for a whale, and attacked it with ſuch fury as not to be able to get out the weapon from the wood. It may alſo ſerve as an inſtrument to looſen and diſengage from the rocks or bottom of the ſea the ſea plants on which it feeds. Theſe fiſhes ſwim ſwiftly, and can only be ſtruck when numbers happen to be found together, and obſtruct their own courſe with their teeth. Their ſkin is white, with black ſpots on the back, and has a great quantity of blubber underneath.

Plate CCCXV.

The tooth of this animal was in old times impoſed upon the world as the horn of an unicorn, and ſold at a very high price. The heirs of the chancellor to Chriſtian Friſius of Denmark, valued one at 8000 imperials. There is a magnificent throne made of this ſpecies of ivory for the Daniſh monarchs, which is ſtill preſerved in the caſtle at Roſenberg. The price of this material was ſuperior to gold.

Monody ‖ Monophyſites.

MONODY, in ancient poetry, a mournful kind of ſong, ſung by a perſon all alone, to give vent to his grief. The word is derived from μονος "alone," and κιρω "I ſing."

MONOECIA, from μονος *alone*, and οικια a *houſe;* the name of the 21ſt claſs in Linnæus's ſexual method. See Botany.

MONOGAMY, compounded of μονος *ſolus*, and γαμος "marriage," the ſtate or condition of thoſe who have only married once, or are reſtrained to a ſingle wife. See Polygamy.

MONOGLOSSUM (anc. geog.), a mart-town of the Hither India, ſituated on the Sinus Canthi, into which the Indus empties itſelf. Said to be Mangalor on the coaſt of Malabar. E. Long. 74°, N. Lat. 13°.

MONOGRAM, a character or cypher, compoſed of one, two, or more letters interwoven; being a kind of abbreviation of a name, anciently uſed as a ſeal, badge, arms, &c.

MONOGYNIA, from μονος *alone*, and γυνη a *woman;* the name of the firſt order or ſubdiviſion in the firſt 13 claſſes of Linnæus's ſexual method; conſiſting of plants which, beſides their agreement in their claſſic character, generally derived from the number of their ſtamina, have only one ſtyle, or female organ.

MONOMOTAPA, a country of Africa, has the maritime kingdom of Sofala on the eaſt, the river Del Spiritu Santo on the ſouth, the mountains of Caffraria on the weſt, and the river Cauma on the north, which parts it from Monoemugi. The air of this country is very temperate; the land fertile in paſtures and all the neceſſaries of life, being watered by ſeveral rivers. The inhabitants are rich in black cattle, which they value more than gold. They have a vaſt number of elephants, as appears from the great quantity of ivory that is exported from hence. There are many gold-mines, and the rivers that run through their veins carry a great deal of gold-duſt along with them. The inhabitants are lovers of war, which is the employment followed by all thoſe who do not apply themſelves to commerce. This country is divided into ſeven provinces or petty kingdoms, vaſſals to the king; viz. Monomotapa Proper, Quiteve, Manica, Inhambana, Inhemior, Sabia, and Sofala.

MONOPETALOUS, in botany, a term applied to flowers that have only one petal or flower-leaf.

MONOPHYSITES, (from μονος *ſolus*, and φυσις *natura*), a general name given to all thoſe ſectaries in the Levant who only own one nature in Jeſus Chriſt; and who maintain, that the divine and human nature of Chriſt were ſo united as to form only one nature, yet without any change, confuſion or mixture of the two natures.

The *monophyſites*, however, properly ſo called, are the followers of Severus, a learned monk of Paleſtine, who was created patriarch of Antioch in 513, and Petrus Fullenſis.

The monophyſites were encouraged by the emperor Anaſtaſius, but depreſſed by Juſtin and ſucceeding emperors. However, this ſect was reſtored by Jacob Baradæus an obſcure monk, inſomuch that when he died bishop of Edessa, A. D. 588, he left it in a most flourishing state in Syria, Mesopotamia, Armenia, Egypt, Nubia, Abyssinia, and other countries. The laborious efforts of Jacob were seconded in Egypt and the adjacent countries, by Theodosius bishop of Alexandria; and he became so famous that all the monophysites of the east considered him as their second parent and founder, and are to this day called *Jacobites*, in honour of their new chief. The monophosites are divided into two sects or parties, the one African, the other Asiatic; at the head of the latter is the patriarch of Antioch, who resides for the most part in the monastery of St. Ananias, near the city of Merdin: the former are under the jurisdiction of the patriarch of Alexandria, who generally resides at Grand Cairo, and are subdivided into Cophts and Abyssinians. From the 15th century downwards, all the patriarchs of the monophysites have taken the name of *Ignatius*, in order to show that they are the lineal successors of Ignatius, who was bishop of Antioch in the first century, and consequently the lawful patriarchs of Antioch. In the 17th century, a small body of the monophysites in Asia abandoned for some time the doctrine and institution of their ancestors, and embraced the communion of Rome: but the African monophysites, notwithstanding that poverty and ignorance which exposed them to the seductions of sophistry and gain, stood firm in their principles, and made an obstinate resistance to the promises, presents, and attempts employed by the papal missionaries to bring them under the Roman yoke: and in the 18th century, those of Asia and Africa have persisted in their refusal to enter into the communion of the Romish church, notwithstanding the earnest intreaties and alluring offers that have been made from time to time by the pope's legates, to conquer their inflexible constancy. The monophysites propagate their doctrine in Asia with zeal and assiduity, and have not long ago gained over to their communion a part of the Nestorians, who inhabit the maritime coasts of India.

MONOPOLY, one or more persons making themselves the sole masters of the whole of a commodity, manufacture and the like, in order to make private advantage of it, by selling it again at a very advanced price. Or it is a licence or privilege allowed by the state for the sole buying and selling, making, working, or using any thing whatsoever. Monopolies had been carried to a great height in England during the reign of Queen Elizabeth; and were heavily complained of by Sir Edward Coke, in the beginning of the reign of King James I.: but were in a great measure remedied by statute 21 Jac. I. c. 3. which declares such monopolies to be contrary to law, and void; except as to patents, not exceeding the grant of 14 years, to the authors of new inventions; and except also patents concerning printing, saltpetre, gunpowder, great ordnance, and shot); and monopolists are punished with the forfeiture of treble damages and double costs, to those whom they attempt to disturb; and if they procure any action brought against them for these damages to be stayed by any extrajudicial order, other than of the court wherein it is brought, they incur the penalties of *præmunire*. Combinations also among victuallers or artificers, to rase the price of provisions, or any commodities, or the rate of labour, are in many cases severely punished by particular statute; and, in general, by statute 2 & 3 Edward VI. c. 15. with the forfeiture of L.10. or 20 days imprisonment, with an allowance of only bread and water for the first offence: L.20 or the pillory for the second; and L.10 for the third, or else the pillory, loss of one ear, and perpetual infamy. In the same manner, by a constitution of the emperor Zego, all monopolies and combinations to keep up the price of merchandise, provisions, or workmanship, were prohibited, upon pain of forfeiture of goods and perpetual banishment,

MONOSYLLABLE, in grammar, a word that consists only of one syllable, and s composed either of one or more letters pronounced at the same time. The too frequent use of monosyllables has a very bad effect in English poetry, as Mr Pope both intimates and exemplifies in the same verse, viz.

"And ten slow words oft creep in one dull line."

MONOTHELITES, (compounded of μονος single, and θελημα "will," of θελω *volo* "I will"), an ancient sect, which sprung out of the Eutychians; thus called, as only allowing of one will in Jesus Christ.

The opinion of the Monothelites had its rise in 630, and had the emperor Heraclius for an adherent: it was the same with that of the Acephalous Severians. They allowed of two wills in Christ, considered with regard to the two natures; but reduced them to one, by reason of the union of the two natures; thinking it absurd there should be two free wills in one and the same person. They were condemned by the sixth general council in 680, as being supposed to destroy the perfection of the humanity of Jesus Christ, depriving it of will and operation. Their sentiments were afterwards embraced by the Maronites.

MONOTONY, an uniformity of sound, or a fault in pronunciation, when a long series of words are delivered in one unvaried tune. See READING.

MONOTROPA, BIRD'S-NEST, A genus of the monogynia order, belonging to the monandria class of plants; and in the natural method ranking with those of which the order is doubtful. There is no calyx, but 10 petals: and of these the five exterior have a melliferous hollow at the base. The capsule is quinquevalved. In some of the flowers a fifth part of the number is excluded as in the *M. Hippopithys*. There are two species; of which the only remarkable one is the hippopithys, a native of Britain and some of the more northerly kingdoms of Europe. It is about five inches high, having no other leaves than oval scales, and terminated with a nodding spike of flowers, which in the seeding state becomes erect: the whole plant is of a pale yellow colour, smelling like the primrose, or like beans in blossom. The country people in Sweden give the dried plant to cattle that have a cough.

MONREAL. See MONTREAL.

MONRO (Dr Alexander, senior), a most eminent physician and anatomist, was descended by his father from the family of Monro of Milton, which had large possessions in the county of Ross; and by his mother, from that of Forbes of Culloden.

His father John, youngest son of Sir Alexander Monro of Bearcrofts, was bred to physic and surgery, and

Monro. and ferved for fome years as a furgeon in the army under King William in Flanders; but, for feveral fucceffive years, obtaining leave of abfence from the army in the winter, he during that feafon refided with his wife in London, where his fon Alexander was born in the year 1697. About three years thereafter, he quitted the army, and went to fettle as a furgeon at Edinburgh; where his knowledge in his profeffion, and engaging manners, foon introduced him into an extenfive practice.

The fon fhowed an inclination to the ftudy of phyfic; and the father, after giving him the beft education that Edinburgh then afforded, fent him fucceffively to London, Paris, and Leyden, to improve himfelf further in his profeffion. At London, he attended the lectures of Meffrs Haukfbee and Whifton on experimental philofophy, and the anatomical demonftrations of Mr Chefelden. At Paris, he attended the hofpitals, and the lectures which were read on the different branches of phyfic and furgery at that time. Towards the end of autumn 1718, he went to Leyden, and ftudied under the great Boerhaave; by whom he was particularly efteemed.

On his return to Edinburgh in autumn 1719, Meffrs Drummond and Macgill, who were then conjunct nominal profeffors and demonftrators of anatomy to the furgeons company, having refigned in his favour, his father prevailed on him to read fome public lectures on anatomy; and to illuftrate them by fhowing the curious anatomical preparations which he had made and fent home when abroad. He at the fame time perfuaded Dr Alfton, then a young man, to give fome public lectures on botany. Accordingly, in the beginning of the winter 1720, thefe two young profeffors began to give regular courfes of lectures, the one on the materia medica and botany, the other on anatomy and furgery; which were the firft regular courfes of lectures on any of the branches of medicine that had ever been read at Edinburgh, and may be looked upon as the opening of that medical fchool which has fince acquired fuch great reputation all over Europe.

In fummer 1721 and 1722, Dr Monro, by the perfuafion of his father, read fome lectures on chirurgical fubjects; particularly on wounds and tumors, which he never would publifh, having wrote them in a hurry and before he had much experience; but inferted from time to time the improvements he thought might be made in furgery, in the volumes of Medical Effays and Obfervations to be hereafter mentioned.

About the year 1720, his father communicated to the phyficians and furgeons at Edinburgh, a plan, which he had long formed in his own mind, of having the different branches of phyfic and furgery regularly taught at Edinburgh; which was highly approved of by them, and by their intereft regular profefforfhips of anatomy and medicine were inftituted in the univerfity. His fon, Dr Monro, was firft made univerfity-profeffor of anatomy; and two or three years afterwards, Drs Sinclair, Rutherford, Innes, and Plummer, were made profeffors of medicine; the profefforfhip of materia medica and botany, which Dr Alfton then held, having been added to the univerfity many years before. Immediately after thefe gentlemen were elected profeffors, they began to deliver regular courfes of lectures on the different branches of medicine, and they and their fucceffors have uniformly continued fo to do every winter,

Monro. The plan for a medical education at Edinburgh was ftill incomplete without an hofpital, where ftudents could fee the practice of phyfic and furgery, as well as hear the lectures of the profeffors. A fcheme was therefore propofed by Dr Monro's father, and others, particularly the members of the royal college of phyficians and board of furgeons, for raifing by fubfcription a fund for building and fupporting an hofpital for the reception of difeafed poor; and our author publifhed a pamphlet fetting forth the advantages that would attend fuch an inftitution. In a fhort time a confiderable fum of money was raifed, a fmall houfe was fitted up, and patients were admitted into it, and regularly attended by many of the phyficians and furgeons in town. The fund for this charity increafing very confiderably, in a great meafure from the activity and influence of that very worthy citizen and magiftrate George Drummond, Efq; the foundation was laid of the prefent large, commodious, and ufeful hofpital, the *Royal Infirmary*: in the planning of which Dr Monro fuggefted many ufeful hints, and in particular the elegant room for chirurgical operations was defigned and executed under his direction. Provoft Drummond and he were nominated the building committee; and the fabric was entirely completed in a fhort fpace of time. It has fince been fo largely endowed, as to be capable of receiving a great number of difeafed poor, whofe cafes the ftudents of phyfic and furgery have an opportunity of feeing daily treated with the greateft attention and care, by phyficians and furgeons eminent in their profeffion; and a regifter of the particulars of all the cafes which have been received into the houfe fince its firft opening has been kept, in books appropriated for that purpofe, for the ufe of the ftudents.

In order to make the hofpital of ftill further ufe to the ftudents, Dr Monro frequently, while he continued profeffor of anatomy, gave lectures on the chirurgical cafes; and the late judicious phyfician, Dr Rutherford profeffor of the practice of phyfic, began, in the year 1748, to deliver clinical lectures to be continued every winter, on the moft remarkable cafes in the hofpital.

Doctor Monro, though he was elected profeffor of anatomy in the year 1721, was not received into the univerfity till the year 1725, when he was inducted along with that great mathematician the late Mr Colin Maclaurin, with whom he ever lived in the ftricteft friendfhip. From this time he regularly every winter gave a courfe of lectures on anatomy and furgery, from October to May, upon a moft judicious and comprehenfive plan: A tafk in which he perfevered with the greateft affiduity, and without the leaft interruption, for near 40 years; and fo great was the reputation he had acquired, that ftudents flocked to him from the moft diftant corners of his majefty's dominions.

In 1759, our profeffor entirely relinquifhed the bufinefs of the anatomical theatre to his fon Dr Alexander, who had returned from abroad, and had affifted him in the courfe of lectures the preceding year. But after this refignation, he ftill endeavoured to render his

 labours

Monro. labours useful to mankind, by reading clinical lectures at the hospital for the improvement of the students; of which Dr Duncan, who was one of his pupils, has given the following account. "There I had myself the happiness of being a pupil, who profited by the judicious conduct of his practice, and was improved by the wisdom and acuteness of his remarks. I have indeed to regret that I attended only the last course of lectures in which he had ever a share, and at a time when he was subjected to a disease which proved at length fatal. Still, however, from what I saw and from what I heard, I can venture to assert, that it is hardly possible to conceive a physician more attentive to practice, or a preceptor more anxious to communicate instructions. His humanity, in the former of these characters, led him to bestow the most anxious care on his patients while they were alive, and his zeal in the latter induced him to make them the subject of useful lessons when they happened to die.—In the different stations of physician, of lecturer, and of manager in the hospital, he took every measure for inquiring into the causes of diseases by dissection.—He personally attended the opening of every body; and he not only dictated to the students an accurate report of the dissection, but with nice discrimination contrasted the diseased and sound state of every organ. Thus, in his own person, he afforded to the students a conspicuous example of the advantages of early anatomical pursuits as the happiest foundation for a medical superstructure. His being at once engaged in two departments, the anatomical theatre and clinical chair, furnished him with opportunities both on the dead and living body, and placed him in the most favourable situation for the improvement of medicine; and from these opportunities he derived every possible advantage which they could afford."

His father, old Mr Monro, lived to an advanced age; and enjoyed the unspeakable pleasure of beholding a son, esteemed and regarded by mankind, the principal actor in the execution of his favourite plan, the great object of his life, the founding a seminary of medical education in his native country: The son, who survived him near 30 years, had the satisfaction to behold this seminary of medical education frequented yearly by 300 or 400 students, many of whom came from the most distant corners of his majesty's dominions, and to see it arrive to a degree of reputation far beyond his most sanguine hopes, being equalled by few, and inferior to none, in Europe.

Few men were members of more societies than Dr Monro: still fewer equally assiduous in their attendance of those which in any way tended to promote public utility. He was a manager of many public charities; and not only a member of different medical societies, but likewise of several others instituted for promoting literature, arts, sciences, and manufactures, in Scotland, and was one of their most useful members.—While he was held in high estimation at home, he was equally esteemed and respected abroad, and was elected member of the Royal Society of London, and an honorary member of the Royal Academy of Surgery at Paris,

He was not only very active in the line of his own profession, but as a citizen and general member of the community; for, after he had resigned the anatomical chair to his son, he executed with the strictest punctuality the duties of several engagements both of a civil and political nature: He was a director of the Bank of Scotland, a Justice of the Peace, a Commissioner of High-Roads, &c. At length, after a life spent in the most active industry, he became afflicted with a tedious and painful disease, which he bore with equal courage and resignation till his death, which happened on July 10th, 1767, in the 70th year of his age. Monro.

Of his works, the first in order is his Osteology, which was written for the use of students, but is capable also of affording instruction to the oldest and most experienced practitioner; as, besides a minute description of the parts copied from nature, it every where abounds with new and important observations immediately applicable to practice. It has been translated into many different languages; has passed through numerous editions; and has been reprinted in foreign countries in the most superb manner, accompanied with elegant and masterly engravings. His description of the Lacteal Sac and Thoracic Duct contains the most accurate account of that important part of the body which has been yet published: and his Anatomy of the Nerves will transmit to posterity an excellent example of accurate dissection, faithful description, and ingenious reasoning. The six volumes of Medical Essays and Observations, published by a society in Edinburgh, are universally known and esteemed. To that society he was appointed secretary; but, after the publication of the first volume, to which he had largely contributed, the members growing remiss in their attendance, he became the sole collector and publisher of the work: To him we are therefore in a great measure indebted for these numerous and important discoveries with which this publication has enriched every department of medical knowledge. In the two first volumes of the Physical and Literary Essays, published by the physical society in Edinburgh, in which he had the rank of one of the presidents, we find several papers written by him, which are not the least ornaments of that collection. His account of the Success of Inoculation in Scotland may be considered as his last publication: It demonstrates his extensive correspondence and indefatigable industry, and has had great influence in promoting that salutary practice. Besides these, he was also the the author of several other elegant and masterly productions, which were either never published, or were published without his knowledge and from incorrect copies. A collection of all his works, properly, arranged, corrected, and illustrated with copperplates, has been published by Dr Alexander Monro, his son and successor in the anatomical chair, in a splendid quarto volume, printed for Elliot, Edinburgh, 1781; to which is prefixed a life of the author, by another of his sons, Dr Donald, physician in London, The observation of an excellent judge, the illustrious Haller concerning our author's Medical Essays and Observations, which now form a part of this collection, may with no less justice be applied to the whole: It is a "book which ought to be in the possession of every medical practitioner."

MONS, an ancient, large, handsome, rich, and very strong city of the Austrian Netherlands in Hainault.

Mons‖Monsonia. nault. There is a chapter, consisting of 30 ladies of distinction, who have the liberty of leaving the community when they intend to marry. They have several manufactures, and a good trade. It was taken by the allies in 1709, and by the French in July 1746; but rendered back by the treaty of Aix-la-Chapelle, after the fortifications were demolished. It stands partly on a hill, and partly on a plain in a marshy soil, on the rivers Haine and Trouli, by which the country about it may be overflowed at pleasure. It has been lately taken by the arms of the French Republic. E. Long. 3. 39. N. Lat. 50. 25.

Mons *Sacer*, (anc. geog.), a mountain of the Sabines beyond the Anio, to the east of Rome; whither the common people retired once and again to avoid the tyranny of the patricians. From this secession, and the altar of *Jupiter Terribilis* erected there, the mountain took its name.

MONSEIGNEUR, in the plural *Messeigneurs*, a title of honour and respect used by the French in writing to persons of superior rank or quality, before the late abolition of all ranks.

Dukes, peers, archbishops, bishops, and presidents *á la mortier*, were complimented with the title of *Monseigneur*. In the petitions presented to the sovereign courts, they used the term *Messeigneurs*.

Monseigneur, absolutely used, was a title restrained to the dauphin of France. This custom was unknown till the time of Louis XIV. before which the dauphin was styled *Monsieur le Dauphin*.

MONSIEUR, in the plural *Messieurs*, a term or title of civility, used by the French in speaking to their equals, or those a little below them, answering to *Mr* or *Sir* among the English.

Monsieur, absolutely used, was a title or quality appropriated to the second son of France, or the king's brother. The king was also called *Monsieur*, but that only by the children of France.

MONSON (Sir William), a brave English admiral, third son of Sir John Monson of South Carlton in Lincolnshire, was born in 1569. He was employed in many expeditions against the Spaniards in Queen Elizabeth's time, and was highly honoured; the queen knighted him for his services in the earl of Essex's expedition to Cadiz, where he assisted much by his wise and moderate counsel to the earl. Military men were no favourites with James I. therefore, on the death of the queen, he received no recompence or pay beyond the ordinary service in which he was engaged: nevertheless, as admiral of the narrow seas, he supported the honour of the British flag against the infant insolence of the Dutch states, of which he frequently complains in his Navy tract; and protected the trade against the encroachments of France. He had the misfortune to fall into disgrace by his vigilance, and was imprisoned in the Tower through the resentment of some powerful courtiers; yet he was discharged, and wrote a vindication of his own conduct, intitled, "Concerning the insolencies of the Dutch, and a Justification of Sir William Monson." He spent his latter days in peace and privacy, which he employed in digesting his Navy Tracts, and died in 1643.—Part of these tracts were printed in 1682; and they were afterwards all included in Churchill's Collection of Voyages.

MONSONIA, in botany: A genus of the dodecandria order, belonging to the polyadelphia class of plants. The calyx is pentaphyllous; the corolla pentapetalous and irregular; the stamina are 15 in number, and coalited into five filaments; the style bifid; the capsule pentacoccous. Monsonia‖Monster.

MONSOON, a regular or periodical wind, in the East Indies, blowing constantly the same way, during six months of the year, and the contrary way the remaining six.

In the Indian ocean, the winds are partly general, and blow all the year round the same way, as in the Ethiopic ocean; and partly periodical, *i. e.* half the year blow one way, and the other half year on the opposite points: and those points and times of shifting differ in different parts of this ocean. These latter are what we call *monsoons*.

The shifting of these monsoons is not all at once; and in some places the time of the change is attended with calms, in others with variable winds, and particularly those of China, at ceasing to be westerly, are very subject to be tempestuous; and such is their violence, that they seem to be of the nature of the West India hurricanes, and render the navigation of those seas very unsafe at that time of the year. These tempests the seamen call the *breaking up of the monsoons*.

Monsoons, then, are a species of what we otherwise call *trade-winds*. They take the denomination *monsoon* from an ancient pilot, who first crossed the Indian sea by means hereof. Though others derive the name from a Portuguese word, signifying motion or change of wind, and sea.

Lucretius and Apollonius make mention of annual winds which arise every year, *etesia flabria*, which seem to be the same with what in the East Indies we now call *monsoons*. For the physical cause of these winds, see Wind.

MONSTER; a birth or production of a living being, degenerating from the proper and usual disposition of parts in the species to which it belongs: As, when there are too many members, or too few; or some of them are extravagantly out of proportion, either on the side of defect or excess. The word comes from the Latin *monstrum*, of *monstrando*, "showing." Whence also the box wherein relics were anciently kept to be shown, was called *monstrum*. Dugdale mentions an inventory of the church of York with this article, *Item unum monstrum cum ossibus sancti Petri in Beryl, & crucifixo in summitate*.

Aristotle defines a monster to be a defect of nature, when, acting towards some end, it cannot attend to it, from some of its principles being corrupted.

Monsters do not propagate their kind; for which reason some rank *mules* among the number of monsters, as also *hermaphrodites*.

Females which bring forth twins, are found most liable to produce monsters. The reason, probably, is owing to this; that though the twins are covered with one common chorion, yet they have each their separate amnios, which by their contiguity may chance to grow together, and so occasion a confusion or blending of the parts. Hence so many double creatures.

F. Malebranche accounts for the production of monsters in the animul world in the following manner:

Monſter. ner: "The Creator has eſtabliſhed ſuch a communication between the ſeveral parts of his creation, that we are not only naturally led to imitate one another, *i. e.* have a diſpoſition to do the ſame things and aſſume the ſame manners with thoſe with whom we converſe; but alſo have certain natural diſpoſitions which incline us to compaſſion as well as imitation. Theſe things moſt men feel, and are ſenſible of; and therefore need not be proved. The animal ſpirits, then, are not only naturally carried into the reſpective parts of the body to perform the ſame actions and the ſame motions which we ſee others do, but alſo to receive in ſome manner their wounds, and take part in their ſufferings.

"Experience tells us, that when we look attentively on any perſon ſeverely beaten, or that hath a large wound, ulcer, or the like, the ſpirits immediately flow into thoſe parts of our body which anſwer to thoſe we ſee ſuffer in the other; unleſs their courſe be ſtopped from ſome other principle. This flux of ſpirits is very ſenſible in perſons of a delicate conſtitution, who frequently ſhudder, and find a kind of trembling in the body on theſe occaſions; and this ſympathy in bodies produces compaſſion in the mind.

"Now it muſt be obſerved, that the view of a wound, &c. wounds the perſon who views it the more ſtrongly and ſenſibly, as the perſon is more weak and delicate; the ſpirits making a ſtronger impreſſion on the fibres of a delicate body than in thoſe of a robuſt one. Thus ſtrong, vigorous men, &c. ſee an execution without much concern, while women, &c. are ſtruck with pity and horror. As to children ſtill in their mother's womb, the fibres of their fleſh being incomparably finer than thoſe in women, the courſe of the animal ſpirits muſt neceſſarily produce much greater alterations.

"Theſe things being laid down, monſters are eaſily accounted for. Suppoſe, *v. gr.* a child born a fool, and with all its legs and arms broke in the ſame manner as thoſe of criminals in ſome countries are; which caſe we chooſe to inſtance in, becauſe we are told from Paris that ſuch a monſter was actually born there, and lived in one of their hoſpitals 20 years: the cauſe of this accident, according to the principles laid down, was, that the mother ſeeing a criminal executed, every ſtroke given to the poor man, ſtruck forcibly the imagination of the woman; and, by a kind of counter-ſtroke, the tender and delicate brain of the child.—Now, though the fibres of the woman's brain were ſtrangely ſhaken by the violent flux of animal-ſpirits on this occaſion, yet they had ſtrength and conſiſtence enough to prevent an entire diſorder; whereas the fibres of the child's brain being unable to bear the ſhock of thoſe ſpirits, were quite ruined, and the ravage was great enough to deprive him of reaſon all his lifetime.

"Again, the view of the execution frighting the woman, the violent courſe of the animal ſpirits was directed forcibly from the brain to all thoſe parts of the body correſponding to the ſuffering parts of the criminal; and the ſame thing muſt happen in the child. But in regard the bones of the mother were ſtrong enough to reſiſt the impulſe of thoſe ſpirits, they were not damaged: and yet the rapid courſe of theſe ſpirits could eaſily overpower and break the tender and delicate fibres of the bones of the child; the bones being the laſt parts of the body that are formed, and having a very ſlender conſiſtence while the child is yet in the womb. Monſter.

"To which it may be here added, that had the mother determined the courſe of theſe ſpirits towards ſome other part of her body, by tickling or ſcratching herſelf vehemently, the child would not in all probability have had its bones broken; but the part anſwering that to which the motion of the ſpirits was determined, would have been the ſufferer. Hence appears the reaſon why women in the time of geſtation, ſeeing perſons, &c. marked in ſuch a manner in the face, impreſs the ſame mark on the ſame parts of the child: and why, upon rubbing ſome hidden part of the body when ſtartled at the ſight of any thing or agitated with any extraordinary paſſion, the mark or impreſſion is fixed on that hidden part rather than on the face of the child. From the principles here laid down, may moſt, if not all, the phenomena of monſters be eaſily accounted for."

Various other theories have been formed by different philoſophers and phyſiologiſts. But after all, it muſt be confeſſed, that we ſeem as yet to be very little acquainted with Nature in her ſports and errors. For each organiſed being there appears to exiſt a primitive germ or model of the different ſpecies drawn by the Creator, determined by forms and ſexes, and realiſed in the individuals of both ſexes, which muſt unite in order to their reproduction. From this model nature never departs, unleſs when compelled by circumſtances which derange the primitive organization common to the ſpecies, and produce what we call *monſters*.

With reſpect to ſtructure, we have already remarked, that monſters are of various kinds. Some have an exceſs or defect in certain parts; ſuch as thoſe which are called *acephalous*, or who want the head; thoſe which have two heads, two arms, two legs, and one body, or which have two bodies and one head, or which have three legs; and thoſe which want the arms or the legs. Others err through an extraordinary and deformed conformation, through an unnatural union of certain parts or viſcera, through a great derangement in one or more of their members, and through the extraordinary place which theſe often occupy in conſequence of this derangement or tranſpoſition. The monſter deſcribed by Dr Eller of the academy of Berlin was of this kind. It was a fœtus of nine months, 28 inches long, with an enormous head and frightful countenance; and in the middle of a broad and vaſt forehead it had a reddiſh eye, without either eyebrows or eyelids, and ſunk deep into a ſquare hole. Immediately below this eye was an excreſcence which ſtrongly reſembled a penis with a glans, a prepuce, and an urethra: the part covered with hair was likewiſe below the nape of the neck. In other monſters we meet with the unnatural union of ſome parts, which, from their deſtination and functions, ought always to be ſeparate; and the ſeparation of other parts, which, for the ſame reaſons, ought conſtantly to be united. The reader may ſee the different ways in which the formation of monſters takes place in four memoirs by M. Lemery, inſerted in *L'Hiſtoire de l'Academie des Sciences*, 1738 and 1739. M. du Verney has likewiſe publiſhed a Memoir on the ſame ſubject.

In the volume published by the Academy of Sciences in 1724, mention is made by M. Geoffroy of a monster born in Barrois 1722. This monstrous production consisted of two children without the inferior extremities, joined together by a common navel: each of them had a nurse, sucked, and eat pap; and the one sucked while the other slept. The reader may likewise consult the second part of Winslow's Memoirs on Monsters, inserted in the volume published by the Academy of Sciences in 1734. where he will find the history of two very extraordinary twin monsters, who evidenced during their life a great difference in their moral and physical qualities. We are obliged simply to refer to those Memoirs, as they are too long for abridgement.

It is observed by Haller, that in some monsters the natural structure is changed by some shock or passion: in others the structure, independent of any accident, is originally monstrous; such as when all the members are reversed from left to right, when the person has six fingers, and in many other instances, M. de Maupertius mentions, that there is at Berlin a family who have had six fingers on each hand for several generations. M. de Riville saw an instance of this at Malta, of which he has given a description. M. Renou, surgeon at Pommeraye in Anjou, has published an account of some families with six fingers, which are to be found in several parishes of the Lower Anjou, and which have existed there for time immemorial. This deformity is perpetuated in these families even when they intermarry with persons who are free from it. Whether the propagation of these supernumerary organs, which are not only useless but inconvenient and even disagreeable, be owing to the father or mother, their children of both sexes are subject to it indiscriminately. A father or mother with six fingers frequently have a part, and sometimes the whole, of their children, free from this deformity; but it again makes its appearance, and in a very great degree, in the third generation. From this it appears, that this fault in the conformation is hereditary. M. Reaumur has likewise published the history of a family in the island of Malta, the children of which are born with six fingers and six toes. But it deserves to be inquired, Whether these supernumerary fingers are real fingers? The reader may here consult the *Journal de Physique* for November 1774, p. 372. This variety of *sexdigitary* hands and feet is not comprehended in the *Recherches sur quelques confirmations monstrueuses des doigts dans l'homme*, which is inserted in the Memoirs of the Academy of Sciences for 1771. In the *Journal de Physique* for August 1776, we find a description of a double uterus and vagina observed in a woman who died in childbed, by Dr Purcell of Dublin: and in that for June 1788, we have an account of a man with seven fingers on each hand, by Baron Dietricht.

Several monstrous productions are to be seen in the cabinet at Chantilly. 1. Two calves joined together in the body, with each a separate head and neck, and four legs in whole. 2. Two calves united only by the pelvis, with only one anus and one tail: the whole is supported by six legs, four before and two behind. 3. A lamb with six legs, four of which are behind. 4. The skeleton of a ram, which has likewise six legs. 5. A hermaphrodite deer. 6. The head of a foal which has only one eye in the middle of the forehead. 7. Some leverets with six and eight legs. 8. A puppy, the lips of which are divided fourfold. 9. Some fœtuses of a hog which have a kind of tube upon their forehead one or two inches long; and another, the hinder part of which is double in every thing. 10. Two double human fœtuses joined by the belly, with four arms and three legs. 11. A young chicken with two bodies and one head. 12. A pigeon and a duck, each with two bills. 13. A duck with two heads. 14. A pigeon with four feet. 15. A capon with three feet; the third being fixed to the anus. 16. Two heads of a calf joined together, each of them with two ears: these two heads were both fixed to one neck. 17. In the *Menagerie* at Chantilly there was formerly to be seen a cow with five feet, the fifth of which was connected with the dug. 18. A rabbit without ears. 19. Two cats, each having two heads. 20. Two leverets newly brought forth, well shaped in the body and legs, but connected together by means of only one head. 21. Several eggs, in the figure of which there occur some monstrous appearances and extraordinary deformities, sufficient to show that they are contrary to the established form of nature.

Everhard Hume, Esq; F. R. S. some time ago presented to John Hunter, Esq; F. R. S. the *double skull* of a child, born at Calcutta in May 1783, of poor parents aged 30 and 35, and which lived to be nearly two years old. The body of this child was naturally formed: but the head had the phenomenon of appearing double; another head of the same size, and almost equally perfect, being attached to its upper part. In this extraneous and preternatural head no pulsation could be felt in the arteries of the temples, but the superficial veins were very evident; one of the eyes had been hurt by the fire, upon which the midwife, in her first alarm, threw the child: the other moved readily; but the iris was not affected by the approach of any thing to it. The external ears of this head were very imperfect; the tongue adhered to the lower jaw, except for about half an inch at the lip, which was loose: the jaw was capable of motion, but there were no teeth. The child was shown about the streets of Calcutta for a curiosity; but was rendered unhealthy by confinement, and died at last of a bite of the *cobra de capello*. It was dug up by the East India Company's agent for salt at Tumlock, and the skull is now in the museum of Mr Hunter.

Among the monstrous productions of the animal kingdom, we may rank those individuals which ought only to possess one sex, but in which we observe the union or the appearance of two. See the articles Androgynes and Hermaphrodite.

M. Fabri arranges mutilations of the members, distortions, gibbosities, tumors, divisions of the lips or of the palate, compressions of the cranium, and many other deformities of this kind, in the class of *morbific* monstruosities. In that which he calls *connatural (connaturelle)* monstruosities, are placed the plurality, transposition, and insertion of the parts. To explain these facts, a great many writers have had recourse to the effect of the imagination of pregnant women.—The causes of the first class of monstruosities are discussed by M. Fabri, who observes that some of them are *internal* with regard to the mother, and others *exter-*

Monster. nal. By an *internal cause*, he here means all those depravations or morbific principles which can affect the fluids, and which vitiate the form and structure of the solids; in particular the uterus, in which such depravations have often been found to occur. To these he adds violent affections of the mind, spasmodic contractions, hysteric convulsions, and the many inconveniences of this kind to which women are extremely subject. External causes comprehend every thing which can act externally upon the fœtus contained in the uterus, such as the pressure of the clothes; and in short every thing which prevents the free dilatation of the belly in women who are pregnant, violent motions, falls, blows, and all accidents of this kind. These external causes, and especially the first, compress the fœtus in the womb, and oblige it to remain in a very confined situation. This, according to the observation of Hippocrates, produces those embryos which are born with some entire part wounded. M. Fabri maintains, that all deformities of the fœtus proceed from mechanical and accidental causes.

The name of *monsters* is likewise given to animals enormous for bulk; such as the elephant among terrestrial quadrupeds, and the shark and the whale among sea animals; to other animals remarkable for fierceness and cruelty; and to animals of an extraordinary species, which, we are told, arises from the copulation of one animal with another of a different genus. According to the report of travellers, Africa abounds with monsters of this kind; and accounts of the East are full of descriptions a sea monsters, which, however, are seldom to be seen, such as *seamen, mermaids* &c.

Monsters are more common and more extraordinary in the vegetable than in the animal kingdom, because the different juices are more easily deranged and confounded together. Leaves are often seen, from the internal part of which other leaves spring forth: and it is not uncommon to see flowers of the ranunculus, from the middle of which issues a stalk bearing another flower. M. Bonnet informs us, that in certain warm and rainy years he has frequently met with monsters of this kind in rose-trees. This observer saw a rose, from the centre of which issued a square stalk of a whitish colour, tender, and without prickles, which at its top bore two flower-buds opposite to each other, and totally destitute of a calyx; a little above the buds issued a petal of a very irregular shape. Upon the prickly stalk which supported the rose, a leaf was observed which had the shape of trefoil, together with a broad flat pedicle. In the memors of the Academy of sciences for 1707, p. 448, mention is made of a rose, from the centre of the leaves of which issued a rose-branch two or three inches long, and furnished with leaves. See the same Memoirs for 1749, p. 44, and for 1724, p. 20. In the Memoirs for 1775, a very singular instance is mentioned of a monstrosity observed by M. Duhamel, in an apple-tree ingrafted with clay. At the place of the insertion, there appeared a bud which produced a stalk and some leaves; the stalk and the pedicle of the leaves were of a pulpy substance, and had the most perfect resemblance both in taste and smell to the pulp of a green apple. An extraordinary *chamæmelum* is mentioned in the *Acta Helvetica*. M. Bonnet, in his *Recherches sur l'usage des feuilles*, mentions likewise some monstrous productions which have been found in fruits with kernels, analagous in their nature to those which occur in the flowers of the ranunculus and of the rose-tree. He has seen a pear, from the eye of which issued a tuft of 13 or 14 leaves, very well shaped and many of them of the natural size. He has seen another pear which gave rise to a ligneous and knotty stalk, on which grew another pear somewhat larger than the first.—The stalk had probably flourished, and the fruit had formed. The *lilium album polyanthos*, observed some years ago at Breslau, which bore on its top a bundle of flowers, consisting of 102 lilies, all of the common shape, is well known. M. Reynier has mentioned some individuals monstrous with respect to the flower, in the *Journal de Physique et d'Histoire Naturelle*, for November 1785. He has likewise mentioned a monstrous tulip which is seen in the gardens of some amateurs; juniper berries with horns; a balsamic with three spurs, &c.

These vegetable productions, which are so extraordinary, and so contrary to the common course of things, do nevertheless present deviations subject to particular laws, and reducible to certain principles, by distinguishing such as are perpetuated either by seed or by transplanting, from those which are only accidental and passing. Monstruosities which are perpetuated exist in the original organization of the seed of the plant, such as marked or curled leaves, &c. The word *monster* is more properly applied to those irregularities in plants which arise from frequent transplantation, and from a particular culture, such as double flowers, &c. but those monstruosities which are not perpetuated, and which arise from accidental and transient causes deranging the primitive organization of the plant, when it comes to be unfolded, as is the effect of diseases, of heat or cold, of a superfluity or scarcity of juices, of a depravation of the vessels contributing to nutrition, of the sting of insects, of contusions and natural graffs, retain also the name of *monsters*. Of this kind are knobs or swellings, stunting, gall-nuts, certain streaks, and other similar defects. All the parts of plants are subject to some of these monstruosities, which very with respect to their situation, figure, proportion, and number. Some trees are naturally of so great a size, that they may be considered as a kind of whale species in the vegetable kingdom: of this kind are the baobab and the ceiba. Others, as the oak, the yew, the willow, the lime, and many others, sometimes though rarely, attain so extraordinary a bulk that they are likewise monsters among the vegetables. It is conjectured, in short that monsters are more common in the vegetable than in the animal kingdom, because in the latter the methods of propagation are not so numerous. Plants are seldom monstrous in all their parts; some are monstrous only through excess in the calyx and corolla; others are so through defect only in the leaves, stamina, and fruit. Now, a monstruosity, says M. Adanson, has never changed the name or affected the immutability of a species. Every skilful succeeding botanist has arranged these monstruosities in plants among accidental circumstances, which in whatever manner they are

Mont-alban || Montague.

are propagated, have always a tendency to revert to the order and regularity of their original species when they are multiplied by means of seed; which method of reproduction is the most natural and the most certain for determining the species. One species may be compared with another; but a monster can only be put in comparison with an individual of the species from which it comes. The reader may consult the *Observations Botaniques* of M. Schlotterbec, of the Society of Basil, concerning monsters in plants, wherein he pretends to demonstrate, that in their production nature follows the same course in the vegetable as in the animal kingdom.

MONT-ALBAN, a strong town of Spain, in the kingdom of Arragon, with a strong citadel; seated on the river Riomartin, 44 miles south of Saragossa, and 92 north by west of Valencia. W. Long. 0. 30. N. Lat. 41. 9.

Mont-didier, an ancient town of France in Picardy, where the kings of France formerly had a palace and kept their court. It is seated on a mountain, 17 miles from Amiens and Compeigne, and 58 north of Paris. W. Long. 2. 34. N. Lat. 49. 39.

Mont-Lheri, a town of the isle of France, 15 miles from paris. Here are the remains of a tower, which may be seen at great distance. E. Long. 2. 0. N. Lat. 48. 38.

Mont-Louis, a small but strong town of France, in the Pyrenees, with a strong citadel; seated on an eminence, 430 miles south of Paris. E. Long. 2. 5. N. Lat. 42. 30.

Mont-Luel, a town of France in Bresse, and capital of the territory of Valbonne; seated in a fertile pleasant country on the river Seraine, eight miles from Lyons, and 205 south-east of Paris. E. Long. 5. 8. N. Lat. 45. 49.

Mont-Luzon, a town of France in Bourbonnois; seated on the river Cher, 35 miles south-west of Moulins, and 150 south of Paris. E. Long. 2. 45. N. Lat. 46. 22.

Mont-Blanc. See *Mont-Blanc*.

MONTABOUR, a small fortified town of Germany, in the electorate of Treves, between Coblentz and Limpurg. E. Lon. 7. 50. N. Lat. 50. 30.

MONTAGNIAC, a considerable town of Asia, in Natolia, and in the province of Bec-Sangel, on the sea of Marmora. It carries on a great trade, especially in fruits, and is seated on a bay of the same name, 12 miles from Bursa, and 60 south-east of Constantinople. E. Long. 29. 40. N. Lat. 40. 20.

MONTAGUE (Edward), earl of Sandwich, an illustrious Englishman, who shone from the age of 19, and united the qualifications of general, admiral, and statesmen; yet there were strange inconsistencies in his character. He acted early against Charles I; he persuaded Cromwell, whom it is said he admired, to take the crown; and he was zealous for the restoration of Charles II. All this is imputed to a fond and unaccountable passion which he had for royalty. Upon general Monk's coming into England, he sailed with the fleet to Holland, and soon after he had the honour to convey his majesty to England. For this he was created knight of the garter; and on the 12th of July 1660 he was created baron Montague of St Neot's in the county of Huntingdon, Viscount Hinchinbrooke in the same county, and earl of Sandwich in Kent, sworn one of his majesty's most honourable privy-council, made master of the king's wardrobe, admiral of the Narrow Seas, and lieutenant-admiral to the duke of York, as lord high admiral of England.

Montague.

When the Dutch war broke out in 1694, and the duke of York took upon himself the command of a fleet as high-admiral, his lordship commanded the blue squadron, and by his industry and care abundance of the enemies ships were taken; and in the great battle fought on the third of June 1665, in which the Dutch lost admiral Opdam, and had 18 men of war taken and 14 destroyed, a large share of the honour of the victory was justly given to the conduct of the earl of Sandwich. On the return of the English navy, the command of the whole fleet was given to the earl of Sandwich, which he was ordered to put as speedily as possible in a condition to return to the coast of Holland. Accordingly the earl sailed on the 5th of July with 60 men of war to the Dutch coast; when finding that their East India and Smyrna fleets were to return home north about, he steered for the coast of Norway, and found they had taken shelter in the port of Bergen, where the fleet were attacked: but leaving them there, and sailing back towards the coast of Holland, he met with four Dutch East Indiamen, with several other merchant ships, under a good convoy, and took eight men of war, two of their East India ships, and 20 sail of merchant-men; and a few days after, a part of the fleet falling in with 18 of the Hollanders, the greatest part of them were also taken, with four Dutch men of war, and above 1000 prisoners. On his return he was received by the king with distinguished marks of favour; and soon after, he was sent ambassador extraordinary to the court of Madrid, to mediate a peace between the crowns of Spain and Portugal; when he had the happiness to conclude a peace between the two nations to their mutual satisfaction.

On the breaking out of the last Dutch war, his lordship went to sea with the duke of York, and commanded the blue squadron; the French admiral, count d'Estrees, commanding the white. The fleet was at sea in the beginning of the month of May; and coming to an anchor in Southwold-bay in order to take in water, we are told, that on the 27th many officers and seamen were permitted to go on shore, and were at Southwold, Dunwich, and Aldborough; when, the weather being hazy, the earl gave it as his opinion, that, the wind standing as it did, the fleet rode in danger of being surprised by the Dutch; and indeed, between two and three the next morning, they were informed of their approach, upon which his royal highness made the signal for weighing anchor. The blue squadron was out first, the red next, and the white was much astern. The earl of Sandwich in the Royal James, which carried 100 guns, began the fight, and fell furiously on the squadron of Van Ghent in order to give the rest of his fleet time to form; when captain Brakel, in the Great Holland, attacked the Royal James but was soon disabled, as were several other men of war, and three fire-ships sunk. By this time most of his men were killed; and the hull of the Royal James, was so pierced with shot, that it was impossible to carry her off. In this distress he might have

Montague. been relieved by his vice-admiral Sir Joseph Jordan, had not that gentlemen been more solicitous about assisting the duke. When therefore he saw him sail by, heedless of the condition in which he lay, he said to those who were about him, "There is nothing left for us now, but to defend the ship to the last man." Being at length grappled by a fourth fire-ship, he begged his captain Sir Richard Haddock, and all his servants, to get into the boat and save themselves, which they did: yet some of the sailors refused to quit the admiral, and staying endeavoured to extinguish the fire, but in vain; the ship blew up about noon. His lordship's body was found about a fortnight after, and was interred with great state in Henry VII.'s chapel.—We have of his lordship's writing, 1. The Art of Metals, in which is declared the manner of their generation, translated from the Spanish of Albaro Alonzo Barba, 8vo. 2. Several letters during his embassy to Spain, published with Arlington's letters. 3. A letter to secretary Thurloe. 4. Original letters and negociations of Sir Richard Fanshaw, the earl of Sandwich, the earl of Sunderland, and Sir William Godolphin, wherein divers matters between the three crowns of England, Spain, and Portugal, from the year 1663 to 1678, are set in a clear light, 2 vols. 8vo.

Montague (Charles), earl of Halifax, fourth son of George Montague of Harton in Northamptonshire, Esq; son of Henry the first earl of Manchester, was born in 1661. He was educated at Westminster-school and Cambridge, showed very early a most pregnant genius, and quickly made great progress in learning. In 1684, he wrote a poem on the death of King Charles II in which he displayed his genius to such advantage, that he was invited to London by the earl of Dorset: and upon his coming thither he soon increased his fame, particularly by a piece which he wrote in conjunction with Prior, published at London in 1687, under the title of, "The Hind and the Panther transversed to the Story of the Country-mouse and the City-mouse." Upon the abdication of King James II. he was chosen one of the members of the convention, and recommended by the earl of Dorset to King William, who immediately allowed him a pension of 500 l. *per annum.* Having given proofs of his great abilities in the house of commons, he was made one of the commissioners of the treasury, and soon after chancellor of the exchequer: in which post he brought about that great work of re-coining all the current money of the nation. In 1698, he was appointed first commissioner of the treasury; and in 1699 was created a peer of England, by the title of *Baron Halifax* in the county of York. In 1701, the house of commons impeached him of six articles, which were dismissed by the house of Lords. He was attacked again by the house of commons in 1702, but without success. In 1705, he wrote, An Answer to Mr Bromley's Speech in relation to the occasional Conformity-bill. In 1706, he was one of the commissioners for the Union with Scotland; and upon passing the bill for the naturalization of the illustrious house of Hanover, and for the better security of the succession of the crown in the Protestant line, he was made choice of to carry that act to Hanover. Upon the death of Queen Anne, when the king had taken possession of his throne, his lordship was appointed first commissioner of the treasury, and created earl of Halifax and knight of the garter. He died in 1715. His lordship wrote several other pieces besides those above-mentioned; all which, with some of his speeches, were published together in 1716 in an octavo volume. Montague.

Montague (Lady Mary Wortley) accompanied her husband who was sent on an embassy to Constantinople in the beginning of this century. On her return she introduced the practice of inoculation into England, and thence acquired great celebrity. She cultivated the belles lettres; and at one period of her life she was the friend of Pope, and at another his enemy. While they were at enmity with each other, Lady Mary Montague embraced every opportunity of defaming the poet, who well knew how to take revenge. Both of them carried their animosity to so great a height, that they became the subject of public conversation. After a long life, full of singular and romantic adventures, she died about the year 1760. From her we have *Letters*, written during her travels from the year 1716 to the year 1718. They have been translated into French, and published at Rotterdam 1764, and at Paris 1783, one vol. 12 mo. They are composed in a lively, interesting, and agreeable style, and contain many curious facts relating to the manners and government of the Turks, which are no where else to be found. The Baron de Tott, who lived many years at Constantinople, attacked them with great severity; but they have been defended with equal zeal by M. Guis of Marseilles, who has published a valuable work on Turkey. It need not appear extraordinary, that persons who have visited the same country should not see things in the same light. How few travellers agree in their accounts of the same objects, which they nevertheless pretend to have seen and to have examined with attention.

Montague (Edward Wortley), son of the former, passed through such variegated scenes, that a bare recital of them would savour of the marvellous. From Westminster-school, where he was placed for education, he ran away three several times. He exchanged clothes with a chimney-sweeper, and followed for some time that sooty occupation. He next joined himself to a fisherman, and cried flounders in Rotherhithe. He then sailed as a cabin-boy to Spain; where he had no sooner arrived, than he ran away from the vessel, and hired himself to a driver of mules. After thus vagabondising it for some time, he was discovered by the consul, who returned him to his friends in England. They received him with a joy equal to that of the father of the prodigal son in the gospel. A private tutor was employed to recover those rudiments of learning which a life of dissipation, of blackguardism, and of vulgarity, might have obliterated. Wortley was sent to the West Indies, where he remained some time; then returned to England, acted according to the dignity of his birth, was chosen a member, and served in two successive parliaments. His expences exceeding his income, he became involved in debt, quitted his native country, and commenced that wandering traveller he continued to the time of his death. Having visited most of the eastern countries, he contracted a partiality for their manners. He drank little wine; a great deal of coffee; wore a long beard; smoked much; and,

and, even whilst at Venice, he was habited in the eastern style. He sat cross-legged in the Turkish fashion through choice. With the Hebrew, the Arabic, the Chaldaic, and the Persian languages, he was as well acquainted as with his native tongue. He published several pieces. One on the "Rise and Fall of the Roman Empire." Another an Exploration of "The Causes of Earthquakes." As this gentleman was remarkable for the uncommon incidents which attended his life, the close of that life was no less marked with singularity. He had been early married to a woman who aspired to no higher a character than that of an industrious washerwoman. As the marriage was solemnized in a frolic, Wortley never deemed her sufficiently the wife of his bosom to cohabit with her. She was allowed a maintenance. She lived contented, and was too submissive to be troublesome on account of the conjugal rites. Mr Montague, on the other hand, was a perfect patriarch in his manners. He had wives of almost every nation. When he was with Ali Bey in Egypt, he had his household of Egyptian females, each striving who should be the happy she who could gain the greatest ascendency over this Anglo-Eastern-bashaw. At Constantinople, the Grecian women had charms to captivate this unsettled wanderer. In Spain, a Spanish brunette, in Italy the olive complexioned female were solicited to partake the honours of the bridal-bed. It may be asked what became of this group of wives? Mr Montague was continually shifting the place, and consequently varying the scene. Did he travel with his wives as the patriarchs did with their flocks and herds? No such thing. Wortley, considering his wives as bad travelling companions, generally left them behind him. It happened, however, that news reached his ears of the death of the original Mrs Montague the washerwoman. Wortley had no issue by her; and without issue male, a very large estate would revert to the second son of Lord Bute. Wortley, owing the family no obligations, was determined, if possible, to defeat their expectations. He resolved to return to England and marry. He acquainted a friend with his intentions; and he commissioned that friend to advertise for any young decent woman who might be in a pregnant state. Several ladies answered it. One out of the number was selected, as being the most eligible object. She waited with eagerness for the arrival of her expected bridegroom; but, behold, whilst he was on his journey, death very impertinently arrested him in his career.

Montague-Island, one of the Hebrides, in the South Sea, near Sandwich Island. E. Long. 168. 37. S. Lat. 17. 26.

MONTAIGNE (Michel de) a French gentleman, was born in Perigord in 1533. His father educated him with great care, and made him learn Latin as other children learn their mother-tongue, His tutors were Nicholas Gronchi, who wrote *De Comitiis Romanorum;* William Guerenti, who wrote on Aristotle; George Buchanan; and M. Anthony Muret. He was also taught Greek by way of recreation; and because some think that starting children out of their sleep spoils their understanding, he was awakened every morning with the sound of music. He was counsellor for a while in the parliament of Bourdeaux; afterwards made mayor of Bourdeaux. He published his *Essays*, so much known in the world, in 1580. Montaigne had a great deal of wit and subtlety, but no small share of conceit and vanity. The learned and ingenious are much divided in their opinion about his works. He died in 1592.

MONTALCINO, a small populous town of Italy, in Tuscany, and in the territory of Sienna, with a bishop's see. It is seated on a mountain, 17 miles south-east of Sienna, and 44 south-east of Florence. E. Long. 11. 30. N. Lat. 43. 7.

MONTALTO, an episcopal town of Italy, in the Marca of Ancona; seated on the river Menacio, 10 miles north of Ascolii, and 45 south of Anconia. E. Long. 13. 30. N. Lat. 42. 54.

MONTANINI (Pietro), called *Petruccio Perugino*, an eminent landscape painter, was born at Perugia in 1619. At first he was instructed by his uncle Pietro Barsotti; but was afterwards placed as a disciple with Ciro Ferri. Yet he did not long adhere to the manner of either of those masters, choosing preferably to study under Salvator Rosa; and he imitated the style of that celebrated painter with exceeding great success. The taste of his landscapes was generally admired; the rocks, situations, torrents, and abrupt precipices, were designed with spirit, and in a grand style; and his figures recommended themselves to the eye by a very uncommon correctness, propriety, and elegance. He died in 1689.

MONTANISTS, Christian heretics, who sprung up about the year 171, in the reign of the emperor Marcus Aurelius. They were so called from their leader, the heresiarch Montanus, a Phrygian by birth; whence they are sometimes styled *Phrygians* and *Cataphrygians*.

Montanus, it is said, embraced Christianity in hopes of rising to the dignities of the church. He pretended to inspiration; and gave out, that the Holy Ghost had instructed him in several points, which had not been revealed to the apostles. Priscilla and Maximilla, two enthusiastic women of Phrygia, presently became his disciples; and in a short time he had a great number of followers. The bishops of Asia, being assembled together, condemned his prophecies, and excommunicated those who dispersed them. Afterwards they wrote an account of what had passed to the western churches, where the pretended prophecies of Montanus and his followers were likewise condemned.

The Montanists, finding themselves exposed to the censure of the whole church, formed a schism, and set up a distinct society under the direction of those who called themselves *prophets*. Montanus, in conjunction with Priscilla and Maximilla, was at the head of the sect.

These sectaries made no alteration in the creed. They only held, that the Holy Spirit made Montanus his organ for delivering a more perfect form of discipline than what was delivered by the apostles. They refused communion for ever to those who were guilty of notorious crimes, and believed that the bishops had no authority to reconcile them. They held it unlawful to fly in time of persecution. They condemned second marriages, allowed the dissolution of marriage, and observed three lents.

The Montanists became separated into two branches; one of which were the disciples of Proclus, and the other of Æschines. The latter are charged with following the heterodoxy of Praxeas and Sabellius concerning the Trinity.

MONTANUS (Benedict Arias), a most learned Spanish theologian, born in the diocese of Badajox, about the year 1528. He assisted at the council of Trent with great reputation; and his merit and writings recommended him to Philip II. of Spain, who employed him in publishing a new polyglot bible after the Complutensian edition, which was printed by the care of Cardinal Ximenes. This bible was printed at Antwerp, whither Montanus went in 1571; and on his return to Spain he refused the bishopric which Philip offered him for his reward, but spent the rest of his days at Sevilla, where he died about the year 1598. Montanus had not only vast erudition, but great good sense; he loved solitude, was very laborious, never drank wine, and seldom ate flesh.

MONTARGIS, a considerable town of France, in the Orleannois, and capital of the Gatinois; seated on the river Loir, near a handsome forest, 15 miles south of Nemours, and 62 south of Paris. E. Long. 2. 36. N. Lat. 48. 1.

MONTAUBAN, a considerable town of France, in Guienne, and territory of Quercy, with a bishop's see, and an academy. The fortifications were demolished in 1629, because it took the part of the Huguenots. It is seated on the river Tarne, 20 miles north of Toulouse, and 30 south of Cahors. E. Long. 1. 27. N. Lat. 43. 56.

MONTBAZON, a town of France, in Touraine, with the title of a duchy; agreeably seated at the foot of a hill, on which there is an ancient castle, 135 miles south-west of Paris. E. Long. 0. 45. N. Lat. 47. 17.

MONTBELLIARD, a handsome and strong town of France, capital of a province of the same name, betwen Alsace and the Franche Compte. It is seated at the foot of a rock, on which there is a large, strong castle, in the form of a citadel. The prince of Montbelliard has a voice and seat in the college of the princes of the empire. It was taken by the French in 1674, who demolished the fortifications, but it was restored to the prince. It is seated near the rivers Alaine and Doux, 33 miles west of Basle, and 45 north-east of Bezanzon. E. Long. 6. 30. N. Lat. 47. 31.

MONTBLANC, a town of Spain, in the province of Catalonia, 15 miles north of Tarragon. E. Long. 1. 5. N. Lat. 41. 20.

MONTBRISION, a considerable town of France, and capital of Forez, seated on the river Veziza, 40 miles west of Vienne, and 250 south by east of Paris. E. Long. 4. 27. N. Lat. 45. 32.

MONTECCHIO, a considerable town of Italy, in the duchy of Reggio, 10 miles south-east of Parma, and eight north-west of Reggio. E. Long. 15. 54. N. Lat. 38. 8.

MONTE-FALCO, a town of Italy, in the territory of the church and duchy of Spalatto; seated on a mountain near the river Clitunno, 12 miles west of Spalatto. E. Long. 12. 40. N. Lat. 42. 58.

Monte-Falcone, a town of Italy, in Friuli, with a castle. It belongs to the Venetians, and is near the river Ponzano, 10 miles north-west of Aquileia, and 12 north west of Triste. E. Long. 13. 0. N. Lat. 46. 4.

Monte-Faiscone, a small but populous town of Italy, in the territory of the Church, with a bishop's see; seated on a mountain, near the lake Bolsena, in a country abounding with excellent wine, 12 miles south-west of Orvietto, and 45 north-west of Rome. E. Long. 12. 4. N. Lat 42. 26.

Monte-Marano, a populous town of Italy, in the kingdom of Naples, and in the Farther Principato; seated on the river Calore, 18 miles south of Benevento. E. Long. 15. 0. N. Lat. 40. 48.

Monte-Mor-o-novo, or *Monte major-el-novo*, a considerable town of Portugal, on the road from Lisbon to Badajox. Long. W. 9. 35. N. Lat. 38. 42.

Monte-Mor-o-velho, or *Monte-major-el-velho*, a town of Portugal in the province of Beira, with a very large castle, seated in a fertile country, 10 miles south-west of Coimbra, and 83 north of Lisbon. W. Long. 8. 9. N. Lat. 40. 5.

Monte-Peloso, an episcopal town of Italy, in the kingdom of Naples, and in the Basilicata; seated on a mountain near the river Basiento, 14 miles east of Cirenza. E. Long. 16. 28. N. Lat. 40. 46.

Monte-Pulsiano, a town of Italy, in Tuscany, with a bishop's sea; seated on a high mountain, near the river Chiana, in a country noted for excellent wine, 25 miles south-east of Sienna, and 50 south by east of Florence. E. Long. 11. 49. N. Lat. 43. 10.

Monte-Sancto, formerly called *Mount-Athos*, a mountain of Turkey in Europe, on the gulph of Contessa. It is called Monte-Sancto, or the Holy Mount, because there are 22 monasteries thereon, in which are 4000 monks, who never suffer a woman to come near them. It is 17 miles south of Salonichi. E. Long. 24. 39. N. Lat. 40. 27.

Monte-Verde, a town of Italy, in the kingdom of Naples, and in the Farther Principato, with a bishop's see: 60 miles east of Naples. E. Long. 15. 42. N. Lat. 40. 51.

MONTECUCULI (Raymond de), generalissimo of the emperor's army, and one of the greatest commanders of his time, was born in the duchy of Modena, of a distinguished family, in 1608. Ernest Montecuculi his uncle, who was general of the artillery in the Imperial army, resolved that he should serve first as a common soldier, and that he should pass through all the military degrees before he was raised to command. This the young Montecuculi did with applause. In 1644, when he was at the head of 2000 horse, he surprised by a precipitate march 10,000 Swedes, who laid siege to Nemessau in Silesia, and obliged them to abandon their artillery and baggage; but a short time after, he was defeated and taken prisoner by the general Banier. Having obtained his liberty at the end of two years, he joined his troops to those of John de Wert; and defeated general Wrangel in Bohemia, who was killed in the battle. In 1657 the emperor made him general marshal de camp; and sent him to the assistance of John Casimir, king of Poland. Montecuculi vanquished Ragotzi prince of Transylvania, drove out the Swedes, and distinguished himself in an extraordinary manner against the Turks in Transylvania and Hungary. In 1673 he commanded the Imperial army against the French, and took Bonne; he then proceeded

ceeded with feint marches in order to deceive Turenne, in which he obtained great honour. However, the command of that army was taken from him the next year; but it was restored to him in 1675, in order that he might make head against the great Turenne. All Europe had their eyes fixed on these two able warriors, who then made use of all the stratagems which genius and military knowledge were capable of suggesting. The marshal de Turenne was obtaining the superiority when he was taken off by a cannon ball. Montecuculi wept at the death of so formidable an enemy, and bestowed upon him the greatest praises. The great prince de Conde was the only French general that could deprive Montecuculi of the superiority he had obtained by Turenne's death. That prince was therefore sent to the Rhine, and stopped the Imperial general; who considered this last campaign as the most glorious of his life, not from his being conqueror, but for his not being conquered, when he was opposed by a Turenne and a Conde. He spent the rest of his life at the Imperial court; and died at Lintz in 1680. He wrote *Memoirs;* the best edition of which is that of Strasburg, in 1735.

MONTEGO-BAY, a town of Jamaica, and, next to Kingston the most flourishing in the island, contains above 350 houses; and carries on a very considerable commerce with Great Britain and her remaining colonies in North America. The harbour is capacious; but rather exposed to the north winds, which at certain times in the year blow with great violence. It is the capital of the parish of St James; in which are 70 sugar-plantations, 70 other settlements, and 27,000 slaves.

MONTESA, a very strong town of Spain, in the kingdom of Valentia. It is the seat of an order of knighthood of the same name; and is five miles from Xativa. W. Long. 0. 10. N. Lat. 39. 0.

MONTESQUIEU (Charles de Secondat) baron, a most illustrious Frenchman descended from an ancient and noble family of Guienne, was born at the castle of La Brede, near Bourdeaux, in 1689. The greatest care was taken of his education; and at the age of 20 he had actually prepared materials for his *Spirit of Laws*, by well digested extracts from those immense volumes of civil law which he had studied, not barely as a civilian, but as a philosopher. He became a counsellor of the parliament of Bourdeaux in 1714, and was received president á mortier two years after. In 1721 he published his *Persian Letters;* in which, under the screen of Oriental manners, he satirized those of France, and treated of several important subjects by delicate transient glances: he did not avow this publication; but was no sooner pointed out as the author, than zeal without knowledge, and envy under the mask of it, united at once against the Persian Letters. He was received into the French academy in 1728; and having previously quitted his civil employments, he entirely devoted himself to his genius, and was no longer a magistrate, but a man of letters. Having thus set himself at liberty, he travelled through Germany, Italy, Switzerland, Holland, and England, in which last country he resided three years, and contracted intimacies with the greatest men then alive; for Locke and Newton were dead. The result of his observations was, "that Germany was fit to travel in, Italy to sojourn in, England to think in, and France to live in." On his return he retired for two years to his estate at La Brede, where he finished his work *On the causes of the Grandeur and Declension of the Romans;* which appeared in 1734. The reputation acquired by this last work only cleared the way for his greater undertaking, the *Spirit of Laws*, which was printed at Geneva in 2 vols 4to. 1750. This was immediately attacked by the adversaries of his Persian Letters, in a multitude of anonymous pamphlets; containing all the reproaches to which a liberal mind is exposed from craft and ignorance. M. Montesquieu drew up a defence of this work; which for truth, moderation, and delicacy of ridicule, may be regarded as a model in its way. This great man was peaceably enjoying that fulness of esteem which his great merits had procured him, when he fell sick at Paris, and died on the 10th of February 1755.—The following character of this great man is drawn by Lord Chesterfield. His virtues did honour to human nature, his writings justice. A friend to mankind, he asserted their undoubted and unalienable rights with freedom, even in his own country; whose prejudices in matters of religion and government he had long lamented, and endeavoured, not without some success, to remove. He well knew, and justly admired, the happy constitution of this country, where fixed and known laws equally restrain monarchy from tyranny, and liberty from licentiousness. His works will illustrate his name, and survive him, as long as right reason, moral obligation, and the true spirit of laws, shall be understood, respected, and maintained." As to his personal qualities, we are told by his elogist, M. d'Alembert, that, "he was of a sweet, gay, and even temper. His conversation was spirited, agreeable, and instructive. Nobody told a story in a more lively manner, or with more grace and less affectation. He had frequent absence of mind; but always awaked from it by some unexpected stroke that re-animated the languishing conversation. Though he lived with the great, he retired whenever he could to his estate in the country, and there met his books, his philosophy, and his repose. Surrounded at his leisure-hours with peasants, after having studied man in the commerce of the world, he studied him in those simple people solely instructed by nature. With them he cheerfully conversed; he endeavoured, like Socrates, to find out their genius, and appeared as happy with them as in the most brilliant assemblies; especially when he reconciled their differences, and by his beneficence relieved them from their distresses."

Besides the works already mentioned, M. Montesquieu wrote several small pieces, as the Temple of Gnidus, Lysimachus, and Essay upon Taste, which is left unfinished. His works have been collected since his death, and printed at Paris in a splendid edition, in quarto. They have likewise all of them been translated into English.

MONTEZUMA, or MONTEÇUMA, was emperor or king of Mexico when Cortez invaded that country in 1518, invited thither, as he pretended, by the inhabitants, whose children Montezuma, in the blindness of his superstition, had sacrificed to his idols. The warlike animals on which the Spanish officers were mounted, the artificial thunder with which they were armed, the wooden castles on which they had crossed the

the ocean, the armour with which they were covered, the victories which they gained wherever they went; all these circumstances, added to that foolish disposition to wonder which always characterises a simple people, so operated upon the minds of the Mexicans, that when Cortez arrived at the city of Mexico, he was received by Montezuma as his master, and by the inhabitants as a god. At first they fell down in the streets when a Spanish valet passed by; but by degrees the court of Montezuma grew familiar with the strangers, and ventured to treat them as men. Montezuma, unable to expel them by force, endeavoured to inspire them with confidence at Mexico by expressions of friendship, while he employed secret means to weaken their power in other quarters. With this view, one of his generals, who had private orders to that purpose, attacked a party of the Spaniards who were stationed at Vera-Cruz; and, although his troops were unsuccessful, yet three or four of the Spaniards were killed. The head of one of them was carried to Montezuma. In consequence of this, Cortez did what has been reckoned one of the boldest political strokes that ever was performed. He ran to the palace, followed by fifty of his troops; and, by persuasion and threats, carried the emperor prisoner into the Spanish quarter. He afterwards obliged him to deliver up those who had attacked his troops at Vera-Cruz; and, like a general who punishes a common soldier, he loaded Montezuma with chains. He next obliged him to acknowledge himself in public the vassal of Charles V.; and, in name of tribute for this homage, Cortez received 600,000 merks of pure gold. Montezuma soon afterwards fell a sacrifice to his submission to the Spaniards. He and Alvaro, the lieutenant of Cortez, were besieged in the palace by 200,000 Mexicans. The emperor proposed to show himself to his subjects, that he might persuade them to desist from the attack: but the Mexicans no longer considered him in any other light but as the slave of foreign conquerors. In the midst of his speech, he received a blow with a stone which wounded him mortally; and he expired soon after, A. D. 1520.—See Cortez. This unfortunate prince left two sons and three daughters, who embraced the Christian faith. The eldest received baptism, and obtained from Charles V. lands, revenues, and the title of Count de Montezuma. He died in 1608; and his family is one of the most powerful in Spain.

MONTFAUCON (Bernard de), a very learned Benedictine of the congregation of St Maur, singularly famous for his knowledge in Pagan and ecclesiastical antiquities, was born of an ancient and noble family in Languedoc, in 1655. He served for some time in the army; but the death of his parents mortified him so with regard to the world, that he commenced Benedictine monk in 1675, and applied himself intensely to study. Though Montfaucon's life was long, healthy, retired, and laborious, his voluminous publications seem sufficiently to have employed the whole; exclusive of his greatest undertaking, for which he will be always memorable. This was his *Antiquité expliqué*, written in Latin and French, illustrated with elegant plates, in 10 vol. folio; to which he added a supplement of 5 vols more. He died at the abbey of St Germain in 1741.

MONTFERRAT, a province of Italy, with the title of a duchy; bounded on the east by the duchy of Milan, and part of the territory of Genoa; on the north, by the Vercellese and Canavese; on the west, by Piedmont properly so called; and on the south by the territory of Genoa, from whence it is separated by the Apennine mountains. It contains 200 towns and castles; and is very fertile and well cultivated, abounding in corn, wine, oil, and silk. It belongs to the king of Sardinia, and Casal is the capital town.

MONTFORT, a town of France, in Upper Bretagne, seated on the river Men, 12 miles from Rennes. W. Long. 1. 58. N. Lat. 48. 8.

Montfort, an handsome and strong town of the Netherlands, in the United Provinces, with an ancient castle; seated on the river Yssel, seven miles from Utrecht. E. Long. 5. 0. N. Lat. 52. 4.

Montfort, a town of Germany, in the circle of Suabia, on the confines of Tirol, 16 miles south of Lindow, and the lake Constance. It is capital of a country of the same, which has been almost all purchased by the house of Austria. E. Long. 9. 51. N. Lat. 47. 22.

Montfort-de-lemos, an ancient town of Spain, in the kingdom of Galicia, with a magnificent castle, where the Comarca of Lemos resides. It is seated in a fertile country, 25 miles north-east of Orensa, and 55 south-east of Compostella. W. Long. 7. 9. N. Lat. 42. 28.

Montfort l'amuly, a town in the isle of France, with the title of a duchy, 25 miles from Paris. E. Long. 2. 50. N. Lat. 48. 45.

MONTFORT (Simon Count de), descended from an illustrious and flourishing family, was lord of a small town of the same name ten leagues from Paris. He was one of the greatest generals of the age in which he lived; and he displayed his bravery in a voyage beyond seas, and in the wars with the English and Germans. The strength of his constitution enabled him to support without inconvenience the severest labours of the field: his majestic stature distinguished him in the midst of the battle; and the motion of his sword was sufficient to strike terror into his boldest enemies. In the greatest dangers he possessed the utmost coolness and presence of mind: he observed every emergency; and was ready to bring assistance, while he himself was employed in attacking the bravest who made head against him. He was appointed to conduct the crusade against the Albigenses in 1209; and the name of Simon de Montfort is highly celebrated in this war. He took Beziers and Carcossonne, raised the siege of Castelnau, and gained a great victory in 1213 over Peter king of Arragon, Raimond VI. count of Toulouse, and the counts de Foix and de Cominge. Simon de Montfort was killed at the siege of Toulouse on the 25th of June 1218, by a blow with a stone discharged by the hands of a woman.—Such was the fate of one who had sullied the glory of his victories by the cruelty of his executions.—Some historians have given him the name of *Maccabeus* and of *Defender of the Faith;* but men, animated with the true spirit of Christianity, have revolted against such titles. "We cannot (says the Abbé Nonotte) read the accounts of his severity, or rather cruelty, towards the Albigenses without horror. He was not guided by the spirit of the religion of Je-

Montgatz, Montgeron.

fus in the massacre of Beziers, the pillage of Carcassonne, and the taking of Lavaur. But our horror is somewhat diminished by the consideration of the dreadful revolt, and massacres committed by the Albigenses themselves." Simon de Montfort treated them at the best with as great cruelty as they had done the Catholics. His younger son afterwards made a great figure in England, and is known by the title of Earl of Leicester.

MONTGATZ, a town of Lower Hungary, in the country of Pereczas, with a fortress composed of three castles, seated on a craggy rock. It is encompassed with a great morass, and art and nature have rendered it almost impregnable. It was defended by the Princess Ragotsky, wife of Count Tekeli, when besieged by an army of the imperiallists, who were obliged to raise the siege in 1688.

MONTGERON (Louis-Basile-Carre de), was born at Paris, A. D. 1686; his father was master of requests. He was scarcely 25 years of age when he purchased the place of counsellor in parliament, where by his wit and external qualifications he gained considerable reputation. Deeply engaged in all the vices which flow from irreligion, he was converted by an unexpected circumstance. He went on the 7th of September 1731 to the tomb of Deacon Paris, with an intention to examine, with the rigour of the severest critic, the miracles which were reported to be performed there. But, according to his own account, he felt himself suddenly beat to the earth by innumerable flashes of light with which he was surrounded. His incredulity was converted into flaming zeal, and he became the apostle of the saint whom he formerly ridiculed. From that moment he devoted himself to the fanaticism of *convulsions*, with the same impetuosity of character with which he had run into the most shameful excesses. He had not long been the disciple of Jansenism, when he suffered persecution. When the chamber of inquests was banished in 1732, he was sent into the mountains of Auvergne; which, instead of cooling, tended rather to inflame his zeal. During his exile, he formed the plan of collecting the proofs of the miracles wrought at the tomb of the Abbé Paris, and of composing what he called a *Demonstration of them.* On his return to Paris, he prepared to execute this plan; and on the 29th of July 1737, he actually presented to the king at Versailles a volume in quarto superbly bound. This work he accompanied with a speech, which is a mixture of zeal and argument in a tolerable style. In consequence of this work, which some consider as a masterpiece of eloquence, and others as a mass of absurdities, he was committed to the Bastile. After a few months confinement, he was sent to an abbey of Benedictine monks in the diocese of Avignon; whence he was, in a short time carried to Viviers. He was afterwards confined in the citadel of Valence, where he died, A. D. 1754, aged 68. The work which he presented to the king was entitled *La verité des Miracles operées par l'intercession de M. Paris*, &c. &c.—The critics, even to this day, seem to be guided in their opinion concerning this book either by hatred or by enthusiasm. "It would be extremely rash (says the Abbé de St Pierre, in the second volume of his *Annales*, p. 593.) to maintain with the Molenists, that no miraculous cure was ever performed at the tomb of the Abbé Paris; and to say with the Jansenists, that these cures were performed by a supernatural power, would be the height of fanatacism. The truth is (adds the same author), that no miracle appears ever to have been performed at this tomb except in the cure of the human body; in all other cases, there would have been the want of that imagination on which the whole miracle depended." Thus, although Montgeron ventured to compare these prodigies with the miracles of Jesus Christ and his apostles, yet we find no person raised from the dead, no multiplication of loaves, no command obeyed by the elements, and no blind or deaf restored to their sight or hearing. It belongs to the Author of nature alone, or to those who have derived power from him, to work such miracles as are recorded by the evangelists, or in the history of the apostles. Montgeron added a second and third volume on the same subject; he left also in manuscript a work which he composed in prison *contre les Incredules*. Religion, it must be confessed has had much more powerful advocates. Fortunately Pascal and Bossuet are among the number: and it could well have wanted both Paris and Montgeron, whatever virtues they might possess in other respects.

Montgomery.

MONTGOMERY, the capital of a county of the same name in north Wales, 158 miles from London, took its name from Roger de Montgomery earl of Shrewsbury, who built the castle: but it is called by the Welsh *Tre Valdwin*, that is, Baldwin's town; having been built by Baldwin, lieutenant of the marches of Wales, in the reign of William I. The Welch, after having put the garrison to the sword, demolished it in 1095; but Henry III. rebuilt it, and granted it the privileges of a free borough, with other liberties. It is a large and tolerably well built town, in a healthful situation and fertile soil. It sends a member to parliament, and has the title of an earldom. It had formerly a tower and castle; but they were demolished in the civil wars. It has a weekly market, and four fairs.

MONTGOMERY (Gabriel de), count de Montgomery in Normandy, was remarkable for his valour and noble atchievments, but still more so for being so unfortunate as to put out the eye of Henry II. on the 29th of June 1559. That prince having engaged several knights in a tournament, given by him on occasion of the marriage of his daughter the princess Elizabeth with Philip king of Spain, at last wished to break a lance with the young Montgomery, at that time lieutenant of the Scotch guard. Montgomery, as if he had foreseen the fatal consequences, again and again declined the combat, and it was with great reluctance he at length yielded, when he saw the king about to take offence at his refusal. In the course, his lance broke in the king's visor, and wounded him in the eye. Henry died on the 11th day after receiving the wound, and gave orders on his death-bed that Montgomery should not be prosecuted, or harrassed in any respect, on account of what had happened. After this unlucky accident, Montgomery retired for some time to his estate in Normandy. He next visited Italy and other foreign countries; and did not return to France till the commencement of the civil wars, when he joined the party of the Protestants, and became one of their principal leaders. In 1562, he defended Rouen against the royal army with great valour and obstinacy. The city being at length taken by storm, Montgomery.

he threw himself into a galley; and having, with equal temerity and good fortune, surmounted by dint of rowing a chain which had been thrown across the Seine at Candebec for the purpose of preventing succours from England, he escaped to Havre. In 1569 Montgomery was sent to the assistance of Bearn, which the Catholics, under the command of Terrides, had almost entirely wrested from the hands of Jane d'Albret, queen of Navarre. He executed this commission with so great dispatch, that Terrides was obliged to raise the siege of Navarreins, and to retire with great precipitation to Orthez. Montgomery pursued him to this city, which he took by assault; and before Terrides had time to recover himself, he and his principal officers were taken prisoners in the castle. After this defeat, the rest of Bearn submitted to the conqueror whereever he made his appearance. This expedition acquired him the greatest glory, and has been celebrated by the Catholic no less than by the Protestant historians. He was at Paris at the time of the massacre on St Bartholomew's day 1572, and lodged in the Faubourg St Germain. Some accident having retarded the execution of that quarter, he was informed of it at the very moment when it was about to begin; and he had just sufficient time to mount his horse and, in company with some Protestant gentleman who lodged near him, to make his escape at full gallop. They were pursued as far as Montfort-l'Amaury; and Montgomery, whose escape alone is particularly attended to, owed his safety on this occasion to the swiftness of his horse, which, according to a manuscript of that time, carried him 30 leagues without halting. Having escaped this danger, he took refuge with his family, first in the island of Jersey and afterwards in England. The following year, Montgomery carried a considerable fleet, which he had armed and fitted out in England, partly on his own credit and partly on that of the inhabitants of Rochelle, to the relief of that city, which was at that time besieged by the Catholics: But, whether distrusting his forces, or for other reasons about which historians do not agree, he left the road without fighting the Catholic fleet, and went to pillage Belleisle on the coast of Brittany. Having disbanded his fleet, he returned to England to Henry de Champernon his son in law, coast admiral of Cornwall. On the renewal of the war in France in 1573 Montgomery, who was then in Jersey, passed over into Normandy, and joined the protestant nobility of that province. Matignon, lieutenant-general in Lower Normandy, to whom Catharine de Medicis had given a particalar charge to use his utmost endeavours to seize the person of the count, came unxpectedly upon him in Saint-Lo, and laid siege to that city. On the evening of the fifth day of the siege, Montgomery left Saint-Lo with between 60 and 80 horse, forced the guard in the suburbs, and escaped amidst a shower of musket bullets, without losing a single man, leaving the command of the place to Coulombieres, François de Briqueville. Montgomery arrived at Domfront May 7, 1574, with only twenty followers, intending to make no longer a stay in that place than was necessary to recruit them after the fatigues of so rapid a march. The same day he was joined by several gentlemen, who brought to his assistance a company of forty horse.—Meanwhile Matignon, informed of his escape, and enraged at having lost his prey, flew at the head of a party of horse, with some companies of foot mounted on horseback, and arrived on the morning of the 9th before Domfront. He blocked up the place on all sides till the infantry and cannon which followed him should arrive. On their arrival, he atacked the city with great violence: and, as it was impossible to defend it, Montgomery was soon obliged to retire into the castle with the garrison amounting to no more than 150 men, including 80 foot soldiers who guarded the city when he entered it. He sustained a furious assault, fought with the greatest boldness and obstinacy, and exposed himself in the breach like one who wished for death. Perceiving, however, that his soldiers partly by the fire of the enemy, and partly by constant desertion, were reduced almost to nothing, he capitulated on the 27th of May. Many Protestant historians affirm, that the articles of capitulation were violated with regard to Montgomery; but, not to mention the testimony of others, it appears evident, from the authority of D'Aubigny himself, who of all the Protestant writers is most worthy of credit, that the Count had no promise from Matignon, except personal safety and good treatment while he continued his prisoner. This general gave him no assurance of pardon from the king or the queen-mother. After the capture of Domfront, Matignon conducted his prisoner to Saint-Lo, the siege of which was still going on, in hopes that he might have some influence with his former friend and fellow-soldier to persuade him to surrender. For this purpose, Montgomery was brought to the side of the ditch; and he exorted Coulombieres, who appeared on the wall, to follow his example. But Coulombieres, full of indignation, reproached him in the severest and most upbraiding terms for his cowardice in entering into a shameful capitulation, instead of dying in the breach like a soldier, with his sword in his hand. This intrepid governor spoke the true sentiments of his heart; for when the assault was made some days after, he was killed defending the breach. In the mean time, Matignon received orders from Catharine de Medicis, now regent of the kingdom by the death of Charles IX. to send Montgomery to Paris under a strong guard. When he arrived there, he was conducted to the gaol belonging to the parliament, and confined in the tower which still bears his name. Commissioners were appointed by the queen to conduct his trial. He was interrogated concerning the conspiracy imputed to the admiral Coligny; but the principal charge on which his condemnation was founded, was his hoisting the English flag on board of these ships which he intended for the relief of Rochelle. The sentence by which he was condemned also deprived his children of the title of nobles. When Montgomery heard this part of the sentence read, *If they have not the virtue of nobles to retrieve this loss* (said he), *I consent to their degradation.*—After undergoing a very severe torture, he was carried to the place de Greve, dressed in mourning, and there beheaded on the 26th of June 1574. D'Aubigny, who was present at his execution, and who stood immediately behind Fervaques, says that he appeared on the scaffold with a firm aud undaunted countenance; and gives us a pretty long speech which he delivered on that occasion, addressing himself first to the spectators

tators on one side of the river, and then to those on the other. When he had finished his speech, he fell down upon his knees beside the block; bade adieu to Fervaques, whom he perceived in the crowd; requested the executioner not to cover his eyes; and submitted to his fate with a constancy truly admirable.

Montgomery has always been considered as a victim to the unjust revenge of Catherine de Medicis. It is evident that he could not be prosecuted or punished for the death of Henry II.; but it has been said, that, after a misfortune of this kind, which was productive of so many calamities to the state, Montgomery was much less excusable than the other Protestants, in carrying arms against his sovereign, the son of that very king of whom he had deprived France. This consideration is mentioned by the Catholics as one reason for diminishing our concern at the tragical death of this illustrious hero. Montgomery married in 1549 Elisabeth de la Fouche of a noble family in Brittany: he left several children, but their number is not exactly known:

He was the eldest son of *James de Montgomery*, Seigneur de Lorges in the Orleannois, one of the bravest men of his age, and famous under the name of *Lorges* in the wars of Francis I. In 1545 he succeeded John Stuart count d'Aubigny in the command of the hundred archers in the Scotch guard; and his son was lieutenant, or perhaps captain, in survivancy when he killed Henry II. It is singular that the same Lorges, father of Montgomery, had wounded Francis I. in the chin with a firebrand, in some frolic with that prince. This accident occasioned the wearing of long beards in France for 50 years. Lorges died aged above 80, a short time after Henry II. He obtained the title of count de Montgomery in 1453, pretending that it belonged to his ancestors, and that he was descended, by the earls of Eglinton in Scotland, from a younger son of the ancient house of Montgomery established in England. According to a memoir given by the family to the author of the Genealogical Dictionary, James was the son of Robert Montgomery, who left Scotland and entered into the service of the French king about the beginning of the reign of Francis I. and this Robert was grandson to Alexander Montgomery, cousin by the mother's side to king James I. king of Scotland.

Montgomeryshire, a county of North Wales, 40 miles in length and 37 in breadth; bounded on the north by Merionethshire and Denbighshire, on the north-east and east by Shropshire, on the south by Radnorshire and Cardiganshire, and on the west by the last mentioned county and part of Merionethshire. It is divided into six hundreds; and contains six market-towns, 47 parishes, and about 5660 houses, and 33,960 inhabitants. It lies in the three several dioceses of St Asaph, Bangor, and Hereford; but sends only two members to parliament, one for the county, and one for the town of Montgomery. The air is pleasant and salubrious; but this county being extremely mountainous, is not very fertile, except in the valleys, which afford some corn and plenty of pasture; however, the south, south-east, and north-east parts being much more level, are extremely fruitful, especially a pleasant vale, through which the Severn glides in beautiful meanders.

MONTH, the twelfth part of a year. See Chronology, N° 17.

Month, in its proper acceptation, is that space of time which the moon takes up in passing from any certain point to the same again, which is called a *periodical month;* or it is the space of time between two conjunctions of the moon with the sun, which is called a *synodical month.* That space of time which the sun takes up in passing through one sign or 12th part of the zodiac, is also called (but improperly) a *month.* So that there are two sorts of months; *lunar*, which are measured by the moon; and *solar*, which are measured by the sun. The lunar periodical month consists of 27 days, 7 hours, 43 minutes, 5 seconds: The lunar synodical month is 29 days; 12 hours, 44 minutes, 3 seconds, and 11 thirds. A solar month contains upon a mean calculation, 30 days, 10 hours, 29 minutes, 5 seconds.

The Jews, Greeks, and Romans, made use of lunar synodical months, but to avoid fractions, they consisted alternately of 29 and 30 days. The former the Romans called *cavi*, and the Greeks χοιλοι; the latter were termed *pleni* and πληρεις.

1. The Hebrew months were ranged differently in their sacred and in their civil year.

Order of the sacred Year.		Answering to our	Order of the civil Year.		Answering to our
1	*Nisan*	Mar.	1	*Tisri*	Sept.
2	*Jiar*	Apr.	2	*Murschevan*	Oct.
3	*Sivan*	June	3	*Casleu*	Nov.
4	*Thammuz*	May	4	*Thebet*	Dec.
5	*Ab*	July	5	*Sebat*	Jan.
6	*Elul*	Aug.	6	*Adar*	Feb.
7	*Tisri*	Sep.	7	*Nisan*	Mar.
8	*Marschevan*	Oct.	8	*Jiar*	Apr.
9	*Casleu*	Nov.	9	*Sivan*	May
10	*Thebet*	Dec.	10	*Thammuz*	June
11	*Sebat*	Jan.	11	*Ab*	July
12	*Adar*	Feb.	12	*Elul*	Aug.

These months being lunar cannot exactly answer to our solar months; but every Jewish month must be conceived to answer to two of ours, and partake of both. As these 12 lunar months consisted only of 354 days, the Jews, in order to bring it nearer to the true year, took care every three years to intercalate a 13th month into the number, which they called *veadar*, or the second adar. The new moon was always the beginning of the month; and it is said the Jews had people posted on elevated places, to give notice to the Sanhedrim as soon as she made her appearance: After this, proclamation was made by sound of trumpet, and "the feast of the new moon, the feast of the new moon," resounded amongst the people.

The ancient Hebrew months were of 30 days each, excepting the last, which consisted of 35; so that the year contained 365 days, with an intercalary month at the end of 120 years, which, by absorbing the odd hours which remained at the conclusion of each year, brought it back nearly to its proper place. This regulation of the year was borrowed from the Egyptians.

2. The months of the Athenian year, as we have before observed, consisted alternately of 29 and 30 days. The first month, according to Meton's reformation of the kalendar, began with the first new moon after the summer solstice, and was called *hecatombæon*, answering to the latter half of June, and the former

former half of July. The order of the months, with the number of days in each, are as follows:

1 *Hecatombæon,*	30	7 *Posideon,*	30
2 *Metagilnion,*	29	8 *Gamelion,*	29
3 *Boedromion,*	30	9 *Elaphebolion,*	30
4 *Mæmacterion,*	29	10 *Munichion,*	29
5 *Panepsion,*	30	11 *Thargelion,*	30
6 *Anthesterion,*	29	12 *Scirrophorion,*	29

Each month was divided into three decades of days called δεχημερα. The first was called Μηνος αρχομενου or ισαμενου, or the decade of the beginning of the month; the second was Μηνος μεσουντος or the decade of the middle; and the third was Μηνος φθινοντος, παυομενου or ληγοντος, the decade of the expiring month.

The first day of the first decade was termed Νεομηνια, because the first month began with the new moon; the second day was δευτερα ισαμενου; the third τριτη ισαμενου, &c. The first day of the second decade was πρωτη μεσουντος, the second δευτερα μεσουντος, &c.—the days of this decade were also called πρωτη επι δεκα δευτερα επι δεκα, &c The first day of the third decade was πρωτη επ' εικαδι; the second was δευτερα επ' εικαδι, &c. i. e. the first, second, &c. after 20, because the last decade began on the 20th day. This decade was also counted by inversion thus; φθινοντος δεκατη the 21st, φθινοντος εννατη the 22d, φθινοντος ογδοη the 23d, and so of the rest to the last day of the month, which was called ενη και νεα, the old and the new, because one part of that day belonged to the old and the other to the new moon; but after the time of Demetrius, the last day of the month was called from him Δημητριας; it sometimes was named τριακας.

The Grecian months, thus consisting of 29 and 30 days alternately, fell short of the solar year 11 days 6 hours. To remedy this defect the cycle of four years, called τετραετηρις, was invented.—In this cycle, after the first two years, they added an intercalated month called εμβολιμος, consisting of 22 days; and again, after the expiration of two years more, they inserted another month of 23 days, the fourth part of a day having in the space of four years amounted to a whole day. See YEAR.

3. The Roman year under Romulus consisted of 10 months only, and began with March, which contained 31 days, then followed April which had 30, May 31, June 30, *Quintilis* 31, *Sextilis* 30, September 30, October 31, November 30, December 30. These 10 months containing no more than 304 days, this account was in a short time found to be deficient. Numa Pompilius, therefore, took away one day from each of these six months, April, June, *Sextilis*, September, November, December; and to the six days thus obtained he added 51, which was the number that Romulus's year, in his opinion, wanted to make it perfect. Numa had now 57 days to dispose of; he therefore divided them, and constituted two other months, January and February; the former consisting of 29 and the latter of 28 days. The month of January, which he placed at the winter solstice, he made instead of March to begin the year. Thus Numa's year consisted of 355 days: but this being found 11 days 6 hours short of the solar year, he made use of the intercalation of 90 days at the expiration of eight years perpetually: which number, being made up of the 11 days and a quarter, kept the year pretty well to its place. The beginning of the year in Julius Cæsar's time had anticipated its true place 67 whole days: these he intercalated betwixt November and December; so that the year consisted, for this one time of 15 months or 445 days. This reformation was called the *Julian correction*, and this year the *year of confusion*. At the end of 12 years, by the ignorance of priests, who did not understand intercalation, 12 days had been intercalated for nine. This was observed by Augustus Cæsar, and rectified, by ordering 12 years to pass without any intercalary days. The order and succession of months was the same as that of Numa: But January, March, May, *Quintilis*, *Sextilis*, October, and December, had each 31 days; April, June, September 30, and February, in common years, 28; but every fourth year or bissextile 29. This, with a very little difference, is the account observed at present. *Quintilis*, in compliment to Julius Cæsar, was called *July*, because in this month he was born; and *Sextilis*, in honour of Augustus, was called *August*; both which names are still continued.—See YEAR.

Each month by the Romans was divided into *kalends*, *nones*, and *ides*, all of which were reckoned backwards. The *kalends* were the first day of the month. The *nones* fell on the seventh, and the *ides* on the 15th, of March, May, July, October—but in all other months the *nones* were on the fifth, and the *ides* on the 13th. For the more easy comprehension of the Roman manner of dating, according to this division of the months, here follows a table.

	March May July October	January August December	April June September November	February.
1	*Kalendæ*	*Kalendæ*	*Kalendæ*	*Kalendæ*
2	6	4	4	4
3	5	3	3	3
4	4	*Prid.Non.*	*Prid.Non.*	*Prid.Non.*
5	3	*Nonæ*	*Nonæ*	*Nonæ*
6	*Prid.Non.*	8	8	8
7	*Nonæ*	7	7	7
8	8	6	6	6
9	7	5	5	5
10	6	4	4	4
11	5	3	3	3
12	4	*Prid.Idus*	*Prid.Idus*	*Prid.Idus*
13	3	*Idus*	*Idus*	*Idus.*
14	*Prid.Idus*	19	18	16
15	*Idus*	18	17	15
16	17	17	16	14
17	16	16	15	13
18	15	15	14	12
19	14	14	13	11
20	13	13	12	10
21	12	12	11	9
22	11	11	10	8
23	10	10	9	7
24	9	9	8	6
25	8	8	7	5
26	7	7	6	4
27	6	6	5	3
28	5	5	4	*Prid.Kal.*
29	4	4	3	
30	3	3	*Prid.Kal.*	
31	*Prid.Kal.*	*Prid.Kal.*		

N. B. Every leap-year, February consisting of 29 days, the 24th and 25th of that month are written *sexto Kal. Mart.*; hence leap-year is called *Bissextilis*.

MONTIA, in botany: A genus of the tryginia order, belonging to the triandria class of plants: and in the natural method ranking with those with which the order is doubtful. The calyx is dyphillous; in corolla monopetalous and irregular; the capsule unilocular and trivalved,

MONTINIA, in botany; A genus of the tetrandria order, belonging to the dioecia class of plants. The perianthium of the male is quadridented superior; and there are four petals. The female calyx and corolla are as in the male; the filaments barren; the style bifid; the capsule oblong and bilocular.

MONTMEDI, a small but strong town of France, in Luxemburg, seated on the river Chire, which devides it into the upper and lower towns. It is 22 miles south-east of Sedan, 27 south-west of Luxemburg, and 135 north-east of Paris. E. Long. 5. 23. N. Lat, 49. 32.

MONTMORENCI (Francois Henry de.) See Luxemburg.

MONTMORENCY, a town of France, with the title of a duchy, remarkable for the tombs of the dukes of this name. It is seated on a hill, near a large valley, fertile in fruits, especially excellent cherries. E. Long. 2. 24. N. Lat. 48. 59.

Montmorency (Anne de), a peer, marshal, and constable, of France, and one of the greatest generals of the 16th century, defended, in 1512, the city of Menziers against the emperor Charles V. and obliged the count of Nassau to raise the siege. The following year he was made marshal of France; and in 1525, following king Francis I. into Italy, he was taken with that prince at the battle of Pavia, which was fought contrary to his advice. The important services he afterwards rendered the state were rewarded by the sword of constable of France, with which he was presented by the king on the 10th of February 1538. He afterwards underwent various revolutions of fortune both at court and in the field. At last, being wounded at the battle of St Denis, which he gained on the 10th of November 1567, he died of his wounds two days after, at 74 years of age. It is said, that a cordelier attempting to prepare him for death, when he was covered with blood and wounds, after the battle of St Denis, he replied in a firm and steady voice: "Do you think that a man who has lived near 80 years with honour, has not learnt to die for a quarter of an hour?"

MONTPELIER, one of the handsomest towns of France, and the most considerable in Languedoc excepting Tholouse, is situated in E. Long. 4. 20. N. Lat. 45. 58. It hath a citadel, a bishop's see, an university, a royal academy of sciences, and a mint. This town has been long famous for a salubrious air and skilful physicians. In reality the air may be salutary in catarrhous consumptions from its dryness and elasticity; but it is too sharp in cases of pulmonary imposthumes. The climate, according to some late travellers, is so much altered for the worse, that the inhabitants themselves scarce know it to be the same: it has been changing many years, and every year becomes worse and worse. It has been known to rain almost three months without intermission: and at intervals such thick stinking fogs, as nothing but the bank of Newfoundland could equal: and several times, for two or three days on a stretch, the sky is so heavily loaded, that neither sun, moon, nor star, can be seen. In summer it is so insufferably hot, that till the cool of the evening there is no stirring out. Its situation, though on an eminence, never could be healthy: as between it and the Mediterranean (which is about three leagues distant) it is one continued marsh and swamp, ever covered with noxious vapours, which, when the sea-breeze sets in, blows directly on the town and the country adjacent; of the sad effects of which, its unhealthy inhabitants, with their yellow meagre looks, are the most convincing proofs.

The town has nothing curious to induce a stranger to stay longer in it than three or four days, except he arrives there about Christmas; at which time it is very gay, as all the nobility of Languedoc meet there at that time to settle the affairs of the province, though it is not the capital, but esteemed nearly the centre. There is during that time a play, which, with an indifferent concert, are all the public amusements. The people in trade are reputed by the French themselves to be the greatest extortioners, and sure not to let a penny escape them, be the means to come at it ever so unjust; as an instance, they had the conscience to charge an English sea officer that died there, 300 livres (twelve guineas and a half) for eight days lodging.

This city stands upon a rising ground fronting the Mediterranean, which is about three leagues to the south-ward; on the other side is an agreeable plain, extending about the same distance towards the mountains of the Cevennes. It is reckoned well built, and what the French call *bien percee*: yet the streets are in general narrow and the houses dark. The inhabitants are supposed to amount to 40,000: they are sociable, gay and good tempered, and they trade very largely in wine cordials, oil, verdigrease, and salt-petre. They have several manufactures in silk and woollen goods. There are many Protestants here and at Nismes. The markets are well supplied with fish, poultry, butcher's meat, and game, at reasonable rates. The wine of the country is strong and harsh: Burgundy is dear, and so is the sweet wine of Frontignan, though made in the neighbourhood of Cette. Liquors of various sorts are compounded and distilled at Montpelier. The environs are extremely pleasant, having on one side La Place de Peyrou, which forms a fine terrace. From thence, on a clear day, may be seen to the eastward the Alps, which form the frontiers of Italy; to the south-west the Pyrenean mountains, which form those of Spain, each esteemed fifty leagues distant; and to the south ward a most extensive view of the Mediterranean. Not far from thence is a noble aqueduct, built like two bridges one above the other; by this water is brought from a mountain at three leagues distance, into two basons in a small elegant temple at the west end of the place; and the king's garden, where on certain days public lectures are held on botany. On the other side of the town is the esplanade, a beautiful walk, bordered on each side by olive trees, from whence there is a pleasing prospect of the sea and the country adjacent to the town: near which is the citadel, a place of no strength though well walled in, as it is commanded by several rising grounds, and has only a dry ditch. There are commonly kept there four battalions of infantry.—

Montreal. Should an Englishman choose to reside here any time, the Grande Rue, that is, the great street, is the genteelest quarter to reside in, where 12 or 18 livres a month is the price for a genteel chamber, which in the time of the states would let for 60; and if he does not choose to mess with the officers, there is a genteel ordinary, where the English commonly eat, in the Rue d' Argenterie, which is contiguous to your lodgings. Families who reside here find their account in keeping house; and every traveller who designs to stay longer than a day or two in any of these towns, will do well to write beforehand to his correspondent to procure furnished lodgings, to which he may be driven immediately, without being under the necessity of lying in an execrable inn, where he must pay four livres a head for every meal, and six livres a day for an apartment.

MONTREAL, an island of north America, in the river St Laurence, about six leagues and a half in length, and three leagues over in the broadest parts, It belonged to the French; but was taken by the generals Amherst and Murray on the 8th of September 1760, without firing a gun, According to the terms of capitulation, all the French forces were to be sent to Old France; and consequently all Canada became subject to the Crown of Great Britain; which cession was confirmed by the peace of 1763. The soil of the island is exceedingly rich and good, producing all kinds of European fruits and vegetables in great abundance, with variety of garden fruits. The south side is the most inhabited, of course best cultivated; and besides the settlements, which are numerous, the island is adorned with villas, for the retirement of the more wealthy merchants during the summer season. No Indians are settled here; nor are they fond of settling on islands, from an hereditary distrust lest they should be cut off by the Europeans. Since this place has been in the possession of Britain, it has suffered much by fires, the houses being mostly built of wood.

The town of MONTREAL, situated on this island, and formerly called *Ville Marie*, is the second place in Canada for extent, buildings, and strength; and besides possessing the advantage of a less rigorous climate; for delightfulness of situation is infinitely preferable to Quebec. It stands on the side of a hill, sloping down to the south, with many agreeable villas upon it, which with the island of St Helen, and the river (which is here about two miles broad), form a most charming landscape. Though the city is not very broad from north to south, it covers a great length of ground from east to west, and is nearly as large and populous as Quebec. The streets are regular, forming an oblong square; the houses well built, and in particular the public edifices, which far exceed those of the capital in beauty and commodiousness; the residence of the knights hospitallers being extremely magnificent.—There are several gardens within the walls, in which, however, the proprietors have consulted use more than elegance, particularly those of the Sisters of the Congregation, the Nunnery Hospital, the Recollets, Jesuits Seminary, and Governor. Besides these, there are many other gardens and beautiful plantations without the gates, as the garden of the General Hospital, and the improvements of Mr Liniere, which exceed all the rest, and are at an agreeable distance on the north side of the town. The three churches and religious houses are plain, and contain no paintings, nor any thing remarkably curious, but carry the appearance of the utmost neatness and simplicity. The city has six or seven gates, large and small; but its fortifications are mean and inconsiderable, being encompassed by a slight wall of masonry, sufficient only to overawe or prevent a surprise from the numerous tribes of Indians with whom they are surrounded, and who used to resort in vast bodies to the annual fair held here, which continued from the beginning of June till the latter end of August, when many solemnities were observed, at which the governor assisted, and guards were placed to preserve good order among such a concourse of different savage nations, all of whom are extremely fond of spirituous liquors, and when drunk commit great excesses, The fortifications were by no means capable of sustaining a regular attack; and though the garrison in 1760 consisted of eight battallions of regular troops, a numerous militia, and a great body of savages. M Vaudreuil and Chevalier de Levis submitted without firing a gun. There are no guns mounted on the wall; only a dry ditch surrounds it, about seven feet deep, encompassed with a regular glacis. On the inside of the town is a cavalier on an artificial eminence, with a parapet of logs or squared timbers and six or eight guns, called the citadel. Such is the strength of Montreal, the number of whose inhabitants may be between 5000 and 6000, extremely gay and well dressed. By the situation of the place, the inhabitants are well supplied with all kinds of river fish, some of which are unknown to Europeans, being peculiar to the lakes and rivers of this country. They have likewise plenty of black cattle, horses, hogs, and poultry. The neighbouring shores supply them with a great variety of game in the different seasons; and the island abounds with well tasted soft springs, which form a multitude of pleasant rivulets. The city now drives a considerable trade in furs, &c. and vessels of 200 tons can come up to it. It stands 60 leagues above Quebec.

MONTREAL, a town of Spain, in the kingdom of Arragon, with a castle, seated on the river Xiloca, 25 miles N. W. of Tervil, and 43 S. E. of Calataud.—W. Lon. 1. 2. N. Lat. 41. 9.

MONTREAL, a town of Italy, in Sicily, and in the valley of Mazara, with an archbishop's see; seated on a rivulet, five miles W. of Palermo, and 50 N. E. of Mazara. E. Lon. 13. 13. N. Lat. 38, 14.

MONTREAL, or *Mount Royal*, a fortress of Germany, in the circle of the Lower Rhine, and electorate of Triers; seated on the river Moselle, 22 miles N. E. of Triers. E. Lon. 7. 6. N. Lat. 49. 59.

Montreal, Montrose. MONTROSE, a handsome town of North Britain, in the shire of Angus, situated at the mouth of the river Esk, on the German Ocean, 46 miles north-east of Edinburgh, but 70 miles distance by road. The houses are neat, and many of them in the modern taste. The most remarkable public buildings are, the town-house, the church, and an elegant episcopal chapel.—Montrose is a parliament town, and a dukedom in the family of Graham. It stands between two rivers, the south and north Esks, over which there have been lately built two very handsome bridges, at a great expence. The salmon fisheries on these rivers are very valuable, and form a good branch of commerce.

Montrose, Montserrat. merce. The harbour is a fine ſemicircular baſon defended by a handſome ſtone pier. A great number of trading veſſels belong to this port.

Montrose (Marquis of). See Graham; and Britain, n° 137, 138, 143, 265.

MONTSERRAT, a mountain of Spain, in Catalonia, one of the moſt ſingular in the world for ſituation, ſhape, and compoſition. It ſtands ſingle, towering over a hilly country like a pile of grotto work or Gothic ſpires; and its height ſo great, that to a beholder on the top, the neighbouring mountains appear to be ſunk to a level with the plain. It is compoſed of ſteep rocks, which at a diſtance ſeem indented; whence it is ſaid to have received the name *Montſerrat* from the Latin word *ſerra* a "ſaw." It is impoſſible to deſcribe the beauty, richneſs, and variety, of the landſcapes diſcovered from the moſt elevated point: but the extenſiveneſs of the proſpect may be conceived by the reader, upon being told that the iſlands of Minorca and Majorca, which are at the diſtance of 60 leagues, are diſcovered from this elevation.

Montſerrat is particularly famous for the adoration that is paid to an image of the Virgin, which, according to tradition, was found in a cave in this mountain by ſome ſhepherds in the year 880. Over this image, Guthred earl of Barcelona cauſed a monaſtery and chapel to be erected; but, after remaining in this receptacle upwards of 700 years, Philip II. and Philip III. built a magnificent church for its reception. Innumerable and aſtoniſhing miracles are aſcribed to this holy image. The convent or monaſtery is ſituated in a nook of the mountain; it ſeems as if vaſt torrents of water, or ſome violent convulſion of nature, had ſplit the eaſtern face of Monſerrat, and formed in the cleft a ſufficient platform to build the monaſtery upon. The river Llobregat roars at the bottom, and perpendicular walls of rock, of prodigious height, riſe from the water edge near half way up the mountain. Upon theſe maſſes of white ſtone reſts the ſmall piece of level ground which the monks inhabit. Cloſe behind the abbey, and in ſome parts impending over it, huge cliffs ſhoot up in a ſemicircle to a ſtupendous elevation: their ſummits are ſplit into ſharp cones, pillars, pipes, and other odd ſhapes blanched and bare; but the interſtices are filled up with foreſts of evergreen and deciduous trees and plants. Fifteen hermitages are placed among the woods; nay, ſome of them on the very pinnacles of the rocks, and in cavities hewn out of the loftieſt of theſe pyramids.

The monaſtery is one of the 45 religious houſes of the Spaniſh congregation of the order of St Benedict; their general chapter is held every fourth year at Valladolid, where the deputies chooſe abbots and other dignitaries for the enſuing quadrennium. In this monaſtery, they elect for abbot a Catalan and a Caſtilian alternately. Their poſſeſſions are great, conſiſting of nine villages lying to the ſouth of the mountain; but the king has lately curtailed their income about 6000 livres a year, by appropriating to his own uſe the beſt houſe in each village, ſome of which, with their tythes, are worth 200 dollars per annum. Their original foundation, in 866, gave them nothing but the mountain; and to donations and economy they owe the great increaſe of their landed property. They are bound to feed and harbour for three days all poor pilgrims that come up to pay their homage to the Virgin; and the allowance is a luncheon of bread in the morning, as much more, with broth, at noon, and bread again at night. Sometimes, on particular feſtivals, 7000 perſons arrive in one day; but people of condition pay a reaſonable price for what they eat.—The number of profeſſed monks, according to Mr Swinburne, is 76 (according to M. Bourgoanne 60); of lay-brothers, 28; and of ſinging boys, 25; beſides phyſician, ſurgeon, and ſervants. The church is a gloomy edifice; and the gilding is much ſullied with the ſmoke of 85 lamps of ſilver, of various forms and ſizes, that hang round the cornice of the Sanctuary. Funds have been bequeathed by different devotees for furniſhing them with oil. The choir above ſtairs is decorated with the life of Chriſt, in good wooden carving. A gallery runs on each ſide of the chancel, for the convenience of the monks. A large iron grate divides the church from the chapel of the Virgin, where the image ſtands in a nich over the altar, before which burn four tapers in large ſilver candleſticks, the preſent of the duke of Medina Celi. In the ſacriſty, and paſſages leading it, are preſſes and cupboards full of relics and ornaments of gold, ſilver and precious ſtones; they point out, as the moſt remarkable, two crowns for the virgin and her ſon, of ineſtimable value; ſome large diamond rings; an excellent cameo of Meduſa's head; the Roman emperors in alabaſter; and the ſword of St Ignatius. But as no offerings to this miraculous ſtatue can be rejected or otherwiſe diſpoſed of, the ſhelves are crowded with moſt whimſical *ex votos*, viz. ſilver legs, fingers, breaſts, ear rings, watches, two wheeled chaiſes, boats, carts, and ſuch like trumpery.

On different parts of the mountain, as already noticed, are a number of hermitages. Each of theſe ſolitary retreats, which at a diſtance ſeem deſtitute of every thing, has a chapel, a cell, a well in the rock, and a little garden. The inhabitants of one of them, which is dedicated to St Beneto, has the privilege of making an annual entertainment on a certain day; on which day all the other hermits are invited, when they receive the ſacrament from the hands of the mountain vicar, and after divine ſervice dine together. They meet alſo at this hermitage, on the days of the ſaints to which their ſeveral hermitages are dedicated, to ſay maſs, and commune with each other. But at other times they live in a very ſolitary and recluſe manner, perform various penances, and adhere to very rigid rules of abſtinence; nor do they ever eat fleſh; nor are they allowed to keep within their walls either dog, cat, bird, or any living thing, leſt their attention ſhould be withdrawn from heavenly to earthly affections. Moſt of theſe hermits are ſaid to be perſons of fortune and family, diſguſted with the world, who have retired thither to devote themſelves to meditation, ſelf-denial, and contrition.

Montserrat, one of the Carribbee Iſles belonging to Great Britain. It is a very ſmall, but very pleaſant iſland, ſo called by Columbus from its reſemblance to the famous mountain near Barcelona in Catalonia. It lies in W. Long. 61. 0. N. Lat. 16. 50. having Antigua to the north-eaſt, St Chriſtopher's and Nevis

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to the north-west, and Guadaloupe lying south south-east at the distance of about nine leagues. In its figure it is nearly round, about nine miles in extent every way, 27 in circumference, and is supposed to contain about 40,000 or 50,000 acres. The climate is warm, but less so than in Antigua, and is esteemed very healthy. The soil is mountainous, but with pleasant valleys, rich and fertile, between them; the hills are covered with cedars and other fine trees. Here are all the animals as well as vegetables and fruits that are to be found in the other islands, and not at all inferior to them in quality. The inhabitants raised formerly a considerable quantity of indigo, which was none of the best, but which they cut four times a-year. The present product is cotton, rum, and sugar. There is no good harbour, but three tolerable roads, at Plymouth, Old Harbour, and Ker's bay, where they ship the produce of the island. Public affairs are administered here as in the other isles, by a lieutenant-governor, council, and assembly, composed of no more than eight members, two from each of the four districts into which it is divided. The wonderful effects of industry and experience in meliorating the gifts of nature have been no where more conspicuous than in these islands, and particularly in this, by gradually improving their produce, more especially of late years, since the art of planting hath been reduced to a regular system, and almost all the defects of soil so thoroughly removed by proper management and manure, that, except from the failure of seasons, or the want of hands, there is seldom any fear of a crop. In 1770 there were exported from this island to Great Britain 167 bags of cotton, 1670 l.; 740 hogsheads of rum, 7400 l. To Ireland 133 ditto, 1330 l.; 4338 hogsheads 232 tierces 202 barrels of sugar, 79,507 l.; in the whole 89,907 l. To North America 12,633 l. There are a few ships employed in trading to this island from London and from Bristol. As to the number of inhabitants, according to the most probable accounts, they consist of between 1200 and 1500 whites, and from 10,000 to 12,000 negroes, though some say not so many.

MONUMENT, in architecture, a building destined to preserve the memory, &c. of the person who raised it, or the person for whom it was raised; such are a mausoleum, a triumphal arch, a pyramid, &c.

MOOD, or Mode. See Mode.

Moods of Syllogism. See Logic n° 85.

Mood, or *Mode*, in grammar, the different manner of conjugating verbs. See Grammar.

MOON, (*Luna*, ☽), in astronomy, one of the heavenly bodies, usually ranked among the planets; but with more propriety accounted a satellite, or secondary planet.

Among the ancients, the moon was an object of prime regard.—By the *Hebrews* she was more regarded than the sun, and they were more inclined to worship her as a deity. The new moon, or first days of every month, were kept as festivals among them, which were celebrated with sound of trumpets, entertainments, and sacrifice. (See Numb. xxviii. 11. x. 16. 1 Sam. xx. 5—18.) People were not obliged on these days to rest. The feasts of new moons were a miniature representation of the feast of trumpets, which was held on the first of the month Tisri, which was the beginning of the civil year. The Jews not being acquainted with the physical cause of eclipses, looked upon them, whether of sun or moon, as signs of the divine displeasure. The Grecians looked upon the moon as favourable to marriage; and the full moons or the times of conjunction of sun and moon, were held the most lucky seasons for celebrating marriages; because they imagined the moon to have great influence over generation. The full moon was held favourable for any undertakings by the Spartans: And no motive could induce them to enter upon an expedition, march an army, or attack an enemy, till the full of the moon. The moon was supposed both by Greeks and Romans to preside over child-birth.—The patricians at Rome wore a crescent on their shoes to distinguish them from the other orders of men. This crescent was called *Lunula*. Some say it was of ivory. others that it was worked upon the shoe, and others that it was only a particular kind of fibula or buckle.

As all the other planets move primarily round the sun, so does the moon round the earth: her orbit is an ellipsis, in which she is retained by the force of gravity; performing her revolution round the earth, from change to change, in 29 days, 12 hours, and 44 minutes, and round the sun with it every year: she goes round her orbit in 27 days, 7 hours, 43 minutes, moving about 2290 miles every hour; and turns round her axis exactly in the time that she goes round the earth, which is the reason of her keeping always the same side towards us; and that her day and night taken together are as long as our lunar month.

The mean distance of the moon from the earth is $60\frac{1}{2}$ semi-diameters of the earth; which is equivalent to 240,000 miles. The mean eccentricity of her orbit is $\frac{655}{10000}$ of her mean distance, or in miles 13,000, which makes a considerable variation in that mean distance. —Her diameter is to that of the earth as 100 to 365, as 11 to 40. 15, or 2180 miles: its mean apparent diameter is 31 minutes $16\frac{1}{2}$, and that of the sun 32 minutes 12 seconds. Its mean diameter as seen from the sun is 6 seconds.

The moon's surface contains 14,898,750 square miles, and its solidity 5,408,246,000 cubical ones. The density of the moon's body is to that of the earth as 48,911 to 39,214; to that of the sun, as 48,911 to 10,000; its quantity of matter to that of the earth, nearly as 1 to 39.15: the force of gravity on its surface is to that on the surface of the earth as 139.2 to 407.8; and the moon's bulk to that of the earth as $\frac{1}{50}$ to 1. The moon has scarce any difference of seasons; because her axis is almost perpendicular to the ecliptic.

The different appearances of the moon are very numerous; sometimes she is increasing, then waning; sometimes horned, then semicircular; sometimes gibbous, then full and round. Sometimes, again, she illumines us the whole night; sometimes only a part of it; sometimes she is found in the southern hemisphere, sometimes in the northern; all which variations having been first observed by Endymion, an ancient Grecian who watched her motions, she was fabled to have fallen in love with him. The source of most of these appearances is, that the moon is a dark, opaque, and spherical body, and only shines with the light she receives from the sun; whence only that half

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turned towards him, at any instant, can be illuminated, the opposite half remaining in its native darkness. The face of the moon visible on our earth, is that part of her body turned towards the earth; whence, according to the various positions of the moon, with regard to the sun and earth, we observe different degrees of illumination; sometimes a large and sometimes a less portion of the enlightened surface being visible.—But for a particular account of the nature, phenomena, &c. of this secondary but interesting planet, see ASTRONOMY-*Index*, at *Moon*.

New Observations on the atmosphere, Twilight, &c. of the MOON. M. Schroeter of the Royal Society of Gottingen has lately published a very curious and elaborate work in German, intitled *Selenotopographische Fragmente*, &c. or Selenotopographical Fragments, intended to promote a more accurate knowledge of the Moon's surface. The several maps of the moon *, which have been delineated by Hevelius, Ricciolus, Cassini, and Mayer, are well known to every person conversant with astronomical subjects. It is evident that these delineations can give only a very general idea of the spots, together with their relative position on the lunar disk; and as, with respect to us, the appearance of these must vary according to the direction in which the rays of the sun fall on them, the moon's surface will not exactly correspond with the representation of it laid down in the map, except when it happens to be illuminated under the same angle as when this map was drawn. This consideration induced the author to apply himself to the invention of a more accurate mode of describing these phenomena than had hitherto been attempted. For this purpose having provided himself with a telescope seven feet in length constructed by Dr Herschel, he resolved, repeatedly and under various angles of illumination, to observe and delineate very small portions of the lunar disk; in order that, by comparing his different drawings of the same objects, he might compile an accurate, topographical description of the moon's surface; but, in this manner, to form a complete lunar atlas, was an undertaking too extensive for a single person. He therefore found himself obliged to prescribe more narrow limits to his design, and confined his plan to the delineation of the several portions of the moon's surface under one angle only of illumination, and this a very small one, that he might obtain more distinct and accurate observations and drawings of the shadows; intending at the same time to examine such parts as appeared either more remarkable or less distinct than the rest, by repeated observations under various angles of illumination: And the present volume contains the result of his observations, with respect to the northern parts of the lunar disk,

* See ASTRONOMY-Index, at Moon.

The author observes, that, through a telescope which magnifies a thousand times, a lunar object of 160 feet in surface appears like a very small point: and that, to be distinguishable with respect to shape, it must not be less than 800 feet in extent. He tells us, that for his observations he preferred those times when the sun's rays fell on the moon under the least angle; that he carefully and repeatedly examined every object that could be distinguished, and either actually measured its apparent diameter and the length of its shadow, or compared these dimensions with others which he had already measured, and that he never used magnifiers of greater power than what was absolutely necessary to render the object distinct. In order to facilitate the delineation, he applied to his telescope a projecting micrometer, divided into small squares, which, by means of a brass rod, could be placed at any distance from the eye, and always be kept parallel to the line of the moon's horns. His maps or drawings are orthographical projections: and his scale is so constructed, that 20 seconds of the moon's disk correspond with half an English inch on the map; thus the space of 4 seconds is represented in the compass of a decimal line, and, according to M. Schroeter's computation, answers to a German mile or 3807 toises. The inconveniencies and inaccuracy of the common method of measuring the lunar mountains, induced him to contrive others capable of greater exactness and more general application: these he varied as the circumstances of the case required; but they are all trigonometrical calculations of the heighth of the mountain, or the depth of the cavity from the angle of illumination and from the length of the shadow.

If, as some have supposed, a great part of the moon's surface be volcanic, it is natural to expect that the marks of eruption should from time to time be discernible. A single instance of this kind occurred to our author: ever since the 27th of August 1788, he had constantly seen a cavity, or, as he terms it, a *volcanic crater*, in the spot Hevelius, which he had never before perceived, though he had often examined this part of the moon with the utmost attention, and in the most favourable circumstances. According to his conjectures, this phenomenon must have commenced between the 24th of October 1787 and the 27th of August 1788.

He observed some alterations in the appearance of lunar objects, which, though too considerable to be attributed to the variation of light, were not sufficiently permanent to be considered as the effect of volcanoes. These he ascribes to meteors; for though he does not suppose the moon to be surrounded with air, exactly like that which invests our globe, he thinks it probable that it may have an atmosphere of some kind, in which some of the elements of bodies. decompounded on its surface, may be suspended; and that some of the lunar mountains may emit nebulous vapours, not unlike the smoke of our volcanoes, which obscure and disguise the objects seen through them.

In regard to those bright points, which have been seen on the moon's surface during eclipses, and at other times on her unenlightened part, and which some have supposed to be burning volcanoes; Schroeter, after the most attentive examination of them, imagines that most of them must be ascribed to the light reflected from the earth to the dark part of the moon's disk, which returns it from the tops of its mountains, under various angles, and with different degrees of brightness. Some of these phenomena he suspects to be no more than optical illusions, arising from igneous meteors floating in our atmosphere, which happen to fall within the field of the telescope.

But the most interesting part of this work consists of the author's "Remarks on the Formation and physical Constitution of the Moon's Surface aud Atmosphere."

The surface of the moon appears to be much more unequal than that of our earth; and these inequalities have great variety both in form and magnitude. There are large irregular plains, on which are observed long and narrow strata of hills running in a serpentine direction; some of the mountains form extensive chains; others, which are in general the highest, stand alone, and are of a conical shape: some have craters; others form a circular ring inclosing a plain; and in the centre of many of these plains, as well as in the middle of some of the craters, other mountains are found, which have likewise their craters. These mountains are various with respect to colour, some being much darker than others.

The most lofty mountain on the surface of our globe is supposed to be Chimboraco, which is not 20,000 feet in height: but there are many in the moon which are much higher; that which is distinguished by the name of *Leibnitz*, is not less than 25,000 feet. This elevation will appear more extraordinary, if compared with the moon's diameter, of which it is $\frac{1}{274}$th, whereas Chimboraco is not above $\frac{1}{1617}$th of that of the earth; thus considered, the lunar mountains are near five times as high as any on our globe.

The craters of the moon are circular, and surrounded with an annular bank of hills; they are remarkable for their width, many of them being from 4 to 15 geographical miles in diameter: some are not deeper than the level of the moon's surface; others are 9000, 12,000, and 15,000 feet in depth: that of one, which our author calls *Bernouilli*, is above 18,000 feet. The height of the annular bank is seldom equal to the depth of the crater which it surrounds; but the quantity of matter in the one appears to be in general nearly equal to the capacity of the other. The principal mountains and cavities seem to be connected by a series of others of less magnitude; and sometimes by hilly strata, which, like the radii of a circle, may betraced to a common centre; this is generally either a mountain or crater, though not of the greatest height or depth. These hilly strata, which, through smaller telescopes, appear like veins on the moon's surface, have often been mistaken for torrents of lava; none of which, M. Schroeter says, he could ever discover.

From all the preceding circumstances, the author concludes, that whatever may have been the cause of the inequalities of the moon's surface, it must not only have operated with great violence, but also have met with great resistance: which inclines him to think, that the substance of this planet must originally have been very hard and refractory. He is of opinion that these mountains and cavities must have been produced in consequence of some great revolution occasioned by the action of a force directed from the centre towards the surface, and in this respect similar to that which gave birth to our volcanoes: but he observes, that we have no reason to suppose it absolutely volcanic, nor that it originated from fire. In some places, this force has only elevated the surface, and thus formed hills and mountains; in others, the ground has yielded to its violence, and has either been thrown up as a bank round the crater thus formed, or else falling into other cavities, has in part filled them up; after having exerted its greatest violence in these mountainous accumulations, it has diffused itself in various directions, and produced the hilly strata which are observed to diverge from them, like the radii of a circle from the centre. In support of this hypothesis, it is alleged, that the largest craters have the least depth, and that in the deepest there is the most equal proportion between the capacity of the crater and the volume of the annular bank around it; but beside the grand revolution here supposed, M. Schroeter is of opinion that there have been others of later date and less extent; to these he ascribes the formation of secondary mountains, which arise either from the middle of the craters of the primary, or from the centre of a plain surrounded by a circle of hills? many of these have also craters, and, like the primary mountains, are connected by a series of cavities and hilly strata, that mark the progress of the cause by which they were produced. The new crater discovered by our author in the spot Hevelius, together with other circumstances here enumerated, seem to indicate that the surface of the moon is far from being permanently settled and quiescent.

The author's observations confirm the opinion that the cavities visible on the lunar surface do not contain water; hence he concludes, that there can be no extensive seas and oceans, like those which cover a great part of the earth: but he allows that there may be springs and small rivers. The question, whether the moon be inhabited? is not omitted by M. Schroeter, who observes, that though it be not adapted to beings organised as we are, this is no proof that it may not be peopled with intelligent agents, endued with bodily constitutions suitable to the nature and economy of the planet for which they are destined.

With regard to a lunar atmosphere, the existence of which has been a subject of much dispute*, our author adduces a variety of proofs in support of the affirmative side of the question. He also makes a number of observations on several of its relative properties, compared with the same in our atmosphere; such as its greater dryness, rarity, and clearness, which, however, do not prevent its refracting the solar rays, having pointed out the circumstance, that the mountains in the dark hemisphere of the moon, near its luminous border, which are of sufficient height to receive the light of the sun, are the more feebly illuminated the more distant they are from that border; from which proofs of a refracting atmosphere, he also deduced the probability of the existence of a faint twilight, though his long series of observations had not yet fully evinced it.—He had however, ascertained the existence of a twilight on Venus; and as one fortunate discovery often leads to another, he had no sooner succeeded in his observations on that planet, than he was induced to direct his attention, for a similar purpose, to the moon, In doing this, he applied the calculations and inferences he there made to some appearances he had already noticed on this satellite. It occured to him, that if in fact there were a twilight on the moon, as there is on Venus and our earth, it could not, considering the greater rarity of its atmosphere, be so considerable: that the vestiges of it, allowing for the brightness of the luminous part of the moon, the strong light that is thence thrown upon the field of the telescope, and in some measure the reflected light of our earth, could only be traced on the limb, particularly

* See Astronomy-Index, at Moon.

Moon. cularly at the cusps; and even this only at the time when our own twilight is not strong, but the air very clear, and when the moon, in one of its least phases, is in a high altitude, either in the spring, following the sun two days after a new moon; or in the autumn, preceding the sun in the morning, with the same aspect: in a word, that the projection of this twilight will be the greater and more perceptible the more falcated the phase, and the higher the moon above the horizon, and out of our own twilight.

All the requisite circumstances do not often coincide. M. Schroetor, however, was so fortunate as to be favoured with a combination of them on the 24th of February 1792: And the observation proved in every respect so complete, and the inferences deducible from it appeared to him so new and interesting, that he could not with hold the immediate communication of it from the public. His observations concerning both the Moon and Venus have been accordingly detailed in a paper sent to the Royal Society of London, and inserted in their Transactions for 1792; from which the following respecting the Moon are extracted.

"On the abovementioned evening, at 5h 40′, two days and 12 hours after the new moon, when in consequence of the libration the western border of the grey surface of the Mare Crisium was 1′ 20″ distant from the western limb of the moon, the air being perfectly clear, I prepared my seven-feet reflector, magnifying 74 times, in order to observe the first clearing up of the dark hemisphere, which was illuminated only by the light of our earth, and more especially to ascertain whether in fact this hemisphere, which, as is well known, is always somewhat more luminous at the limb than in the middle, would emerge out of our twilight at many parts at once, or first only at the two cusps. Both these points appeared now, most distinctly and decidedly, tapering in a very sharp, faint, scarce any where interrupted, prolongation; each of them exhibiting, with the greatest precision, its farthest extremity faintly illuminated by the solar rays, before any part of the dark hemisphere could be distinguished. But this dark hemisphere began soon after to clear up at once at its border, though immediately only at the cusps, where, but more particularly at their points, this border displayed, on both at the same time, a luminous margin, above a minute in breadth, of a very pale grey light, which, compared with that of the farthest extremities of the cusps themselves, was of a very different colour, and relatively as faint as the twilight I discovered on the dark hemisphere of Venus, and that of our own earth, when compared with the light immediately derived from the sun. This light, however, faded away so gradually towards the east, as to render the border on that side perfectly undefined, the termination losing itself imperceptibly in the colour of the sky.

"I examined this light with all possible care, and found it of the same extent at both points, and fading away at both in the same gradual proportion. But I also, with the same caution, explored whether I could distinguish any part of the limb of the moon farther towards the east; since, if this crepuscular light had been the effect of the light reflected from our globe, it would undoubtedly have appeared more sensibly at the parts most remote from the glare of the illuminated hemisphere. But, with the greatest exertion of my visual powers, I could not discover any part of the, as yet, wholly darkened hemisphere, except one single speck, being the summit of the mountainous ridge Leibnitz, which was then strongly illuminated by the solar light: and indeed eight minutes elapsed before the remainder of the limb became visible; when not only separate parts of it, but the whole, displayed itself at once. Moon.

"This alone gave me certain hopes of an ample recompence and satisfied me that the principles I had laid down in my Selenotop. Fragm. § 525. *et seq.* concerning the atmospheres of the planets, and especially of the moon, are founded on truth. But a similar observation made on the 6th, after seven o'clock, afforded me several collateral circumstances, which strongly corroborate what I have there advanced on this subject. The whole limb of the dark hemisphere, illuminated only by the reflected light of our globe, appeared now so clear and distinct, that I could very readily discern not only the large but also the smaller spots, and among these Plato, Aristarchus, Menelaus, Manilius, Copernicus, &c. and even the small speck to the north-west of Aristarchus, marked β Tab. XXVII. fig. 1. of the Fragments. I could apply the usual power, magnifying 161 times; and had full leisure, and the means, to examine every thing carefully and repeatedly, and to take very accurate measurements.

"Although a just idea of so delicate a phenomenon as this crepuscular light cannot possibly be conveyed by a drawing, but must be gathered from actual inspection, I have, nevertheless, attempted a delineation of it, and of the southern and eastern cusps, fig. 1. and Plate
2. as deduced from my measurements, especially at CCCXIV.
the southern cusp, in hopes thereby to render what I have farther to say concerning this observation the more intelligible.

"The southern cusp (fig. 1.) extended from *a* to *c*, with a gradually fading but still resplendent solar light, of its usual pale yellow colour, and terminated at *c* with a mountain. That this was really the point of the cusp, appears not only from the general construction of the falcated segment, which was sufficiently narrow even at its beginning *a*, near which it was somewhat disfigured at *b* by a high mountain, but also from the narrowness of its luminous curve at *d e* and *f*, the breadth of which seldom exceeded 1″, and had a sensible interruption so near as *d*. This curve was throughout, from *a* to *c*, except where the glare of the solar rays spread some degree of light, bordered with the pale ash-colour of the dark hemisphere, glimmering with the faint light reflected from our earth; out of which, however, rose the higher mountains *g*, *h*, *i*, *c*, which were now already illuminated by the sun; and farther on, not less than 30 lines, or, according to my usual projection, two minutes distant from the point *c*, was seen another mountain *l*, which belonged to the high ridge Leibnitz, and also received its light immediately from the sun.

"There can hence be no doubt of the termination of the cusp being at *c*; and this being well ascertained, I now distinguished with the greatest certainty the twilight extending from *c* to *k*. The most remarkable circumstances attending this light were, that it was broadest and brightest at *c*, and that it dwindled away and contracted towards *k*, where it lost itself in the faint glimmering of our terrestrial light; and that at the northern cusp (fig. 2.), at which there do not appear to be so many mountains and inequalities as at the southern, this light exhibited the same pyramidal form, and was of equal length, and alike fading in intensity and colour, as that at the southern.

"This light, compared with that of the thinnest and least bright part of the cusp *d c*, was as faint as the pale ash-coloured spots in the luminous hemisphere, when opposed to the bright ones. But this is still better illustrated by a comparison between the high mountain *l* (fig. 1.) which now already appeared illuminated by the solar light and the spot Aristarchus, which shone moderately merely with the light reflected from our globe. The said mountain had, comparatively with the thin luminous arc *d e f* of the bright hemisphere, and the mountains *g, h, i, c*, a very pale, fading, but yet brighter light than Aristarchus, as indeed might have been expected from what I said in my Selenotop. Fragm.; but this reflected light upon Aristarchus was, however, sensibly brighter than the glimmering light from *c* to *k*. And, respecting the still fainter terrestrial light which bordered the luminous curve from *c* to *k* (fig. 1. and 2.), I cannot give a better idea of it than by observing, that the light at the extremities of both the cusps appeared of a pyramidal form, similar to, but though gradually fading, and very undefined, yet brighter than that of our zodiacal light, when, in the months of March and April, it blends itself, comparatively with the remaining colour of the sky, with the terrestrial light, terminating in a very sharp point.

"The undefined and gradually fading appearance of this light was the cause that, though I had recourse to a dark projection table. I could not, however, take any accurate measurements of it. I found nevertheless, by repeated comparisons, that the length of this pyramidal glimmering light, in which I could perceive no sensible inequality at the limb of the moon, amounted to about $\frac{2}{3}$ of the distance between the two mountains *c, l*, (fig. 1.) which shone with the solar light. Comparing also this southern twilight with the northern, it appeared of the same length; and, on measuring the distance *c l*, I found it repeatedly = 30 lines = 2′; so that the length of the twilight must have amounted to 20 lines = 1′ 20″. Its greatest breadth at *c* could, on the other hand, because of the extent and greater density of its light, be easily ascertained by means of the immediate application of the projection table. This measurement gave at most $\frac{2}{3}$ of a line, or full 2″.

"Although I be positively certain of this very remarkable appearance at both cusps, and of its perfect similarity, in all my observations, I could not, however, trace any vestige of a like crepuscular light at any other part of the terminating border: nor could I on the very next evening, being the 25th, and also on the 26th of February, perceive, even at the cusps, any of the twilight I expected to see there; the very thin, faint, luminous line, which did indeed appear on the 26th, at the southern cusp between *a* and *b*, (fig. 3.), being undoubtedly the effect of the immediate solar light, probably illuminating some prominent, flat areas, as yet situated in the dark hemisphere.

"Thus far the observations: and now for the application of them.

"I need hardly insist upon the proofs, that the very faint pyramidal glimmering light observed on the 24th of February at the extremities of both cusps, could by no means be the immediate effect of the solar light, all the circumstances of the observations militating uniformly and decidedly against this supposition, which, were it true, would oblige us to admit a most unaccountable diminution of light, and thence also a density of the lunar atmosphere, that ought to exceed even the density of ours; a fact absolutely contradicted by all the lunar observations hitherto made. This light, indeed, was so very faint, that it disappeared at 7^h 20′, when the moon approached the horizon; whilst, on the other hand, Aristarchus, which had no light but what it received from the earth, was still very distinguishable; and the summit of Leibnitz *l*, fig. 1. (which, though far within the dark hemisphere, was, however, illuminated by the immediate solar rays) displayed a degree of brightness, which, although when compared with that of the cusp *d e f*, it appeared very faint and dwindling, equalled, however, that of our Peak of Teneriff. Nor can it be conceived why this glimmering light broke off so suddenly at both the cusps, without a progressive diminution. It can hardly be supposed, that similar, grey, prominent, flat areas, of the same form and dimensions, and comparatively of a faint light, which, whilst in the dark hemisphere, they derive immediately from the sun, exist on all parts of the moon; more especially as, at the places observed, the limb happened to exhibit throughout an exact spherical form, without the least sensible inequality; and as in both the bordering regions of the northern and southern hemispheres, especially in the latter, no such grey prominent planes are any where discernible. It may then be asked, why did this faint glimmering light appear at both cusps, along equal arcs of the limb, of equal length and breadth, and of the same pyramidal form? and why did its farther extremity blend itself with the terrestrial light of the dark hemisphere, which, according to a great number of my selenotopographic observations, is by no means the case, even with those grey prominent areas, which, being at some distance on the dark side of the terminating border, are nevertheless illuminated immediately by the sun?

"These, therefore, could certainly not derive their light immediately from the sun; whence this appearance, like the similar ones on the planet Venus, can only be ascribed to the solar rays reflected by the atmosphere of the moon upon those planes, producing on them a very faint, gradually diminishing, glimmering light, which at last loses itself in the reflected terrestrial light, in the same manner as our twilight blends itself with the light of the moon. Every circumstance of the above observation seems to me to confirm this supposition; and hence the observation itself, which, though single, was however a most fortunate and complete one, must appear of no small degree of importance, since it not only confirms the observations and inferences on the long contested lunar atmo-

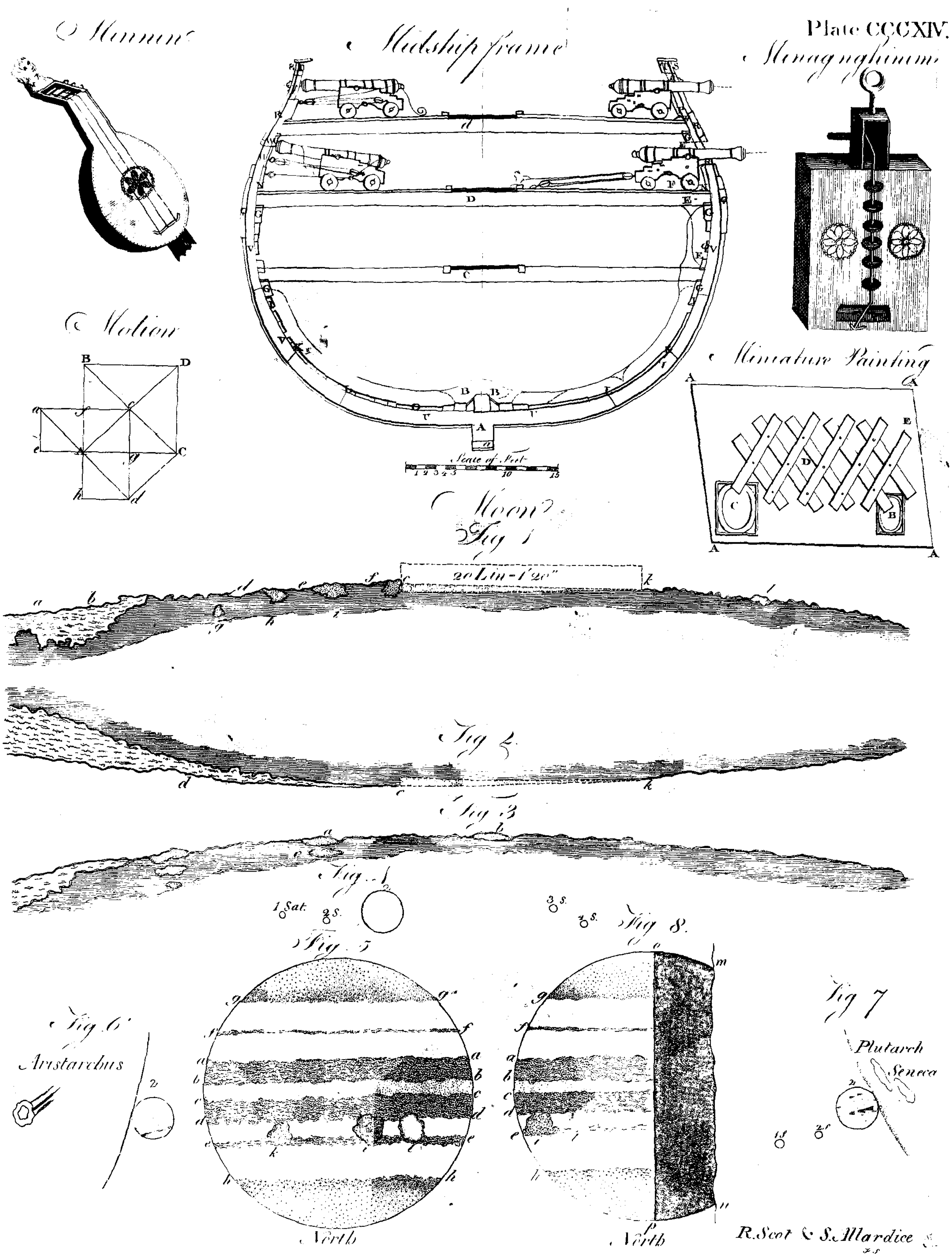
Plate CCCXIV.
Midship frame
Motion
Miniature Painting
Scale of Feet
Moon
Fig 1
20 Lin - 1' 20"
Fig 2
Fig 3
Fig 4
1 Sat.
Fig 5
Fig 6
Aristarchus
Fig 7
Plutarch
Seneca
Fig 8
North
North
R. Scot & S. Allardice

Moon.

atmosphere contained in my Selenotop. Fragm. but also furnishes us with many more lights concerning the atmosphere of planets in general than had been afforded us by all those observations collectively."

This, and the mathematical certainty that the phenomenon is in fact nothing but a real twilight in the lunar atmosphere, he farther evinces by a series of theoretical deductions and calculations, which do not admit of being here stated. Among other results, it appears, that the lower and more dense part of the lunar atmosphere, that part, namely, which has the power of reflecting this bright crepuscular light, is only 1356 Paris feet in height, and hence it will easily be explained how, according to the different librations of the moon, ridges of mountains, even of a moderate height, situated at or near the terminating border, may partially interrupt, or at times wholly prevent, this crepuscular light, either at one or the other cusp, and sometimes at both. "I cannot hence (says our author) but consider the discovery I here announce as a very fortunate one, both as it appears to me decisive, and as it may induce future observers to direct their attention to this phenomenon. Admitting the validity of this new observation, which I think cannot well be called in question, I proceed now to deduce from it the following inferences.

"1. It confirms, to a degree of evidence, all the selenotopographic observations I have been so successful as to make on the various and alternate changes of particular parts of the lunar atmosphere. If the inferior and more dense part of this atmosphere be in fact of sufficient density to reflect a twilight over a zone of the dark hemisphere 2° 34′, or $10\frac{1}{4}$ geographical miles in breadth, which shall in intensity exceed the light reflected upon its dark hemisphere by the almost wholly illuminated disk of the earth; and if, by an accidental computation, this dense part be found to measure 1356 feet in perpendicular height, it may, according to the strictest analogy, be asserted, that the upper, and gradually more rarified strata, must, at least, reach above the highest mountains in the moon. And this will appear the more evident, if we reflect, that notwithstanding the inferior degree of gravitation on the surface of the moon, which Newton has estimated at somewhat less than one-sixth of that on our earth, the lower part of its atmosphere is nevertheless of so considerable a density, This considerable density will, therefore, fully account for the diminution of light observed at the cusps, and on the high ridges Leibnitz and Doerfel, when illuminated in the dark hemisphere; as also for the several obscurations and returning serenity, the eruptions, and other changes, I have frequently observed in the lunar atmosphere. This observation also implies:

"2. That the atmosphere of the moon is, notwithstanding this considerable density, much rarer than that of our earth. And this indeed is sufficiently confirmed by all our other lunar observations. I think I may assert, with the greatest confidence, that the clearer part of our twilight, when the sun is 4° below our horizon, and when we can conveniently read and write by the light we receive from it, surpasses considerably in intensity the light which the almost wholly illuminated disk of our earth reflects upon the dark hemisphere of the moon $2\frac{1}{4}$ days before and after the new moon. But should we even admit an equal degree of intensity, it will, however, appear from computation, that our inferior atmosphere, which reflects as strong a light over 4° as that of the moon does over 2° 34′ of their respective circumferences, must be at least eight times higher than that of the moon.

"3. The striking diminution of light I noticed in my twelve years observations on Venus, likewise indicates, that the atmosphere of that planet, which is in many respects similar to ours, is much denser than that of the moon; and this will be still farther corroborated, if we compare together the several measurements and computations made concerning the twilights of different planets. There is no doubt but that the faintest twilight of Venus, as seen either before or after the rising and setting of the sun across our twilight, is much brighter than that of the moon; and it appears, moreover, from computation, that the denser part of the atmosphere of Venus measures at least 15000 Paris feet in height, and spreads its twilight 67 geographical miles into the dark hemisphere, whilst the denser part of the lunar atmosphere, whose height does not exceed 1356 feet, produces a faint twilight not above $10\frac{1}{2}$ geographical miles in breadth. Thus, as my successful observations on the twilight of Venus led me to the discovery of that of the moon, so did these latter reciprocally confirm the former: and thus, which ever way we contemplate the subject, must we be struck with the coincidence that prevails throughout.

"4. But if the lunar atmosphere be comparatively so rare, it follows, that the inflection of light produced by it cannot be very considerable; and hence does the computation of M. du Sejour, according to which the inflection of the solar rays which touch the moon amounts to no more than $4\frac{1}{2}''$, receive an additional degree of authenticity *. Besides which,

"5. As the true extent of the brightest lunar twilight amounts to 2° 34′, the obliquity of the ecliptic in the moon only to 1° 29′; the inclination of the orbit of the moon, on the contrary, to 5° 15′, and its synodic period, during which it performs a revolution round its axis is = 29d. 12h; it follows, that its brightest twilight, to where it loses itself in the light reflected by the almost fully illuminated disk of our earth, must, at least at its nodes, last 5h. 3′, and that it will be still longer at other parts of the orbit, according to the situation of the nodes.

"6. And lastly, it being a well known fact † that the fixed stars, as they approach the moon, diminish in splendor at the most only a very few seconds before their occultations, it was natural for me, after the successful observations I had made on the twilight of the moon, to pay particular attention to this circumstance. On the 25th of February, at 6h. P. M. the sky being very clear, the limb of the dark part of the moon appeared uncommonly distinct; and only a few seconds of a degree from its edge was seen a telescopic star of about the 10th or 12th magnitude. I counted full 20″ before its occultation, and $18\frac{1}{2}$ of these, without the least perceptible diminution of light. The star, however, began now gradually to fade, and after the remaining $1\frac{1}{2}''$, during which I observed it with all possible attention, it vanished in an instant. This observation agrees perfectly with the above computations

* De la Londe's Astron. § 1992—1194.

† Selenot. Fragm. § 531.

Moon.

putations. Although it be proved that the inferior denſe part of the lunar atmoſphere reflects a ſtronger light than that which the dark hemiſphere receives from an almoſt fully illuminated diſk of our earth; and although, conſidering the inferiority of gravitation on the ſurface of the moon, there be no doubt that this denſe part, together with the ſuperior gradually more rarified regions of its atmoſphere, muſt extend far above its higheſt mountains; it is yet a fact, that the breadth of this obſerved twilight, to where it loſes itſelf in our reflected terreſtrial light, does not meaſure more than 2° 34′: it is therefore highly probable, that its greateſt extent in the moſt favourable phaſes near our new moon can never exceed the double of the above arc, or 5° 8′; and hence we can only infer a perpendicular height of an atmoſphere, capable of inflecting the ſolar rays, which at moſt meaſures 5376 feet: nor is it very likely that, unleſs accidental and hitherto unknown circumſtances ſhould occaſionally condenſe different parts of this atmoſphere, theſe upper ſtrata ſhould materially affect the diſtinctneſs of a ſtar ſeen through it.

"But admitting the height of the atmoſphere, which may affect the brightneſs of a fixed ſtar, not to be leſs than 5376 feet, this will amount to an arc of only 0,94″, or not quite one ſecond; and as the moon deſcribes an arc of 1″ in 2″ of time, it follows, that in general the fading of a ſtar, which approaches to an occultation, cannot laſt quite 2″ in time; that if the appulſe be at a part of a limb of the moon where a ridge of mountains interferes, the gradual obſcuration will laſt a ſhorter time; and that it may, under ſome circumſtances of this nature, be even inſtantaneous."

To the foregoing obſervations, M. Schroter ſubjoins the following account of an occultation of Jupiter by the moon when near its full, which occurred to him by mere accident on the 7th of April 1792.

"The ſky being very ſerene, and Jupiter uncommonly bright, I prepared my ſeven-feet reflector, magnifying 74 times, in hopes that the ſtrong light and diſtinctneſs it afforded would enable me to compare the appearances of this phenomenon with the reſults which I had deduced from my late obſervations on the height and denſity of the atmoſphere of the moon.

Plate CCCXIV.

"Fig. 4. repreſents the ſituation of Jupiter's four ſatellites, as they appeared, moſt diſtinctly, two of them to the weſtward, the ſecond about one, and the firſt near two of Jupiter's diameters diſtant, from its limb; and the two others to the eaſtward, the third about ſeven, and the fourth near eight of the ſame diameters, diſtant from the ſaid limb.

"Fig. 5. ſhows Jupiter with its belts, and of a ſomewhat ſpheroidal form, as it now appeared to me, and as diſtinctly as I had ever ſeen it. The equatorial belt, from *a* to *d*, was very apparent. It conſiſted properly of two zones, *a b* and *c d*, of a browniſh-grey colour, with a more luminous interval *b c* between them. At *e* and *f* were two comparatively well defined ſtripes, which I had noticed for many years back, but which now croſſed the whole diſk; and the polar regions appeared again, from *g* and *h*, more dim and grey than the bright part of the planet. But what particularly ſtruck me, were two nebulous undefined ſpots, *i* and *k*, which were ſenſibly darker than the principal zone *d d*; and at *l* a ſtill more remarkable, circular, though imperfectly defined ſpot, ſomewhat brighter than the luminous interval between the zones, and perfectly ſimilar to the remarkable luminous ſpot which I had obſerved in 1786 and 1787 on the ſame part of Jupiter, and which then led me to ſome very unexpected inferences concerning the atmoſphere of that planet *.

"Theſe favourable circumſtances led me to the following accurate obſervation, which I was certain would prove inſtructive to me. At 10h. 40′ 50″ I ſaw the ſpot *i* at about the middle of its parallel; and immediately after began the occultation; than which a more diſtinct and beautiful one was perhaps never ſeen.

* Beytr zu den neuſten Aſtron. Entd. p. 75 and Tab. I. fig. 6.

"*Immerſions*. The weſtern, preceding, firſt ſatellite, diſappeared behind the ſharp bright limb of the moon, at 10h. 43′ 12″.

The ſecond ſatellite diſappeared, without becoming at all indiſtinct, exactly at 10h. 44′ 19″.

The weſtern limb of Jupiter came in contact, moſt diſtinctly, with the eaſtern limb of the moon, at 10h. 46′ 32″,5.

Jupiter's eaſtern limb diſappeared, as diſtinctly, at 10h. 48′ 20″,5. This immerſion took place, as repreſented in fig 6. to the eaſtward of Ariſtarchus, at about the 25th degree of north latitude.

"The third ſatellite diſappeared, after having been for about one or two ſeconds faint and indiſtinct, at 10° 58′ 57″,5.

"The fourth ſatellite, which appeared the leaſt of them all, became undiſcernible near the limb, and vaniſhed at about 11h. 2′ 16″.

"*Emerſions*. The two preceding firſt and ſecond ſatellites were here likewiſe of uſe in determining preciſely the emerſion of both the limbs of Jupiter from the dark hemiſphere of the moon.

"The firſt appearance of Jupiter's weſtern limb was very diſtinct at 11h. 43′ 54″.

"Emerſion of the eaſtern limb, as diſtinct, at 11h. 45′ 39″, 5. This emerſion took place, as repreſented in fig. 7. to the north-eaſtward of Seneca (B. Tab. VIII. of the Frag.), at about the 23d degree of north latitude.

"The emerſion of the next, or third ſatellite, was not obſerved.

"That of the fourth was diſtinct at 11h. 59′ 1″.

"This obſervation gave me the more ſatisfaction, as it ſingularly contributed to confirm the diſcovery I had been ſo fortunate as to make of the twilight in the moon, and the height and denſity of the lower ſtratum of its atmoſphere.

"Experience has ſufficiently proved, that a ſtronger will ever obſcure a fainter light; and it follows hence, that the light of a bright ſtar approaching the moon, when full or nearly ſo, will loſe ſomething of its luſtre: but little can be inferred in favour of an atmoſphere either of the Moon or of Mars, from the obſervation of Caſſini; : in which, as Dr Herſchel has illuſtrated by ſome obſervations of his own*, a ſtar in Aquarius, of the ſixth magnitude, and as yet ſix minutes diſtant from Mars, diminiſhed in light when both were ſeen in the ſame field of the teleſcope. A mere apparent diminution of light, occaſioned by the glare of a larger luminous object, when ſeen at the ſame time with a ſmaller

* Phil. Tranſ. 1784.

ſmaller one in the field of the teleſcope, is one thing; and another thing is a real indiſtinctneſs of the ſmall luminous body, which increaſes in proportion as they approach nearer to each other.

"It was very natural for Jupiter to diminiſh in brightneſs when it approached ſo near to the moon, then almoſt at its full, as to be ſeen at the ſame time in the field of the teleſcope, which was in fact the circumſtance of this obſervation: but I could not obſerve any progreſſive variation of light in the eaſtern and weſtern, equally luminous, diſks, proportional to their diſtances from the limb of the moon, much leſs a real indiſtinctneſs; and this neither when the limbs of the two planets were nearly in contact, nor when Jupiter was partly, or about one half covered by the moon.

"It was a ſight truly gratifying to an eye accuſtomed to the light of the moon, or in general to ſimilar obſervations, to behold how Jupiter, at its immerſion as well as emerſion, being half or more than half covered by the moon, exhibited its belts and other parts as diſtinctly cloſe to the limb of the moon as it does at ſome diſtance from it? and had I not already ſucceeded in numerous obſervations on the atmoſphere of the moon, and very recently in thoſe which enabled me to determine its twilight, I ſhould perhaps have adopted the doubts the ancient aſtronomers entertained concerning the exiſtence of a lunar atmoſphere; and this the rather, as when Jupiter in its immerſion was ſo far covered, that the luminous ſpot *l*, fig. 5. was cloſe to the moon, I could plainly diſtinguiſh this ſpot, although it be in itſelf by no means very perceptible.

"Such, however, muſt have been the appearances, according to my new obſervations and meaſurements of the twilight of the moon; for if it be proved, that the extent of this twilight, to where it loſes itſelf in the light reflected from the almoſt wholly illuminated diſk of our earth, amounts to no more than an arc of 2° 34′ of the circumference of the moon, and if it be hence demonſtrable, that its greateſt dilatation does barely amount to 5° 8′, and the perpendicular height of that part of the lower more condenſed ſtratum of its atmoſphere, which is capable of reflecting the ſolar rays, and of producing ſome other, perhaps more remarkable obſcurities in the ſtars ſeen through it, does not exceed 5000 Paris feet, and hence cannot reach above one ſecond of a degree above the limb of the moon: we need not wonder that ſo ſmall a magnitude which loſes itſelf in the inequalities of the limb, many parts of which are known to be conſiderably mountainous, ſhould not become ſenſible, eſpecially at the approach of a body of ſo large a diameter as Jupiter, and when ſo ſmall a magnifying power is applied. And thus may I with confidence aſſert a perfect coincidence between this and my many other obſervations.

"The appearance, fig. 8. when Jupiter, at the emerſion, the objects being particularly ſharp and diſtinct, came forth from behind the moon, which now covered no more than one quarter of its diameter, was truly ſplendid and ſatisfactory: and I muſt here particularly mention the circumſtance, that the part of the moon's dark hemiſphere, between its bright terminating edge *m n* and its out ward limb, bordering upon the emerging planet *op*, was particularly opaque and hence produced a very ſtriking effect.

"I omit entering here upon any further conſiderations; and ſhall conclude with obſerving, that, after the occultation was completely ended, the luminous ſpot *l* had at 12h. 1′ ſo far advanced in its parallel *d e* as to have reached to within $\frac{1}{7}$, or at moſt $\frac{1}{7}$, of its whole length of the weſtern limb: and that on the 28th of March, five days after a new moon; I obſerved an occultation of a very diſtinct, though teleſcopic, ſtar, by the dark hemiſphere of the moon; in which, agreeably to the above obſervation, not the leaſt gradual diminution of light or indiſtinctneſs could be perceived, the ſtar being ſeen to vaniſh on a ſudden."

Influence of the Moon *on the human body, the weather*, &c. The vulgar doctrine concerning the influence of the moon on the changes of *weather* is very ancient, and has gained credit among the learned without ſufficient examination; but it ſeems now to be pretty generally exploded by philoſophers, as equally deſtitute of all foundation in phyſical theory, and unſupported by any plauſible analogy. The common opinion is, that the lunar influence is exerted at the ſyzygies and quadratures, and for three days before and after each of theſe epochs. There are 24 days therefore, in each ſynodic month, over which the moon at this rate is ſuppoſed to preſide; and as the whole conſiſts but of 29 days 12 $\frac{3}{4}$ hours only $5\frac{1}{2}$ days are exempt from her pretended dominion. Hence, though the changes of the weather ſhould happen to have no connection whatever with the mooon's aſpects, and they ſhould be diſtributed in an equal proportion through the whole ſynodic month, yet any one who ſhall predict, that a change ſhall happen on ſome one of the 24 days aſſigned, rather than in any of the remaining $5\frac{1}{2}$, will always have the chances 24 to $5\frac{1}{2}$ in his favour. Men may, therefore, eaſily deceive themſelves, eſpecially in ſo unſettled a climate as ours. Moreover, the writers who treat of the ſigns of the weather, derive their prognoſtics from circumſtances which neither argue any real influence of the moon as a cauſe, nor any belief of ſuch an influence, but are merely indications of the ſtate of the air at the time of obſervation: ſuch are, the ſhape of the horns, the degree and colour of the light, and the number and quality of the luminous circles which ſometimes ſurround the moon, and ther circumſtances attending the diſappearance. (See the Διοσημεια of Aratus and the *Scholia* of Theon.) The vulgar ſoon began to conſider theſe things as cauſes: which had been propoſed to them only as ſigns: and the notion of the moon's influence on all terreſtrial things was confirmed by her manifeſt effect upon the ocean. See, on this ſubject, Phil. Tranſ. vol. lxv. part 2. p. 178. &c.

The famous Dr Mead was a believer in the influence of the ſun and *moon* on the *human body*, and publiſhed a book to this purpoſe, intitled *De Imperio Solis ac Lunæ in Corpore humano*: but this opinion has been exploded by moſt philoſophers as equally unreaſonable in itſelf, and contrary to fact. As the moſt accurate and ſenſible barometer is not affected by the various poſitions of the moon, it is not thought likely that the human body ſhould be affected by them. Several learned and ingenious men, however ſtill conſidered Dr Mead's doctrine as far from being unfounded.

Harveſt-Moon. It is remarkable, that the moon, during the week in which ſhe is full in harveſt, riſes, ſooner after ſun-ſetting than ſhe does in any other full moon week in the year. By doing ſo ſhe affords an immediate ſupply of light after ſun-ſet, which is very beneficial to the farmers for reaping and gathering in the fruits of the earth; and therefore they diſtinguiſh this full moon from all the others in the year, by calling it the *harveſt-moon*. For an account of which, ſee ASTRONOMY, n° 370, 371.

Moon-Eyes, in the manege. A horſe is ſaid to have moon-eyes when the weakneſs of his eyes increaſes or decreaſes according to the courſe of the moon; ſo that in the wane of the moon his eyes are muddy and troubled, and at new moon they clear up; but ſtill he is in danger of loſing his eye-ſight quite.

Moon-ſtone, a genus of ſiliceous earths, of a clear white colour approaching to that of milk, When looked at in a certain poſition, it reflects a ſtrong light like mother-of-pearl; in others, it ſhows ſpots of a carnation colour. It is found in pieces with obtuſe angles, ſometimes of a quadrangular figure. When broken, it appears evidently foliated. According to Werner it agrees in hardneſs and moſt other reſpects with felt-ſpar. He tells us, likewiſe, that it is probably the *androdamal* of Pliny, the common *giraſole* of the Italians, and the *water opa* of Ceylon. Sometimes, he tells us it is claſſed with the opal, and ſometimes with the cat's eye. According to M. Magellan, this ſtone is of the chalcedony or pſeudo-opal kind: it reflects a whitiſh light, with ſome various ſhades of few intermixed colours on a bluiſh bottom, like the face of the moon when high enough not to appear reddiſh by the interpoſition of earthy vapours. The iris, or rainbow-ſtone, ſeems to be no other than a moon-ſtone in which the yellow, purple, and blue rays are moſt conſpicuouſly reflected. When looked at, it appears of a reddiſh brown; but on holding it in the light of the ſun, we diſcover the figure of a rainbow. There are, however, ſeveral other ſtones which have the ſame appearance in the ſun's light.

Moon-wort in botany. Se LUNARIA.

MOOR (Sir Karel de), a capital painter of portraits, hiſtory, and converſations, was born at Leyden, in 1656: and at firſt was a diſciple of Gerard Douw, with whom he continued for a conſiderable time. He afterwards ſtudied ſucceſſively under Abraham Vanden Tempel, Francis Mieris, and Godfrey Schalcken. As ſoon as he began to follow his profeſſion, the public in a ſhort time did juſtice to his extraordinary merit; and he took the moſt effectual method to eſtabliſh his reputation, by working with a much ſtronger deſire to acquire fame than to increaſe his fortune. According to Mr Pilkington, he painted portraits in a beautiful ſtyle, in ſome of them imitating the taſte, the dignity, the force, and the delicacy of Vandyck; and in others, he ſhowed the ſtriking effect and ſpirit of Rembrandt. His pictures were always neatly and highly finiſhed; he deſigned them excellently, and grouped the figures of his objects with great ſkill, His works were univerſally admired; and ſome of the moſt illuſtrious princes of Europe ſeemed ſolicitous to employ his pencil. The grand duke of Tuſcany deſired to have the portrait of De Moor, painted by himſelf, to be placed in the Florentine gallery; and on the receipt of it, that prince ſent him in return a chain of gold and a large medal of the ſame metal. The imperial ambaſſador count Sinzendorf, by order of his maſter, engaged him to paint the portraits of Prince Eugene and the duke of Marlborough on horſeback; and in that performance, the dignity and expreſſion of the figures, and alſo the attitudes of the horſes, appeared ſo maſterly; that it was beheld with admiration, and occaſioned many commendatory poems in elegant Latin verſe to be publiſhed to the honour of the artiſt; and the emperor, on ſeeing that picture, created De Moor a knight of the holy Roman empire. He likewiſe had the honour to paint the portrait of Peter the great czar of Muſcovy; and an extraordinary number of other portraits, for which he received very large prices.—His hiſtorical paintings were admirable; although he moſt frequently was employed to paint in a large ſize, yet he often painted ſmall eaſel pictures, with ſubjects of hiſtory or converſations: and theſe are exceedingly valued, having all the merit of neat penciling and ſweet colouring added to an elegant taſte of deſign. He died in 1738.

MOOR, in country affairs, denotes an unlimited tract of land, uſually over-run with heath.

Moon-Cock, or *Gor-Cock*. See TERTAG.

Moon-Land, or *Moory ſoil*, in agriculture, is a black, light, and ſoft earth, very looſe, and without any admixture of ſtones; and with very little clay or ſand.

The uppermoſt ſtratum of the fen-lands is uſually of this earth, and it commonly conſtitutes a moderately thick or deep bed. Intermixed with water it cannot eaſily be worked up into a paſte: and when with labour worked up into ſomewhat of a firm maſs, its ſurface appears ſpongy and porous; and as ſoon as dry, it eaſily moulders away to powder.

It is uſually ſoft to the touch, unleſs it be worked very cloſely between the fingers; then it ſhows a mixture of a ſmall quantity of ſand, both to the touch and to the eye. It ſeems indeed to conſiſt almoſt entirely of pure vegetable matter; and this lying in ſuch plenty on the ſurface of the fen-lands is the cauſe of their being ſo very fertile.

The great diſadvantage of the places which have this ſoil, is their being liable to be glutted with wet; and to remedy the inconveniences ariſing from thence, the farmers who rent theſe land have a cuſtom of burning the ſoil at proper ſeaſons. It burns very freely and eaſily, the ſurface readily catching flame: and a ſubſtance ſomewhat bituminous, uſually contained among the ſoil, helps the burning.

MOORE, or MORE, (Edward), a late ingenious writer, was bred a linen-draper but quitted buſineſs to join the retinue of the muſes: and he certainly had a very happy and pleaſing talent for poetry, in his *Trial of Selim the Perſian*, he complimented lord Lyttleton in an elegant kind of panegyric, couched under the appearance of accuſation; and his *Fables for the female ſex*, for eaſy verſification, poignant ſatire, and ſtriking morals, approach nearer to the manner of Gay than any other of the numerous imitations of that author. He wrote alſo three dramatic pieces? The Gameſter, a tragedy; the Foundling, and Gil Blas, comedies. The ſucceſs of theſe was not ſuch as they merited; the firſt of them having met with a cold reception,

ception, for no other apparent reaſon but becauſe it too nearly touched a favourite and faſhionable vice: and the ſecond having been condemned for its ſuppoſed reſemblance to Sir Richard Steele's *Conſcious Lovers*, but to which good judges have been inclined to give it greatly the preference. Mr Moore married a lady of the name of *Hamilton*, daughter to Mr Hamilton table-decker to the princeſſes; who had herſelf a very poetical turn, and has been ſaid to have aſſiſted him in the writing of his tragedy. One ſpecimen of her poetry, however, was handed about before their marriage, and has ſince appeared in print in different collections of ſongs, particularly in one called the *Goldfinch*. It was addreſſed to a daughter of the famous Stephen Duck; and begins with the following ſtanza:

Would you think it, my Duck? (for the fault I muſt own),
Your Jenny at laſt is quite covetous grown:
Tho' millions if Fortune ſhould laviſhly pour,
I ſtill ſhou'd be wretched if I had not MORE.

And after half a dozen ſtanzas more, in which, with great ingenuity and delicacy, and yet in a manner that expreſſes a ſincere affection, ſhe has quibbled on our author's name, ſhe concludes with the following lines:

You may wonder, my girl, who this dear one can be,
Whoſe merit can boaſt ſuch a conqueſt as me:
But you ſhan't know his name, tho' I told you before,
It begins with an M, but I dare not ſay MORE.

In the year 1753, Mr Moore commenced a weekly miſcellaneous paper intitled *The World, by Adam Fitz-Adam;* in which undertaking he was aſſiſted by Lord Cheſterfield with ſome eſſays. This paper was collected into volumes, and Mr Moore died ſoon after.

MOORING, the act of confining and ſecuring a ſhip in a particular ſtation, by chains or cables, which are either faſtened to the adjacent ſhore, or to anchors in the bottom,

A ſhip may be either moored by the head, or by the head and ſtern: that is to ſay, ſhe may be ſecured by anchors before her, without any behind; or ſhe may have anchors out, both before and behind her; or her cables may be attached to poſts, rings, or moorings, which anſwer the ſame purpoſe.

When a ſhip is moored by the head with her own anchors, they are diſpoſed according to the circumſtances of the place where ſhe lies, and the time ſhe is to continue therein. Thus wherever a tide ebbs and flows, it is uſual to carry one anchor out towards the flood, and another towards the ebb, particularly where there is little room to range about; and the anchors are laid in the ſame manner, if the veſſel is moored head and ſtern in the ſame place. The ſituation of the anchors, in a road or bay, is uſually oppoſed to the reigning winds, or thoſe which are moſt dangerous; ſo that the ſhip rides therein with the effort of both her cables. Thus if ſhe rides in a bay, or road, which is expoſed to a northerly wind and heavy ſea from the ſame quarter, the anchors paſſing from the oppoſite bows ought to lie eaſt and weſt from each other: hence both the cables will retain the ſhip in her ſtation with equal effort againſt the action of the wind and ſea.

MOORINGS, in ſea-language, are uſually an aſſemblage of anchors, chains, and bridles, laid athwart the bottom of a river or haven, to ride the ſhipping contained therein. The anchors employed on this occaſion have rarely more than one fluke, which is ſunk in the water near low-water mark. Two anchors being fixed in this manner in the oppoſite ſide of the river, are furniſhed with a chain extending acroſs from one to the other. In the middle of the chain is a large ſquare link, whoſe lower end terminates in a ſwivel, which turns round in the chain as about an axis, whenever the ſhip veers about with the change of the tide. To this ſwivel link are attached the bridles, which are ſhort pieces of cable, well ſerved, whoſe upper ends are drawn into the ſhip at the mooring-ports, and afterwards faſtened to the maſts or cable-bolts. A great number of moorings of this ſort are fixed in the harbours adjacent to the Engliſh dock-yards, as Deptford, Chatham, Portſmouth, Plymouth, &c.

MOORLANDS, a tract ſo called, in the north part of Staffordſhire, where the land riſes gradually into ſmall hills, which run through the midſt of England in one continued ridge, riſing higher and higher to Scotland, and ſending forth many rivers. The ſoil here is ſo foul and cold, that the ſnows lie almoſt all the year on the tops of the hills; and it is withal very rugged and barren: it, however, yields plenty of coal, lead, copper, rance-marble, and mill-ſtones; and ſome of the limeſtone hills bear ſuch a ſweet though ſhort graſs, as is very grateful to the oxen, of which there is a very good breed. It is obſerved here, that the weſt wind always brings rain, and the eaſt and ſouth fair weather; that though this tract is full of bogs, it is as healthy as any other part of the county; and that it produces the ſame plants as the Peak of Derby.

MOORS. See MOROCCO.

MOORS, in the Iſle of Man, thoſe who ſummon the courts for the ſeveral ſheadings; ſuch as the lord's bailiffs. Every Moor has the like office with the Engliſh bailiff of the hundred.

MOOSE, or ELK. See CERVUS.

MOOT, a difficult caſe, argued by the young barriſters and ſtudents at the inns of court, by way of exerciſe, the better to qualify them for practice, and to defend the cauſes of their clients. This, which is called *mooting*, is the chief exerciſe of the inns of court. Particular times are appointed for the arguing moot-caſes: the place where this exerciſe is performed was anciently called *moot-hall;* and there is a bailiff, or ſurveyor of the moots, annually choſen by the bench, to appoint the moot-men for the inns of chancery, and to keep an account of the performance of exerciſes. The word is formed either from the Saxon *metan, gemetan*, "meeting;" or from the French *mot*, "word."

MOPSUS (fab. hiſt.), a celebrated prophet, ſon of Manto and Apollo during the Trojan war. He was conſulted by Amphimachus, king of Colophon, who wiſhed to know what ſucceſs would attend his arms in a war which he was going to undertake. He predicted the greateſt calamities; but Calchas, who had been a ſoothſayer of the Greeks during the Trojan war, promiſed the greateſt ſucceſſes. Amphimachus followed the opinion of Calchas; but the prediction of Mopſus was fully verified. This had ſuch an effect upon Calchas, that he died ſoon after. His death is

Mopsus || Morai.

is attributed by some to another mortification of the same nature. The two soothsayers, jealous of each other's fame, came to a trial of their skill in divination. Calchas first asked his antagonist, how many figs a neighbouring tree bore? 10,000 except one, replied Mopsus, and one single vessel can contain them all. The figs were gathered, and his conjectures were true. Mopsus now, to try his adversary, asked him how many young ones a certain pregnant sow would bring forth? Calchas confessed his ignorance; and Mopsus immediately said that the sow would bring forth on the morrow ten young ones, of which only one should be a male, all black, and that the females should all be known by their white streaks. The morrow proved the veracity of his prediction; and Calchas died by excess of the grief which his defeat produced. Mopsus after death was ranked among the gods, and had an oracle at Malia, celebrated for the true and decisive answers which it gave—Another *Mopsus*, son of Ampyx and Chloris, born at Titaressa in Thessaly. He was the prophet and soothsayer of the Argonauts, and died at his return from Colchis by the bite of a serpent in Libya. Jason erected him a monument on the sea-shore, where afterwards the Africans built him a temple where he gave oracles. He has often been confounded with the son of Manto, as their professions and their names were alike.

MORÆA, in botany: A genus of the monogynia order, belonging to the triandria class of plants; and in the natural method ranking under the 6th order, *Ensatæ*. The corolla is hexapetalous; the three interior petals patent, the rest like those of the iris.

MORAI, is the name given at Otaheite in the South Sea to their burying-grounds, which are also places of worship. This is a pile of stone raised pyramidically upon an oblong base or square 267 feet long and 87 wide. On each side is a flight of steps; those at the sides being broader than those at the ends; so that it terminated not in a square of the same figure with the base, but in a ridge like the roof of a house. There were 11 of these steps to one of these morais, each of which was 4 feet high, so that the height of the pile was 44 feet; each step was formed of one course of white coral stone, which was neatly squared and polished; the rest of the mass (for there was no hollow within) consisted of round pebbles, which from the regularity of their figure seemed to have been wrought. The foundation was of rock-stones, which were also squared. In the middle of the top stood an image of a bird carved in wood, and near it lay the broken one of a fish carved in stone. The whole of this pyramid made part of one side of a spacious area or square 360 feet by 354, which was walled in with stone, and paved with flat stones in its whole extent. About 100 yards to the west of this building was another paved area or court, in which were several small stages raised on wooden pillars about 7 feet high, which are called by the Indians *ewattas*, and seem to be a kind of altars, as upon these are placed provisions of all kinds, as offerings to their gods. On some of them are seen whole hogs, and on others the skulls of above 50, besides the skulls of many dogs. The principal object of ambition among the natives is to have a magnificent morai. The male deities (for they have them of both sexes) are worshipped by the men, and the female by the women; and each have morais, to which the other sex is not admitted, though they have also morais common to both.

Morai.

MORAL PHILOSOPHY, or MORALS.

MORAL PHILOSOPHY is, "The science of MANNERS OR DUTY; which it traces from man's nature and condition, and shows to terminate in his happiness." In other words, it is "The knowledge of our DUTY and FELICITY;" or, "The art of being VIRTUOUS and HAPPY."

It is denominated an *art*, as it contains a system of rules for becoming virtuous and happy. Whoever practises these rules, attains an habitual power or facility of becoming virtuous and happy. It is likewise called a *science*, as it deduces those rules from the principles and connections of our nature, and proves that the observance of them is productive of our happiness.

It is an art, and a science, of the highest dignity, importance, and use. Its object is man's duty, or his conduct in the several moral capacities and connections which he sustains. Its office is to direct that conduct; to show whence our obligations arise, and where they terminate. Its use, or end, is the attainment of happiness; and the means it employs are rules for the right conduct of our moral powers.

Moral Philosophy has this in common with Natural Philosophy, that it appeals to nature or fact; depends on observation; and builds its reasonings on plain uncontroverted experiments, or upon the fullest induction of particulars of which the subject will admit. We must observe, in both these sciences, how nature is affected, and what her conduct is in such and such circumstances: Or, in other words, we must collect the appearances of nature in any given instance; trace these to some general principles or laws of operation; and then apply these principles or laws to the explaining of other phenomena.

Therefore Moral Philosophy inquires, not how man might have been, but how he is, constituted: not into what principles or dispositions his actions may be artfully resolved: but from what principles and dispositions they actually flow: not what he may, by education, habit, or foreign influence, come to be or do; but what, by his nature, or original constituent principles, he is formed to be and do. We discover the office, use, or destination of any work, whether natural or artificial, by observing its structure, the parts of which it consists, their connection or joint action. It is thus we understand the office and use of a watch, a plant, an eye, or hand. It is the same with a living creature of the rational or brute kind. Therefore, to determine the office, duty, or destination of man; or, in other words, what his business is, or what conduct he he is obliged to purſue; we muſt inſpect his conſtitution, take every part to pieces, examine their mutual relations one to the other, and the common effort or tendency of the whole.

It has not been thus, however, that the ſcience has always been taught. The earlieſt moraliſts did not erect ſyſtems upon a juſt analyſis of the powers of the human mind; nor have all thoſe who thought ſuch a foundation neceſſary to be laid, deduced their theories from the very ſame principles. As moral truths are not capable of rigid demonſtration, it appears to us, that we cannot more properly introduce the ſyſtem which we have adopted, than by giving our readers a ſhort view of the moſt celebrated ſyſtems that have been maintained by others. They will thus have an opportunity of judging for themſelves of the reſpective merits of the different theories, and of adopting that which ſhall appear to them to place practical virtue on the firmeſt baſis.

History of the Science of Morals.

1
Various opinions concerning the criterion of virtue, &c.

Whilst there has been a remarkable agreement among the writers on morality, as to the particular actions which are virtuous and thoſe which are vicious; and whilſt they have uniformly taught, that it is our duty and our intereſt to perform the one and to avoid the other; they have yet differed exceedingly concerning the *teſt* or *criterion* of virtue, as well as concerning the *principle* or *motive* by which men are induced to purſue it. One cauſe of this difference in opinion reſpecting matters of ſuch univerſal importance, may perhaps be traced to the miſtakes into which philoſophers are apt to fall concerning the original ſtate of man.

2
Probable cauſe of this variety.

It is very generally taken for granted, that the firſt men were ſavages of the loweſt rank, and that the race gradually civilized itſelf during the courſe of many ſucceeding ages. Without mutual intercourſe, the progreſs of civilization could never have commenced; and as the practice of juſtice is abſolutely neceſſary to every ſpecies of friendly intercourſe, thoſe original ſavages, it is ſuppoſed, muſt have been juſt in their dealings, and juſt upon ſome principle which has its foundation in human nature. But to develope the principle by which ſavages are influenced in their conduct, no tedious or intricate proceſs of reaſoning can be neceſſary. It muſt have a place in every mind, and be inſtantaneous in all its deciſions. Hence it has been ſuppoſed, that the principle to which modern philoſophers have given the name of the *moral ſenſe*, is inſtinctive; that it is the ſole judge of virtue and vice; and that its admonitions have ſuch authority, as to enforce obedience without regard to the conſequences of any action.

Other philoſophers, who deny that the moral ſenſe is inſtinctive, and who yet ſuppoſe that the original ſtate of man was ſavage, are forced to pile hypotheſis upon hypotheſis, each unnatural in itſelf, and all contradictory to one another, in order to account for the commencement of civilization and the formation of ſociety. It has been ſuppoſed, that the deſire of ſelf-preſervation and the love of power are the governing principles in human nature; that in the ſavage ſtate every man had a right to every thing which he could ſeize by fraud or force; that all had an innate propenſity to invade each other's property; and that hence war, rapine, and bloodſhed, prevailed univerſally, till the ſavages diſcovered the expediency of uniting under ſome form of government for their mutual protection.

But before the original ſtate of man had been made the baſis of ſuch oppoſite theories as theſe, it would ſurely have been proper to inquire upon what grounds that ſtate has been ſuppoſed to be ſavage. To us theſe grounds appear to be nothing better than mere imaginations; the dreams of poets, and of ſuch philoſophers as bend facts to their own ſyſtems. In the authentic *hiſtory* of our ſpecies, there is no evidence, indeed there can be no evidence, that the firſt men were ſavages; and every thing which we know of human nature leads us to believe, that had they been ſo, the race could never have been civilized but by the miraculous interpoſition of ſome ſuperior being. The only record of the earlieſt ages of the world to which the ſmalleſt credit is due, repreſents all the nations of the earth as having ſprung from one pair, and that pair as having been inſtructed in their duty by their beneficent Creator. If this be the fact, and no conſiſtent theiſt can controvert it, the precepts of morality would be originally conveyed from one generation to another; not in a ſyſtematical or ſcientific form, but as the laws of the Univerſal Sovereign, whoſe authority 3

3
Modes of communicating inſtruction by the earlieſt moraliſts.

demanded implicit obedience. Accordingly we find, that the firſt teachers of morals were men of ſuperior rank as well as of eminent talents, who formed collections of maxims derived from their anceſtors, "with the view of perfecting ſubordination ‡, poliſhing manners, and educating youth. Such were the proverbs of Solomon, the words of Agur, and the wiſdom of the ſon of Sirach." Theſe inſtructors did not analyſe the human mind into its various faculties, and build a ſyſtem of morals either upon a particular inſtinct pointing to the ſupreme good, or upon the fitneſs of things diſcovered by reaſon. Short iſolated ſentences were the mode in which they conveyed their precepts; which they prefaced by obſerving, that "the fear of the Lord is the beginning of knowledge;" and enforced by the aſſurance, that "length of days, and long life, and peace, ſhould they add to thoſe who obeyed them." The ſayings of the celebrated wiſe men of Greece were collections of apophthegms, made in the ſame manner and delivered with ſimilar views. Thales and Pythagoras †, who founded the one the Ionic and the other the Italic ſchool, made collections of precepts for the conduct as well of a ſtate as of a private life. "Neither the crimes nor the thoughts of bad men (ſaid Thales) are concealed from the gods. The only method of being juſt, is to avoid doing that which we blame in others." Of Pythagoras it is related by Porphyry and Laertius, that from Samos he repaired to Delos, and after preſenting an offering of cakes to Apollo, there received, or pretended to receive, moral dogmas from the prieſteſs; which he afterwards delivered to his diſciples under the character of divine precepts. Amongſt theſe were the following: That, "next to gods and demons, the higheſt reverence is due to parents and legiſlators; and that the laws and cuſtoms of our country are to be religiouſly obſerved."

‡ Bruce's Elements of the Science of Ethics.

† Bruce's Elements, and Enfield's Hiſtory of Philoſophy.

To theſe maxims or apophthegms, which, for the ſake of delighting the ear and aiding the memory, were

were ſometimes delivered in verſe, ſucceeded, as has been ſuppoſed, the mode of inſtruction by fable or allegory. But the truth ſeems to be, that this method, of communicating moral and political wiſdom was as ancient as the other; for we have a beautiful ſpecimen of it in the ninth chapter of the book which relates the tranſactions of the judges of Iſrael. The fables of Eſop, too, which were written at a very early period, remain laſting models of this ſpecies of art among the Greeks.

When the inſtructors of mankind had proceeded thus far as to give an artificial form to their precepts, they ſoon advanced a ſtep farther, and reduced their obſervations into claſſes or predicaments. Pythagoras, who viſited Egypt, has been ſuppoſed to have learned from its prieſts the method of arranging the virtues into diſtinct claſſes. But it is the opinion of an excellent writer †, founded on the previous aſpects of ethics, and on the comprehenſive talents of the Samian philoſopher, that the honour of the invention ought to be aſcribed to himſelf. Be this as it may, it was obſerved by the inventor, that "all the maxims of morality might be referred to the duties which men owe to themſelves, and the duties which they owe to each other." Hence the four cardinal virtues of the ancients, PRUDENCE, TEMPERANCE, FORTITUDE, and JUSTICE; of which the firſt three refer to the individual, and the fourth to ſociety.

† Mr Bruce.

4 The moral principles of Socrates.

Hitherto leſſons in morality had not taken a ſyſtematic form; but they were gradually approaching to it. Socrates was perhaps the firſt Pagan philoſopher who eſtabliſhed all his precepts on one ſure and ſteady baſis. In his lectures and diſcourſes, he ſeems to have had one great object in view §, to connect the moral maxims which were fitted to regulate the conduct of mankind, with ſublime conceptions reſpecting the character and government of a ſupreme Being. The firſt principles of virtuous conduct which are common to all mankind, are, according to this excellent moraliſt, laws of God: and the concluſive argument by which he ſupports this opinion is, that no man departs from theſe principles with impunity. "It is frequently poſſible (ſays he) for men to ſcreen themſelves from the penalty of human laws, but no man can be unjuſt or ungrateful without ſuffering for his crime; hence I conclude, that theſe laws muſt have proceeded from a more excellent legiſlator than man." From this it would appear, that in the opinion of Socrates, conſcience, or the moral ſenſe, approving of any action, is the criterion by which it is known to be virtuous, and the will of God, that which obliges men to perform it.

§ Bruce's Elements, and Enfield's Hiſtory, &c.

5 Origin of the Greek ſects.

Socrates himſelf left no writings behind him, nor, as far as we know, offered any regular and complete theory of ethics. His diſciples, however, who were numerous and diſtinguiſhed, became the founders of the celebrated Greek ſects. Among them the firſt great queſtion was, "what are the foundations of virtue?" and the ſecond, "what are the diſtinctions betwixt good and evil, happineſs and miſery?" The anſwers given to theſe important queſtions divided the philoſophers and their diſciples into diſtinct orders.

6 Theories of Plato.

In anſwer to the former queſtion, Plato taught *, that "virtue is to be purſued for its own ſake; and that being a divine attainment, it cannot be taught, but is the gift of God." This ſeems to differ in nothing but the name from the doctrine of thoſe moderns who place the ſole foundation of virtue in the approbation of the moral ſenſe. The founder of the academy indeed has no ſuch phraſe as *moral ſenſe* in any of his writings with which we are acquainted; but if virtue cannot be taught, and if it is to be purſued for its own ſake, it muſt in itſelf be *good*, and the object of ſome feeling, whether called *ſenſe*, *inſtinct*, or *paſſion*. His ſolution of the ſecond queſtion agitated among the ſects is not indeed very conſiſtent with this neceſſary inference from his anſwer to the firſt; but for his inconſiſtencies we are not accountable. "Our higheſt good (he ſays) conſiſts in the contemplation and knowledge of the firſt good, which is mind or God; and all thoſe things which are called *good* by men, are in reality ſuch only ſo far as they are derived from the firſt and higheſt good. The only power in human nature which can acquire a reſemblance to the ſupreme good, is reaſon; and this reſemblance conſiſts in prudence, juſtice, ſanctity, and temperance."

* Enfield

7 Of Ariſtotle.

Ariſtotle, the founder of the Peripatetic ſchool, was the pupil of Plato; but of the two great moral queſtions he gives ſolutions ſomewhat different from thoſe of his maſter. "Virtue (according to him ‡) is either theoretical or practical. Theoretical virtue conſiſts in the due exerciſe of the underſtanding: practical, in the purſuit of what is *right* and *good*. Practical virtue is acquired by habit and exerciſe." This theory ſeems to differ little from that adopted by Cudworth, Clarke, and Price, which ſhall be conſidered afterwards. With reſpect to happineſs or good, the doctrine of Ariſtotle is very rational. "Pleaſures (he ſays) are eſſentially different in kind. Diſgraceful pleaſures are wholly unworthy of the name. The pureſt and nobleſt pleaſure is that which a good man derives from virtuous actions. Happineſs, which conſiſts in a conduct conformable to virtue, is either contemplative or active. Contemplative happineſs, which conſiſts in the purſuit of knowledge and wiſdom, is ſuperior to active happineſs, becauſe the underſtanding is the higher part of human nature, and the objects on which it is employed are of the nobleſt kind. The happineſs which ariſes from external poſſeſſions is inferior to that which ariſes from virtuous actions; but both are neceſſary to produce perfect felicity."

‡ Enfield.

8 Of the Stoics.

The Stoics, another celebrated ſect of Greek philoſophers, maintained †, that "nature impels every man to purſue whatever appears to him to be good." According to them, "ſelf-preſervation and defence is the firſt law of animated nature. All animals neceſſarily derive pleaſure from thoſe things which are ſuited to them; but the firſt object of purſuit is, not pleaſure, but conformity to nature. Every one, therefore, who has a right diſcernment of what is good, will be chiefly concerned to conform to nature in all his actions and purſuits. This is the origin of moral obligation." With reſpect to happineſs or good, the ſtoical doctrine was altogether extravagant: They taught, that "all external things are indifferent, and cannot affect the happineſs of man; that pain, which does not belong to the mind, is no evil; and that a wiſe

† Enfield.

wiſe man will be happy in the midſt of torture, becauſe virtue itſelf is happineſs (B).

As the ſtoics held that there is but one ſubſtance, partly active and partly paſſive, in the univerſe (ſee METAPHYSICS, n° 261, 262.), and as they called the active principle *God*, their doctrine, which makes virtue conſiſt in a conformity to *nature*, bears no ſmall reſemblance to that of thoſe moderns who reſt moral obligation on the *Divine will*. It was therefore on better grounds than has been ſometimes ſuppoſed, that Warburton, when characterizing the founders of the three principal ſects in Greece, repreſented * *Plato* as the patron of the *moral ſenſe; Ariſtotle*, of the *eſſential differences*; and *Zeno*, of *arbitrary will*. Theſe principles, when ſeparated from each other, and treated in the manner of the ancients, may not each be able to bear the ſuperſtructure which was raiſed upon it; but the principles of moſt of the other ſects were much leſs pure, and infinitely more dangerous.

* Div. Leg. of Moſes.

† Eternal and immutable Morality.

9
Of Ariſtippus, Democritus, and Protagoras

Cudworth †, whoſe teſtimony when relating the doctrines of antiquity is entitled to the fulleſt credit, affirms, that Ariſtippus the founder of the Cyrenaic ſchool, Democritus, and Protagoras, with their followers among the atomiſts, taught, that "the diſtinction between virtue and vice is merely arbitrary; that nothing is juſt or unjuſt, ſacred or profane, but as it is agreeable or contrary to eſtabliſhed laws and cuſtoms; that what is juſt to-day, human authority may make unjuſt to-morrow; and that preſent pleaſure is the ſovereign good of man."

10
And of Epicurus.

With theſe impieties, the moral doctrines of Epicurus have very unjuſtly been confounded. The phyſical and metaphyſical ſyſtems of that philoſopher are indeed ſtrange compoſitions of ingenuity and abſurdity, truth and falſehood; and the moral precepts of many of his followers were in the higheſt degree licentious and impure. But his own life was exemplary; and his ethical ſyſtem, if candidly interpreted, is much more rational than that of the Stoics; though it muſt be confeſſed, that no ſect produced men of more determined virtue than the ſchool of Zeno.—According to Epicurus ‡, "the end of living, or the ultimate good which is to be ſought for its own ſake, is happineſs. The happineſs which belongs to man, is that ſtate in which he enjoys as many of the good things, and ſuffers as few of the evils incident to human nature as poſſible; paſſing his days in a ſmooth courſe of tranquillity. Pleaſure is, in its own nature good, as pain is in its nature evil. The one is therefore to be purſued, and the other to be avoided, for its own ſake. Pleaſure and pain are not only good and evil in themſelves, but they are the meaſure of what is good or evil in every object of deſire and averſion; for the ultimate reaſon why we purſue one thing and avoid another is, becauſe we expect pleaſure from the former, and apprehend pain from the latter. That pleaſure, however, which prevents the enjoyment of a greater pleaſure, or produces a greater pain, is to be ſhunned; and that pain, which either removes a greater pain, or procures a greater pleaſure, is to be endured."

‡ Enfield's Hiſtory.

Upon theſe ſelf-evident maxims, Epicurus builds his ſyſtem of ethics; and proves with great force of argument, "that a ſteady courſe of virtue produces the greateſt quantity of happineſs of which human nature is capable." Without a *prudent* care of the body, and a ſteady government of the mind to guard the one from diſeaſes and the other from the clouds of prejudice, happineſs is unattainable. By *temperance* we enjoy pleaſure, without ſuffering any conſequent inconvenience. *Sobriety* enables us to content ourſelves with ſimple and frugal fare. *Gentleneſs*, as oppoſed to an iraſcible temper, greatly contributes to the tranquillity and happineſs of life, by preſerving the mind from perturbation, and arming it againſt the aſſaults of calumny and malice. *Fortitude* enables us to bear thoſe pains which prudence cannot ſhun, and baniſhes fear from the mind; and the practice of *juſtice* is abſolutely neceſſary to the exiſtence of ſociety, and by conſequence to the happineſs of every individual." Theſe reaſonings come home to every man's boſom; and had not this philoſopher, by denying the providence, if not the being, of God, moſt unhappily excluded from his ſyſtem the very poſſibility of a future ſtate of retribution, his moral philoſophy would have been the moſt rational, and of courſe the moſt uſeful, of any that was taught in the ſchools of Greece. This enormous defect, however, laid it open to the groſſeſt corruptions; and by his followers it was in fact corrupted ſo as to countenance the moſt impure and criminal pleaſures of ſenſe.

11
The eclectic philoſophers of Alexandria.

Theſe ſeveral ſyſtems of ethics continued to be cultivated with more or leſs purity through all the revolutions of the Grecian ſtates, and they were adopted by the Romans after Greece itſelf became a province of the empire. They had been introduced into Egypt during the reigns of the Ptolemies, and were taught with much celebrity in the ſchools of Alexandria.—The philoſophy which was moſt cultivated in thoſe ſchools was that of Plato; but from a deſire of uniformity which took poſſeſſion of the Alexandrian Platoniſts, many of the dogmas of Ariſtotle and Zeno, as well as the extravagant fictions of the eaſt, were incorporated with the principles of the old academy.—The patrons of this heterogeneous maſs have been called *eclectic* philoſophers, becauſe they profeſſed to ſelect from each ſyſtem thoſe doctrines which were rational and important, and to reject every thing which was falſe or futile; but they added nothing to the purity of Plato's ethics, and they increaſed the obſcurity and myſticiſm of his phyſics and metaphyſics.

12
Extinction and revival of moral ſcience in Europe.

After the ſubverſion of the Roman empire, every ſpecies of philoſophy, if ſyllogiſtic wrangling deſerve not that name, was baniſhed for ages from the ſchools of Europe; and ethics, properly ſo called, gave place to eccleſiaſtical caſuiſtry, and to the ſtudy of the civil and canon law. When the Greeks, whom the fury and fanaticiſm of Mahomet II. had driven from Conſtantinople, introduced into Italy the knowledge of their own language, the cabinets of ancient philoſophy were again unlocked; the ſyſtems of the different ſects were adopted with the utmoſt avidity; and, without accurate

(B) Since this ſhort hiſtory was written, a very pleaſing view of Stoiciſm has been given to the public in Ferguſon's *Principles of moral and political Science;* a work which the ſtudent of ethics will do well to conſult. Perhaps the amiable author may unintentionally have ſoftened the auſtere dogmas of the Porch, by transfuſing into them ſomething of the mild ſpirit of the goſpel; but if ſo, he has much improved the ſyſtem of Zeno.

accurate inveſtigation of their reſpective merits, men became Platoniſts, Peripatetics, or Stoics, as fancy or caprice prompted them to chooſe their leaders. The αυτος εφη of Ariſtotle in particular, had not leſs authority over his modern admirers than it had of old in the Lyceum at Athens. At length the ſpirit of Luther and the genius of Bacon broke theſe fetters, and taught men to think for themſelves as well in ſcience as in religion. In phyſics, the effects produced by the writings of Bacon were great and rapid; for in phyſics the ancient theories were totally and radically wrong.—With reſpect to morals, however, the caſe was different. Each of the celebrated ſchools of antiquity was in poſſeſſion of much moral truth, blended indeed with error; and long after the Stagyrite and his rivals had loſt all influence in phyſical ſcience, philoſophers of eminence followed them implicitly in the ſcience of ethics.

13 Theories of Hobbes.

At this day, indeed, there is hardly a theory of morals at all diſtinguiſhed, to which ſomething very ſimilar may not be found in the writings of the ancients. —Hobbes adopted the principles of Democritus and Protagoras, and taught expreſsly that "there is no criterion of juſtice or injuſtice, good or evil, beſides the laws of each ſtate; and that it is abſurd to inquire at any perſon except the eſtabliſhed interpreters of the law, whether an action be right or wrong, good or evil (A)." Theſe impious abſurdities have been often confuted. Cudworth, who compoſed his *True Intellectual Syſtem of the Univerſe* in order to trace the metaphyſical atheiſm of Hobbes to its ſource, and to expoſe it to the public in all its weakneſs, undertook likewiſe to overthrow his ethical ſyſtem, in a treatiſe, intitled *Of Eternal and Immutable Morality*. That work was left unfiniſhed; but the theory of its great author was adopted, illuſtrated, and very ably ſupported, by the Doctors Clarke and Price.

14 Of Cudworth, Clarke, and Price.

Acccording to theſe three admirable ſcholars, "we feel ourſelves irreſiſtibly determined to approve ſome actions, and to diſapprove others. Some actions we cannot but conceive of as *right*, and others as *wrong;* and of all actions we are led to form ſome idea, as either *fit* to be performed, or *unfit*, or as neither fit nor unfit to be performed, i. e. as *indifferent*. The power within us which thus perceives and determines, they declare to be the *underſtanding;* and they add, that it perceives or determines immediately or by intuition, becauſe *right* and *wrong* denote *ſimple ideas*. As there are ſome propoſitions, which when attended to neceſſarily determine all minds to *believe* them, ſo are there ſome actions whoſe natures are ſuch, that when obſerved all rational beings immediately and neceſſarily *approve* them. He that can impartially attend, it is ſaid, to the nature of his own perceptions, and determine that when he conceives gratitude or beneficence to be *right*, he perceives nothing *true* of them, or *underſtands* nothing, but only *ſuffers* from a ſenſe, has a turn of mind which appears unaccountable: for the more we examine, the more indiſputable it wlll appear to us, that we expreſs *neceſſary* truth, when we ſay of ſome actions that they are right, and of others that they are wrong." It is added, that "we cannot perceive an action to be right without *approving* it, or *approve* it without being conſcious of ſome degree of *ſatisfaction* and complacency; that we cannot perceive an action to be wrong without *diſapproving* it, or *diſapprove* it without being diſpleaſed with it; and that the *firſt* muſt be liked, the *laſt* diſliked; the *firſt* loved, the *laſt* hated." By the patrons of this ſyſtem, *obligation* to action, and *rightneſs* of action, are held to be coincident or identical. "Virtue, they affirm, has a real, full, obligatory power, antecedently to all laws, and independently of all will; for obligation is involved in the very nature of it. To affirm that the performance of that which to omit would be wrong is not obligatory, unleſs conducive to private good, or enjoined by a ſuperior power, is a manifeſt contradiction *."

* Price's Review, and Clarke on the attributes.

Few men have deſerved better of letters and philoſophy than Cudworth, Clarke, and Price; and yet their theory of morals appears to us to be contradictory and unintelligible. It is certainly romantic, and founded upon principles which, if they be denied, no man by argument can be compelled to grant. There is, ſay they, an abſolute right and wrong, fitneſs and unfitneſs, in actions; but if ſo, the actions which are *right* and *fit* muſt be right and fit for ſomething, becauſe fitneſs, which reſpects no end, is wholly inconceivable. To ſay that any particular action is *fit*, and yet fit for *no particular purpoſe*, is juſt as abſurd as to ſay that the angles at the baſe of an iſoſceles triangle are equal, but neither to *one another*, nor to *any other angles;* and we may with no leſs propriety talk of the relation of equality attaching to a particular angle, and to nothing elſe with which the angle is equal, than of the *abſolute* fitneſs or rightneſs of any action or courſe of actions. If it be ſaid that ſuch actions are fit and right, becauſe they tend to promote the harmony of the world and the happineſs of men, this may be granted; but it overturns the intellectual theory from its very foundation. Actions which are fit and right only for their conſequences, are approved and liked for the ſake of thoſe conſequences; and the happineſs of men, among whom the virtuous perſon himſelf is to be included, is the motive or ultimate obligation to their performance.

Similar to this theory, and liable to the ſame objections is that which reſolves moral approbation into a ſenſe of propriety; for if actions be approved becauſe they are proper, it muſt be becauſe they are proper for ſome *end* or *purpoſe*, propriety in the abſtract being a word without meaning.

15 Of Lord Shafteſbury and Hutcheſon, &c.

Many philoſophers, feeling the force of theſe and of ſimilar objections to the intellectual theory of Cudworth, Clarke, and Price, as well as to a ſenſe of *propriety* in the abſtract, have had recourſe to another hypotheſis apparently better founded. Obſerving that all mankind decide on the morality of characters and actions inſtantaneouſly, without weighing their conſequences in the balance of reaſon, they ſuppoſe that ſuch deciſions are made by an *inſtinct* of our common nature, implanted in the human breaſt by the hand that formed it. To this inſtinct ſome of them give the the

(A) Doctrinas de juſto et injuſto, bono et malo, præter leges in unaquaque civitate conſtitutas, authenticas eſſe nullas: et utrum aliqua actio juſta vel injuſta, bona vel mala futura ſit, a nemine inquirendum eſſe, præterquam ab illis, quibus legum ſuarum interpretationem civitas demandaverit. *De cive*, p. 343.

the name of *conscience*, and others that of *moral sense*, in contradiction to *external sense*, the other great and universal inlet of human knowledge. By this *moral sense* we intuitively discover an essential difference in the *quality* of all thoughts and actions, and a general distinction of them into *good* and *evil*, just as by the *tongue* and *palate* we discover an essential difference in the *taste* of all objects, and a general distinction of them into *pleasant* and *unpleasant*. The ablest advocates for this instinctive system agree, that the moral sense is the immediate and involuntary criterion of only a few general truths, which, in their joint operation upon the mind, lay the basis of moral obligation. Others have carried it to what we think a very dangerous extreme; as, by affirming that we cannot prove, in regard to our moral feelings, that they are conformable to any extrinsic and external relations of things, they seem to wish that reason were banished from the science of ethics. Were this true, it would in many cases be impossible to distinguish the prejudices of early education from the pure dictates of original instinct, and the most pernicious conduct might be sanctified with the approbation of what would be deemed the ultimate test of virtue and vice.

To remedy the defects of the intellectual and instinctive theories of morality, Mr Hume blended them together; and, upon the broader basis of reason and internal sense co-operating with each other, he reared a system which, though different from those of all his predecessors, he rendered plausible, and supported with his usual ingenuity.

16 Of Mr Hume.

According to him, *sentiment* and *reason* concur in almost all moral determinations; and he proves, that for this purpose "there is implanted in the human breast a disinterested principle of *benevolence* or *sympathy* which makes men take pleasure in each other's happiness. The merit or demerit of actions consists wholly in their utility or natural tendency to add to the sum of human happiness: and the same he holds to be true of qualities whether bodily or mental. This utility or natural tendency it is the office of reason to discover; for that faculty alone can trace relations and consequences. Such qualities or actions as reason discovers to be useful, either to the individual or to society, the instinctive principle of benevolence makes us instantly approve, and this approbation constitutes their morality. Thus, temperance, fortitude, courage, and industry, &c. reason discovers to be useful to him who possesses them; and upon this discovery they are approved of by the sentiment of sympathy. They are therefore moral qualities, and the sources of the *private* virtues. In like manner,[f] generosity, cheerfulness of temper, mercy and justice, are discovered to be useful to society; and are accompanied with the approbation of that sentiment of sympathy which makes every man feel a satisfaction in the felicity of all other men. They therefore constitute the *social* virtues. Of every quality and every action, the merit or demerit, and of consequence the degree of approbation or disapprobation which is bestowed upon it, is in exact proportion to its utility and the circumstances of the case in which it occurs. The social virtues are therefore greater than those which are private, and one social virtue is greater than another; but every quality and every action which is useful, either to society or to the individual, is more or less virtuous, provided the good of the individual be considered as subordinate to the good of the public."

This theory is ingenious: and in placing the merit of actions in their utility, it furnishes a criterion of virtue which can be employed by reason; but it seems not to be wholly free from error, and it is obviously defective. By pretending that the same sentiment of approbation is given to useful actions voluntarily performed, and to useful qualities which are merely constitutional, Mr Hume confounds the merit of virtuous habits with the value of natural talents. Yet every man's consciousness will surely tell him, that the feeling or sentiment which attaches to deeds of justice, clemency, and beneficence, is very different from that which attaches to beauty of form, strength of body, vigour of mind, and mere extent of capacity. All these actions and qualities are useful; but when we approve of the former, besides attending to their utility we consider them as in the man's power, and attribute the merit of them immediately to himself. When we approve, or rather admire, the latter on account of their utility, we know them to be not in the man's power, and we attribute the merit of them immediately to the Author of nature,

But the defects of this theory are in practice more pernicious than its errors. The author well observes that the end of all moral speculations is to teach us our duty; and, by proper representations of the deformity of vice and beauty of virtue, to beget correspondent habits, and engage us to avoid the one and embrace the other: but the theory under review holds out no motive sufficient in all cases for this purpose.

It is indeed true, as Mr Hume affirms, that the virtues which are immediately useful or agreeable to the person possessed of them, are desirable in a view to self-interest, and that a regard to self-interest ought to engage us in their pursuit. It is likewise true, that the virtues which are *useful* and *agreeable* to others, are generally more desirable than the contrary qualities: for as by the constitution of our nature no enjoyment is sincere without some reference to company and society; so no society can be agreeable, or even tolerable where a man feels his presence unwelcome, and discovers all around him symptoms of disgust and aversion. These considerations he deems sufficient to enforce the duties of humanity, clemency and beneficence; but he states a case himself, in which they would certainly fail to make a man abstain from his neighbour's property. The greater part of property he considers, and rightly considers, as having its foundation in human laws, which are so calculated as to preserve the peace and promote the general good of the society, at the unavoidable expence sometimes of the individual. Now, in particular incidents, a sensible knave, by secretly purloining from the hoards of a worthless miser, might make himself comfortable and independent for life, without causing any breach in the social union, and even without hurting a single individual. What then should hinder him from acting thus? His self-interest would be promoted; and if he possessed a generous spirit, he might gratify his sentiment of benevolence or sympathy by doing good with his money to the poor, which the miser never did. For enforcing the uniform practice of justice in such cases as this, Mr Hume's theory of morals contains no adequate motive; but a very sufficient

sufficient one is held out by the system which we are now to consider.

17 A system of ethics built upon religion.

That system, which seems to have been unknown to the ancients, is built upon religion, of which indeed it constitutes a very essential part; and those by whom it has been taught, maintain that no other foundation is sufficient to bear a regular superstructure of practical ethics. The philosophers of this school (D) define virtue to be "the doing good to mankind, in obedience to the will of God, and for the sake of everlasting happiness:" So that with them "the good of mankind" is the *subject*, "the will of God" the *criterion* or *rule*, and "everlasting happiness" the *motive*, of human virtue. The moral sense, supposing it real, they consider as a very inadequate rule of conduct, as being in many cases difficult to be distinguished from prejudice; and many of them confidently deny its existence. The other rules, such as the *fitness of things*, abstract *right*, the *truth of things*, the *law of reason*, &c. they consider either as unintelligible, or as relative to some end by which the rules must themselves be tried. The two great questions, which in the system of these religious philosophers demand solution, are; *1st*, By what means shall a man in every case discover precisely what is the will of God? and, *2dly*, what evidence have we that there will be a future state of retribution and of everlasting happiness!

Of these two questions, the latter belongs wholly to religion: and to solve it they call in the aid of revelation, as well as that of which is called the religion of nature. The former question is in the province of morality: and to find answers to it which will apply to every case, is the whole business of their system:

The will of God respecting human conduct may be discovered by reasoning *à priori* from his existence and attributes, or *á posteriori* from the tendency of his works. Being himself independent and all-perfect, it is inconceivable that his view in creating the world could be any thing else than to communicate some portion of his own felicity. (See METAPHYSICS, n° 312.) This conclusion is agreeable to what we perceive of his works, in which there are a thousand contrivances, all tending to give happiness to man, and to all animated nature; and not one of which the natural tendency is to inflict pain, or prove ultimately injurious. Mankind are linked together by various ties, and made to depend in a great measure upon each other's conduct. That conduct, therefore, which is naturally productive of the greatest sum of human happiness, must be agreeable to the will of God; or, in other words, virtuous conduct. That, of which the natural tendency is the reverse, must be vicious; and that conduct, if there be any such, which tends to produce neither happiness nor misery, must be indifferent, i. e. neither morally good nor morally evil. It is to be observed, however, that as, previous to their own obedience or disobedience, all men stand in the same relation to their Creator, it must be his will that an equal portion of the happiness of which human nature is capable be communicated to all by whom that nature is shared. Whence it follows, that only such conduct as, if universally pursued by all men in the same station and circumstances, would be productive of the greatest sum of human happiness on the whole, can be agreeable to the will of the Creator; and that, in judging of the morality of actions, we are not to regard their immediate consequences in any particular case, but their natural and ultimate tendency if performed in all cases.

This is a criterion of virtue which differs widely from the local or occasional utility set up by Mr Hume; for the particular consequences of an action and its general tendency may often be at variance, so that what might in certain circumstances be immediately useful, would yet be highly criminal and ultimately pernicious. The general tendency of actions, too, may be always known, and known with the utmost certainty; the whole of their particular consequences can never be discovered. One thing, however, is evident, that if all men in their respective stations would regulate their conduct by the natural tendency of every action, the *particular* and *general* consequences of their conduct would be the same, and the greatest happiness would result from it of which human nature is in this world capable. And therefore, since it is only through the perverseness of some person or persons concerned, that the *particular consequences* of any action, of which the *natural tendency* is to produce *misery*, can ever bring *happiness* to a single individual; it can no more be the will of God that we make these *occasional* and *distorted* consequences the rule of our conduct, than it can be his will that the *vices* of other men should be the basis of our *virtues*. According to this scheme of morals, which rests all obligation on private happiness, the whole difference between an act of *prudence* and an act of *duty*, is this; That in the former case we consider only what we shall gain or lose in this world; in the latter, what we shall gain or lose in the world to come.

Although the patrons of this theory question the reality of the moral sense as an instinct, they allow that a sentiment of approbation or disapprobation of actions, according as they are virtuous or vicious, is generated by the associating principle (see INSTINCT, and METAPHYSICS, n° 97.); and that this sentiment, though factitious, operates instantaneously as if it were instinctive. They insist that our earliest actions are the result of imitation; that when we first begin to trace consequences, education and the desire of immediate enjoyment are our only guides; that as our mind expands and our knowledge increases, the hopes and fears of futurity become the *motives*, and the will of God the *rule* of our conduct: and that long practice in virtue, upon these principles, pruduces habits by which we go on with satisfaction in the same course, without looking forward, on every *particular* occasion, to the ultimate consequences and first motives of our actions. Thus do habits of justice, benevolence, clemency, and moral approbation, spring, through a proper course of discipline, out of the selfish principle; and when these habits are completely formed and deeply rooted, man has attained the utmost perfection of which he is capable in this state of probation, and is fitted for another of retribution and happiness.

19 Defects and excellency of the system.

That these philosophers have not a just view of human nature, when they deny that there is any innate principal of benevolence in man, we shall endeavour to

(D) GASTRELL, CUMBERLAND, PUFFENDORF, NORRIS, BERKELEY, GAY, LOW, RUTHERFORTH, SOAME, JENYNS, DR JOHNSON, MR PALEY, and MR GISBORNE, &c.

to ſhow when we lay the foundation of that theory which we think deſerves to be preferred to all others; but we fully agree with a candid and able writer †, who ſeems to conſider them as under the ſame miſtake, "that their theory of morals has no tendency to weaken the foundations of virtue; and that by the account which it gives of the riſe of the ſocial affections, it obviates many of the arguments which had formerly been urged againſt the ſelfiſh ſyſtem." Nay, we ſcruple not to confeſs, that the mode of inveſtigation which it employs in *all caſes* to diſcover the will of God, may in *ſome caſes* be neceſſary in any ſyſtem which does not baniſh the uſe of reaſon from the ſcience of ethics. On this account, as well as out of reſpect to the firſt moraliſt ‡ of the age, who affirms, that "it muſt be embraced by all who are willing to know why they act, or why they forbear, to give any reaſon of their conduct to themſelves or to others," we ſhall apply it to one of thoſe caſes of ſocial duty which Mr Hume's principle of utility could not reſolve. Such an example will enable the meaneſt of our readers to decide between the merits of it and of the theory which we ſhall adopt; or, as we rather hope, it will ſhow them that the two theories lead to the ſame practical concluſions.

† Stuart's Elements of the Philoſophy of the Human Mind.

‡ Johnſon.

Having thus given our readers a ſhort view of the moſt celebrated ſyſtems of ethics which have prevailed from the earlieſt ages of the world to the preſent day, we now proceed, agreeably to our definition of the ſcience, to trace man's duty from his nature and connections, and to ſhow that the ſteady practice of virtue muſt terminate in his ultimate happineſs.

PART I.

CHAP. I. *Of* MAN *and his* CONNECTIONS.

20 Man's infant ſtate.

MAN is born a weak, helpleſs, delicate creature, unprovided with food, clothing, and whatever elſe is neceſſary for ſubſiſtence or defence. And yet, expoſed as the infant is to numberleſs wants and dangers, he is utterly incapable of ſupplying the *former*, or ſecuring himſelf againſt the *latter*. But, though thus feeble and expoſed, he finds immediate and ſure reſources in the *affection* and *care* of his parents, who refuſe no labours, and forego no dangers, to nurſe and rear up the tender babe. By theſe powerful inſtincts, as by ſome mighty chain, does nature link the *parent* to the *child*, and form the ſtrongeſt *moral connection* on his part, before the child has the leaſt apprehenſion of it. *Hunger* and *thirſt*, with all the ſenſations that accompany or are connected with them, explain themſelves by a language ſtrongly expreſſive, and irreſiſtibly moving. As the ſeveral ſenſes bring in notices and informations of ſurrounding objects, we may perceive in the young ſpectator early ſigns of a growing *wonder* and *admiration*. Bright objects and ſtriking ſounds are beheld and heard with a ſort of commotion and ſurpriſe. But, without reſting on any, he eagerly paſſes on from object to object, ſtill pleaſed with whatever is moſt new. Thus the *love* of *novelty* is formed, and the paſſion of *wonder* kept awake. By degrees he becomes acquainted with the moſt familiar objects, his parents, his brethren, and thoſe of the family who are moſt converſant with him. He contracts a *fondneſs* for them, is uneaſy when they are gone, and charmed to ſee them again. Theſe feelings become the foundation of a *moral attachment* on his ſide; and by this reciprocal ſympathy he forms the domeſtic alliance with his parents, brethren, and other members of the family. Hence he becomes intereſted in their concerns; and feels *joy* or *grief*, *hope* or *fear*, on their account, as well as his own. As his affections now point beyond himſelf to others, he is denominated a *good* or *ill* creature, as he ſtands *well* or *ill affected* to them. Theſe, then, are the firſt links of the *moral chain;* the early rudiments, or outlines, of his character; his firſt rude eſſays towards agency, freedom, manhood.

When he begins to make excurſions from the nurſery, and extends his acquaintance abroad, he forms a little circle of companions; engages with them in play, or in queſt of adventures; and leads, or is led by them, as his genius is more or leſs aſpiring. Though this is properly the ſeaſon in which *appetite* and *paſſion* have the *aſcendant*, yet his *imagination* and *intellectual* powers open apace; and as the various images of things paſs before the mental eye, he forms variety of taſtes; reliſhes ſome things, and diſlikes others, as his parents, companions, and a thouſand other circumſtances, lead him to combine agreeable or diſagreeable ſets of ideas, or repreſent to him objects in alluring or odious lights. 21 His childhood.

As his views are enlarged, his *active* and *ſocial* powers expand themſelves in proportion; the *love of action*, of *imitation*, and of *praiſe*, *emulation*, *curioſity*, *docility*, *a paſſion for command*, and *fondneſs of change*.—His paſſions are quick, variable, and pliant to every impreſſion; his attachments and diſguſts quickly ſucceed each other. He compares things, diſtinguiſhes actions, judges of characters, and loves or hates them, as they appear well or ill affected to himſelf, or to thoſe he holds dear. Mean while he ſoon grows ſenſible of the conſequences of his own actions, as they attract applauſe, or bring contempt: he triumphs in the former; and is aſhamed of the latter, wants to hide them, and bluſhes when they are diſcovered. By means of theſe powers he becomes a fit ſubject of culture, the moral tie is drawn cloſer, he feels that he is accountable for his conduct to others as well as to himſelf, and thus is gradually ripening for ſociety and action.

As man advances from *childhood* to *youth*, his paſſions as well as perceptions take a more extenſive range. New ſenſes of pleaſure invite him to new purſuits; he grows ſenſible to the attractions of beauty, feels a peculiar ſympathy with the ſex, and forms a more tender kind of attachment than he has yet experienced. This becomes the cement of a *new moral relation*, and gives a ſofter turn to his paſſions and behaviour. In this turbulent period he enters more deeply into a *reliſh of friendſhip*, *company*, *exerciſes*, and *diverſions;* the *love of truth*, of *imitation*, and of *deſign*, grows upon him; and as his connections ſpread among his neighbours, fellow-citizens, and countrymen, 22 His youth.

trymen, his *thirst of praise*, *emulation*, and *social affections* grow more intense and active. Mean while, it is impossible for him to have lived thus long without having become sensible of those more august signatures of order, wisdom, and goodness, which are stamped on the visible creation; and of those strong suggestions within himself of a parent mind, the source of all intelligence and beauty; an object as well as source of that activity, and those aspirations which sometimes rouse his inmost frame, and carry him out of himself to an almighty and all-governing power: Hence arise those sentiments of *reverence*, and those affections of *gratitude*, *resignation*, and *love*, which link the soul with the Author of Nature, and form that most sublime and god-like of all connections.

23 His manhood.

Man having now reached his prime, either new passions succeed, or the old set are wound up to an higher pitch. For, growing more sensible of his connections with the public, and that particular community to which he more immediately belongs; and taking withal a larger prospect of human life, and its various wants and enjoyments; he forms more intimate friendships, grasps at power, courts honour, lays down cooler plans of interest, and becomes more attentive to the concerns of society: he enters into family connections, and indulges those charities which arise from thence. The *reigning* passions of this period powerfully prompt him to provide for the decays of life; and in it *compassion* and *gratitude* exert their influence in urging the *man*, now in full vigour, to requite the affection and care of his parents, by supplying their wants, and alleviating their infirmities.

24 Old age.

At length human life verges downwards; and *old age* creeps on apace, with its *anxiety*, *love of ease*, *interestedness*, *fearfulness*, *foresight*, and *love of offspring*. —The experience of the aged is formed to direct, and their coolness to temper, the heat of youth: the former teaches them to look back on past follies; and, the latter to look forward into the consequences of things, and provide against the worst. Thus every age has its peculiar genius and set of passions corresponding to that period, and most conducive to the prosperity of the rest. And thus are the *wants* of one period supplied by the *capacities* of another, and the *weaknesses* of one age tally to the *passions* of another.

25 Passions of every age.

Besides these, there, are other passions and affections of a less *ambulatory* nature, not peculiar to one period, but belonging to every age, and acting more or less in every breast throughout life. Such are *self-love*, *benevolence*, *love of life*, *honour*, *shame*, *hope*, *fear*, *desire*, *aversion*, *joy*, *sorrow*, *anger*, and the like. The two first are affections of a cooler strain; one pointing to the good of the individual, the other to that of the species: *joy* and *sorrow*, *hope* and *fear*, seem to be only modifications, or different exertions, of the same *original* affections of *love* and *hatred*, *desire* and *aversion*, arising from the different circumstances or position of the object desired or abhorred, as it is present or absent. From these likewise arise other *secondary* or *occasional* passions, which depend, as to their existence and several degrees, upon the original affections being gratified or disappointed; as *anger*, *complacence*, *confidence*, *jealousy*, *love*, *hatred*, *dejection*, *exultation*, *contentment*, *disgust*, which do not form *leading* passions, but rather hold of them.

By these simple but powerful springs, whether *periodical* or *fixed*, the life of man, weak and indigent as he is, is preserved and secured, and the creature is prompted to a constant round of action, even to supply his own numerous and ever-returning *wants*, and to guard against the various *dangers* and *evils* to which he is obnoxious. By these links men are connected with each other, formed into families, drawn into particular communities, and all united as by a common league into one system or body, whose members feel and sympathise one with another. By this admirable adjustment of the constitution of *man* to his *state*, and the gradual evolution of his powers, order is maintained, society upheld, and human life filled with that variety of passion and action which at once enliven and diversify it.

26 Their joint effects.

27 The directing power.

This is a short sketch of the *principal movements* of the human mind. Yet these movements are not the whole of man; they impel to action, but do not direct it: they need a *regulator* to guide their motions, to measure and apply their forces; and accordingly they have one that naturally *superintends* and *directs* their action. We are conscious of a principle within us, which examines, compares, and weighs things; notes the differences, observes the forces, and foresees the consequences, of affections and actions. By this power we look back on past times, and forward into futurity, gather experiences, estimate the real and comparative value of objects, lay out schemes, contrive means to execute them, and settle the whole order and œconomy of life. This power we commonly distinguish by the name of *reason* or *reflection*, the business of which is not to suggest any original notices or sensations, but to canvass, range, and make deductions from them.

28 The judging or approving powers.

We are intimately conscious of another principle within us, which approves of certain *sentiments*, *passions*, and *actions*, and disapproves of their contraries. In consequence of the decisions of this inward judge, we denominate some actions and principles of conduct *right*, *honest*, *good*; and others *wrong*, *dishonest*, *ill*. The former excite our *esteem*, *moral complacence*, and *affection*, immediately and originally of themselves, without regard to their consequences, and whether they affect our interest or not. The latter do as naturally and necessarily call forth our *contempt*, *scorn*, and *aversion*. That power by which we perceive this difference in affections and actions, and feel a consequent relish or dislike, is commonly called *conscience* or the *moral sense*.

That there is such a power as this in the mind of every man of sound understanding, is a fact which cannot be controverted; but whether it be an instinctive power, or the result of early and deep rooted associations, has been long and ably debated. The question is of importance in the science of human nature, as well as in ascertaining the standard of practical virtue; but to us it appears that the contending parties have carried their respective opinions to dangerous extremes.

When it is affirmed, as it sometimes has been, that reason has nothing to do in ethical science, but that in every possible situation our duty is pointed out and the performance of it enforced by mere sentiment, the consequence seems to be, that virtue and vice are nothing

thing permanent in themſelves, but change their nature according to local circumſtances. Certain it is, that ſentiment has in ſimilar ſituations approved of very different practices in different ages and different nations.

29 An attempt to prove that we have from nature no ſuch powers,

At preſent this ſentiment in Europe approves of the univerſal practice of juſtice, and of parents protecting their children, whether well or ill formed, whether ſtrong or weak: but in Sparta we know that theft, if dexterouſly practiſed, was approved, and not unfrequently rewarded; and that the expoſition of lame and deformed children was not only permitted but abſolutely enjoined. There is nothing which our conſcience or moral ſenſe condemns with greater ſeverity, or views as a crime of a deeper dye, than childrens unkind treatment of their aged parents; yet there are ſavages among whom inſtincts of all kinds ought to prevail in greater purity than in civilized nations, whoſe moral ſenſe permits them to put their aged and decrepid parents to death. If this ſenſe be inſtinctive, and the ſole judge of right and wrong, how comes it to decide ſo differently on the ſame line of conduct in different ages and diſtant countries? The inſtincts of brutes, in ſimilar circumſtances, prompt uniformly to ſimilar actions in every age and in every region where the ſpecies is found; and the external ſenſes of man afford in all nations the ſame unvaried evidence concerning their reſpective objects. To theſe obſervations we may add, that inſtincts muſt be calculated for the ſtate of nature, whatever that ſtate may be, and therefore cannot be ſuppoſed capable of directing our ſteps through all the labyrinths of poliſhed ſociety, in which duties are to be performed that in a ſtate of nature would never have been thought of.

But though for theſe reaſons it is apparent that mere ſentiment, whether called conſcience or the moral ſenſe, would *alone* be a very unſafe guide to virtue in every individual caſe that may occur, we think that thoſe who reſolve all ſuch ſentiment into habit and the effect of education, without giving any part of it to nature, advance an opinion which is equally ill-founded and not leſs dangerous. There are, indeed, men who affirm that all benevolence is hypocriſy, friendſhip a cheat, public ſpirit a farce, fidelity a ſnare to procure truſt and confidence; and that while all of us at bottom purſue only our private intereſt, we wear thoſe fair diſguiſes, in order to put thoſe off their guard with whom we have to deal, and to expoſe them the more to our wiles and machinations. Others again, too virtuous to accuſe themſelves and all mankind of direct knavery, yet inſiſt, that whatever affection one may feel, or imagine he feels, for others, no paſſion is or can be diſintereſted; that the moſt generous friendſhip, however ſincere, is only a modification of ſelf-love; and that even unknown to ourſelves we ſeek only our own gratification, while we appear the moſt deeply engaged in ſchemes for the liberty and happineſs of mankind.

Surely the mildeſt of theſe repreſentations is an exaggerated picture of the ſelfiſhneſs of man. Self-love is indeed a very powerful as well as an eſſential principle in human nature; but that we had likewiſe an inſtinctive principle of benevolence, which, without any particular regard to our own intereſt, makes us feel pleaſure in the happineſs of other men, is a fact which we think admits of very complete proof. For, as Mr Hume well argues, "when a man grieves for a friend who could be of no ſervice to him, but on the contrary ſtood in need of his conſtant patronage and protection, how it is poſſible to ſuppoſe that ſuch paſſionate tenderneſs ariſes from ſelf intereſt, which has no foundation in nature?

30 Examined and ſhown.

What intereſt (aſks the ſame deep thinker) can a fond mother have in view, who loſes her health by her aſſiduous attendance on her ſick child, and afterwards languiſhes and dies of grief when freed by its death from the ſlavery of attendance?—Have we no ſatisfaction (continues he) in one mans company above another's, and no deſire of the welfare of our friend, even though abſence or death ſhould prevent us from all participation in it? Or what is it commonly that gives us any participation in it, even while alive and preſent, but our affection and regard to him?" Nor is it to contemporaries and individuals alone, that, independant of all intereſt, we feel a benevolent attachment. We conſtantly beſtow praiſe on actions calculated to promote the good of mankind, thoughp erformed in ages very diſtant and in countries moſt remote; and he who was the author of ſuch actions is the object of our eſteem and affection. There is not perhaps a man alive, however ſelfiſh in his diſpoſition who does not applaud the ſentiment of that emperor, who, recollecting at ſupper that he had done nothing in that day for any one, exclaimed with regret, that the day had been loſt! yet the utmoſt ſubtility of imagination can diſcover no appearance of intereſt that *we* can have in the generoſity of *Titus*, or find any connection of our preſent happineſs with a character removed ſo far from us both in time and in place. But, as Mr Hume juſtly obſerves, if we even feign a character conſiſting of all the moſt generous and beneficent qualities, and give inſtances in which theſe diſplay themſelves, after an eminent and moſt extraordinary manner, for the good of mankind, we ſhall inſtantly engage the eſteem and approbation of all our audience, who will never ſo much as inquire in what age or country the accompliſhed perſon lived.

Theſe are facts which cannot be controverted; and they are wholly unaccountable, if there be not in human nature an inſtinctive ſentiment of benevolence or ſympathy, which feels a diſintereſted pleaſure in the happineſs of mankind. But an end in which we feel pleaſure we are naturally prompted to purſue; and therefore the ſame ſentiment impels every man, with greater or leſs force, to promote the happineſs of other men, which by means of it becomes in reality his own good, and is afterwards purſued from the combined motives of benevolence and ſelf-enjoyment. For in obeying this ſentiment we all feel an inward *complacency*, *ſelf-approbation*, or conſciouſneſs of *worth* or *merit*; and in diſobeying it, which cannot be done but with reluctance, we feel *remorſe*, or a conſciouſneſs of *unworthineſs* or *demerit*. It appears, however, from hiſtory, that the ſentiment, as it is inſtinctive, points only to the good of mankind, without informing us how that good is to be promoted. The means proper for this purpoſe muſt be diſcovered by reaſon; and when they are brought into view, this *ſentiment*, *conſcience*, or *moral ſenſe*, inſtantly ſhows us that it is our duty to purſue them.

Hence we ſee how different lines of conduct may in ſimilar circumſtances be approved of as virtuous in dif-

Of Man and his Connections.

ferent nations. When the Spartan exposed his sickly and deformed child, and when the savage put his aged parents to death, neither of them erred from want of sentiment, or from having sentiments originally different from ours. Their errors resulted from a defect in reasoning. They both imagined that they were obeying the law of benevolence by preventing misery; for a weak and deformed person was very ill qualified to exist with any degree of comfort under the military constitution of Sparta, where all were soldiers, and under the necessity of undergoing the greatest hardships; and in a state where the people have no fixed habitations, and where the chace supplies even the necessaries of life, an aged and infirm person is in danger of perishing through hunger, by one of the cruellest and most lingering of deaths. The theft allowed in Sparta, if theft it may be called, was a still less deviation from the instinctive law of benevolence. Boys were taught to slip as cunningly as they could into the gardens and public halls, in order to steal away herbs or meat; and if they were caught in the fact, they were punished for their want of dexterity. This kind of theft, since it was authorised by the law and the consent of the citizens, was no robbery; and the intention of the legislator in allowing it, was to inspire the Spartan youth, who were all designed for war, with the greater boldness, subtlety, and address; to enure them betimes to the life of a soldier; and to teach them to shift for themselves, and to live upon little. That the Spartan legislator did wrong in giving his countrymen a constitution, of which successful war was the ultimate object: and that savages, rather than kill their aged parents, or suffer them to die of hunger, ought to cultivate the ground; and abandon the chace, is readily granted; but the faults of the one as well as of the other arose not from any improper decision of the moral sense, but from a defect in their reasoning powers, which were not able to estimate the advantages and disadvantages of different modes of life. In moral decisions, therefore, conscience and reason are aiding to each other. The former principle, when separated from the latter, is defective, enjoining only the good of mankind, but unable to point out the means by which it can be most effectually promoted: and the latter principle, when separated from the former, only directs a man to do what is most prudent, but cannot give him a conception of duty.

31 To originate in the objector's mistaking the extent of those powers;

32 Which are different in nature and kind from the passions and affections.

These two powers of *reason* and *conscience* are evidently principles different in *nature* and *kind* from the passions and affections. For the passions are mere *force* or *power*, *blind impulses*, acting violently and without choice, and ultimately tending each to their respective objects, without regard to the interest of the others, or of the whole system. Whereas the *directing* and *judging* powers distinguish and ascertain the different forces, mutual proportions and relations, which the passions bear to each other and to the whole; recognise their several degrees of merit, and judge of the whole temper and conduct, as they respect either the individual or the species; and are capable of directing or restraining the blind impulses of passion in a due consistency one with the other, and a regular subordination to the whole system.

This is some account of the *constituent principles* of our nature, which, according to their different mixtures, degrees, and proportions, mould our character and sway our conduct in life. In reviewing that large train of affections which fill up the different stages of human life, we perceive this obvious distinction among them; that some of them respect the *good* of the *individual*, and others carry us beyond ourselves to the *good* of the *species* or *kind*. The former have therefore been called *private*, and the latter *public* affections. Of the first sort are *love of life*, of *pleasure*, of *power*, and the like. Of the last are *compassion*, *gratitude*, *friendship*, *natural affection*, and the like. Of the *private* passions (B), some respect merely the *security* and *defence* of the creature, such as *resentment* and *fear*; whereas others aim at some *positive* advantage or good, as *wealth ease fame*. The former sort, therefore, because of this difference of objects, may be termed *defensive* passions. These answer to our *dangers*, and prompt us to avoid them if we can, or boldly to encounter them when we cannot.

Of Moral Obligation.

33 Division of the passions

34 Defensive passions.

35 Private or appetitive passions.

The other class of *private* passions, which pursue *private positive* good, may be called *appetitive*. However, we shall still retain the name of *private* in contradistinction to the *defensive* passions. Man has a great variety of wants to supply, and is capable of many enjoyments, according to the several periods of life, and the different situations in which he is placed. To these therefore a suitable train of *private* passions correspond, which engage him in the pursuit of whatever is necessary for his subsistence or welfare.

36 Public passions.

Our *public* or *social* affections are adapted to the several *social connections* and *relations* which we bear to others, by making us sensible of their dangers, and interesting us in their wants, and so prompting us to secure them against one and supply the other.

This is the first step then to discover the *duty* and *destination* of man, the having analysed the principles of which he is composed. It is necessary, in the next place, to consider in what *order*, *proportion*, and *measure* of those inward principles, *virtue*, or a sound moral temper and right conduct, consists; that we may discover whence *moral obligation* arises.

Chap. II. *Of* Duty, *or* Moral Obligation.

37 The measure of powers.

It is by the end or design of any power or movement that we must direct its motions, and estimate the degree of force necessary to its just action. If it want the force requisite for the obtaining its end, we reckon it defective; if it has too much, so as to be carried beyond it, we say it is overcharged; and in either case it is imperfect and ill-contrived. If it has just enough to reach the scope, we esteem it right and as it should be. Let us apply this reasoning to the passions.

38 Measure of the defensive passions.

The *defence* and *security* of the individual being the *aim* of the *defensive passions*, that *security* and *defence* must be the measure of their *strength* or *indulgence*. If they are so *weak* as to prove insufficient for that end, or if they *carry us beyond it*, i. e. raise unnecessary commotions, or continue longer than is needful, they are unfit to answer their original design, and therefore are in an unsound and unnatural state. The exercise of *fear* or of *resentment* has nothing desirable in it; nor can

(B) Here we use passions and affections without distinction. Their difference will be marked afterwards.

Of Moral Obligation. can we give way to either without painful ſenſations. Without a certain degree of them, we are naked and expoſed. With too high a proportion of them, we are miſerable, and often injurious to others. Thus *cowardice* or *timidity*, which is the exceſs of fear, inſtead of ſaving us in danger, gives it too formidable an appearance, makes us incapable of attending to the beſt means of preſervation, and diſarms us of *courage*, our natural armour. *Fool-hardineſs*, which is the want of a due meaſure of *fear*, leads us heedleſsly into danger, and lulls us into a pernicious ſecurity. *Revenge*, i. e. *exceſſive reſentment*, by the violence of its commotion, robs us of the *preſence of mind* which is often the beſt guard againſt injury, and inclines us to purſue the aggreſſor with more ſeverity than ſelf-defence requires. *Puſillanimity*, or the want of a juſt indignation againſt wrong, leaves us quite unguarded, and tends to ſink the mind into a paſſive enervated tameneſs. Therefore, "to keep the defenſive paſſions duly proportioned to our dangers, is their natural pitch and tenor."

39 Meaſure of the private paſſions. The *private* paſſions lead us to purſue ſome *poſitive* ſpecies of *private* good: that *good* therefore which is the object and end of each muſt be the meaſure of their reſpective force, and direct their operation. If they are too *weak* or *ſluggiſh* to engage us in the purſuit of their ſeveral objects, they are evidently *deficient;* but if they defeat their end by their *impetuoſity*, then are they ſtrained beyond the juſt tone of nature. Thus *vanity*, or an *exceſſive paſſion for applauſe*, betrays into ſuch meanneſſes and little arts of popularity, as makes us forfeit the honour we ſo anxiouſly court. On the other hand, *a total indifference, about the eſteem of mankind*, removes a ſtrong guard and ſpur to virtue, and lays the mind open to the moſt abandoned proſecutions. Therefore, "to keep our private paſſions and deſires proportioned to our *wants*, is the juſt meaſure and pitch of this claſs of affections."

40 Comparative force. The *defenſive* and *private* paſſions do all agree in general, in their tendency or conduciveneſs to the intereſt or good of the individual. Therefore, when there is a colliſion of intereſt, as may ſometimes happen, that *aggregate of good* or *happineſs*, which is compoſed of the particular goods to which they reſpectively tend, muſt be the common ſtandard by which their *comparative degrees* of ſtrength are to be meaſured: that is to ſay, if any of them, in the degree in which they prevail, are incompatible with the greateſt aggregate of good or moſt extenſive intereſt of the individual, then are they unequal and diſproportionate. For in judging of a particular *ſyſtem* or *conſtitution* of powers, we call that the *ſupreme* or *principal* end in which the aims of the ſeveral parts or powers coincide, and to which they are ſubordinate; and reckon them in due proportion to each other, and right with regard to the whole, when they maintain that ſubordination of ſubſerviency. Therefore, "to proportion our defenſive and private paſſions in ſuch meaſure to our dangers and wants as beſt to ſecure the individual, and obtain the greateſt aggregate of private good or happineſs, is their juſt balance or comparative ſtandard in caſe of competition."

41 Meaſure of the public affections. In like manner as the *public* or *ſocial* affections point at the good of others, that *good* muſt be the meaſure of their force. When a particular *ſocial* affection, as *gratitude* or *friendſhip*, which belongs to a particular *ſocial connection, viz.* that of a *benefactor* or of a *friend*, is too feeble to make us act the *grateful* or *friendly* part, that affection, being inſufficient to anſwer its end, is *defective* and *unſound*. If, on the other hand, a particular paſſion of this claſs counteract or defeat the intereſt it is deſigned to promote, by its violence or diſproportion, then is that paſſion *exceſſive* and *irregular*. Thus *natural affection*, if it degenerates into a *paſſionate* fondneſs, not only hinders the parents from judging coolly of the intereſt of their offspring, but often leads them into a moſt partial and pernicious indulgence.

42 Colliſion of ſocial affections. As every kind affection points at the good of its particular object, it is poſſible there may be ſometimes a colliſion of intereſts or goods. Thus the regard due to a *friend* may interfere with that which we owe to a *community*. In ſuch a competition of intereſts, it is evident that the *greateſt* is to be choſen; and that is the greateſt intereſt which contains the greateſt ſum or aggregate of public good, greateſt in *quantity* as well as *duration*. This then is the *common ſtandard* by which the reſpective forces and ſubordinations of the ſocial affections muſt be adjuſted. *Therefore* we conclude, that "this claſs of affections are ſound and regular when they prompt us to purſue the *intereſt* of *individuals* in an entire conſiſtency with the *public good;*" or, in other words, "when they are duly proportioned to the *dangers* and *wants* of others, and to the various *relations* in which we ſtand to *individuals* or to *ſociety*."

Thus we have found, by an induction of particulars, the *natural pitch* or *tenor* of the *different orders of affection*, conſidered apart by themſelves. Now, as the *virtue* or *perfection* of every creature lies in following its nature, or acting ſuitably to the juſt proportion and harmony of its ſeveral powers; therefore, "the VIRTUE of a creature endowed with ſuch affections as *man* muſt conſiſt in obſerving or acting agreeably to their *natural pitch and tenor*."

43 Balance of affection. But as there are no independent affections in the fabric of the mind, no paſſion that ſtands by itſelf, without ſome relation to the reſt, we cannot pronounce of any one, conſidered APART, that it is either *too ſtrong* or *too weak*. Its ſtrength and juſt proportion muſt be meaſured not only by its ſubſerviency to its own immediate end, but by the reſpect it bears to the whole ſyſtem of affection. Therefore, we ſay a paſſion is *too ſtrong*, not only when it defeats its own end, but when it impairs the force of other paſſions, which are equally neceſſary to form a *temper of mind* ſuited to a certain *economy* or *ſtate;* and too weak, not merely on account of its inſufficiency to anſwer its end, but becauſe it cannot ſuſtain its *part* or *office* in the balance of the whole ſyſtem. Thus the *love of life* may be *too ſtrong* when it takes from the *regard* due to one's country, and will not allow one bravely to encounter dangers, or even death, on its account. Again, the *love of fame* may be *too weak* when it throws down the fences which render virtue more ſecure, or weakens the incentives which make it more active and public ſpirited.

44 Limits of private affections. If it be aſked, "How far may the affections towards private good or happineſs be indulged?" One limit was before fixed for the particular indulgence of each, *viz.* their ſubordination to the common aggregate of good to the private ſyſtem. In theſe therefore a due

regard is always supposed to be had to *health*, *reputation*, *fortune*, the *freedom of action*, the *unimpaired exercise of reason*, the *calm enjoyment of one's self*, which are all private goods. Another limit now results from the balance of affection just named, *viz.* "The security and happiness of others;" or, to express it more generally, "a *private* affection may be safely indulged, when, by that indulgence, we do not violate the obligations which result from our higher relations or public connections." A just respect therefore being had to these boundaries which nature has fixed in the breast of every man, what should limit our pursuits of private happiness? Is nature sullen and penurious? or, does the God of nature envy the happiness of his offspring?

45 Collision of interests.

Whether there is ever a real collision of interests between the *public* and *private* system of affections, or the ends which each class has in view, will be afterwards considered; but where there is no collision, there is little or no danger of carrying either, but especially the *public* affections, to excess, provided both kinds are kept subordinate to a discreet and cool *self-love*, and to a calm and universal *benevolence*, which principles stand as guards at the head of each system.

46 Result.

This then is the conduct of the passions, considered as *particular* and *separate* forces, carrying us out to their respective ends; and this is their balance or œconomy, considered as *compound* powers, or powers mutually related, acting in conjunction towards a *common* end, and consequently as forming a *system* or *whole*.

47 Subordination of powers.

Now, whatever adjusts or maintains this *balance*, whatever in the human constitution is formed for *directing* the passions so as to keep them from defeating their own end or interfering with each other, must be a principle of a *superior* nature to them, and *ought* to direct their measures and govern their proportion. But it was found that *reason* or reflection is such a principle, which points out the tendency of our passions, weighs their influence upon private and public happiness, and shows the best means of attaining either. It having been likewise found that there is another directing or controling principle, which we call CONSCIENCE or the MORAL SENSE, which, by a native kind of authority, judges of affections and actions, pronouncing some *just* and *good*, and others *unjust* and *ill;* it follows, that the passions, which are mere impulse or blind forces, are principles inferior and subordinate to this *judging* faculty. Therefore, if we would follow the order of nature, *i. e.* observe the mutual respects and the subordination which the different parts of the human constitution bear one to another, the passions ought to be subjected to the direction and authority of the *leading* or *controling* principles.

48 In what it consists.

We conclude, therefore, from this *induction*, that "the *constitution* or *just œconomy* of *human nature* consists in a regular *subordination* of the *passions* and *affections* to the *authority* of *conscience* and the *direction* of *reason*."

49 Oeconomy of nature, or right temper.

That *subordination* is *regular*, when the proportion formerly mentioned is maintained; that is to say, "when the *defensive* passions are kept proportioned to our *dangers;* when the *private* passions are proportioned to our *wants;* and when the *public* affections are adapted to our *public connections*, and proportioned to the wants and dangers of others."

But the *natural state*, or the *sound* and *vigorous constitution* of any creature, or the *just œconomy* of its powers, we call its *health* and *perfection;* and the acting agreeably to these, its *virtue* or *goodness*. Therefore, "the *health* and *perfection* of man must lie in the aforesaid *supremacy* of *conscience* and *reason*, and in the *subordination* of the passions to their *authority* and *direction*. And his *virtue* or *goodness* must consist in acting agreeably to that *order* or *œconomy*." 50 Human virtue and perfection.

That such an ornament of the mind, and such a conduct of its powers and passions, will stand the test of *reason*, cannot admit of any dispute. For, upon a fair examination into the consequences of things, or the relations and aptitudes of *means* to *ends*, *reason* evidently demonstrates, and *experience* confirms it, that, "to have our *defensive passions* duly proportioned to our *dangers*, is the surest way to avoid or get clear of them, and obtain the security we seek after.—To proportion our *private passions* to our *wants*, is the best means to supply them;—and, to adapt our *public affections* to our *social relations*, and the *good* of others, is the most effectual method of fulfilling *one*, and procuring the *other*." In this sense, therefore, *virtue* may be said to be a "*conduct* conformable to *reason*," as reason discovers an apparent *aptitude*, in such an *order* and *œconomy* of powers and passions, to answer the end for which they are *naturally* formed. 51 How conformable to reason.

If the idea of *moral obligation* is to be deduced merely from this *aptitude* or *connection* between certain passions, or a certain order and balance of passions, and certain ends obtained or to be obtained by them, then is *reason* or *reflection*, which perceives that aptitude or connection, the proper judge of *moral obligation;* and on this supposition it may be defined, as hath been done by some, the connection between the *affection* and the *end*, or, which is the same thing, between the *action* and the *motive;* for the *end* is the *motive* or the *final cause*, and the *affection* is the *action*, or its immediate natural cause. A man, from mere self-love, may be induced to fulfil that obligation which is founded on the connection between the *defensive* passions and their *ends*, or the *private* passions and their *ends;* because in that case his own interest will prompt him to indulge them in the due proportion required. But if he has no affections which point beyond himself, no principle but *self-love*, or some subtle modification of it, what shall interest him in the happiness of others, where there is no connection between it and his own? or what sense can he have of *moral obligation* to promote it? Upon this scheme, therefore, without public or social affection there could be no *motive*, and consequently no moral obligation, to a beneficent disinterested conduct. 52 Connection between affections and ends, not the idea of moral obligation.

But if the mere connection between certain passions, or a certain order of passions and certain ends, are what constitutes or gives us the idea of *moral obligation*, then why may not the appositeness of any temper or conduct, nay, of any piece of machinery, to obtain its end, form an equally strict *moral obligation?* for the connection and aptitude are as strong and invariable in the latter instances as in the former. But as this is confounding the most obvious differences of things, we must trace the idea of *moral obligation* to another and a more natural source.

Let us appeal, therefore, to our inmost sense and experience, "how we stand affected to those different 53 Idea of it from experience.

sets of passions, in the just measure and balance of which we found a right temper to consist." For this is entirely a matter of experience, in which we must examine, as in any other natural inquiry, "what are the genuine feelings and operations of nature, and what affections or symptoms of them appear in the given instance."

54 Why the defensive passions are approved.

The defensive passions, as *anger* and *fear*, give us rather pain than pleasure, yet we cannot help feeling them when provoked by injury, or exposed to harm. We account the creature imperfect that wants them because they are necessary to his defence. Nay, we should in some measure condemn ourselves, did we want the necessary degree of *resentment* and *caution*. But if our *resentment* exceeds the wrong received, or our *caution* the evil dreaded, we then blame ourselves for having over-acted our part. Therefore, while we are in danger, to be totally destitute of them we reckon a **blameable defect**, and to feel them in a just *i. e.* necessary measure, we *approve*, as suited to the nature and condition of such a creature as man. But our security obtained, to continue to indulge them, we not only *disapprove* as *hurtful*, but *condemn* as *unmanly*, *unbecoming*, and *mean spirited*: Nor will such a conduct afford any self-approving-joy when we coolly reflect upon it.

55 Why the private.

With regard to the *private* passions, such as *love of life*, *pleasure*, *ease*, and the like, as these aim at private good, and are necessary to the perfection and happiness of the individual, we should reckon any creature *defective*, and even *blameable*, that was destitute of them. Thus, we condemn the man who imprudently ruins his fortune, impairs his health, or exposes his life; we not only pity him as an unfortunate creature, but feel a kind of *moral indignation* and contempt of him, for having made himself such. On the other hand, though a discreet self-regard does not attract our esteem and veneration, yet we approve of it in some degree, in an higher and different degree from what we would regard a well-contrived machine as necessary to constitute a finished creature, nay, to complete the virtuous character, as exactly suited to our present indigent state. There are some passions respecting private good, towards which we feel higher degrees of approbation, as the *love of knowledge*, of *action*, of *honour*, and the like. We esteem them as marks of an ingenious mind: and cannot help thinking the character in which they are wanting remarkably stupid, and in some degree *immoral*.

56 Why the public.

With regard to the social affections, as *compassion*, *natural affection*, *friendship*, *benevolence*, and the like, we approve, admire, and love them in ourselves; and, in all in whom we discover them, with an esteem and approbation, if not different in kind, yet surely far superior in degree, to what we feel towards the other passions. These we reckon necessary; just, and excellently fitted to our structure and state; and the creature which wants them we call defective, ill constituted, a kind of abortion. But the *public* affections we esteem as self-worthy, originally and externally amiable.

57 Distinction between vehement and calm affections.

But among the *social* affections we make an obvious and constant distinction, viz. between those particular passions which urge us with a sudden violence, and uneasy kind of sensation, to pursue the good of their respective objects, as *pity*, *natural affection*, and the like; and those calm dispassionate affections and desires which prompt us more steadily and uniformly to promote the happiness of others. The former we generally call ***passions***, to distinguish them from the other sort, which go more commonly by the name of ***affections*** or *calm desires*. The first kind we approve indeed, and delight in; but we feel still higher degrees of approbation and moral complacence towards the *last*, and towards all limitation of the particular instincts, by the principle of *universal benevolence*. The more objects the calm affections take in, and the worthier these are, their dignity rises in proportion, and with this our approbation keeps in exact pace. A character, on the other hand, which is quite divested of these public affections, which feels no love for the species, but instead of it entertains malice, rancour, and ill-will, we reckon totally immoral aud unnatural.

Such then are the sentiments and dispositions we feel when these several orders of affection pass before the mental eye.

Therefore, "that state in which we feel ourselves moved, in the manner above described, towards those affections and passions, as they come under the mind's review, and in which we are, instantaneously and independently of our choice or volition, prompted to a *correspondent* conduct, we call a state of *moral obligation*." Let us suppose, for instance, a parent, a friend, a benefactor, reduced to a condition of the utmost indigence and distress, and that it is in our power to give them immediate relief. To what conduct are we *obliged?* what *duty* does nature dictate and require in such a case? Attend to nature, and nature will tell, with a voice irresistibly audible and commanding to the ***human heart***, with an authority which no man can silence without being self-condemned, and which no man can elude but at his peril, "that immediate relief ***ought*** to be given." Again, let a friend, a neighbour, or even a stranger, have lodged a ***deposit*** in our hands, and after some time reclaim it; no sooner do these ideas of the confidence reposed in us, and of property not ***transferred***, but ***deposited***, occur, than we immediately and unavoidably feel and recognize the ***obligation*** to restore it. In both these cases we should condemn and even loathe ourselves if we acted otherwise, as having done, or omitted doing, what we ***ought*** not, as having acted beneath the dignity of our nature;—contrary to our most intimate sense of ***right*** and ***wrong***:—we should accuse ourselves as guilty of ingratitude, injustice, and inhumanity,—and be conscious of deserving the censure, and therefore dread the resentment, of all rational beings.—But in complying with the *obligation*, we feel joy and self approbation,—are conscious of an inviolable harmony between our nature and duty, and think ourselves intitled to the applause of every impartial spectator of our conduct.

To *describe* therefore what we cannot perhaps *define*, a state of ***moral obligation***, is "that state in which a creature, endued with such senses, powers, and affections as man, would condemn himself, and think he deserved the condemnation of all others, should he refuse to fulfil it; but would approve himself, and expect the approbation of all others, upon complying with it." 58 Moral obligation.

And

Of Moral Obligation. And we call him a MORAL AGENT, who is in such a *state*, or is subject to *moral obligation*. Therefore, as

59 Moral agent. man's *structure* and *connections* often subject him to such a state of *moral obligation*, we conclude that *he* is a *moral agent*. But as man may sometimes act without *knowing* what he does, as in cases of *frenzy* or *disease*, or in many *natural functions*; or, knowing what he does, he may act without *choice* or *affection*, as in cases of *necessity* or *compulsion*; therefore to denominate an

60 Moral action good and bad. action *moral*, i. e. *approveable*, or *blameable*, it must be done *knowingly* and *willingly*, or *from affection* and *choice*. "A *morally good action*, then, is to fulfil a *moral obligation* knowingly and willingly." And a *morally bad action* or an *immoral action*, is, "to violate a *moral obligation* knowingly and willingly."

61 Moral character and temper good and bad. As not an *action*, but a *series of actions*, constitute a *character*; as not an *affection* but a *series of affections*, constitute a *temper*; and as we denominate things by the gross, *à fortiori*, or by the qualities which chiefly prevail in them; therefore to call that a "*morally good character*, in which a *series of morally good actions* prevail;" and that a "*morally good temper*, in which a *series of morally good affections* have the ascendant." A bad character and bad temper are the reverse. But where the abovementioned *order* or *proportion* of passions is maintained, there a *series* of *morally* good *affections and actions* will prevail. *Therefore*, "to maintain that order and proportion, is to have a *morally good temper and character*." But a "morally good temper and character

62 How we come by the idea of moral obligation. is *moral rectitude*, *integrity*, *virtue*, or the *completion of duty*."

If it be asked after all, "how we come by the idea "of *moral obligation* or *duty*?" we may answer. That we come by it the same way as by our other *original* and *primary* perceptions. We receive them all from nature, or the great Author of nature. For this idea of *moral obligation* is not a creature of the mind, or dependent on any previous act of volition; but arises on certain occasions, or when certain other ideas are presented to the mind, as necessarily, instantaneously, and unavoidably, as *pain* does upon too near an approach to the fire, or *pleasure* from the fruition of any good. It does not, for instance, depend on our choice, whether we shall feel the *obligation* to succour a distressed parent, or to restore a deposit intrusted to us when it is recalled. We cannot call this a *compound idea* made up of one or more simple ideas. We may indeed, nay we must, have some ideas antecedent to it, *e. g.* that of a parent—in distress—of a child—able to relieve—of the relation of one to the other—of a trust—of right, &c. But none of these ideas constitute the perception of *obligation*. This is an idea quite distinct from, and something superadded to, the ideas of the correlatives, or the relation subsisting between them. These indeed, by a law of our nature, are the occasion of suggesting it; but they are as totally different from it as colours are from sounds. By sense of reflection we perceive the correlatives; our memory recalls the favours or deposit we received; the various circumstances of the case are matters of fact or experience; but some delicate inward *organ* or *power*, or call it what we please, does, by a certain instantaneous sympathy, antecedent to the cool deductions of reason, and independent of previous instruction, art, or volition, *perceive*

the moral harmony, the *living*, *irresistible charms of moral obligation*, which immediately interests the correspondent passions, and prompts us to fulfil its lawful dictates. Of Perception and Affection.

63 The use of reason in moral cases. We need not apprehend any danger from the quickness of its decisions, nor be frightened because it looks like *instinct*, and has been called so. Would we approve one for deliberating long, or reasoning the matter much at leisure, whether he should relieve a distressed parent, feed a starving neighbour, or restore the trust committed to him? should we not suspect the reasoner of knavery, or of very weak affections to virtue? We employ *reason*, and worthily employ it, in examining the condition, relations, and other circumstances of the agent or patient, or of those with whom either of them are connected, or, in other words, the *state of the case*: and in complicated cases, where the circumstances are many, it may require no small attention to find the true state of the case; but when the relations of the agent or patient and the circumstances of the action are obvious, or come out such after a fair trial, we should scarce approve him who demurs on the obligation to that conduct which the case suggests.

64 Pleasure, not the idea of obligation. From what has been said, it is evident, that it is not the pleasure or agreeable sensations which accompany the exercise of the several affections, nor those consequent to the actions, that constitute *moral obligation*, or excite in us the idea of it. That pleasure is posterior to the idea of obligation; and frequently we are obliged, and acknowledge ourselves under an obligation, to such affections and actions as are attended with pain; as in the ~~trials~~ of virtue, where we are obliged to sacrifice private to public good, or a present pleasure to a future interest. We have pleasure in serving an aged parent, but it is neither the perception nor prospect of that pleasure which gives us the the idea of obligation to that conduct.

CHAP. III. *The* FINAL *Causes of our moral Faculties of* PERCEPTION *and* AFFECTION.

65 The survey proposed. We have now taken a *general* prospect of MAN and of his *moral powers* and *connections*, and on these erected a scheme of *duty*, or *moral obligation*, which seems to be confirmed by *experience*, consonant to *reason*, and approved by his most inward and most sacred *senses*. It may be proper in the next place to take a more particular view of the *final causes* of those delicate *springs* by which he is *impelled* to action, and of those *clogs* by which he is restrained from it. By this detail we shall be able to judge of their aptitude to answer their end, in a creature endued with his *capacities*, subject to his *wants*, exposed to his *dangers*, and susceptible of his *enjoyments*; and from thence we shall be in a condition to pronounce concerning the *end* of his *whole structure*, its *harmony*, with its *state* and consequently its subserviency to answer the great and benevolent intentions of its author.

66 Inward anatomy of the system of the mind. The Supreme Being has seen fit to blend in the whole of things a prodigious variety of discordant and contrary principles, *light* and *darkness*, *pleasure* and *pain*, *good* and *evil*. There are multifarious natures, *higher* and *lower*, and many intermediate ones between the

wide-

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wide-distant extremes. These are differently situated, variously adjusted, and subjected to each other, and all of them subordinate to the order and perfection of the whole. We may suppose *man* placed as in a centre amidst those innumerable orders of beings, by his *outward* frame drawing to the *material* system, and by his *inward* connected with the INTELLECTUAL or *moral*, and of course affected by the laws which govern both, or affected by that good and that ill which result from those laws. In this infinite variety of *relations* with which he is surrounded, and of *contingencies* to which he is liable, he feels strong attractions to the *good*, and violent repulsions or aversions to the *ill*. But as good and ill are often blended, and wonderfully complicated one with the other; as they sometimes immediately produce and run up into each other, and at other times lie at great distances, yet by means of intervening links introduce one another; and as these effects are often brought about in consequence of hidden relations and general laws, of the energy of which he is an incompetent judge; it is easy for him to mistake *good* for *evil*, and *evil* for *good*, and consequently he may be frequently attracted by such things as are destructive, or repel such as are salutary. Thus, by the tender and complicated frame of his body, he is subjected to a great variety of ills, to *sickness*, *cold*, *heat*, *fatigue*, and innumerable *wants*. Yet his knowledge is so narrow withal, and his reason so weak, that in many cases he cannot judge, in the way of investigation or reasoning, of the connections of those effects with their respective causes, or of the various latent energies of natural things.—He is therefore informed of this connection by the experience of certain *senses* or *organs* of *perception*, which, by a mechanical instantaneous motion, feel the *good* and the *ill*, receiving pleasure from *one*, and pain from the *other*. By these, without any reasoning, he is taught to attract or choose what tends to his welfare, and to repel and avoid what tends to his ruin. Thus, by his senses of *taste* and *smell*, or by the *pleasure* he receives from certain kinds of food, he is admonished which agree with his constitution; and by an opposite sense of *pain* he is informed which sort disagree, or are destructive of it; but is not by means of this instructed in the inward natures and constitutions of things.

67 Use of appetites and passions.

Some of those senses are armed with strong degrees of *uneasiness* or *pain*, in order to urge him to seek after such objects as are suited to them. And these respect his more immediate and pressing *wants*; as the sense of *hunger*, *thirst*, *cold*, and the like; which, by their painful importunities, compel him to provide *food*, *drink*, *raiment*, *shelter*. Those instincts by which we are thus prompted with some kind of commotion or violence to attract and pursue *good*, or to repel and avoid *ill*, we call *appetites* and *passions*. By our senses then we are informed of what is *good* or *ill* to the *private system*, or the *individual*; and by our *private appetites* and *passions* we are impelled to one, and restrained from the other.

68 Man's outward state.

In consequence of this machinery, and the great train of wants to which our nature subjects us, we are engaged in a continued series of occupations, which often require much application of thought or great bodily labour, or both. The necessaries of life, food, clothes, shelter, and the like, must be provided; conveniencies must be acquired to render life still more easy and comfortable. In order to obtain these, arts, industry, manufactures, and trade, are necessary. And to secure to us the peaceable enjoyment of their fruits, civil government, policy, and laws, must be contrived, and the various business of public life carried on: thus, while man is concerned and busied in making provision, or obtaining security for himself, he is by degrees engaged in connections with a family, friends, neighbours, a community, or a commonwealth. Hence arise new wants, new interests, new cares, and new employments. The passions of one man interfere with those of another. Interests are opposed. Competitions arise, contrary courses are taken. Disappointments happen, distinctions are made, and parties formed. This opens a vast scene of distraction and embarrassment, and introduces a mighty train of good and ill, both public and private. Yet amidst all this confusion and hurry, plans of action must be laid, consequences foreseen or guarded against, inconveniences provided for; and frequently particular resolutions, must be taken, and schemes executed, without reasoning or delay.

69 Provisions for it.

Now what provision has the Author of our nature made for this necessitous condition? how has he fitted the actor, man, for playing his part in this perplexed and busy scene?

70 By public senses and passions.

Our supreme Parent, watchful for the whole, has not left himself without a witness here neither, and hath made nothing imperfect, but all things are double one against the other. He has not left man to be informed, only by the cool notices of reason, of the *good* or *ill*, the *happiness* or *misery* of his fellow-creatures.—He has made him sensible of their good and happiness, but especially of their ill and misery, by an immediate sympathy, or quick *feeling* of *pleasure* and of *pain*.

71 Pity.

The latter we call PITY or COMPASSION. For the former, though every one, who is not quite divested of humanity, feels it in some degree, we have not got a name, unless we call it CONGRATULATION or *joyful* SYMPATHY, or that *good humour* which arises on seeing others pleased or happy. Both these feelings have been called in general the PUBLIC OR COMMON SENSE, κοινη μνημοσυνη, by which we feel for others, and are interested in their concerns as really, though perhaps less sensibly than in our own.

72 Congratulation.

73 Resentment.

When we see our fellow-creatures unhappy through the fault or injury of others, we feel *resentment* or *indignation* against the *unjust* causers of that misery. If we are conscious that it has happened through our fault or *injurious* conduct, we feel *shame*; and both these classes of *senses* and *passions*, regarding *misery* and *wrong*, are armed with such sharp sensations of *pain*, as not only prove a powerful guard and security to the *species*, or *public system*, against those ills it may, but serve also to lessen or remove those ills it does, suffer. Compassion draws us out of ourselves to bear a part of the misfortunes of others, powerfully solicits us in their favour, melts us at the sight of their distress, and makes us in some degree unhappy till they are relieved from it. It is peculiarly well adapted to the condition of human life, because it is much more and oftener in our power to do mischief than good, and to prevent or lessen misery than to communicate positive

tive happiness; and therefore it is an admirable restraint upon the more *selfish* passions, or those violent impulses that carry us to the hurt of others.

74 Public affections.

There are other particular *instincts* or *passions* which interest us in the concerns of others, even while we are most busy about our own, and which are strongly attractive of *good*, and repulsive of *ill* to them. Such are *natural affection*, *friendship*, *love*, *gratitude*, *desire of fame*, *love of society*, of *one's country*, and others that might be named. Now as the *private* appetites and passions were found to be armed with strong sensations of desire and uneasiness, to prompt man the more effectually to sustain labours, and to encounter dangers in pursuit of those goods that are necessary to the preservation and welfare of the individual, and to avoid those ills which tend to his destruction; in like manner it was necessary, that this *other* class of desires and affections should be prompted with as quick sensations of pain, not only to counteract the strength of their antagonists, but to engage us in a virtuous activity for our relations, families, friends, neighbours, country. Indeed our *sense* of *right* and *wrong* will admonish us that it is our *duty*, and *reason* and *experience* farther assure us that it is both our *interest* and best *security*, to promote the happiness of others; but that *sense*, that *reason*, and that *experience*, would frequently prove but weak and ineffectual prompters to such a conduct, especially in cases of danger and hardship, and amidst all the importunities of nature, and that constant hurry in which the *private* passions involve us, without the aid of those particular *kind* affections which mark out to us particular spheres of duty, and with an agreeable violence engage and fix us down to them.

75 Contrast or balance of passions.

It is evident, therefore, that those two classes of affection, the *private* and *public*, are set one against the other, and designed to controul and limit each other's influence, and thereby to produce a just balance in the whole*. In general, the violent sensations of pain and uneasiness which accompany hunger, thirst, and the other private appetites, or too great fatigue of mind as well as of body, prevent the individual from running to great excesses in the exercise of the higher functions of the mind, as too intense thought in the search of truth, violent application to business of any kind, and different degrees of romantic heroism. On the other hand, the finer senses of *perception*, and those *generous desires* and *affections* which are connected with them, the *love of action*, of *imitation*, of *truth*, *honour*, *public virtue*, and the like, are wisely placed in the opposite scale, in order to prevent us from sinking into the dregs of the *animal* life, and debasing the dignity of man below the condition of brutes. So that, by the mutual re-action of those opposite powers, the bad effects are prevented that would naturally result from their acting singly and apart, and the good effects are produced which each are severally formed to produce.

* Vide Hutcheson's Conduct of the Passions, treat. I. § 2.

76 Contrast or balance of public and private passions.

The same wholesome opposition appears likewise in the particular counter-workings of the *private* and *public* affections one against the other. Thus *compassion* is adapted to counterpoise the *love of ease*, of *pleasure*, and of *life*, and to disarm or to set bounds to *resentment*; and *resentment* of injury done to ourselves, or to our friends who are dearer than ourselves, prevents an effeminate *compassion* or *consternation*, and gives us a noble contempt of labour, pain, and death. *Natural affection*, *friendship*, *love of one's country*, nay, *zeal* for any particular virtue, are frequently more than a match for the whole train of *selfish* passions. —On the other hand, without that intimate overruling passion of *self-love*, and those private desires which are connected with it, the *social* and *tender instincts* of the human heart would degenerate into the wildest dotage, the most torturing anxiety, and downright frenzy.

77 Contrasts among those of the same classes.

But not only are the different orders or classes of affection checks one upon another, but passions of the same classes are mutual clogs. Thus, how many are with-held from the violent outrages of *resentment* by *fear?* and how easily is *fear* controlled in its turn, while mighty wrongs awaken a mighty *resentment!* The *private* passions often interfere, and therefore moderate the violence of each other; and a calm *self-love* is placed at their head, to direct, influence, and controul their particular attractions and repulsions. The *public* affections likewise restrain one the other: and all of them are put under the controul of a calm dispassionate *benevolence*, which ought in like manner to direct and limit their particular motions. Thus most part, if not all the passions, have a twofold aspect, and serve a twofold end. In *one* view they may be considered as *powers*, impelling mankind to a certain course, with a *force* proportioned to the *apprehended moment* of the good they aim at. In *another* view they appear as *weights*, balancing the action of the *powers*, and controling the violence of their impulses. By means of these *powers* and *weights* a natural *poise* is settled in the human breast by its all-wise Author, by which the creature is kept tolerably steady and regular in his course, amidst that variety of stages through which he must pass.

78 Particular perceptions or instincts of approbation.

But this is not all the provision which God has made for the hurry and perplexity of the scene in which man is destined to act. Amidst those infinite attractions and repulsions towards private and public good and ill, mankind either cannot often foresee the *consequences* or *tendencies* of all their actions towards one or other of these, especially where those tendencies are intricate and point different ways, or those consequences remote and complicated; or though, by careful and cool enquiry, and a due improvement of their rational powers, they might find them out, yet, distracted as they are with business, amused with trifles, dissipated by pleasure, and disturbed by passion, they either have or can find no leisure to attend to those consequences, or to examine how far this or that conduct is productive of private or public good on the whole. Therefore, were it left entirely to the slow and sober deductions of reason to trace those tendencies, and make out those consequences, it is evident, that in many particular instances the business of life must stand still, and many important occasions of action be lost, or perhaps the grossest blunders be committed. On this account, the Deity, besides that general approbation which we bestow on every degree of *kind* affection, has moreover implanted in man many particular *perceptions* or *determinations* to approve of certain *qualities* or *actions*, which, in effect, tend to the advantage of society, and are connected

with

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with private good, though he does not always see that tendency, nor mind that connection. And these *perceptions* or *determinations* do without reasoning point out, and, antecedent to views of interest, prompt to a conduct beneficial to the *public*, and useful to the *private* system. Such is that *sense of candour and veracity*, that *abhorrence of fraud and falsehood*, that *sense of fidelity*, *justice*, *gratitude*, *greatness of mind*, *fortitude*, *clemency*, *decorum*; and that *disapprobation of knavery*, *injustice*, *ingratitude*, *meanness of spirit*, *cowardice*, *cruelty*, and *indecorum*, which are natural to the human mind. The former of those dispositions, and the actions flowing from them, are approved, and those of the latter kind disapproved by us, even abstracted from the view of their tendency or conduciveness to the happiness or misery of others, or of ourselves. In one we discern a *beauty*, a *superior excellency*, a congruity to the *dignity* of man; in the other a *deformity*, a *littleness*, a *debasement*, of human nature.

79 Others of an inferior order.

There are other principles also connected with the good of society, or the happiness and perfection of the individual, though that connection is not immediately apparent, which we behold with real complacency and approbation, though perhaps inferior in degree, if not in kind, such as *gravity*, *modesty*, *simplicity of deportment*, *temperance*, *prudent œconomy*; and we feel some degree of contempt and dislike where they are wanting, or where the opposite qualities prevail. These and the like *perceptions* or *feelings* are either different *modifications* of the *moral sense*, or *subordinate* to it, and plainly serve the same important purpose, being expeditious *monitors*, in the several emergencies of a various and distracted life, of what is *right*, what is *wrong*, what is to be *pursued*, and what *avoided*; and, by the pleasant or painful consciousness which attends them, exerting their influence as powerful *prompters* to a suitable conduct.

80 Their general tendencies.

From a slight inspection of the above-named principles, it is evident they all carry a friendly aspect to *society* and the *individual*, and have a more immediate or a more remote tendency to promote the *perfection* or *good* of both. This tendency cannot be always foreseen, and would be often mistaken or seldom attended to by a weak, busy, short-sighted creature like man, both rash and variable in his opinions, a dupe to his own passions or to the designs of others, liable to sickness, to want, and to error. Principles, therefore, which are so nearly linked with *private security* and *public good*, by directing him, without operose reasoning, where to find *one*, and how to promote the *other*; and, by prompting him to a conduct conducive to both, are admirably adapted to the exigencies of his present state, and wisely calculated to obtain the ends of universal benevolence.

81 Passions fitted to a state of trial;

It were easy, by considering the subject in another light, to show, in a curious detail of particulars, how wonderfully the inside of man, or that astonishing train of *moral powers* and *affections* with which he is endued, is fitted to the several stages of that *progressive* and *probationary* state through which he is destined to pass. As our faculties are narrow and limited, and rise from very small and imperfect beginnings, they must be improved by exercise, by attention, and repeated trials. And this holds true, not only of our *intellectual*, but of our *moral* and *active* powers. The former are liable to errors in speculation, the latter to blunders in practice, and both often terminate in misfortunes and pains. And those errors and blunders are generally owing to our passions, or to our too forward and warm *admiration* of those partial *goods* they naturally pursue, or to our fear of those partial *ills* they naturally repel. Those misfortunes, therefore, lead us back to consider where our misconduct lay, and whence our errors flowed; and consequently are salutary pieces of trial, which tend to enlarge our views, to *correct* and *refine* our passions, and consequently improve both our *intellectual* and *moral* powers. Our passions then are the rude materials of our virtue, which Heaven has given us to work up to refine and polish into an harmonious and divine piece of workmanship. They furnish out the whole machinery, the calms and storms, the lights and shades of human life. They show mankind in every attitude and variety of character, and give *virtue* both its struggles and triumphs. To conduct them well in every state, is merit; to abuse or misapply them, is demerit.

82 To a progressive state.

The different sets of *senses*, *powers*, and *passions*, which unfold themselves in those successive stages, are both necessary and adapted to that *rising* and *progressive* state. Enlarging views and growing connections require new passions and new habits; and thus the mind, by these continually expanding and finding a progressive exercise, rises to higher improvements, and pushes forward to maturity and perfection.

83 Harmony of our structure and state.

In this beautiful œconomy and harmony of our structure, both outward and inward, with that state we may at once discern the great lines of our duty traced out in the fairest and brightest characters, and contemplate with admiration a more august and marvellous scene of divine wisdom and goodness laid in the human breast, than we shall perhaps find in the whole compass of nature.

84 In what œconomy virtue consists.

From this detail it appears, that man, by his original frame, is made for a *temperate*, *compassionate*, *benevolent*, *active*, and *progressive* state. He is strongly *attractive* of the *good*, and *repulsive* of the *ills* which befal others as well as himself. He feels the highest *approbation* and *moral complacence* in those affections, and in those actions, which immediately and directly respect the good of others, and the highest *disapprobation* and *abhorrence* of the contrary. Besides these, he has many particular *perceptions* or *instincts* of *approbation*, which, though perhaps not of the same kind with the others, yet are accompanied with correspondent degrees of affection, proportioned to their respective tendencies to the *public good*. *Therefore*, by acting agreeably to these principles, *man* acts agreeable to his structure, and fulfils the benevolent intentions of its author. But we call a thing *good* when it answers its *end*, and a creature *good*, when he acts in a *conformity* to his *constitution*. Consequently, *man* must be denominated *good* or *virtuous* when he acts suitably to the *principles* and *destination* of his nature.

PART. II.

CHAP. I. *The principal distinctions of* DUTY *or* VIRTUE.

WE have now considered the *constitution* and *connections* of *man*, and on those erected a general system of *duty* or *moral obligation*, consonant to *reason*, approved by his most sacred and intimate *sense*, suitable to his *mixed condition*, and confirmed by the *experience* of mankind. We have also traced the *final causes* of his *moral faculties* and *affections* to those noble purposes they answer, with regard both to the *private* and the *public system*.

85 General division of duty. From this induction it is evident, that there is one order or class of duties which *man* owes to *himself*: another to *society*: and a third to God.

86 Duty to one's self. The duties he owes to *himself* are founded chiefly on the *defensive* and *private* passions, which prompt him to pursue whatever tends to *private good* or *happiness*, and to avoid or ward off whatever tends to *private ill* or *misery*. Among the various goods which allure and solicit him, and the various ills which attack or threaten him, "to be intelligent and accurate in selecting *one*, and rejecting the *other*, or in preferring the most *excellent goods*, and avoiding the most *terrible ills*, when there is a competition among either, and to be discreet in using the best means to attain the *goods* and avoid the *ills*, is what we call *prudence*." This, in our *inward* frame, corresponds to *sagacity*, or *quickness of sense*, in our *outward*.—"To proportion our *defensive passions* to our *dangers*, we call *fortitude*; which always implies "a just mixture of calm resentment or animosity, and well governed caution." And this *firmness of mind* answers to the *strength* and *muscling* of the *body*. And "duly to adjust our *private passions* to our wants, or to the respective moment of the good we effect or pursue, we call *temperance*;" which does therefore always imply, in this large sense of the word, "a just balance or command of the passions."

87 Duties to society. The *second class* of *duties* arises from the *public* or *social affections*, "the just harmony or proportion of which to the *dangers* and *wants* of others, and to the several *relations* we bear, commonly goes by the name of *justice*." This includes the whole of our duty to *society*, to our *parents*, and the *general polity* of *nature*; particularly *gratitude*, *friendship*, *sincerity*, *natural affection*, *benevolence*, and the other *social virtues*: This, being the *noblest temper*, and *fairest complexion* of the soul, corresponds to the *beauty* and *fine proportion* of the person. The virtues comprehended under the former class, especially *prudence* and *fortitude*, may likewise be transferred to this; and according to the various circumstances in which they are placed, and the more confined or more extensive sphere in which they operate, may be denominated *private*, *œconomical*, or *civil prudence*, *fortitude*, &c. These direct our conduct with regard to the *wants* and *dangers* of those lesser or greater circles with which they are connected.

88 Duties to God. The third class of duties respects the DEITY, and arises from the *public affections*, and the several glorious *relations* which he sustains to us as our *creator*, *benefactor*, *lawgiver*, *judge*, &c.

89 Method. We chose to consider this *set* of duties in the last place; because, though *prior* in dignity and excellency, they seem to be *last* in order of time, as thinking it the most simple and easy method to follow the gradual progress of nature, as it takes its rise from individuals, and spreads through the *social* system, and still ascends upwards, till at length it stretches to its Almighty Parent and Head, and so terminates in those duties which are *highest* and *best*.

90 Piety. The duties resulting from these *relations* are, *reverence*, *gratitude*, *love resignation*, *dependence*, *obedience*, *worship*, *praise*: which, according to the model of our finite capacities, must maintain some sort of proportion to the grandeur and perfection of the object whom we venerate, love, and obey. "This *proportion* or *harmony* is expressed by the general name of *piety* or *devotion*," which is always stronger or weaker according to the greater or less apprehended excellency of its object. This sublime principle of virtue is the enlivening soul which animates the *moral system*, and that cement which binds and sustains the other duties which *man* owes to *himself* or to *society*.

91 Conscience. This then is the general temper and constitution of virtue, and these are the principal lines or divisions of duty. To those good dispositions which respect the several objects of our duty, and to all actions which flow from such dispositions, the mind gives its sanction or testimony. And this sanction or judgment concerning the moral quality, or the goodness of actions or dispositions, moralists call *conscience*. When it judges of an action that is to be performed, it is called an *antecedent conscience*; and when it passes sentence on an action which is performed, it is called a *subsequent conscience*. The tendency of an action to produce happiness, or its external conformity to a law, is termed its *material* goodness. But the good dispositions from which an action proceeds, or its conformity to law in every respect, constitutes its *formal* goodness.

92 Its divisions. When the mind is ignorant or uncertain about the moment of an action or its tendency to private or public good; or when there are several circumstances in the case, some of which, being doubtful render the mind dubious concerning the morality of the action; this is called a *doubtful* or *scrupulous conscience*; if it mistakes concerning these, it is called an *erroneous conscience*. If the *error* or *ignorance* is *involuntary* or *invincible*, the action proceeding from that *error*, or from that *ignorance*, is reckoned *innocent*, or not imputable. If the error or ignorance is *supine* or *affected*, *i. e.* the effect of negligence, or of affectation and wilful inadvertence, the conduct flowing from such error, or such ignorance, is *criminal* and *imputable*.—Not to follow one's conscience, though erroneous and ill-informed, is *criminal*, as it is the guide of life: and to counteract it, shows a depraved and incorrigible spirit. Yet to follow an erroneous conscience is like-

Of Man's duty to Himſelf.

wiſe criminal, if that error which miſled the conſcience was the effect of inattention, or of any criminal paſſion*.

If it be aſked, "How an erroneous conſcience ſhall be rectified, ſince it is ſuppoſed to be the only guide of life, and judge of morals?" we anſwer, in the very ſame way that we would rectify reaſon if at any time it ſhould judge wrong, as it often does, *viz.* by
93 giving it proper and ſufficient materials for judging right, *i. e.* by inquiring into the whole ſtate of the caſe, the relations, connections, and ſeveral obligations of the actor, the conſequences and other circumſtances of the action, or the ſurpluſage of private or public good which reſults, or is likely to reſult, from the action or from the omiſſion of it. If thoſe circumſtances are fairly and fully ſtated, the conſcience will be juſt and impartial in its deciſion: for, by a neceſſary law of our nature, it approves and is well affected to the *moral form;* and if it ſeems to approve of *vice* or *immorality*, it is always under the notion or maſk of ſome *virtue.* So that, ſtrictly ſpeaking, it is not conſcience which errs; for its ſentence is always conformable to the view of the caſe which lies before it; and is *juſt*, upon the ſuppoſition that the caſe is truly ſuch as it is repreſented to it. All the fault is to be imputed to the agent, who neglects to be better informed, or who, through weakneſs or wickedneſs, haſtens to paſs ſentence from an imperfect evidence.

How conſcience is to be rectified.

* Hutcheſ. Mor. Inſt. lib. 2. c. 3.

Chap. II. *Of Man's duty to* Himself. *Of the Nature of* Good, *and the Chief* Good.

94 Every creature, by the conſtitution of his nature, is determined to love himſelf; to purſue whatever tends to his preſervation and happineſs, and to avoid whatever tends to his hurt and miſery. Being endued with ſenſe and perception, he muſt neceſſarily receive *pleaſure* from ſome objects, and *pain* from others. Thoſe objects which give pleaſure are called *good;* and thoſe which give pain, *evil.* To the former he feels that attraction or motion we call *deſire*, or *love;* to the latter, that impulſe we call *averſion*, or *hatred.*— To objects which ſuggeſt neither pleaſure nor pain, and are apprehended of no uſe to procure one or ward off the other, we feel neither *deſire* nor averſion; and ſuch objects are called *indifferent.* Thoſe objects which do not of themſelves produce pleaſure or pain, but are the *means* of procuring either, we call *uſeful* or *noxious.* Towards them we are affected in a ſubordinate manner, or with an *indirect* and *reflective* rather than a *direct* and *immediate* affection. All the original and particular affections of our nature lead us out to and ultimately reſt in the firſt kind of objects, *viz.* thoſe which give immediate pleaſure, and which we therefore call *good, directly ſo.* The calm affection of *ſelf-love* alone is converſant about ſuch objects as are only *conſequentially good*, or merely uſeful to ourſelves.

Diviſions of good.

95 But, beſides thoſe ſorts of objects which we call *good*, merely and ſolely as they give pleaſure, or are means of procuring it, there is an higher and nobler ſpecies of good, towards which we feel that peculiar movement we call *approbation* or *moral complacency;* and which we *therefore* denominate *moral good.* Such are our affections, and the conſequent actions to them. The perception of this is, as has been already obſerved, quite diſtinct in kind from the perception of other ſpecies; and though it may be connected with *pleaſure* or *advantage* by the benevolent conſtitution of nature, yet it conſtitutes a *good* independent of that pleaſure and that advantage, and far ſuperior not in degree only but in dignity to both. The *other, viz.* the *natural good*, conſiſts in obtaining thoſe pleaſures which are adapted to the peculiar ſenſes and paſſions ſuſceptible of them, and is as various as are thoſe ſenſes and paſſions. This, *viz.* the *moral* good, lies in the right conduct of the ſeveral ſenſes and paſſions, or their juſt proportion and accommodation to their reſpective objects and relations; and this is of a more ſimple and invariable kind.

Moral good.

By our ſeveral ſenſes we are capable of a great variety of pleaſing ſenſations. Theſe conſtitute diſtinct 96
ends or objects ultimately purſuable for their own ſake. To theſe ends, or ultimate objects, correſpond peculiar appetites or affections, which prompt the mind to purſue them. When theſe ends are attained, there it reſts, and looks no farther. Whatever therefore is purſuable, not on its own account, but as ſubſervient or neceſſary to the attainment of ſomething elſe that is intrinſically valuable for its own ſake, be that value ever ſo great or ever ſo ſmall, we call a *mean*, and not an *end.* So that *ends* and *means* conſtitute the *materials* or the very *eſſence* of our *happineſs.* Conſequently happineſs, *i. e. human* happineſs, cannot be one ſimple uniform thing in creatures conſtituted, as we are, with ſuch various ſenſes of pleaſure, or ſuch different capacities of enjoyment. Now, the ſame principle, or law of our nature, which determines us to purſue any one end or ſpecies of good, prompts us to purſue every other end or ſpecies of good of which we are ſuſceptible, or to which our Maker has adapted an original propenſion. But, amidſt the great multiplicity of *ends* or *goods* which form the various ingredients of our happineſs, we perceive an evident *gradation* or *ſubordination* ſuited to that gradation of *ſenſes, powers*, and *paſſions*, which prevails in our mixed and various conſtitution, and to that aſcending ſeries of connections which open upon us in the different ſtages of our progreſſive ſtate.

Human happpeſs.

Thus the goods of the *body*, or of the *external ſenſes*, 97
ſeem to hold the loweſt rank in this gradation or ſcale of goods. Theſe we have in common with the brutes; and though many men are brutiſh enough to purſue the goods of the body with a more than brutal fury, yet, when at any time they come in competition with goods of an higher order, the unanimous verdict of mankind, by giving the laſt the preference condemns the firſt to the meaneſt place. Goods conſiſting in exterior ſocial connections, as *fame, fortune, power, civil authority*, ſeem to ſucceed next, and are chiefly valuable as the means of procuring *natural* or *moral* good, but principally the latter. Goods of the *intellect* are ſtill ſuperior, as *taſte, knowledge, memory, judgment*, &c. The higheſt are moral goods of the mind, directly and ultimately regarding ourſelves, *command of the appetites* and *paſſions, prudence, fortitude, benevolence*, &c. Theſe are the great objects of our purſuit, and the principal ingredients of our hap-

Gradation of goods.

Of Man's duty to Himself. pinefs. Let us confider each of them as they rife one above the other in this natural feries or fcale, and touch briefly on our obligations to purfue them.

98 Goods of the body. Thofe of the body are *health*, *ftrength*, *agility*, *hardinefs*, and *patience of change*, *neatnefs*, and *decency*.

99 Good health; Good health, and a regular eafy flow of fpirits, are in themfelves fweet natural enjoyments, a great fund of pleafure, and indeed the proper feafoning which gives a flavour and poignancy to every other pleafure. The want of health unfits us for moft duties of life, and is efpecially an enemy to the focial and humane affections, as it generally renders the unhappy fufferer peevifh and fullen, difgufted at the allotments of Providence, and confequently apt to entertain fufpicious and gloomy fentiments of its Author. It obftructs the free exercife and full improvement of our reafon, makes us a burden to our friends, and ufelefs to fociety. Whereas the uninterrupted enjoyment of good health is a conftant fource of good humour, and good humour is a great friend to opennefs and benignity of heart, enables us to encounter the various ills and difappointments of life with more courage, or to fuftain them with more patience; and, in fhort, conduces much, if we are otherwife duly qualified, to our acting our part in every exigency of life with more firmnefs, confiftency, and dignity. Therefore it imports us much to preferve and improve an habit or enjoyment, without which every other external entertainment is taftelefs, and moft other advantages of little avail.—

100 How preferved. And this is beft done by a ftrict temperance in diet and regimen, by regular exercife, and by keeping the mind ferene and unruffled by violent paffions, and unfubdued by intenfe and conftant labours, which greatly impair and gradually deftroy the ftrongeft conftitutions.

101 Strength, agility, &c. *Strength*, *agility*, *hardinefs*, and *patience of change*, fuppofe health, and are unattainable without it; but they imply fomething more, and are neceffary to guard it, to give us the perfect ufe of life and limbs, and to fecure us againft many otherwife unavoidable ills.— The exercife of the neceffary manual, and of moft of the elegant arts of life, depends on ftrength and agility of body: perfonal dangers, private and public dangers, the demands of our friends, our families, and country, require them; they are neceffary in war, and ornamental in peace; fit for the employment of a country and a town life, and they exalt the entertainments and diverfions of both.

102 How attained. They are chiefly obtained by moderate and regular exercife.

103 Patience of change; Few are fo much raifed above want and dependence, or fo exempted from bufinefs and care, as not to be often expofed to inequalities and changes of diet, exercife, air, climate, and other irregularities. Now, what can be fo effectual to fecure one againft the mifchiefs arifing from fuch unavoidable alterations, as hardinefs, and a certain verfatility of conftitution which can bear extraordinary labours, and fubmit to great changes, without any fenfible uneafinefs or bad confequences.

104 How attained. This is beft attained, not by an over-great delicacy and minute attention to forms, or by an invariable regularity in diet, hours, and way of living, but rather by a bold and difcreet latitude of regimen. Befides, deviations from eftablifhed rules and forms of living, if kept within the bounds of fobriety and reafon, are friendly to thought and original fentiments, animate the dull fcene of ordinary life and bufinefs, and agreeably ftir the paffions, which ftagnate or breed ill-humour in the calms of life.

Neatnefs, *cleanlinefs*, and *decency*, to which we may add *dignity* of *countenance*, and *demeanor*, feem to have fomething refined and moral in them: at leaft we generally efteem them indications of an orderly, genteel, and well-governed mind, confcious of an inward worth, or the refpect due to one's nature. Whereas *naftinefs*, *flovenlinefs*, *aukwardnefs*, and *indecency*, are fhrewd fymptoms of fomething mean, carelefs, and deficient, and betray a mind untaught, illiberal, unconfcious of what is due to one's felf or to others. How much cleanlinefs conduces to health, needs hardly to be mentioned; and how neceffary it is to maintain one's character and rank in life, and to render us agreeable to others as well as to ourfelves, is as evident.—There are certain motions, airs, and geftures, which become the human countenance and form, in which we perceive a *comelinefs*, *opennefs*, *fimplicity*, *gracefulnefs*; and there are others, which to our fenfe of decorum appear *uncomely*, *affected*, *difingenuous*, and *aukward*, quite unfuitable to the native dignity of our face and form. The *firft* are in themfelves the moft eafy, natural, and commodious, give one boldnefs and prefence of mind, a modeft affurance, an addrefs both awful and alluring; they befpeak candour and greatnefs of mind, raife the moft agreeable prejudices in one's favour, render fociety engaging, command refpect, and often love, and give weight and authority both in converfation and bufinefs; in fine, they are the colouring of virtue, which fhow it to the greateft advantage in whomfoever it is; and not only imitate, but in fome meafure fupply it where it is wanting. Whereas the laft, *viz. rudenefs*, *affectation*, *indecorum*, and the like, have all the contrary effects; they are burdenfome to one's felf, a difhonour to our nature, and a nuifance in fociety. The former qualities or goods are beft attained by a liberal education, by preferving a juft fenfe of the dignity of our nature, by keeping the beft and politeft company, but, above all, by acquiring thofe virtuous and ennobling habits of mind which are decency in perfection, which will give an air of unaffected grandeur, and fpread a luftre truly engaging over the whole form and deportment. 105 Neatnefs, decency, &c. 106 How attained.

We are next to confider thofe goods which confift in exterior focial connections, as *fame*, *fortune*, *civil authority*, *power*. 107 Goods of exterior focial connections.

The firft has a two-fold afpect, as a good pleafant in itfelf, or gratifying to an original paffion, and then as expedient or ufeful towards a farther end. Honour from the wife and good, on the account of a virtuous conduct, is regaling to a good man; for then his heart re-echoes to the grateful found. There are few quite indifferent even to the commendation of the vulgar. Though we cannot approve that conduct which proceeds entirely from this principle, and not from good affection or love of the conduct itfelf, yet, as it is often a guard and additional motive to virtue in creatures imperfect as we are, and often diftracted by interfering paffions, it might be dangerous to fupprefs it altogether, however wife it may be to reftrain it within due bounds, and however laudable to ufe it only as a fcaffolding to our virtue, which may be taken down when that glorious ftructure is finifhed, but hardly till then. 108 Fame.

Of Man's duty to Himself.

then. To pursue fame for itself, is innocent; to regard it only as an auxiliary to virtue, is noble; to seek it chiefly as an engine of public usefulness, is still more noble, and highly praise-worthy. For though the opinion and breath of men are transient and fading things, often obtained without merit, and lost without cause; yet as our business is with men, and as our capacity of serving them is generally increased in proportion to their esteem of us, therefore sound and well-established *moral* applause may and will be modestly, not ostentatiously, sought after by the *good*; not indeed as a solitary refined sort of luxury, but as a public and proper instrument to serve and bless mankind. At the same time they will learn to despise that reputation which is founded on rank, fortune, and any other circumstances or accomplishments that are foreign to real merit, or to useful services done to others, and think that praise of little avail which is purchased without desert, and bestowed without judgment.

109 Fortune, power, &c.

Fortune, *power*, and *civil authority*, or whatever is called influence and weight among mankind, are *goods* of the *second* division, that is, valuable and pursuable only as they are *useful*, or as means to a farther end, *viz.* procuring or preserving the immediate objects of enjoyment or happiness to ourselves or others. Therefore to love such goods on their own account, and to pursue them as ends, not the means of enjoyment, must be highly preposterous and absurd. There can be no measure, no limit, to such pursuit; all must be whim, caprice, extravagance. Accordingly such appetites, unlike all the *natural* ones, are increased by possession, and whetted by enjoyment. They are always precarious, and never without fears, because the objects lie without one's self; they are seldom without sorrow and vexation, because no accession of wealth or power can satisfy them.

110 How far pursuable.

But if those goods are considered only as the materials or means of private or public happiness, then the same obligations which bind us to pursue the latter, bind us likewise to pursue the former. We may, and no doubt we ought, to seek such a measure of wealth as is necessary to supply all our real wants, to raise us above servile dependence, and provide us with such conveniences as are suited to our rank and condition in life. To be regardless of this measure of wealth, is to expose ourselves to all the temptations of poverty and corruption; to forfeit our natural independency and freedom; to degrade, and consequently to render the rank we hold, and the character we sustain in society, useless, if not contemptible. When these important ends are secured, we ought not to murmur or repine that we possess no more; yet we are not secluded by any obligation, moral or divine, from seeking more, in order to give us that happiest and most god-like of all powers, the *power* of *doing good*. A supine indolence in this respect is both absurd and criminal; *absurd*, as it robs us of an inexhausted fund of the most refined and durable enjoyments; and *criminal*, as it renders us so far useless to the society to which we belong.

111 Avarice.

"That pursuit of wealth which goes beyond the former end, viz. the obtaining the necessaries, or such conveniencies of life, as, in the estimation of reason, not of vanity or passion, are suited to our rank and condition, and yet is not directed to the latter, viz. the doing good, is what we call *avarice*." And "that pursuit of *power*, which, after securing one's self, *i. e.* having attained the proper independence and liberty of a rational social creature, is not directed to the good of others, is what we call *ambition*, or the *lust of power*;

112 Ambition.

To what extent the strict measures of virtue will allow us to pursue either wealth or power, and civil authority, is not perhaps possible precisely to determine. That must be left to prudence, and the peculiar character, condition, and other circumstances of each man. Only thus far a limit may be set, that the pursuit of either must encroach upon no other duty or obligation which we owe to ourselves, to society, or to its parent and head. The same reasoning is to be applied to *power* as to *wealth*. It is only valuable as an instrument of our own security, and of the free enjoyment of those original goods it may, and often does, administer to us, and as an engine of more extensive happiness to our friends, our country, and mankind.

113 How fame and power are attained.

Now the best, and indeed the only way to obtain a solid and lasting fame, is an uniform inflexible course of virtue, the employing one's ability and wealth in supplying the wants, and using one's power in promoting or securing the happiness, the rights and liberties of mankind, joined to an universal affability and politeness of manners. And surely one will not mistake the matter much, who thinks the same course conducive to the acquiring greater accessions both of wealth and power; especially if he adds to those qualifications a vigorous industry, a constant attention to the characters and wants of men, to the conjunctures of times, and continually-varying genius of affairs; and a steady intrepid honesty, that will neither yield to the allurements, nor be over-awed with the terrors, of that corrupt and corrupting scene in which we live. We have sometimes heard indeed of other ways and means, as fraud, dissimulation, servility, and prostitution, and the like ignoble arts, by which the men of the world (as they are called, shrewd politicians, and men of address!) amass wealth, and procure power; but as we want rather to form a man of virtue, an honest, contented, happy man, we leave to the men of the world their own ways, and permit them, unenvied and unimitated by us, to reap the fruit of their doings.

114 Goods of the intellect.

The next species of objects in the scale of good, are the goods of the *intellect*, as *knowledge*, *memory*, *judgement*, *taste*, *sagacity*, *docility*, and whatever else we call intellectual virtues. Let us consider them a little, and the means as well as obligations to improve them.

115 Their moment.

As *man* is a *rational* creature, capable of knowing the differences of things and actions;—as he not only sees and feels what is present, but remembers what is past, and often foresees what is future;—as he advances from small beginnings by slow degrees, and with much labour and difficulty, to knowledge and experience;—as his opinions sway his passions,—as his passions influence his conduct,—and as his conduct draws consequences after it, which extend not only to the present but to the future time, and therefore is the principal source of his happiness or misery; it is evident, that he is formed for intellectual improvements, and that it must be of the utmost consequence for him to improve and cultivate his intellectual powers, on which those opinions, those passions, and that conduct depend*.

* Philos. Sinic. Confuc. lib. 1. § 3, 4. &c.

But besides the future consequences and moment of improving

improving our intellectual powers, their immediate exercise on their proper objects yields the most rational and refined pleasures. Knowledge, and a right taste in

116 The pleasures they give. the arts of *imitation* and *design*, as *poetry*, *painting*, *sculpture*, *music*, *architecture*, afford not only an innocent, but a most sensible and sublime entertainment. By

117 Knowledge and taste; these the understanding is instructed in ancient and modern life, the history of men and things, the energies and effects of the passions, the consequences of virtue and vice; by these the imagination is at once entertained and nourished with the beauties of nature and art, lighted up and spread out with the novelty, grandeur, and harmony of the universe; and, in fine, the passions are agreeably roused, and suitably engaged, by the greatest and most interesting objects that can fill the human mind. He who has a taste formed to these ingenious delights, and plenty of materials to gratify it, can never want the most agreeable exercise and entertainment, nor once have reason to make that fashionable complaint of the tediousness of time. Nor can he want a proper subject for the discipline and improvement of his heart. For, being daily conversant with *beauty*, *order*, and *design*, in inferior subjects, he bids fair for growing in due time an admirer of what is fair and well-proportioned in the conduct of life and the order of society, which is only order and design exerted in their highest subject. He will learn to transfer the numbers of poetry to the harmony of the mind and of well-governed passions; and, from admiring the virtues of others in moral paintings, come to approve and imitate them himself. Therefore, to cultivate a *true* and *correct taste* must be both our interest and our duty, when the circumstances of our station give leisure and opportunity for it, and when the doing it is not inconsistent with our higher obligations or engagements to society and mankind.

118 How attained.

It is best attained by reading the best books, where *good sense* has more the ascendant than *learning*, and which pertain more to *practice* than to *speculation*; by studying the best models, *i. e.* those which profess to imitate nature most, and approach the nearest to it, and by conversing with men of the most refined taste, and the greatest experience in life.

119 Other intellectual goods;

As to the other intellectual goods, what a fund of entertainment must it be to investigate the truth and various relations of things, to trace the operations of nature to general laws, to explain by these its manifold phenomena, to understand that order by which the universe is upheld, and that œconomy by which it is governed! to be acquainted with the human mind, the connections, subordinations, and uses of its powers, and to mark their energy in life! how agreeable to the ingenious inquirer, to observe the manifold relations and combinations of individual minds in society, to discern the causes why they flourish or decay, and from thence to ascend, through the vast scale of beings, to that general mind which presides over all, and operates unseen in every system and in every age, through the whole compass and progression of nature! Devoted to such entertainments as these, the contemplative have abandoned every other pleasure, retired from the body, so to speak, and sequestered themselves from social intercourse; for these, the *busy* have often preferred to the hurry and din of life the calm retreats of contemplation; for these, when once they came to taste them, even the *gay* and *voluptuous* have thrown up the lawless pursuits of sense and appetite, and acknowledged these mental enjoyments to be the most *refined*, and indeed the *only* luxury. Besides, by a just and large knowledge of nature, we recognise the perfections of its author; and thus piety, and all those pious affections which depend on just sentiments of his character, are awakened and confirmed; and a thousand superstitious fears, that arise from partial views of his nature and works, will of course be excluded. An extensive prospect of human life, and of the periods and revolutions of human things, will conduce much to the giving a certain greatness of mind, and a noble contempt to those little competitions about power, honour, and wealth, which disturb and divide the bulk of mankind; and promote a calm endurance of those inconveniences and ills that are the common appendages of humanity. Add to all, that a just knowledge of human nature, and of those hinges upon which the business and fortunes of men turn, will prevent our thinking either too highly or too meanly of our fellow creatures, give no small scope to the exercise of friendship, confidence, and good will, and at the same time brace the mind with a proper caution and distrust (those nerves of prudence), and give a greater mastery in the conduct of private as well as public life. Therefore, by cultivating our intellectual abilities, we shall best promote and secure our interest, and be qualified for acting our part in society with more honour to ourselves, as well as advantage to mankind. Consequently, to improve them to the utmost of our power is our duty; they are talents committed to us by the Almighty Head of society, and we are accountable to him for the use of them.

The intellectual virtues are best improved by accurate and impartial observation, extensive reading, and unconfined converse with men of all characters, especially with those who, to private study, have joined the widest acquaintance with the world, and greatest practice in affairs; but, above all, by being much in the world, and having large dealings with mankind. Such opportunities contribute much to divest one of prejudices and a servile attachment to crude systems, to open one's views, and to give that experience on which the most useful because the most practical knowledge is built, and from which the surest maxims for the conduct of life are deduced. 120 How attained.

The highest goods which enter into the composition of human happiness are *moral* goods of the mind, directly and ultimately regarding ourselves; as *command of the appetites and passions*, *prudence and caution*, *magnanimity*, *fortitude*, *humility*, *love of virtue*, *love of God*, *resignation*, and the like. These sublime goods are goods by way of eminence, goods recommended and enforced by the most intimate and awful sense and consciousness of our nature; goods that constitute the quintessence, the very temper of happiness, that form and complexion of soul which renders us approveable and lovely in the sight of God; goods, in fine, which are the elements of all our future perfection and felicity. 121 Moral goods.

Most of the other goods we have considered depend partly on ourselves, and partly on accidents which we can neither foresee nor prevent, and result from causes which we cannot influence or alter. They are such goods as we may possess to-day and lose to-morrow, 122 Their moment.

and

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and which require a felicity of conſtitution, and talents to attain them in full vigour and perfection, and a felicity of conjunctures to ſecure the poſſeſſion of them. Therefore, did our happineſs depend altogether or chiefly on ſuch tranſitory and precarious poſſeſſions, it were itſelf moſt precarious, and the higheſt folly to be anxious about it.——But though creatures, conſtituted as we are, cannot be indifferent about ſuch goods and muſt ſuffer in ſome degree, and conſequently have our happineſs incomplete without them, yet they weigh but little in the ſcale when compared with moral good. By the benevolent conſtitution of our nature, theſe are placed within the ſphere of our activity, ſo that no man can be deſtitute of them unleſs he is firſt wanting to himſelf. Some of the wiſeſt and beſt of mankind have wanted moſt of the former goods, and all the external kind, and felt moſt of the oppoſite ills, ſuch at leaſt as ariſe from without; yet by poſſeſſing the latter, *viz.* the moral goods, have declared they were happy; and to the conviction of the moſt impartial obſervers have appeared happy. The worſt of men have been ſurrounded with every outward good and advantage of fortune, and have poſſeſſed great parts; yet, for want of moral rectitude, have been and have confeſſed themſelves, notoriouſly and exquiſitely miſerable. The exerciſe of virtue has ſupported its votaries, and made them exult in the midſt of tortures almoſt intolerable; nay, how often has ſome falſe form or ſhadow of it ſuſtained even the greateſt (D) villains and bigots under the ſame preſſures! But no external goods, no goods of fortune, have been able to alleviate the agonies or expel the fears of a guilty mind conſcious of the deſerved hatred and reproach of mankind, and the juſt diſpleaſure of Almighty God.

123 The mixed condition of human life requires particular virtues.

As the preſent condition of human life is wonderfully chequered with good and ill, and as no height of ſtation, no affluence of fortune, can abſolutely inſure the good, or ſecure againſt the ill, it is evident that a great part of the comfort and ſerenity of life muſt lie in having our minds duly affected with regard to both, *i. e.* rightly attempered to the loſs of one and the ſufferance of the other. For it is certain that outward calamities derive their chief malignity and preſſure from the inward diſpoſitions with which we receive them. By managing theſe right, we may greatly abate that malignity and preſſure, and conſequently diminiſh the number, and weaken the moment, of the ills of life, if we ſhould not have it in our power to obtain a large ſhare of its goods. There are particularly three virtues which go to the forming this right temper towards ill, and which are of ſingular efficacy, if not totally to remove, yet wonderfully to alleviate the calamities of life. Theſe are *fortitude* or *patience*, *humility* and *reſignation*.

124 Fortitude.

Fortitude is that calm and ſteady habit of mind which either moderates our fears, and enables us bravely to encounter the proſpect of ill, or renders the mind ſerene and invincible under its immediate preſſure. It lies equally diſtant from raſhneſs and cowardice; and though it does not hinder us from feeling, yet prevents our complaining or ſhrinking under the ſtroke. It always includes a generous contempt of, or at leaſt a noble ſuperiority to, thoſe precarious goods of which we can inſure neither the poſſeſſion nor continuance. The man therefore who poſſeſſes this virtue in this ample ſenſe of it, ſtands upon an eminence, and ſees human things below him; the tempeſt indeed may reach him, but he ſtands ſecure and collected againſt it upon the baſis of conſcious virtue, which the ſevereſt ſtorms can ſeldom ſhake, and never overthrow.

125 Humility.

Humility is another virtue of high rank and dignity, though often miſtaken by proud mortals for meanneſs and puſillanimity. It is oppoſed to *pride*, which commonly includes in it a falſe or over-rated eſtimation of our own merit, an aſcription of it to ourſelves, as its only and original cauſe, an undue compariſon of ourſelves with others, and in conſequence of that ſuppoſed ſuperiority, an arrogant preference of ourſelves, and a ſupercilious contempt of them. *Humility*, on the other hand, ſeems to denote that modeſt and ingenuous temper of mind, which ariſes from a juſt and equal eſtimate of our own advantages compared with thoſe of others, and from a ſenſe of our deriving all originally from the Author of our being. Its ordinary attendants are mildneſs, a gentle forbearance, and an eaſy unaſſuming humanity with regard to the imperfections and faults of others; virtues rare indeed, but of the faireſt complexion, the proper offspring of ſo lovely a parent, the beſt ornament of ſuch imperfect creatures as we are, precious in the ſight of God, and which ſweetly allure the hearts of men.

126 Reſignation.

Reſignation is the mild and heroic temper of mind which ariſes from a ſenſe of an infinitely wiſe and good providence, and enables one to acquieſce with a cordial affection in its juſt appointments. This virtue has ſomething very particular in its nature, and ſublime in its efficacy. For it teaches us to bear ill, not only with patience, and as being unavoidable, but it transforms, as it were, ill into good, by leading us to conſider it, and every event that has the leaſt appearance of ill, as a divine diſpenſation, a wiſe and benevolent temperament of things, ſubſervient to univerſal good, and of courſe including that of every individual, eſpecially of ſuch as calmly ſtoop to it. In this light, the adminiſtration itſelf, nay every act of it, becomes an object of affection, the evil diſappears, or is converted into a balm which both heals and nouriſheth the mind. For though the firſt unexpected acceſs of ill may ſurpriſe the ſoul into grief, yet that grief, when the mind calmly reviews its object, changes into contentment, and is by degrees exalted into veneration and a divine compoſure. Our private will is loſt in that of the Almighty, and our ſecurity againſt every real ill reſts on the ſame bottom as the throne of him who lives and reigns for ever.

127 Chief good, objective; and formal.

Before we finiſh this ſection, it may be fit to obſerve, that as the Deity is the ſupreme and inexhauſted ſource of good, on whom the happineſs of the whole creation

(D) As Ravillac, who aſſaſſinated Henry IV. of France; and Balthaſar Geraerd, who murdered William I. prince of Orange.

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creation depends; as he is the highest object in nature, and the only object who is fully proportioned to the intellectual and moral powers of the mind, in whom they ultimately rest, and find their most perfect exercise and completion; he is therefore termed the *Chief good of man*, objectively considered. And *virtue*, or the proportioned and vigorous exercise of the several powers and affections on their respective objects, as above described, is, in the schools, termed the *chief good*, formally considered, or its formal idea, being the inward temper and native constitution of human happiness.

From the detail we have gone through, the follow-
128 Corollaries ing corollaries may be deduced.

First, It is evident, that the happiness of such a *progressive* creature as man can never be at a stand, or continue a fixed invariable thing. His finite nature, let it rise ever so high, admits still higher degrees of improvement and perfection. And his progression in improvement or virtue always makes way for a progression in happiness. So that no possible point can be assigned in any period of his existence in which he is perfectly happy, that is, so happy as to exclude higher degrees of happiness. All his perfection is only comparative. 2. It appears that many things must conspire to complete the happiness of so *various* a creature as man, subject to so many wants, and susceptible of such different pleasures. 3. As his capacities of pleasure cannot be all gratified at the same time, and must often interfere with each other in such a precarious and fleeting state as human life, or be frequently disappointed, perfect happiness, *i. e.* the undisturbed enjoyment of the several pleasures of which we are capable, is unattainable in our present state. 4. That state is most to be sought after, in which the fewest competitions and disappointments can happen, which least of all impairs any sense of pleasure, and opens an inexhausted source of the most refined and lasting enjoyments. 5. That state which is attended with all those advantages, is a state or course of virtue. 6. *Therefore*, a state of *virtue*, in which the moral goods of the mind are attained, is the *happiest state*.

Chap. III. *Duties of* Society.

Sect. I. *Filial and Fraternal Duty*.

As we have followed the order of nature in tracing the history of man, and those duties which he owes to himself, it seems reasonable to take the same method with those he owes to society, which constitute the *second* class of his *obligations*.

129 Connection of parents. His parents are among the earliest objects of his attention; he becomes soonest acquainted with them, reposes a peculiar confidence in them, and seems to regard them with a fond affection, the early prognostics of his future *piety* and *gratitude*. Thus does nature dictate the first lines of filial duty, even before a just sense of the connection is formed. But when the child is grown up, and has attained to such a degree of understanding, as to comprehend the *moral tie*, and be sensible of the obligations he is under to his parents: when he looks back on their tender and disinterested affection, their incessant cares and labours in nursing, educating, and providing for him, during that state in which he had neither prudence nor strength to care

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and provide for himself, he must be conscious that he owes to them these peculiar duties.

1. To reverence and honour them, as the instruments of nature in introducing him to life, and to that state of comfort and happiness which he enjoys; and therefore to esteem and imitate their good qualities, to alleviate and bear with, and spread, as much as possible a decent veil over their faults and weaknesses. 130 Duties to parents.

2. To be highly grateful to them, for those favours which it can hardly ever be in his power fully to repay: to show this gratitude by a strict attention to their wants, and a solicitous care to supply them; by a submissive deference to their authority and advice, especially by paying great regard to it in the choice of a wife, and of an occupation; by yielding to, rather than peevishly contending with, their humours, as remembering how oft they have been persecuted by his; and, in fine, by soothing their cares, lightening their sorrows, supporting the infirmities of age, and making the remainder of their life as comfortable and joyful as possible.

As his brethren and sisters are the next with whom the creature forms a *social* and *moral* connection, to them he owes a *fraternal* regard; and with them ought he to enter into a strict league of friendship, mutual sympathy, advice, assistance, and a generous intercourse of kind offices, remembering their relation to common parents, and that brotherhood of nature which unites them into a closer community of interest and affection. 131 Duties to brethren and sisters.

Sect. II. *Concerning Marriage*.

When man arrives to a certain age, he becomes sensible of a peculiar sympathy and tenderness towards the other sex: the charms of beauty engage his attention, and call forth new and softer dispositions than he has yet felt. The many amiable qualities exhibited by a fair outside, or by the mild allurement of female manners, or which the prejudiced spectator without much reasoning supposes those to include, with several other circumstances both natural and accidental, point his view and affection to a particular object, and of course contract that general rambling regard, which was lost and useless among the undistinguished crowd, into a peculiar and permament attachment to one woman, which ordinarily terminates in the most important, venerable, and delightful connections in life. 132 Connection with the other sex.

The state of the brute creation is very different from that of human creatures. The former are clothed and generally armed by their structure, easily find what is necessary to their subsistence, and soon attain their vigour and maturity; so that they need the care and aid of their parents but for a short while; and therefore we see that nature has assigned to them vagrant and transient amours. The connection being purely *natural*, and merely for propagating and rearing their offspring, no sooner is that end answered, than the connection dissolves of course. But the human race are of a more tender and defenceless constitution; their infancy and non-age continue longer; they advance slowly to strength of body and maturity of reason; they need constant attention, and a long series of cares and labours, to train them up to decency, virtue, and the various arts of life. Nature has, 133 The grounds of this connection.

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therefore, provided them with the most affectionate and anxious tutors, to aid their weakness, to supply their wants, and to accomplish them in those necessary arts, even their own parents, on whom she has devolved this mighty charge, rendered agreeable by the most alluring and powerful of all ties, parental affection. But unless both concur in this grateful task, and continue their joint labours, till they have reared up and planted out their young colony, it must become a prey to every rude invader, and the purpose of nature in the original union of the human pair be defeated. Therefore our structure as well as condition is an evident indication, that the human sexes are destined for a more intimate, for a moral and lasting union. It appears likewise, that the principal end of marriage is not to propagate and nurse up an offspring, but to educate and form minds for the great duties and extensive destinations of life. Society must be supplied from this original nursery with useful members, and its fairest ornaments and supports.

134 Moral ends of marriage.

The mind is apt to be dissipated in its views and acts of friendship and humanity; unless the *former* be directed to a particular object, and the *latter* employed in a particular province When men once indulge in this dissipation, there is no stopping their career; they grow insensible to moral attractions; and, by obstructing or impairing the decent and regular exercise of the tender and generous feelings of the human heart, they in time become unqualified for, or averse to, the forming a moral union of souls, which is the cement of society, and the source of the purest domestic joys. Whereas a rational, undepraved *love*, and its fair companion, *marriage*, collect a man's views, guide his heart to its proper object, and, by confining his affection to that object, do really enlarge its influence and use. Besides, it is but too evident from the conduct of mankind, that the common ties of humanity are too feeble to engage and interest the passions of the generality in the affairs of society. The connections of neighbourhood, acquaintance and general intercourse, are too wide a field of action for many, and those of a *public* or *community* are so for more; and in which they *either care not, or know not how* to exert themselves. Therefore nature, ever wise and benevolent, by implanting that strong sympathy which reigns between the individuals of each sex, and by urging them to form a particular moral connection, the spring of many domestic endearments has measured out to each pair a particular *sphere of action*, proportioned to their views, and adapted to their respective capacities. Besides, by interesting them deeply in the concerns of their own little circle, she has connected them more closely with society, which is composed of particular families, and bound them down to their good behaviour in that particular community to which they belong. This *moral connection* is *marriage*, and this *sphere of action* is a *family*.

135 Duties of marriage.

Of the *conjugal* alliance the following are the *natural laws*. First, mutual fidelity to the marriage-bed. Disloyalty defeats the very end of marriage; dissolves the natural cement of the relation; weakens the moral tie, the chief strength of which lies in the reciprocation of affection; and, by making the offspring uncertain, diminishes the care and attachment necessary to their education.

2. A conspiration of counsels and endeavours to promote the common interest of the family, and to educate their common offspring. In order to observe these laws, it is necessary to cultivate, both before and during the married state, the strictest decency and chastity of manners, and a just sense of what becomes their respective characters.

3. The union must be inviolable, and for life. The nature of friendship, and particularly of this species of it, the education of their offspring, and the order of society and of successions, which would otherwise be extremely perplexed, do all seem to require it. To preserve this union, and render the matrimonial state more harmonious and comfortable, a mutual esteem and tenderness, a mutual deference and forbearance, a communication of advice, and assistance and authority, are absolutely necessary. If either party keep within their proper departments, there need be no disputes about power or superiority, and there will be none. They have no *opposite*, no *separate* interests, and therefore there can be no just ground for opposition of conduct.

From this detail, and the present state of things, in which there is pretty near a parity of numbers of both sexes, it is evident that *polygamy* is an *unnatural* state; and though it should be granted to be more fruitful of children, which however, it is not found to be, yet it is by no means so fit for rearing minds, which seems to be as much, if not more, the intention of natue than the propagation of bodies. 136 Polygamy.

Sect. III. *Of Parental Duty*.

The connection of parents with their children is a natural consequence of the matrimonial connection; and the duties which they owe them result as naturally from that connection. The feeble state of children, subject to so many wants and dangers, requires their incessant care and attention; their ignorant and uncultivated minds demand their continual instruction and culture. Had human creatures come into the world with the full strength of *men*, and the weakness of reason and vehemence of passions which prevail in *children*, they would have been too strong or too stubborn to have submitted to the government and instruction of their parents. But as they were designed for a progression in knowledge and virtue, it was proper that the growth of their bodies should keep pace with that of their minds, lest the purposes of that progression should have been defeated. Among other admirable purposes which this gradual expansion of their outward as well as inward structure serves, this is one, that it affords ample scope to the exercise of many tender and generous affections, which fill up the domestic life with a beautiful variety of duties and enjoyments; and are of course a noble discipline for the heart, and an hardy kind of education for the more honourable and important duties of *public* life. 137 Connection of parents and children.

The abovementioned weak and ignorant state of children seems plainly to invest their parents with such authority and power as is necessary to their support, protection, and education; but that authority and power can be construed to extend no farther than is necessary to answer those ends, and to last no longer than that weakness and ignorance continue; wherefore, the foundation or reason of the authority and 138 The authority founded on that connection

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power ceasing, they cease of course. Whatever power or authority then it may be necessary or lawful for parents to exercise during the non-age of their children, to assume or usurp the same when they have attained the maturity or full exercise of their strength and reason would be tyrannical and unjust. From hence it is evident, that parents have no right to punish the persons of their children more severely than the nature of their wardship requires, much less to invade their lives, to encroach upon their liberty, or transfer them as their property to any master whatsoever.

139 Duties of parents.

The first class of duties which parents owe their children respect their natural life; and these comprehend protection, nurture, provision, introducing them into the world in a manner suitable to their rank and fortune, and the like.

140 Education.

The second order of duties regards the *intellectual* and *moral* life of their children, or their education in such arts and accomplishments as are necessary to qualify them for performing the duties they owe to themselves and to others. As this was found to be the principal design of the matrimonial alliance, so the fulfilling that design is the most important and dignified of all the parental duties. In order therefore to fit the child for acting his part wisely, and worthily as a *man*, as a *citizen*, and a *creature of God*, both parents ought to combine their joint wisdom, authority, and power, and each party to employ those talents which are the peculiar excellency and ornament of their respective sex. The father ought to *lay out* and *superintend* their education, the mother to execute and manage the detail of which she is capable. The *former* should direct the manly exertion of the intellectual and moral powers of his child. His imagination, and the manner of those exertions, are the peculiar province of the *latter*. The *former* should advise, protect, command, and, by his experience, masculine vigour, and that superior authority which is commonly ascribed to his sex, brace and strengthen his pupil for *active* life, for gravity, integrity, and firmness in suffering. The business of the *latter* is to bend and soften her *male* pupil, by the charms of her conversation, and the softness and decency of her manners, for *social* life, for politeness of taste, and the elegant decorums and enjoyments of humanity; and to improve and refine the tenderness and modesty of her *female* pupil, and form her to all those mild domestic virtues which are the peculiar characteristics and ornaments of her sex. To conduct the opening minds of their sweet charge through the several periods of their progress, to assist them in each period, in throwing out the latent seeds of reason and ingenuity, and in gaining fresh accessions of light and virtue; and at length, with all these advantages, to produce the young adventurers upon the great theatre of human life, to play their several parts in the sight of their friends, of society, and mankind!

Sect. IV. *Herile and Servile Duty.*

141 The ground of this connection.

In the natural course of human affairs, it must necessarily happen that some of mankind will live in plenty and opulence, and others be reduced to a state of indigence and poverty. The former need the labours of the latter and the latter provision and support of the former. This mutual necessity is the foundation of that connection, whether we call it *moral* or *civil*, which subsists between masters and servants.

142 The conditions of service.

He who feeds another has a right to some equivalent, the labour of him whom he maintains, and the fruits of it. And he who labours for another has a right to expect that he should support him. But as the labours of a man of ordinary strength are certainly of greater value than mere food and clothing; because they would actually produce more, even the maintenance of a family, were the labourer to employ them in his own behalf; therefore he has an undoubted right to rate and dispose of his service for certain wages above mere maintenance; and if he has incautiously disposed of it for the latter only, yet the contract being of the *onerous* kind, he may equitably claim a supply of that deficiency. If the service be specified, the servant is bound to that only; if not, then he is to be construed as bound only to such services as are consistent with the laws of justice and humanity. By the voluntary servitude to which he subjects himself he forfeits no rights but such as are necessarily included in that servitude, and is obnoxious to no punishment but such as a voluntary failure in the service may be supposed reasonably to require. *The offspring of such servants* have a right to that liberty which neither they nor their parents have forfeited.

143 The case of great offenders.

As to those who, because of some heinous offence, or for some notorious damage, for which they cannot otherwise compensate, are condemned to perpetual service, they do not, on that account, forfeit all the rights of men; but those, the loss of which is necessary to secure society against the like offences for the future, or to repair the damage they have done.

144 The case of captives.

With regard to captives taken in war, it is barbarous and inhuman to make perpetual slaves of them, unless some peculiar and aggravated circumstances of guilt have attended their hostility. The bulk of the subjects of any government engaged in war may be fairly esteemed innocent enemies; and therefore they have a right to that clemency which is consistent with the common safety of mankind, and the particular security of that society against which they are engaged. Though ordinary captives have a grant of their lives, yet to pay their liberty as an equivalent is much too high a price. There are other ways of acknowledging or returning the favour, than by surrendring what is far dearer than life itself *. To those who, under pretext of the necessities of commerce, derive the unnatural trade of bargaining for human flesh, and consigning their innocent but unfortunate fellow creatures to eternal servitude and misery, we may address the words of a fine writer; "Let avarice defend it as it will, there is an honest reluctance in humanity against buying and selling, and regarding those of our own species as our wealth and possessions."

* Hutchef. Mor. Inst. Phil. lib. 3. c. 3.

Sect. V. *Social Duties of the private Kind.*

Hitherto we have considered only the *domestic œconomical* duties, because these are first in the progress of nature. But as man passes beyond the little circle of a family, he forms connections with relations, friends, neighbours, and others; from whence results

a new

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a new train of duties of the more private social kind, as "friendship, chastity, courtesy, good-neighbourhood, charity, forgiveness, hospitality."

145 Man's aptitude for society.

Man is admirably formed for particular social attachments and duties. There is a peculiar and strong propensity in his nature to be affected with the sentiments and dispositions of others. Men, like certain musical instruments, are set to each other, so that the vibrations or notes excited in one raise correspondent notes and vibrations in the others. The impulses of *pleasure* or *pain*, *joy* or *sorrow*, made on one mind, are by an instantaneous sympathy of nature communicated in some degree to all; especially when hearts are (as an humane writer expresses it) in *unison* of kindness; the joy that vibrates in one communicates to the other also. We may add, that though joy thus imparted swells the harmony, yet grief vibrated to the heart of a friend, and rebounding from thence in sympathetic notes, melts as it were, and almost dies away. All the passions, but especially those of the social kind, are contagious; and when the passions of one man mingle with those of another, they increase and multiply prodigiously. There is a most moving eloquence in the human countenance, air, voice, and gesture, wonderfully expressive of the most latent feelings and passions of the soul, which darts them like a subtle flame into the hearts of others, and raises correspondent feelings there: friendship, love, good-humour, joy, spread through every feature, and particularly shoot from the eyes their softer and fiercer fires with an irresistible energy. And in like manner the opposite passions of hatred, enmity, ill humour, melancholy, diffuse a sullen and saddening air over the face, and, flashing from eye to eye, kindle a train of similar passions. By these, and other admirable pieces of machinery, men are formed for society and the delightful interchange of friendly sentiments and duties, to increase the happiness of others by participation, and their own by rebound; and to diminish, by dividing, the common stock of their misery.

146 Duties arising from private relation.

The first emanations of the *social* principle beyond the bounds of a family lead us to form a nearer conjunction of friendship or good-will with those who are any wise connected with us by *blood* or *domestic alliance*. To them our affection does commonly exert itself in a greater or less degree, according to the nearness or distance of the relation. And this proportion is admirably suited to the extent of our powers and the indigence of our state; for it is only within those lesser circles of consanguinity or alliance that the generality of mankind are able to display their abilities or benevolence, and consequently to uphold their connection with society and subserviency, to a public interest. Therefore it is our duty to regard these closer connections as the next department to that of a family, in which nature has marked out for us a sphere of activity and usefulness; and to cultivate the kind affections which are the cement of those endearing alliances.

147 Ingredients of friendship.

Frequently the view of distinguishing moral qualities in some of our acquaintance may give birth to that more noble connection we call FRIENDSHIP, which is far superior to the alliances of consanguinity. For these are of a superficial, and often of a transitory nature, of which, as they hold more of *instinct* than of *reason*, we cannot give such a rational account. But *friendship* derives all its strength and beauty, and the only existence which is durable, from the qualities of the heart, or from virtuous and lovely dispositions. Or, should these be wanting, they or some shadow of them must be supposed present.—Therefore *friendship* may be described to be, "The union of two souls by means of *virtue*, the common object and cement of their mutual affection." Without virtue, or the supposition of it, friendship is only a *mercenary* league, an alliance of interest, which must dissolve of course when that interest decays or subsists no longer. It is not so much any particular passion, as a composition of some of the noblest feelings and passions of the mind. *Good sense*, a *just taste* and *love of virtue*, a *thorough candour* and *benignity of heart*, or what we usually call a *good temper*, and a generous sympathy of sentiments and affections, are the necessary ingredients of this virtuous connection. When it is grafted on esteem strengthened by habit, and mellowed by time, it yields infinite pleasure, ever new and ever growing; is a noble support amidst the various trials and vicissitudes of life, and an high seasoning to most of our other enjoyments.—To form and cultivate virtuous friendship, must be very improving to the temper, as its principal *object* is *virtue*, set off with all the allurement of countenance, air, and manners, shining forth in the native graces of manly honest sentiments and affections, and rendered *visible* as it were to the friendly spectator in a conduct unaffectedly great and good; and as its principal exercises are the very energies of virtue, or its effect and emanations. So that wherever this amiable attachment prevails, it will exalt our admiration and attachment to virtue, and, unless impeded in its course by unnatural prejudices, run out into a friendship to the human race. For as no one can merit, and none ought to usurp, the sacred name of friend, who hates mankind; so whoever truly loves *them*, possesses the most essential quality of a true friend.

148 Its duties.

The duties of friendship are a mutual esteem of each other, unbribed by interest, and independent of it, a generous confidence as far distant from suspicion as from reserve, an inviolable harmony of sentiments and dispositions of designs and interests, a fidelity unshaken by the changes of fortune, a constancy unalterable by distance of time or place, a resignation of one's personal interest to those of one's friend, and a reciprocal, unevious, unreserved exchange of kind offices.—But, amidst all the exertions of this moral connection, humane and generous as it is, we must remember that it operates within a narrow sphere, and its immediate operations respect only the individual; and therefore its particular impulses must still be subordinate to a more public interest, or be always directed and controlled by the more extensive connections of our nature.

149 Love and chastity.

When our friendship terminates on any of the other sex, in whom beauty or agreeableness of person and external gracefulness of manners conspire to express and heighten the moral charm of a tender honest heart, and sweet, ingenious, modest temper, lighted up by good sense; it generally grows into a more soft and endearing attachment. When this attachment is im-

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proved by a growing acquaintance with the worth of its object, is conducted by discretion, and issues at length, as it ought to do, in the moral connection formerly mentioned ‡, it becomes the source of many amiable duties, of a communication of passions and interests, of the most refined decencies, and of a thousand nameless deep-felt joys of reciprocal tenderness and love, flowing from every look, word, and action. Here friendship acts with double energy, and the *natural* conspires with the *moral* charms to strengthen and secure the love of virtue. As the delicate nature of female honour and decorum, and the inexpressible grace of a chaste and modest behaviour, are the surest and indeed the only means of kindling at first, and ever after of keeping alive, this tender and elegant flame, and of accomplishing the excellent ends designed by it; to attempt by fraud to violate one, or, under pretence of passion, to sully and corrupt the other, and, by so doing, to expose the too often credulous and unguarded object, with a wanton cruelty, to the hatred of her own sex and the scorn of ours, and to the lowest infamy of both, is a conduct not only base and criminal, but inconsistent with that truly rational and refined enjoyment, the spirit and quintessence of which is derived from the bashful and sacred charms of virtue kept untainted, and therefore ever alluring to the lover's heart.

‡ See Sect. ii. of this chap.

150 Courtesy, good-neighbourhood, &c.

Courtesy, *good-neighbourhood*, *affability*, and the like duties, which are founded on our private social connections, are no less necessary and obligatory to creatures united in society, and supporting and supported by each other in a chain of mutual want and dependence. They do not consist in a smooth address, an artificial or obsequious air, fawning adulations, or a polite servility of manners; but in a just and modest sense of our own dignity and that of others, and of the reverence due to mankind, especially to those who hold the higher links of the social chain; in a discreet and manly accommodation of ourselves to the foibles and humours of others; in a strict observance of the rules of decorum and civility; but, above all, in a frank obliging carriage, and generous interchange of good deeds rather than words. Such a conduct is of great use and advantage, as it is an excellent security against injury, and the best claim and recommendation to the esteem, civility, and universal respect of mankind. This inferior order of virtues unites the particular members of society more closely, and forms the lesser pillars of the civil fabric; which, in many instances, supply the unavoidable defects of laws, and maintain the harmony and decorum of social intercourse, where the more important and essential lines of virtue are wanting.

151 Charity, Forgiveness.

Charity and *forgiveness* are truly amiable and useful duties of the social kind. There is a twofold distinction of rights commonly taken notice of by moral writers, viz. *perfect* and *imperfect*. To fulfil the former, is necessary to the being and support of society; to fulfil the latter, is a duty equally sacred and obligatory, and tends to the improvement and prosperity of society; but as the violation of them is not equally prejudicial to the public good, the fulfilling them is not subjected to the cognizance of law, but left to the candour, humanity, and gratitude of individuals. And by this means ample scope is given to exercise all the generosity, and display the genuine merit and lustre, of virtue. Thus the wants and misfortunes of others call for our charitable assistance and seasonable supplies. And the good man, unconstrained by law, and uncontrouled by human authority, will cheerfully acknowledge and generously satisfy this mournful and moving claim; a claim supported by the sanction of heaven, of whose bounties he is honoured to be the grateful trustee. If his own *perfect* rights are invaded by the injustice of others, he will not therefore reject their *imperfect* right to pity and forgiveness, unless his grant of these should be inconsistent with the more extensive rights of society, or the public good. In that case he will have recourse to public justice and the laws, and even then he will prosecute the injury with no unnecessary severity, but rather with mildness, and humanity. When the injury is merely personal, and of such a nature as to admit of alleviations, and the forgiveness of which would be attended with no worse consequences, especially of a public kind, the good man will generously forgive his offending brother. And it is his duty to do so, and not to take private revenge, or retaliate evil for evil. For though resentment of injury is a natural passion, and implanted, as was observed * above, for wise and good ends; yet, considering the manifold partialities which most men have for themselves, was every one to act as judge in his own cause, and to execute the sentence dictated by his own resentment, it is but too evident that mankind would pass all bounds in their fury, and the last sufferer be provoked in his turn to make full reprisals. So that evil, thus encountering with evil, would produce one continned series of violence and misery, and render society intolerable, if not impracticable. Therefore, where the security of the individual, or the good of the public, does not require a proportionable retaliation, it is agreeable to the general law of benevolence, and to the particular end of the passion (which is to prevent injury and the misery occasioned by it), to forgive personal injuries, or not to return evil for evil. This duty is one of the noble refinements which *Christianity* has made upon the general maxims and practice of mankind, and enforced, with a peculiar strength and beauty, by sanctions no less alluring than awful. And indeed the practice of it is generally its own reward; by expelling from the mind the most dreadful intruders upon its repose, those rancorous passions which are begot and nursed by resentment, and by disarming and even subduing every enemy one has, except such as have nothing left of men but the outward form.

* See Part I. chap. ii. and iv.

152 Hospitality.

The most enlarged and humane connection of the private kind seems to be the hospitable alliance, from which flow the amiable and disinterested duties we owe to strangers. If the exercise of passions of the most private and instinctive kind is beheld with moral approbation and delight, how lovely and venerable must those appear which result from a calm philanthropy, are founded in the common rights and connections of society, and embrace men, not of a particular sect, party, or nation, but all in general without distinction, and without any of the little partialities of self-love.

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Sect. VI. *Social duties of the* Commercial *kind.*

The next order of connections are thoſe which ariſe from the wants and weakneſſes of mankind, and
153 Commercial duties. from the various circumſtances in which their different ſituations place them. Theſe we may call *commercial* connections, and the duties which reſult from them *commercial* duties, as *juſtice, fair-dealing, ſincerity, fidelity to compacts*, and the like.

154 Their foundation. Though nature is perfect in all her works, yet ſhe has obſerved a manifeſt and eminent diſtinction among them. To all ſuch as lye beyond the reach of human ſkill and power, and are properly of her own department, ſhe has given the finiſhing hand. Theſe man may deſign after and imitate, but he can never rival them, nor add to their beauty or perfection. Such are the forms and ſtructure of vegetables, animals, and many of their productions, as the honey-comb the ſpider's web, and the like. There are others of her works which ſhe has of deſign left unfiniſhed, as it were, in order to exerciſe the ingenuity and power of man. She has preſented to him a rich profuſion of materials of every kind for his conveniency and uſe; but they are rude and unpoliſhed, or not to be come at without art and labour. Theſe therefore he muſt apply, in order to adapt them to his uſe, and to enjoy them in perfection. Thus nature has given him an infinite variety of herbs, grain, foſſils, minerals, wood, water, earth, air, and a thouſand other crude materials, to ſupply his numerous wants. But he muſt ſow, plant, dig, refine, poliſh, build, and, in ſhort, manufacture the various produce of nature, in order to obtain even the neceſſaries, and much more the conveniences and elegancies of life. Theſe then are the price of his labour and induſtry, and, without that, nature will ſell him nothing. But as the wants of mankind are many, and the ſingle ſtrength of individuals ſmall, they could hardly find the neceſſaries, and much leſs the conveniencies of life, without uniting their ingenuity and ſtrength in acquiring theſe, and without a mutual intercourſe of good offices. Some men are better formed for ſome kinds of ingenuity and labour, and others for other kinds; and different ſoils and climates are enriched with different productions; ſo that men, by exchanging the produce of their reſpective labours, and ſupplying the wants of one country with the ſuperfluities of another, do in effect diminiſh the labours of each, and increaſe the abundance of all. This is the foundation of all commerce, or exchange of commodities and goods, one with another; in order to facilitate which, men have contrived different ſpecies of coin, or money, as a common ſtandard by which to eſtimate the comparative values of their reſpective goods. But to render commerce ſure and effectual, *juſtice, fair dealing, ſincerity*, and *fidelity to compacts*, are abſolutely neceſſary.

155 Juſtice; *Juſtice* or *fair dealing*, or, in other words, a diſpoſition to treat others as we would be treated by them, is a virtue of the firſt importance, and inſeparable from the virtuous character. It is the cement of ſociety, or that pervading ſpirit which connects its members, inſpires its various relations, and maintains the order and ſubordination of each part to the whole. Without it, ſociety would become a den of thieves and banditti, hating and hated, devouring and devoured, by one another.

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And here it may be proper to take a view of Mr Hume's ſuppoſed caſe of the ſenſible knave and the worthleſs miſer (n° 16.). and conſider what would be the duty of the former according to the theory of thoſe moraliſts who hold the *will of God* to be the *criterion* or *rule*, and *everlaſting happineſs* the *motive* of human virtue.

156 Univerſally a duty on the principles of thoſe who hold the will of God to be the criterion. It has been already obſerved, and the truth of the obſervation cannot be controverted, that, by ſecretly purloining from the coffers of a miſer part of that gold which there lies uſeleſs, a man might in particular circumſtances, promote the good of ſociety, without doing any injury to a ſingle individual; and it was hence inferred, that, in ſuch circumſtances, it would be no duty to abſtain from theft were *local utility* ariſing from *particular conſequences* the real criterion or ſtandard of juſtice. Very different, however, is the concluſion which muſt be drawn by thoſe who conſider the natural tendency of actions, if univerſally performed, as the criterion of their merit or demerit in the ſight of God. Such philoſophers attend, not to the particular conſequences of a ſingle action in any given caſe, but to the general conſequences of the principle from which it flows, if that principle were univerſally adopted. You cannot (ſay they) permit one action and forbid another, without ſhowing a difference between them. The ſame ſort of actions, therefore, muſt be generally permitted or generally forbidden. But were every man allowed to aſcertain for himſelf the circumſtances in which the good of ſociety would be promoted, by ſecretly abſtracting the ſuperfluous wealth of a worthleſs miſer, it is plain that no property could be ſecure: that all incitements to induſtry would be at once removed; and that, whatever might be the *immediate* conſequences of any *particular theft*, the *general* and *neceſſary* conſequences of the *principle* by which it was authorized muſt ſoon prove fatal. Were one man to purloin part of the riches of a real miſer, and to conſider his conduct as vindicated by his intention to employ thoſe riches in acts of generoſity, another might by the ſame ſort of caſuiſtry think himſelf authoriſed to appropriate to himſelf part of his wealth; and thus theft would ſpread through all orders of men, till ſociety were diſſolved in ſeparate, hoſtile, and ſavage families, mutually dreading and ſhunning each other. The general conſequences, therefore, of encroaching upon private property tend evidently and violently to univerſal miſery.

On the other hand, indeed, the particular and immediate conſequences of that principle which conſiders every man's property as ſacred, may in ſome caſes, ſuch as that ſuppoſed, be in a ſmall degree injurious to a few families in the neighbourhood of the miſer and the knave. But that injury can never be of long duration; and it is infinitely more than counterbalanced by the general good conſequences of the principle from which it accidentally reſults; for theſe conſequences extend to all nations and to all ages. Without a ſacred regard to property, there could neither be arts nor induſtry nor confidence among men, and happineſs would be for ever baniſhed from this world. But the communication of happineſs being the end which

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which God had in view when he created the world, and all men standing in the same relation to him, it is impossible to suppose that he does not approve, and will not ultimately reward, those voluntary actions of which the natural tendency is to increase the sum of human happiness; or that he does not disapprove, and will not ultimately punish, those which naturally tend to aggravate human misery. The conclusion is, that a strict adherence to the principle of justice is universally, and in all possible circumstances, a duty from which we cannot deviate without offending our Creator, and ultimately bringing misery upon ourselves.

175 Sincerity.

Sincerity or *veracity*, in our words and actions, is another virtue or duty of great importance to society, being one of the great bands of mutual intercourse, and the foundation of mutual trust. Without it, society would be the dominion of mistrust, jealousy, and fraud, and conversation a traffic of lies and dissimulation. It includes in it a conformity of our words with our sentiments, a correspondence between our actions and dispositions, a strict regard to truth, and an irreconcileable abhorence of falsehood. It does not indeed require, that we expose our sentiments indiscreetly, or tell all the truth in every case; but certainly it does not, and cannot admit the least violation of truth or contradiction to our sentiments. For if these bounds are once passed, no possible limit can be assigned where the violation shall stop, and no pretence of private or public good can possibly counterbalance the ill consequences of such a violation.

158 Fidelity to promises, compacts, &c.

Fidelity to promises, compacts, and *engagements* is likewise a duty of such importance to the security of commerce and interchange of benevolence among mankind, that society would soon grow intolerable without the strict observance of it. Hobbes and others who follow the same track, have taken a wonderful deal of pains to puzzle this subject, and to make all the virtues of this sort merely *artificial*, and not at all *obligatory*, antecedent to human conventions. No doubt compacts suppose people who make them: and promises persons to whom they are made; and therefore both suppose some society, more or less, between those who enter into these mutual engagements. But is not a compact or promise binding, till men have agreed that they shall be binding? or are they only binding, because it is our interest to be bound by them or to fulfil them? Do not we highly approve the man who fulfils them, even though they should prove to be against his interest? and do not we condemn him as a knave who violates them on that account? A promise is a voluntary declaration by words, or by an action equally significant; of our resolution to do something in behalf of another, or for his service. When it is made, the person who makes it is by all supposed under an obligation to perform it. And he to whom it is made may demand the performance as his right. That perception of *obligaton* is a simple idea, and is on the same footing as our other moral perceptions, which may be described by instances, but cannot be defined. Whether we have a perception of such obligation quite distinct from the interest, either public or private, that may accompany the fulfilment of it must be referred to the conscience of every individual. And whether the mere sense of that obligation apart from its concomitant, is not a sufficient inducement or motive to keep one's promise, without having recourse to any selfish principle of our nature, must be likewise appealed to the conscience of every honest man.

159 Shown to be duties independent of the authority of the moral sense.

It may, however, be not improper to remark, that in this, as in all other instances, our chief good is combined with our duty. "Men act from expectation. Expectation is in most cases determined by the assurances and engagements which we receive from others. If no dependence could be placed upon these assurances, it would be impossible to know what judgement to form of many future events, or how to regulate our conduct with respect to them. Confidence, therefore, in promises, is essential to the intercourse of human life, because without it the greatest part of our conduct would proceed upon chance. But there could be no confidence in promises, if men were not obliged to perform them." Those, therefore, who allow not to the perceptions of the moral sense all that authority which we attribute to them, must still admit the obligation to perform promises; because such performance may be shown to be agreeable to the will of God, in the very same manner in which upon their principles we have shown the uniform practice of justice to be so.

160 What those duties require.

Fair dealing and *fidelity* to *compacts* require that we take no advantage of the ignorance, passion, or incapacity of others, from whatever cause that incapacity arises;—that we be explicit and candid in making bargains, just and faithful in fulfilling our part of them. And if the other party violates his engagements, redress is to be sought from the laws, or from those who are intrusted with the execution of them. In fine, the *commercial* virtues and duties require that we not only do not invade, but maintain the rights of others;—that we be fair and impartial in transferring, bartering, or exchanging property, whether in goods or service: and be inviolably faithful to our word and our engagements, where the matter of them is not criminal, and where they are not extorted by force. See Promise.

Sect. VII. *Social Duties of the* Political *Kind*.

161 Political connections.

We are now arrived at the last and highest order of duties respecting society, which result from the exercise of the most generous and heroic affections, and are founded on our most enlarged connections.

The *social* principle in man is of such an expansive nature, that it cannot be confined within the circuit of a family, of friends, or a neighbourhood; it spreads into wider systems, and draws men into larger confederacies, communities, and commonwealths. It is in these only that the higher powers of our nature attain the highest improvement and perfection of which they are capable. These principles hardly find objects in the solitary state of nature. *There* the principle of action rises no higher at farthest than *natural affection* towards one's offspring. There personal or family wants entirely engross the creature's attention and labour, and allow no leisure, or, if they did, no exercise for views and affections of a more enlarged kind. In *solitude* all are employed in the same way, in providing for the *animal* life. And even after their utmost labour and care, single and unaided by the industry of others, they find but a sorry supply of their wants, and a feeble precarious security against dangers from wild beasts; from inclement skies and seasons;

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sons; from the mistakes or petulant passions of their fellow-creatures; from their preference of themselves to their neighbours; and from all the little exorbitances of self-love. But in *society*, the mutual aids which men give and receive shorten the labours of each, and the combined strength and reason of individuals give security and protection to the whole body. There is both a variety and subordination of genius among mankind. Some are formed to lead and direct others, to contrive plans of happiness for individuals, and of government for communities, to take in a public interest, invent laws and arts, and superintend their execution, and, in short, to refine and civilize human life. Others, who have not such good heads, may have as honest hearts, a truly public spirit, love of liberty, hatred of corruption and tyranny, a generous submission to laws, order, and public institutions, and an extensive philanthropy. And others, who have none of those capacities either of heart or head, may be well formed for manual exercises and bodily labour. The former of these principles has no scope in solitude, where a man's thoughts and concerns do all either centre in himself or extend no farther than a family; into which little circle all the duty and virtue of the solitary mortal is crowded. But society finds proper objects and exercises for every genius, and the noblest objects and exercises for the noblest geniuses, and for the highest principles of the human constitution; particularly for that warmest and most divine passion which God hath kindled in our bosoms, the inclination of doing good, and reverencing our nature; which may find here both employment and the most exquisite satisfaction. In society, a man has not only more leisure, but better opportunities, of applying his talents with much greater perfection and success, especially as he is furnished with the joint advice and assistance of his fellow creatures, who are now more closely united one with the other, and sustain a common relation to the same moral system or community. This then is an object proportioned to his most enlarged social affections; and in serving it he finds scope for the exercise and refinement of his highest intellectual and moral powers. *Therefore society, or a state of civil government*, rests on these two principal pillars, "That in it we find security against those evils which are unavoidable in solitude—and obtain those goods, some of which cannot be obtained at all, and others not so well, in that state where men depend solely on their individual sagacity and industry."

From this short detail it appears, that *man* is a *social* creature, and formed for a *social* state; and that *society*, being adapted to the higher principles and destinations of his nature, must of necessity be his *natural* state.

162 Political duties,

The duties suited to that state, and resulting from those principles and destination, or, in other words, from our social passions and social connections, or relation to a public system, are, *love of our country, resignation, and obedience to the laws, public spirit, love of liberty, sacrifice of life and all to the public, and the like.*

163 Love of one's country.

Love of our country, is one of the noblest passions that can warm and animate the human breast. It includes all the limited and particular affections to our parents, friends, neighbours, fellow-citizens, countrymen. It ought to direct and limit their more confined and partial actions within their proper and natural bounds, and never let them encroach on those sacred and first regards we owe to the great public to which we belong. Were we solitary creatures, detached from the rest of mankind, and without any capacity of comprehending a *public interest*, or without affections leading us to desire and pursue it, it would not be our duty to mind it, nor criminal to neglect it. But as we are PARTS of the *public system*, and are not only capable of taking in large views of its interests, but by the strongest affections connected with it, and prompted to take a share of its concerns, we are under the most sacred ties to prosecute its security and welfare with the utmost ardour, especially in times of public trial. This *love of our country* does not import an attachment to any particular soil, climate or spot of earth, where perhaps we first drew our breath, though those *natural* ideas are often associated with the *moral* ones, and, like external signs or symbols, help to ascertain and bind them; but it imports an affection to that *moral system*, or *community*, which is governed by the same laws and magistrates, and whose several parts are variously connected one with the other, and all united upon the bottom of a common interest. Perhaps indeed every member of the community cannot comprehend so large an object, especially if it extends through large provinces, and over vast tracts of land; and still less can he form such an idea, if there is no *public*, *i. e.* if all are subject to the caprice and unlimited will of one man; but the preference the generality show to their native country, the concern and longing after it which they express when they have been long absent from it; the labours they undertake and sufferings they endure to save or serve it, and the peculiar attachment they have to their countrymen, evidently demonstrate that the passion is *natural*, and never fails to exert itself when it is fairly disengaged from foreign clogs; and is directed to its proper object. Wherever it prevails in its genuine vigour and extent, it swallows up all sordid and selfish regards; it conquers the love of *ease*, *power*, *pleasure*, and *wealth*; nay, when the amiable partialities of *friendship*, *gratitude*, *private affection*, or *regards to a family*, come in competition with it, it will teach us bravely to sacrifice all, in order to maintain the rights, and *promote* or *defend* the honour and happiness of our country.

Resignation and *obedience to the laws* and *orders* of the society to which we belong, are *political* duties necessary to its very being in security, without which it must soon degenerate into a state of licentiousness and anarchy. The welfare, nay, the nature of civil society, requires that there should be a subordination of orders, or diversity of ranks and conditions in it;—that certain men, or orders of men, be appointed to superintend and manage such affairs as concern the public safety and happiness;—that all have their particular provinces assigned them;—that such a subordination be settled among them as none of them may interfere with another; and finally, that certain *rules* or *common measures of action* be agreed on, by which each is to discharge his respective duty to govern or be governed, and all may concur in securing the order

164 Resignation and obedience to the Laws, &c.

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der, and promoting the felicity, of the whole political body. Those *rules of action* are the *laws* of the community; and those different *orders* are the several officers or magistrates appointed by the public to explain them, and superintend or assist in their execution. In consequence of this settlement of things, it is the duty of each individual to obey the laws enacted; to submit to the executors of them with all due deference and homage, according to their respective ranks and dignity, as to the keepers of the public peace, and the guardians of public liberty; to maintain his own rank, and perform the functions of his own station, with diligence, fidelity, and incorruption. The superiority of the *higher* orders, or the authority with which the state has invested them, intitle them, especially if they employ their authority well, to the obedience and submission of the *lower*, and to a proportionable honour and respect from all. The subordination of the lower ranks claims protection, defence, and security from the higher. And the laws, being superior to all, require the obedience and submission of all, being the last resort, beyond which there is no decision or appeal.

165 Foundation of public spirit, love of liberty, &c.

Public spirit, heroic zeal, love of liberty, and the other *political* duties, do, above all others, recommend those who practise them to the admiration and homage of mankind; because, as they are the offspring of the noblest minds, so *are they* the parents of the greatest blessing to society. Yet, exalted as they are, it is only in equal and free governments where they can be exercised and have their due effect. For there only does a true *public spirit* prevail, and there only is the *public good* made the standard of the civil constitution. As the end of society is the *common interest* and *welfare* of the people associated, this end must of necessity be the *supreme law* or *common standard*, by which the particular rules of action of the several members of the society towards each other are to be regulated. But a *common interest* can be no other than that which is the result of the *common reason* or *common feelings* of all. Private men, or a particular order of men, have interests and feelings peculiar to themselves, and of which they may be good judges; but these may be separate from, and often contrary to the interests and feelings of the rest of the society; and therefore they can have no right to make, and much less to impose, laws on their fellow-citizens, inconsistent with, and opposite to, those interests and those feelings. Therefore, a *society*, a *government*, or *real public*, truly worthy the name, and not a confederacy of banditti, a clan of lawless savages, or a band of slaves under the whip of a master, must be such a one as consists of freemen, chusing or consenting to laws themselves: or, since it often happens that they cannot assemble and act in a *collective body*, delegating a sufficient number of *representatives*, i. e. such a number as shall most fully comprehend, and most equally represent, their *common feelings* and *common interest*, to digest and vote laws for the conduct and controul of the whole body, the most agreeable to those common feelings and common interests.

166 Political duties of every citizen.

A society thus constituted by *common reason*, and formed on the plan of a *common interest*, becomes immediately an object of public attention, public veneration, public obedience, a public and inviolable attachment, which ought neither to be seduced by bribes, nor awed by terrors; an object, in fine, of all those extensive and important duties which arise from so glorious a confederacy. To watch over such a system; to contribute all he can to promote its good by his reason, his ingenuity, his strength, and every other ability, whether natural or acquired; to resist, and, to the utmost of his power, defeat every incroachment upon it, whether carried on by a secret corruption or open violence; and to sacrifice his ease, his wealth, his power, nay life itself, and, what is dearer still, his family and friends, to defend or save it, is the duty, the honour, the interest, and the happiness of every citizen; it will make him venerable and beloved while he lives, be lamented and honoured if he falls in so glorious a cause, and transmit his name with immortal renown to the latest posterity.

167 Of the people.

As the PEOPLE are the fountain of power and authority, the original seat of majesty, the authors of laws, and the creators of officers to execute them; if they shall find the power they have conferred abused by their trustees, their majesty violated by tyranny or by usurpation, their authority prostituted to support violence or screen corruption, the laws grown pernicious through accidents unforeseen or unavoidable, or rendered ineffectual through the infidelity and corruption of the executors of them; then it is their right, and what is their right is their duty, to resume that delegated power, and call their trustees to an acount; to resist the usurpation, and extirpate the tyranny; to restore their sullied majesty and prostituted authority; to suspend, alter, or abrogate those laws, and punish their unfaithful and corrupt officers. Nor is it the duty only of the united body; but every member of it ought, according to his respective rank, power, and weight in the community, to concur in advancing and supporting these glorious designs.

Resistance, therefore, being undoubtedly lawful in extraordinary emergencies, the question, among good reasoners, can only be with regard to the degree of necessity which can justify resistance, and render it expedient or commendable, And here we must acknowledge, that, with Mr Hume *, "we shall always incline to their side that draw the bond of allegiance very close, and who consider an infringement of it as the last refuge in desperate cases, when the public is in the highest danger from violence and tyranny. For besides the mischiefs of a civil war, which commonly attends insurrection, it is certain, that where a disposition to rebellion appears among any people, it is one chief cause of tyranny in the rulers, and forces them into many violent measures, which, had every one been inclined to submission and obedience, they would never have embraced. Thus the *tyrannicide*, or assassination approved of by ancient maxims, instead of keeping tyrants and usurpers in awe, made them ten times more fierce and unrelenting; and is now justly abolished on that account by the laws of nations, and universally condemned as a base and treacherous method of bringing to justice those disturbers of society."

* Essays, vol. I.

CHAP. IV. *Duty to* GOD.

168 Divine connections.

OF all the *relations* which the human mind sustains, that which subsists between the *Creator* and his *creatures*,

tures, the supreme *Lawgiver* and his *subjects*, is the highest and the best. This relation arises from the *nature* of a *creature* in general, and the *constitution* of the *human mind* in particular; the noblest powers and affections of which point to an *universal* mind, and would be imperfect and abortive without such a direction. How lame then must that system of morals be, which leaves a *Deity* out of the question! How disconsolate, and how destitute of its firmest support!

169 Existence of God.

It does not appear, from any true history or experience of the mind's progress, that any man, by any formal deduction of his discursive power, ever reasoned himself into the belief of a God. Whether such a belief is only some *natural anticipation* of soul, or is derived from father to son, and from one man to another, in the way of *tradition*, or is suggested to us in consequence of an *immutable law of our nature*, on beholding the august aspect and beautiful order of the universe, we will not pretend to determine. What seems most agreeable to experience is, that a *sense* of its *beauty* and *grandeur*, and the *admirable fitness* of one thing to another in its vast apparatus, leads the mind *necessarily* and *unavoidably* to a perception of a *design*, or of a *designing cause*, the origin of all, by a progress as simple and natural as that by which a *beautiful picture* or a *fine building* suggests to us the idea of an *excellent artist*. For it seems to hold universally true, that wherever we discern a *tendency* or *co-operation of things towards a certain end*, or producing a common effect, there, by a necessary *law of association*, we apprehend *design*, a *designing energy* or *cause*. No matter whether the objects are *natural* or *artificial*, still that suggestion is unavoidable, and the *connection* beween the *effect* and its *adequate cause* obtrudes itself on the mind, and it requires no nice search or elaborate deduction of reason to trace or prove that connection. We are particularly satisfied of its truth in the subject before us by a kind of direct intuition; and we do not seem to attend to the maxim we learn in schools, "That there cannot be an *infinite series* of *causes* and *effects* producing and produced by one another." That maxim is familiar only to metaphysicians; but all men of sound understanding are led to believe the existence of a God. We are conscious of our *existence*, of *thought*, *sentiment*, and *passion*, and sensible withal that these came not of ourselves; therefore we immediately recognise a *parent-mind*, an *original intelligence*, from whom we borrowed those little portions of thought and activity. And while we not only feel *kind* affections in ourselves, and discover them in others, but likewise behold round us such a number and variety of creatures, endued with natures nicely adjusted to their several stations and œconomies, supporting and supported by each other, and all sustained by a *common order* of things, and sharing different degrees of happiness according to their respective capacities, we are naturally and necessarily led up to the Father of such a numerous off-spring, the fountain of such wide-spread happiness. As we conceive this Being before all, above all, and greater than all, we naturally, and without reasoning, ascribe to

170 His relation to the human mind.

him every kind of perfection, wisdom, power, and goodness without bounds, existing through all time, and pervading all space. We apply to him those glorious epithets of our *Creator*, *Preserver*, *Benefactor*, the *supreme Lord* and *Lawgiver* of the whole society of rational and intelligent creatures. Not only the imperfections and wants of our being and condition, but some of the noblest instincts and affections of our minds, connect us with this great and universal nature. The mind, in its progress from object to object, from one character and prospect of beauty to another, finds some blemish or deficiency in each, and soon exhausts or grows weary and dissatisfied with its subject; it sees no character of excellency among men equal to that pitch of esteem which it is capable of exerting; no object within the compass of human things adequate to the strength of its affection: nor can it stay any where in this self-expansive progress, or find repose after its highest flights, till it arrives at a Being of unbounded greatness and worth, on whom it may employ its sublimest powers without exhausting the subject, and give scope to the utmost force and fulness of its love without satiety or disgust. So that the nature of this Being corresponds to the nature of man; nor can his intelligent and moral powers obtain their entire end, but on the supposition of such a Being, and without a real sympathy and communication with him. The native propensity of the mind to reverence whatever is *great* and *wonderful* in nature, finds a proper object of homage in him who spread out the heavens and the earth, and who sustains and governs the whole of things. The *admiration* of beauty, the *love* of order, and the *complacency* we feel in goodness, must rise to the highest pitch, and attain the full vigour and joy of their operations, when they unite in him who is the sum and source of all perfection.

171 Immorality of impiety.

It is evident from the slightest survey of morals, that how punctual soever one may be in performing the duties which result from our relations to mankind, yet to be quite deficient in performing those which arise from our *relation* to the *Almighty*, must argue a strange perversion of *reason* or depravity of *heart*. If imperfect degrees of worth attract our veneration, and if the want of it would imply an insensibility, or, which is worse, an aversion to merit, what lameness of affection or immorality of character must it be to be unaffected with, and much more to be ill-affected to, a Being of superlative worth! To love society, or particular members of it, and yet to have no sense of our connection with its Head, no affection to our common Parent and Benefactor; to be concerned about the approbation or censure of our fellow-creatures, and yet to feel nothing of this kind towards him who sees and weighs our actions with unerring wisdom and justice, and can fully reward or punish them, betrays equal madness and partiality of mind. It is plain, therefore, beyond all doubt, that some regards are due to the great Father of all, in whom every lovely and adorable quality combines to inspire veneration and homage.

172 Right opinions of God.

As it has been observed already, that our *affections* depend on our *opinions* of their objects, and generally keep pace with them, it must be of the highest importance, and seems to be among the first duties we owe to the Author of our being, "to form the least imperfect, since we cannot form perfect, conceptions of his *character* and *administration*." For such *conceptions*, thoroughly imbibed, will render our *religion* rational, and our *dispositions* refined. If our *opinions* are diminutive and distorted, our religion will be super-

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stituous, and our temper abject. Thus, if we ascribe to the Deity that false majesty which consists in the unbenevolent and sullen exercise of mere *will* or *power*, or suppose him to delight in the prostrations of servile fear, or as servile praise, he will be worshipped with mean adulation and a profusion of compliments. Farther, if he be looked upon as a stern and implacable Being, delightful in vengeance, he will be adored with pompous offerings, sacrifices, or whatever else may be thought proper to soothe and mollify him. But if we believe *perfect goodness* to be the character of the supreme Being, and that he loves those most who resemble him most, the worship paid him will be rational and sublime, and his worshippers will seek to please him by imitating that goodness which they adore.

173 Rational faith.

The foundation then of all true religion is a *rational faith*. And of a rational faith these seem to be the chief articles to believe, "that an infinite all perfect Mind exists, who has no opposite nor any separate interest from that of his creatures;—that he superintends and governs all creatures and things;—that his goodness extends to all his creatures, in different degrees indeed, according to their respective natures, but without any partiality or envy:—that he does every thing for the best, or in a subserviency to the perfection and happiness of the whole: particularly that he directs and governs the affairs of men, inspects their actions, distinguishes the *good* from the *bad*, loves and befriends the former is displeased with and pities the latter in *this* world, and will according to their respective deserts reward one and punish the other in the next;—that in fine, he is always carrying on a scheme of virtue and happiness through an unlimited duration; and is ever guiding the universe through its successive stages and periods, to higher degrees of perfection and felicity." This is true *Theism*, the glorious scheme of divine faith; a scheme exhibited in all the works of God, and executed through his whole administration.

174 Morality of theism.

This faith, well founded and deeply felt, is nearly connected with a *true moral taste*, and hath a powerful efficacy on the temper and manners of the theist. He who admires goodness in others, and delights in the practice of it, must be conscious of a reigning order within, a rectitude and candour of heart, which disposes him to entertain favourable apprehensions of men, and, from an impartial survey of things, to presume that *good order* and *good meaning* prevail in the universe; and if good meaning and good order, then an *ordering*, an *intending mind*, who is no enemy, no tyrant to his creatures, but a *friend*, a *benefactor*, an *indulgent sovereign*.

175 Immorality of atheism.

On the other hand, a bad man, having nothing goodly or generous *to contemplate within*, no right intentions, nor honesty of heart, suspects every person and every thing: and, beholding nature through the gloom of a selfish and guilty mind, is either averse to the belief of a reigning order, or, if he cannot suppress the unconquerable anticipations of a governing mind, he is prone to tarnish the beauty of nature, and to impute malevolence, or blindness and impotence at least to the Sovereign Ruler. He turns the universe into a forlorn and horrid waste, and transfers his own character to the Deity, by ascribing to him that uncommunicative grandeur, that arbitrary or revengeful spirit, which he affects or admires in himself. As such a temper of mind naturally leads to *atheism*, or to a *superstition* full as bad; therefore, as far as that temper depends on the unhappy creature in whom it prevails, the propensity to atheism or superstition consequent thereto must be *immoral*. Farther, if it be true that the belief or sense of a Deity is natural to the mind and the evidence of his existence reflected from his works so full as to strike even the superficial observer with conviction, then the supplanting or corrupting that sense, or the want of due attention to that evidence, and, in consequence of both, a supine ignorance or affected unbelief of a Deity, must argue a bad temper or an immoral turn of mind. In the case of invincible ignorance, or a very bad education, tho' nothing can be concluded directly against the character; yet whenever ill passions and habits pervert the judgment, and by perverting the judgment terminate in atheism, then the case becomes plainly criminal.

176 The connection of theism and virtue.

But let casuists determine this as they will, a true faith in the divine character and administration is generally the consequence of a virtuous state of mind. The man who is truly and habitually good, feels the *love of order*, of *beauty*, and *goodness*, in the strongest degree; and therefore cannot be insensible to those emanations of them which appear in all the works of God, nor help loving their supreme source and model. He cannot but think, that he who has poured such beauty and goodness over all his works, must himself delight in beauty and goodness, and what he delights in must be both amiable and happy. Some indeed, there are, and it is pity there should be any such, who through the unhappy influence of a wrong education, have entertained dark and unfriendly thoughts of a Deity and his administration, though otherwise of a virtuous temper themselves. However, it must be acknowledged, that such sentiments have, for the most part, a bad effect on the temper: and when they have not, it is because the undepraved affections of an honest *heart* are more powerful in their operation than the speculative opinions of an ill informed *head*.

177 Duties of gratitude, love, &c.

But whenever right conceptions of the Deity and his providence prevail, when he is considered as the inexhausted source of light, and love, and joy, as acting in the joint character of a *Father* and *Governor*, imparting an endless variety of capacities to his creatures, and supplying them with every thing necessary to their full completion and happiness; what veneration and gratitude must such conceptions, thoroughly believed, excite in the mind! How natural and delightful must it be to one whose heart is open to the perception of truth, and of every thing *fair*, *great*, and *wonderful* in nature, to contemplate and adore him who is the first *fair*, the first *great*, and first *wonderful*; in whom *wisdom*, *power*, and *goodness*, dwell vitally, essentially, originally, and act in perfect concert? What *grandeur* is here to fill the most enlarged capacity, what *beauty* to engage the most ardent love, what a mass of *wonder* in such exuberance of perfection to astonish and delight the human mind through an unfailing duration!

178 Other affections.

If the *Deity* is considered as our supreme *Guardian* and *Benefactor*, as the *Father of Mercies*, who loves his creatures with infinite tenderness, and in a particular manner all good men, nay all who delight in goodness, even in its most imperfect degrees, what resignation, Duty to God. nation, what dependence, what generous confidence, what hope in God and his all wise providence, must arise in the soul that is possessed of such amiable views of him? All those exercises of piety, and above all a superlative esteem and love, are directed to God as to their *natural*, their *ultimate*, and indeed their only *adequate* object; and though the immense obligations we have received from him may excite in us more lively feelings of divine goodness than a general and abstracted contemplation of it, yet the affections of *gratitude* and *love* are of themselves of the generous disinterested kind, not the result of self-interest, or views of reward. A perfect character, in which we always suppose infinite goodness, guided by unerring wisdom, and supported by almighty power, is the proper object of perfect love; which, as such, we are forcibly drawn to pursue and to aspire after. In the contemplation of the divine nature and attributes, we find at last what the ancient philosophers sought in vain, the SUPREME AND SOVEREIGN GOOD; from which all other goods arise, and in which they are all contained. The Deity therefore challenges our supreme and sovereign love, a sentiment which, whosoever indulges, must be confirmed in the love of virtue, in a desire to imitate its all-perfect pattern, and in a cheerful security that all his great concerns, those of his friends and of the universe, shall be absolutely safe under the conduct of unerring wisdom and unbounded goodness. It is in his care and providence alone that the good man, who is anxious for the happiness of all, finds perfect serenity; a serenity neither ruffled by partial ill nor soured by private disappointment.

179 Repentance &c. When we consider the unstained purity and absolute perfection of the *divine* nature, and reflect withal on the imperfection and various blemishes of our own, we must sink, or be convinced we ought to sink, into the deepest humility and prostration of soul before him who is so wonderfully great and holy. When, further, we call to mind what low and languid feelings we have of the divine presence and majesty, what insensibility of his fatherly and universal goodness, nay, what ungrateful returns we have made to it, how far we come short of the perfection of his law and the dignity of our own nature, how much we have indulged to the selfish passions, and how little to the benevolent ones; we must be conscious that it is our duty to repent of a temper and conduct so unworthy our nature and unbecoming our obligations to its Author, and to resolve and endeavour to act a wiser and better part for the future,

180 Hopes of pardon. Nevertheless, from the character which his works exhibit of him, from those delays or alleviations of punishment which offenders often experience, and from the merciful tenor of his administration in many other instances, the sincere penitent may entertain good hopes that his Parent and Judge will not be strict to mark iniquity, but will be propitious and favourable to him, if he honestly endeavours to avoid his former practices, and subdue his former habits, and to live in a greater conformity to the divine will for the future. If any doubts or fears should still remain, how far it may be consistent with the rectitude and equity of the divine government to let his iniquities pass unpunished, yet he cannot think it unsuitable to his paternal clemency and wisdom to contrive a method of retrieving the penitent offender, that shall unite and reconcile the majesty and mercy of his government. If reason cannot of itself suggest such a scheme, it gives at least some ground to expect it. But though *natural religion* cannot let in moral light and assurance on so interesting a subject, yet it will teach the humble theist to wait with great submission for any farther intimations it may please the supreme Governor to give of his will; to examine with candour and impartiality whatever evidence shall be proposed to him of a *divine revelation*, whether that evidence is *natural* or *supernatural*; to embrace it with veneration and cheerfulness, if the evidence is clear and convincing; and finally, if it bring to light any *new relations* or *connections*, *natural religion* will persuade its sincere votary faithfully to comply with the *obligations*, and perform the *duties* which result from those relations and connections. This is *theism piety*, the *completion of morality*!

181 Worship, praise, thanksgiving. We must farther observe, that all those affections which we supposed to regard the Deity as their *immediate* and *primary* object, are vital energies of the soul, and consequently exert themselves into act, and, like all other energies, gain strength or greater activity by that exertion. It is therefore our *duty* as well as highest *interest*, often at stated times, and by decent and solemn acts, to contemplate and adore the great Original of our existence, the Parent of all beauty and of all good; to express our veneration and love by an awful and devout recognition of his perfections; and to evidence our gratitude by celebrating his goodness, and thankfully acknowledging all his benefits. It is likewise our duty, by proper exercises of sorrow and humiliation, to confess our ingratitude and folly; to signify our dependence on God, and our confidence in his goodness, by imploring his blessing and gracious concurrence in assisting the weakness and curing the corruptions of our nature; and finally, to testify our sense of his authority, and our faith in his government, by devoting ourselves to do his will, and resigning ourselves to his disposal. These duties are not therefore obligatory, because the Deity needs or can be profited by them; but as they are apparently *decent* and *moral*, suitable to the relations he sustains of our *Creator*, *Benefactor*, *Lawgiver*, and *Judge*; expressive of our state and obligations; and improving to our tempers, by making us more rational, social, god-like, and consequently more happy.

182 External worship. We have now considered INTERNAL piety, or the *worship of the mind*, that which is in spirit and in truth; we shall conclude the section with a short account of that which is EXTERNAL. *External* worship is founded on the same principles as *internal*, and of as strict moral obligation. It is either *private* or *public*. *Devotion* that is *inward*, or *purely intellectual*, is too spiritual and abstracted an operation for the bulk of mankind. The operations of their minds, such especially as are employed on the most sublime, immaterial objects, must be assisted by their outward organs, or by some help from the imagination; otherwise they will soon be dissipated by sensible impressions, or grow tiresome if too long continued. Ideas are such fleeting things, that they must be fixed; and so subtle, that they must be expressed and delineated, as it were, by sensible marks and images; otherwise we cannot

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attend to them nor be much affected by them. *Therefore verbal adoration, prayer praise, thanksgiving,* and *confession*, are admirable aids to *inward* devotion, fix our attention, compose and enliven our thoughts, impress us more deeply with a sense of the awful presence in which we are, and, by a natural and mechanical sort of influence, tend to heighten those devout feelings and affections which we ought to entertain, and after this manner reduce into formal and explicit act.

183 Public worship.

This holds true in an higher degree in the case of *public* worship, where the presence of our fellow-creatures, and the powerful contagion of the *social* affections, conspire to kindle and spread the devout flame with greater warmth and energy. To conclude; As *God* is the *parent* and *head* of the *social system*, as he has formed us for a *social state*, as by *one* we find the best security against the ills of life, and in the *other* enjoy its greatest comforts, and as, by means of *both*, our nature attains its highest improvements and perfection; and moreover, as there are *public blessings* and *crimes* in which we all share in some degree, and *public wants* and *dangers* to which all are exposed—it is therefore evident, that the various and solemn offices of *public religion* are duties of indispensable moral obligation, among the best cements of society, the firmest prop of government, and the fairest ornament of both.

PART III.

CHAP. I. *Of* PRACTICAL ETHICS, *or the* CULTURE *of the* MIND.

184 Dignity and importance of the subject.

WE have now gone through a particular detail of the several duties we owe to OURSELVES, to SOCIETY, and to GOD. In considering the *first order* of duties, we just touched on the methods of acquiring the different kinds of goods which we are led by nature to pursue; only we left the consideration of the method of acquiring the *moral* goods of the mind to a chapter by itself, because of its singular importance. This chapter then will contain a brief enumeration of the arts of acquiring *virtuous habits*, and of eradicating *vicious ones*, as far as is consistent with the brevity of such a work: a subject of the utmost difficulty as well as importance in morals; to which, nevertheless, the least attention has been generally given by *moral* writers. This will properly follow a detail of duty, as it will direct us to such *means* or *helps* as are most necessary and conducive to the practice of it.

185 Sensible ideas and sensible taste.

In the first part of this inquiry we traced the order in which the passions shoot up in the different periods of human life. That order is not accidental, or dependent on the caprice of men, or the influence of custom and education, but arises from the original constitution and laws of our nature; of which this is one, viz. "That sensible objects make the first and strongest impressions on the mind." These, by means of our outward organs, being conveyed to the mind, become objects of its attention, on which it reflects when the outward objects are no longer present, or in other words, when the impressions upon the outward organs cease. These objects of the mind's reflection are called *ideas* or *notions*. Towards these, by another law of our nature, we are not altogether indifferent; but correspondent movements of *desire* or *aversion*, *love* or *hatred*, arise, according as the objects which they denote made an agreeable or disagreeable impression on our organs. Those *ideas* and *affections* which we experience in the *first* period of life, we refer to the *body*, or to *sense*; and the *taste* which is formed towards them, we call a *sensible*, or a merely *natural taste*; and the objects corresponding to them we in general call *good* or *pleasant*.

But as the mind moves forward in its course, it extends its views, and receives a new and more *complex* set of ideas, in which it observes *uniformity*, variety, *similitude*, *symmetry of parts*, *reference to an end*, *novelty*, *grandeur*. These compose a vast train and diversity of *imagery*, which the mind compounds, divides, and moulds into a thousand forms, in the absence of those objects which first introduced it. And this more complicated imagery suggests a new train of *desires* and *affections*, full as sprightly and engaging as any which have yet appeared. This whole class of *perceptions* or *impressions* is referred to the *imagination*, and forms an higher taste than the *sensible*, and which has an immediate and mighty influence on the *finer* passions of our nature, and is commonly termed a *fine taste*. 186 Ideas of beauty and a fine taste.

The objects which correspond to this taste we use to call *beautiful*, *great*, *harmonious*, or *wonderful*, or in general by the name of *beauty*.

187 Moral ideas and a moral taste.

The mind, still pushing onwards and increasing its stock of ideas, ascends from those to an higher species of objects, viz. the *order* and *mutual relations* of *minds* to each other, their reciprocal *affections*, *characters*, *actions*, and various *aspects*. In these it discovers a *beauty* a *grandeur*, a *decorum*, more interesting and alluring than any of the former kinds. These objects, or the notions of them, passing in review before the mind, do, by a necessary law of our nature, call forth another and nobler set of affections, as *admiration*, *esteem*, *love*, *honour*, *gratitude*, *benevolence*, and others of the like tribe. This class of *perfections*, and their correspondent *affections*, we refer, because of their objects *(manners)*, to a *moral* sense, and call the *taste* or *temper* they excite, *moral*. And the objects which are agreeable to this *taste* or *temper* we denominate by the general name of *moral beauty*, in order to distinguish it from the other which is termed *natural*.

188 Sources of association.

These different sets of *ideas* or *notions* are the materials about which the mind employs itself, which it blends, ranges, and diversifies ten thousand different ways. It feels a strong propension to connect and associate those ideas among which it observes any *similitude* or any *aptitude*, whether *original* and *natural*, or *customary* and *artificial*, to suggest each other. See METAPHYSICS.

189 Laws of association.

But whatever the reasons are, whether *similitude*, *co-existence*, *causality*, or any other *aptitude* or *relation*, why any two or more ideas are connected by the mind at first, it is an established law of our nature, "that when two or more ideas have often started in company,

company, they form so strong an union, that it is very difficult ever after to separate them." Thus the *lover* cannot separate the idea of *merit* from his *mistress*; the *courtier* that of *dignity* from his *title* or *ribbon*; the *miser* that of *happiness* from his *bags*. It is these associations of *worth* or *happiness* with any of the different sets of *objects* or *images* before specified, that form our *taste* or *complex idea* or *good*. By another law of our nature, "our *affections* follow and are governed by this *taste*. And to these *affections* our *character* and *conduct* are similar and proportioned; on the general tenor of which our *happiness* principally depends.'

190 Leading passions follow taste.

As all our *leading* passions then depend on the direction which our *taste* takes, and as it is always of the same strain with our *leading* associations, it is worth while to inquire a little more particularly how these are formed, in order to detect the secret sources from whence our passions derive their principal strength, their various rises and falls. For this will give us the true key to their management, and let us into the right method of correcting the *bad* and improving the *good*.

191 The importance and use of the imagination.

No kind of objects make so powerful an impression on us as those which are immediately impressed on our *senses*, or strongly painted on our *imaginations*. Whatever is purely *intellectual*, as abstracted or scientific truths, the subtle relations and differences of things, has a fainter sort of existence in the mind; and though it may exercise and whet the *memory*, the *judgment*, or the *reasoning power*, gives hardly any impulse at all to the *active* powers, the *passions*, which are the main springs of motion. On the other hand, were the mind entirely under the direction of *sense*, and impressible only by such objects as are present, and strike some of the outward organs, we should then be precisely in the state with the brute creation, and be governed solely by *instinct* or *appetite*, and have no power to controul whatever impressions are made upon us: Nature has therefore endued us with a *middle faculty*, wonderfully adapted to our *mixed* state, which holds partly of *sense* and partly of *reason*, being strongly allied to the *former*, and the common receptacle in which all the notices that come from that quarter are treasured up; and yet greatly subservient and ministerial to the *latter*, by giving a body, a coherence, and beauty to its conceptions. This *middle* faculty is called the *imagination*, one of the most busy and fruitful powers of the mind. Into this common storehouse are likewise carried all those *moral forms* which are derived from our *moral faculties* of perception; and there they often undergo new changes and appearances, by being mixed and wrought up with the ideas and forms of *sensible* or *natural* things. By this coalition of imagery, *natural beauty*, is dignified and heightened by *moral qualities* and *perfections*, and *moral qualities* are at once exhibited and set of by *natural beauty*. The *sensible* beauty, or good, is refined from its dross by partaking of the *moral*; and the *moral* receives a stamp, a visible character and currency, from the *sensible*

192 Its energy in various instances in heightening sensible pleasures.

As we are first of all accustomed to *sensible* impressions and *sensible* enjoyments, we contract early a *sensual relish* or *love of pleasure*, in the lower sense of the word. In order, however, to justify this relish, the mind, as it becomes open to *higher* perceptions of ***beauty*** and ***good***, borrows from thence a noble set of *images*, as *fine taste*, *generosity*, *social affections*, *friendship*, *good fellowship*, and the like; and, by dressing out the old pursuits with these new ornaments, gives them an additional dignity and lustre. By these ways the *desire of a table*, *love of finery*, *intrigue*, and *pleasure*, are vastly increased beyond their natural pitch, having an impulse combined of the force of the *natural* appetites, and of the superadded strength of those

193 In heightening the pleasures of beauty, harmony, &c.

passions which tend to the *moral species*. When the mind becomes more sensible to those objects or appearances in which it perceives *beauty*, *uniformity*, *grandeur*, and *harmony*, as fine clothes, elegant furniture, plate, pictures, gardens, houses, equipages, the beauty of animals, and particularly the attractions of the sex; to these objects the mind is led by *nature* or taught by *custom*, the *opinion* and example of others, to annex certain ideas of *moral character*, *dignity*, *decorum honour*, *liberality*, *tenderness*, and *active* or *social enjoyment*. The consequence of this association is, that the objects to which these are annexed must rise in their value, and be pursued with proportionable ardour. The *enjoyment* of them is often attended with *pleasure*; and the mere *possession* of them, where that is wanting, frequently draws respect from one's fellow-creatures: This *respect* is, by many, thought equivalent to the pleasure of *enjoyment*. Hence it happens that the idea of *happiness* is connected with the mere *possession*, which is therefore eagerly sought after, without any regard to the *generous use* or *honourable enjoyment*. Thus the passion resting on the *means*, not the *end*, i. e. losing sight of its *natural* object, becomes wild and extravagant.

194 In raising the value of external symbols, &c.

In fine, any *object*, or *external denomination*, a *staff*, a *garter*, a *cup*, a *crown*, a *title*, may become a *moral* badge or emblem of *merit*, *magnificence*, or *honour*, according as these have been found or thought by the possessors or admirers of them, to accompany them; yet by the deception formerly mentioned, the *merit* or the *conduct* which intitled, or should intitle to those marks of distinction, shall be forgot or neglected, and the *badges* themselves be passionately affected or pursued, as including every excellency. If these are attained by any means, all the concomitants which *nature*, *custom*, or *accidents* have joined to them, will be supposed to follow of course. Thus, *moral ends*, with which the unhappy admirer is apt to colour over his passion and views, will, in his opinion, justify the most *immoral means*, as *prostitution*, *adulation fraud treachery*, and every species of ***knavery***, whether more open or more disguised.

195 In heightening the value of wealth, power, &c.

When men are once engaged in *active* life, and find that *wealth* and *power*, generally called INTEREST, are the great avenues to every kind of enjoyment, they are apt to throw in many engaging *moral forms* to the object of their pursuit, in order to justify their passion, and varnish over the measures they take to gratify it, as *independency on the vices* or *passions* of others, *provision* and *security to themselves* and *friends*, *prudent œconomy*, or *well placed charity*, *social communication*, *superiority to their enemies*, who are all villains, *honourable service*, and many other ingredients of *merit*. To attain such capacities of *usefulness* or *enjoyment*, what arts, nay what meannesses, can be thought blameable by those cool pursuers of interest?—Nor have they whom the gay world is pleased to indulge with

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with the title of *men of pleasure*, their imaginations less pregnant with *moral images*, with which they never fail to ennoble, or, if they cannot do that, to palliate their gross pursuits. Thus *admiration of wit*, of *sentiments* and *merit*, *friendship*, *love*, *generous sympathy*, *mutual confidence*, *giving* and *receiving pleasure*, are the ordinary ingredients with which they season their gallantry and pleasurable entertainments; and by which they impose on themselves, and endeavour to impose on others, that *their amours* are the joint issue of good sense and virtue.

196
Its influence on all the passions.

These *associations*, variously combined and proportioned by the *imagination*, form the chief *private* passions, which govern the lives of the generality, as the *love of action*, of *pleasure*, *power*, *wealth*, and *fame*; they influence the *defensive*, and affect the *public passions*, and raise *joy* or *sorrow* as they are gratified or disappointed. So that in effect these associations of *good* and *evil*, *beauty* and *deformity*, and the passions they raise, are the main *hinges of life* and *manners*, and the great *sources* of our *happiness* or *misery*. It is evident, therefore, that the whole of *moral culture* must depend on giving a right direction to the *leading passions*, and duly proportioning them to the *value* of the *objects* or *goods* pursued, under what name soever they may appear.

197
Moral culture, by correcting our taste or imagination.

Now, in order to give them this *right direction* and *due proportion*, it appears, from the foregoing detail, that those *associations* of ideas, upon which the passions depend, must be *duly* regulated; that is to say, as an exorbitant passion for *wealth pleasure*, or *power*, flows from an *association* or *opinion* that more *beauty* and *good*, whether *natural* or *moral*, enters into the enjoyment or possession of them, than really belongs to either; *therefore*, in restoring those passions to their just proportion, we must begin with correcting the *opinion*, or breaking the *false association*, or, in other words, we must decompound the *complex phantom* of *happiness* or *good*, which we fondly admire; disunite those ideas that have no natural alliance; and separate the *original* idea of *wealth*, *power*, or *pleasure*, from the foreign mixtures incorporated with it, which enhance its value, or give it its chief power to enchant and seduce the mind. For instance, let it be considered how poor and inconsiderable a thing *wealth* is, if it be disjoined from *real use*, or from ideas of *capacity* in the possessor *to do good*, from *independency*, *generosity*, *provision for a family* or *friends*, and *social communication* with others. By this *standard* let its true value be fixed; let its misapplication, or unbenevolent enjoyment, be accounted sordid and infamous; and nothing worthy or estimable be ascribed to the *mere possession* of it, which is not borrowed from its *generous use*.

198
By self denial, and a counter-process.

If that *complex* form of *good* which is called *pleasure* engage us, let it be analysed into its constituent principles, or those allurements it draws from the *heart* and *imagination*, in order to heighten the low part of the indulgence; let the *separate* and *comparative* moment of each be distinctly ascertained and deduced from that gross part, and this remainder of the accumulated enjoyment will dwindle down into a poor, insipid, transitory thing. In proportion as the *opinion* of the *good* pursued abates, the *admiration* must decay, and the *passions* lose strength of course. One effectual way to lower the *opinion*, and consequently to weaken the habit founded upon it, is to practise lesser pieces of self-denial, or to abstain, to a certain pitch, from the pursuit or enjoyment of the favourite object; and that this may be the more easily accomplished, one must avoid those occasions, that company, those places, and the other circumstances, that inflamed *one* and endeared the *other*. And, as a *counter-process*, let *higher* or even *different* enjoyments be brought in view, other passions played upon the former, different places frequented, other exercises tried, company kept with persons of a different or more correct way of thinking, both in *natural* and *moral* subjects.

199
By a sound and natural education.

As much depends on our setting out well in life, let the *youthful* fancy, which is apt to be very florid and luxuriant, be early accustomed by *instruction*, *example*, and significant *moral exercises*, nay, by looks, gestures, and every other testimony of just approbation or blame, to annex ideas of *merit*, *honour*, and *happiness*, not to *birth*, *dress*, *rank*, *beauty*, *fortune*, *power*, *popularity*, and the like *outward* things, but to *moral* and *truly virtuous qualities*, and to those *enjoyments* which spring from a well-informed judgement and a regular conduct of the affections, especially those of the *social* and *disinterested* kind. Such dignified forms of *beauty* and *good*, often suggested, and, by moving pictures and examples warmly recommended to the *imagination*, enforced by the authority of *conscience*, and demonstrated by *reason* to be the surest means of enjoyment, and the only independent, undeprivable, and durable goods, will be the best counterbalance to meaner passions, and the firmest foundation and security to virtue.

200
By rightly studying human nature.

It is of great importance to the forming a *just taste*, or pure and large conceptions of happiness, to study and understand *human nature* well, to remember what a complicated system it is, particularly to have deeply imprinted on our mind that GRADATION of *senses*, *faculties*, and *powers of enjoyment* formerly mentioned, and the *subordination* of *goods* resulting from thence, which nature points out, and the experience of mankind confirms. Who when they think seriously, and are not under the immediate influence of some violent prejudice or passion, prefer not the pleasures of *action*, *contemplation*, *society*, and most *exercises* and *joys* of the *moral* kind, as *friendship*, *natural affection*, and the like, to all *sensual* gratifications whatsoever? Where the different species of pleasure are blended into *one complex form*, let them be accurately distinguished, and be referred each to its proper *faculty* and *sense*, and examined apart what they have peculiar, what common with others, and what foreign and adventitious. Let *wealth*, *grandeur*, *luxury*, *love*, *fame*, and the like, be tried by this test, and their true alloy will be found out. Let it be farther considered, whether the mind may not be easy and enjoy itself greatly, though it want many of those elegancies and superfluities of life which some possess, or that load of wealth and power which others eagerly pursue, and under which they groan. Let the difficulty of attaining, the precariousness of possessing, and the many abatements in enjoying overgrown wealth and envied greatness, of which the weary possessors so frequently complain, as the hurry of business, the burden of company, of paying attendance to the *few*, and giving it to the *many*, the cares of keeping, the fears of

201
By comparing the moment and abatements of different goods.

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of losing, and the desires of encreasing what they have, and the other troubles which accompany this pitiful drudgery and pompous servitude; let these and the like circumstances be often considered, that are conducive to the removing or lessening the *opinion* of such goods, and the attendant *passion* or *set* of *passions* will decay of course.

202 By observing our own bent and character, &c.

Let the peculiar bent of our nature and character be observed, whether we are most inclined to form associations and relish objects of the *sensible*, *intellectual*, or *moral* kind. Let that which has the ascendant be particularly watched; let it be directed to right objects, be improved by proportioned exercises, and guarded by proper checks from an opposite quarter. Thus the *sensible* turn may be exalted by the *intellectual*, and a taste for the beanty of the *fine arts*, and both may be made subservient to convey and rivet sentiments highly *moral* and *public-spirited*. This inward survey must extend to the *strength* and *weaknesses* of one's *nature*, one's *conditions*, *connections*, *habitudes*, *fortune*, *studies*, *acquaintance*, and the other circumstances of one's life, from which every man will form the justest estimate of his own dispositions and character, and the best rules for correcting and improving them. And in order to do this with more advantage, let those *times* or *critical seasons* be watched when the mind is best disposed towards a change; and let them be improved by rigorous *resolutions*, *promises*, or whatever else will engage the mind to persevere in virtue. Let the *conduct*, in fine, be often reviewed, and the *cause*, of its *corruption* or *improvement* be carefully observed.

203 By frequent moral exercises.

It will greatly conduce to refine the *moral taste*, and strengthen the *virtuous temper*, to accustom the mind to the frequent exercise of *moral sentiments* and *determinations*, by reading *history*, *poetry*, particularly of the *picturesque* and *dramatic* kind, the study of the *fine arts*; by conversing with the most eminent for good sense and virtue; but, above all, by frequent and repeated acts of *humanity*, *compassion*, *friendship*, *politeness*, and *hospitality*. It is exercise that gives health and strength. He that reasons most frequently becomes the wisest, and most enjoys the pleasures of wisdom. He who is most often affected by objects of compassion in poetry, history, or real life, will have his soul most open to pity, and its delightful pains and duties. So he also who practises most diligently the offices of kindness and charity, will by it cultivate that disposition from whence all his pretensions to personal merit must arise, his present and his future happiness.

204 By an honest employment.

An useful and honourable employment in life will administer a thousand opportunities of this kind, and greatly strengthen a sense of virtue and good affections, which must be nourished by right training, as well as our understanding. For such an employment, by enlarging one's experience, giving an habit of attention and caution, or obliging one, from necessity or interest, to keep a guard over the passions, and study the outward decencies and appearances of virtue, will by degrees produce good habit, and at length insinuate the love of virtue and honesty for its own sake.

205 By viewing men and manners in a fair light.

It is a great inducement to the exercise of benevolence to view *human nature* in a favourable light, to observe the characters and circumstances of mankind on the *fairest* sides, to put the best construction on their actions they will bear, and to consider them as the result of *partial* and *mistaken*, rather than *ill* affections, or, at worst, as the excesses of a pardonable self love, seldom or never the effect of pure malice.

206 By consideration and pious exercises.

Above all, the *nature* and *consequences* of *virtue* and *vice*, their consequences being the law of our nature and will of heaven; the light in which they appear to our supreme *Parent* and *Lawgiver*, and the reception they will meet with from him, must be often attended to. The exercises of *piety*, as *adoration*, and *praise* of the *divine* excellency, *invocation* of and *dependence* on his aid, *confession*, *thanksgiving*, and and *resignation*, are habitually to be indulged, and frequently performed, not only as *medicinal*, but highly *improving* to the temper.

207 By just views of human life, and its connection with a future.

To conclude: it will be of admirable efficacy towards eradicating *bad* habits, and implanting *good* ones, frequently to contemplate *human life* as the great *nursery* of our *future* and *immortal existence*, as that *state* of *probation* in which we are to be *educated* for a *divine life*: to remember, that our *virtues* or *vices* will be *immortal* as ourselves, and influence our *future* as well as our *present* happiness,—and therefore, that every disposition and action is to be regarded as pointing beyond the *present* to an *immortal* duration.—An habitual attention to this wide and important *connection* will give a vast compass and dignity to our sentiments and actions, a noble superiority to the pleasures and pains of life, and a generous ambition to make our *virtue* as *immortal* as our *being*.

CHAP. II. *Motives to* VIRTUE *from Personal* HAPPINESS.

208 Motives from personal happiness.

WE have already considered our *obligations* to the practice of *virtue*, arising from the *constitution* of our nature, by which we are led to *approve* a certain *order* and *œconomy* of *affections*, and a certain *course of action* correspondent to it †. But, besides this, there are several motives which strengthen and secure virtue, though not themselves of a *moral* kind. These are, its *tendency to personal happiness*, and the *contrary tendency of vice*. "Personal happiness arises either from the state of a man's own mind, or from the state and disposition of external causes towards him."

† Vide Part I. chap. i. ii. &c.

209 Happiness of virtue from within.

We shall first exammine the "tendency of virtue to happiness with respect to the state of a man's own mind," This is a point of the utmost consequence in morals, because, unless we can convince ourselves, or show to others, that, by doing our *duty*, or fulfilling our *moral obligations*, we consult the greatest satisfaction of our own mind, or our highest interest on the whole, it will raise strong and often unsurmountable prejudices against the practice of virtue, especially whenever there arises any appearance of *opposition* between our *duty* and our *satisfaction* or *interest*. To creatures so desirous of happiness, and averse to misery, as we are, and often so oddly situated amidst contending passions and interests, it is necessary that virtue appear not only an *honourable* but a *pleasing* and *beneficent* form. And in order to justify our choice to ourselves as well as before others, we must ourselves feel and be able to avow in the face of the whole world, that her ways are ways of pleasantness, and her paths the paths of peace. This will show, beyond all contradiction

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tradiction, that we not only approve, but can give a sufficient reason for what we do.

210 Influence of vice on the temper of the mind

Let any man in a cool hour, when he is disengaged from business, and undisturbed by passion (as such cool hours will sometimes happen), sit down, and seriously reflect with himself what state or temper of mind he would choose to feel and indulge, in order to be easy and to enjoy himself. Would he choose, for that purpose, to be in a constant dissipation and hurry of thought; to be disturbed in the exercise of his reason; to have various and often interfering phantoms of good playing before his imagination, soliciting and distracting him by turns, now soothing him with amusing hopes, then torturing him with anxious fears; and to approve this minute what he shall condemn the next? Would he choose to have a strong and painful sense of every petty injury? quick apprehensions of every impending evil, incessant and insatiable desires of power, wealth, honour, pleasure; an irreconcileable antipathy against all competitors and rivals; insolent and tyrannical dispositions to all below him; fawning, and at the same time envious, dispositions to all above him: with dark suspicions and jealousies of every mortal? Would he choose neither to love nor be beloved of any; to have no friend in whom to confide, or with whom to interchange his sentiments or designs; no favourite, on whom to bestow his kindness, or vent his passions; in fine, to be conscious of no merit with mankind, no esteem from any creature, no good affection to his Maker, no concern for, nor hopes of, his approbation: but, instead of all these, to hate, and know that he is hated, to condemn, and know that he is condemned by all; by the good, because he is so unlike: and by the bad, because he is so like themselves; to hate or to dread the very Being that made him: and, in short, to have his breast the seat of pride and passion, petulance and revenge, deep melancholy, cool malignity, and all the other furies that ever possessed and tortured mankind?—Would our calm inquirer after happiness pitch on such a state, and such a temper of mind, as the most likely means to put him in possession of his desired ease and self-enjoyment?

211 Influence of virtue on the temper.

Or would he rather choose a serene and easy flow of thought: a reason clear and composed; a judgment unbiassed by prejudice, and undistracted by passion; a sober and well-governed fancy, which presents the images of things true, and unmixed with delusive and unnatural charms, and therefore administers no improper or dangerous fuel to the passions, but leaves the mind free to choose or reject, as becomes a reasonable creature: a sweet and sedate temper, not easily ruffled by hopes or fears, prone neither to suspicion nor revenge, apt to view men and things in the fairest lights, and to bend gently to the humours of others rather than obstinately to contend with them? Would he choose such moderation and continence of mind, as neither to be ambitious of *power*, fond of *honours*, covetous of *wealth*, nor a slave to *pleasure;* a mind of course neither elated with success, nor dejected with disappointment; such a modest and noble spirit as supports power without insolence, wears honour without pride, uses wealth without profusion or parsimony; and rejoices more in giving than in receiving pleasure; such fortitude and equanimity as rises above misfortunes, or turns them into blessings: such integrity and greatness of mind, as neither flatters the vices, nor triumphs over the follies of men; as equally spurns servitude and tyranny, and will neither engage in low designs, nor abet them in others? Would he choose, in fine, such mildness and benignity of heart as takes part in all the joys, and refuses none of the sorrows, of others: stands well affected to all mankind; is conscious of meriting the esteem of all, and of being beloved by the best; a mind which delights in doing good without any shew, and yet arrogates nothing on that account: rejoices in loving and being beloved by its Maker, acts ever under his eye, resigns itself to his providence, and triumphs in his approbation?—Which of these dispositions would be his choice, in order to be contented, serene, and happy?—The *former* temper is VICE, the *latter* VIRTUE. Where *one* prevails, there MISERY prevails, and by the generality is acknowledge to prevail Where the *other* reigns, there HAPPINESS reigns, and by the confession of mankind it acknowledged to reign. The *perfection* of either temper is *misery* or *happiness in perfection.*—THEREFORE, every *approach* to *either extreme* is an *approach* to *misery* or to *happiness; i. e.* every *degree* of *vice* or *virtue* is accompanied with a *proportionabe degree* of *misery* or *happiness*.

From Happiness.

212 The alleviations of his ills.

The principal alleviations of a virtuous man's calamities are these:—That though some of them may have been the effect of his imprudence or weakness, yet few of them are sharpened by a sense of guilt, and none of them by a consciousness of wickedness, which surely is their keenest sting;—that they are common to him with the best of men;—that they seldom or never attack him quite unprepared, but rather guarded with a consciousness of his own sincerity and virtue, with a faith and trust in providence, and a firm resignation to its perfect orders;—that they may be improved as means of correction, or materials to give scope and stability to his virtues;—and, to name no more, they are considerably lessened, and often sweetened to him, by the general sympathy of the wise and good.

213 His enjoyments.

His enjoyments are more numerous, or, if less numerous, yet more intense than those of the bad man; for he shares in the joys of others by rebound; and every increase of *general* or *particular* happiness is a real addition to his own. It is true, his friendly *sympathy* with others subjects him to some pains which the hard-hearted wretch does not feel: yet to give a loose to it, is a kind of agreeable discharge. It is such a sorrow as he loves to indulge; a sort of pleasing anguish that sweetly melts the mind, and terminates in a self-approving joy. Though the good man may want means to execute, or be disappointed in the success of his benevolent purposes; yet, as was formerly* observed, he is still conscious of good affection, and that consciousness is an enjoyment of a more delightful savour than the greatest triumphs of successful vice. If the *ambitious*, *covetous*, or voluptuous, are disappointed, their passions recoil upon them with a fury proportioned to their opinion of the value of what they pursue, and their hope of success; while they have nothing within to balance the disapppointment, unless it is an useless fund of pride, which, however, *frequently* turns mere accidents into mortifying affronts, and exalts grief into rage and frenzy. Whereas the meek, humble,

* See Part II. chap. ii.

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humble, and benevolent temper, is its own reward, is satisfied from within; and, as it magnifies greatly the pleasure of success, so it wonderfully alleviates, and in a manner annihilates, all pain for the want of it.

214 From merited esteem and sympathy.

As the good man is conscious of loving and wishing well to all mankind, he must be sensible of his deserving the esteem and good-will of all; and this supposed reciprocation of social feelings is, by the very frame of our nature, made a source of very intense and enlivening joys. By this sympathy of affections and interests, he feels himself intimately united with the human race; and, being sensibly *alive* over the whole system, his heart receives and becomes responsive to every touch given to any part. So that, as an eminent *philosopher* § finely expresses it, he gathers contentment and delight from the pleased and happy states of those around him, from accounts and relations of such happiness, from the very countenances, gestures, voices, and sounds, even of creatures foreign to our kind whose signs of joy and contentment he can any way discern.

§ Vide Shaftsb. Inq. into Virtue, Book II.

215 Do not interfere with other joys.

Nor do those generous affections stop any other natural source of joy whatever, or deaden his sense of any innocent gratification. They rather keep the several *senses* and *powers of enjoyment* open and disengaged, intense and uncorrupted by riot or abuse: as is evident to any one who considers the dissipated, unfeeling state of men of *pleasure*, *ambition*, or *interest*, and compares it with the serene and gentle state of a mind at peace with itself, and friendly to all mankind, unruffled by any violent emotion, and sensible of every good-natured and alluring joy.

216 The misery of excess in the private passions.

It were easy, by going through the different sets of affections mentioned formerly*, to show, that it is only by maintaining the proportion settled there, that the mind arrives at true repose and satisfaction. If *fear* exceeds that proportion, it sinks into melancholy and dejects. If *anger* passes just bounds, it ferments into rage and revenge, or subsides into a sullen corroding gloom, which embitters every good, and renders one exquisitely sensible to every ill. The *private* passions, the *love of honour* especially, whose impulses are more generous, as its effects are more diffusive, are instruments of private pleasure; but if they are disproportioned to our *wants*, or to the *value* of their several objects, or to the *balance* of other passions equally necessary and more amiable, they become instruments of intense pain and misery. For, being now destitute of that counterpoise which held them at a due pitch, they grow turbulent, peevish, and revengeful, the cause of constant restlessness and torment, sometimes flying out into a wild delirious joy, at other times settling in a deep splenetic grief. The concert between reason and passion is then broke: all is dissonance and distraction within. The mind is out of frame, and feels an agony proportioned to the violence of the reigning passion.

*See part I. chap. i. ii.

217 In the public affections.

The case is much the same, or rather worse, when any of the particular *kind* affections are out of their natural order and proportion; as happens in the case of *effeminate pity*, *exorbitant love*, *parental dottage*, or any *party-passion*, where the just regards to society are supplanted. The more *social* and *disinterested* the passion is, it breaks out into the wilder excesses, and makes the more dreadful havoc both within and abroad; as is but too apparent in those cases where a false species of *religion*, *honour*, *zeal*, *or party rage*, has seized on the natural enthusiasm of the mind, and worked it up to madness. It breaks through all ties *natural* and *civil*, disregards the most sacred and solemn obligations, silences every other affection whether *public* or *private*, and transforms the most gentle natures into the most savage and inhuman.

From Happiness.

218 Happiness of well proportioned passions.

Whereas, the man who keeps the *balance* of *affection* even, is easy and serene in his motions; mild and yet affectionate; uniform and consistent with himself; is not liable to disagreeable collisions of interests and passions; gives always place to the most friendly and humane affections, and never to dispositions or acts of resentment, but on high occasions, when the *security* of the *private*, or *welfare* of the *public* system, or the *great interest* of mankind, necessarily require a noble indignation; and even then he observes a just measure in wrath: and last of all, he proportions every passion to the value of the object he affects, or to the importance of the end he pursues.

219 Sum of the argument.

To sum up this part of the argument, the *honest* and *good* man has eminently the advantage af the *knavish* and *selfish* wretch in every respect. The pleasures which the last enjoys flow chiefly from external advantages and gratifications; are superficial and transitory; dashed with long intervals of satiety, and frequent returns of remorse and fear; dependent on favourable accidents and conjectures; and subjected to the humours of men. But the *good* man is satisfied from himself? his principal possessions lie within, and therefore beyond the reach of the caprice of men or fortune; his enjoyments are exquisite and permanent; accompanied with no inward checks to damp them, and always with ideas of dignity and self approbation: may be tasted at any time, and in any place. The gratifications of *vice* are turbulent and unnatural, generally arising from the relief of passions in themselves intolerable, and issuing in tormenting reflection: often irritated by disappointment, always inflamed by enjoyment, and yet ever cloyed with repetition. The pleasures of *virtue* are calm and natural; flowing from the exercise of kind affections, or delightful reflections in consequence of them; not only agreeable in the prospect, but in the present feeling: they never satiate nor lose their relish; nay, rather the admiration of virtue grows stronger every day; and not only is the desire but the enjoyment heightened by every new gratification; and, unlike to most others, it is increased, not diminished, by sympathy and communication.—In fine, the satisfactions of *virtue* may be purchased without a bribe, and possessed in the humblest as well as the most triumphant fortune, they can bear the strictest review, do not change with circumstances, nor grow old with time. Force cannot rob nor fraud cheat us of them; and, to crown all, instead of abating, they enhance every other pleasure.

220 External effects of virtue.

But the happy consequences of *virtue* are seen not only in the internal enjoyments it affords a man, but "in the favourable disposition of external causes towards him, to which it contributes."

221 On the body.

As virtue gives the sober possession of one's self, and the command of one's passions, the consequence must be heart's ease, and a fine natural flow of spirits, which conduce more than any thing else to health and long

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long life. Violent passions, and the excesses they occasion, gradually impair and wear down the machine. But the calm placid state of a temperate mind, and the healthful exercises in which *virtue* engages her faithful votaries, preserve the natural functions in full vigour and harmony, and exhilarate the spirits, which are the chief instruments of action.

222 On one's fortune, interest, &c.

It may by some be thought odd to assert, that *virtue* is no enemy to a man's *fortune* in the present state of things.—But if by *fortune* be meant a moderate or competent share of *wealth, power*, or *credit*, not overgrown degrees of them; what should hinder the virtuous man from obtaining that? He cannot cringe or fawn, it is true, but he can be civil and obliging as well as the knave; and surely his civility is more alluring, because it has more manliness and grace in it than the mean adulation of the other; he cannot cheat or undermine; but he may be cautious, provident, watchful of occasions, and equally prompt with the rogue in improving them; he scorns to prostitute himself as a pander to the passions, or as a tool to the vices, of mankind; but he may have as sound an understanding and as good capacities for promoting their real interests as the veriest court-slave; and then he is more faithful and true to those who employ him. In the common course of business, he has the same chances with the knave of acquiring a fortune, and rising in the world. He may have equal abilities, equal industry, equal attention to business; and in other respects he has greatly the advantage of him. People love better to deal with him; they can trust him more; they know he will not impose on them, nor take advantage of them, and can depend more on his word than on the oath or stongest securities of others. Whereas what is commonly called *cunning*, which is the *offspring of ignorance*, and constant *companion* of *knavery*, is not only a mean-spirited, but a very short-sighted talent, and a fundamental obstacle in the road of business. It may procure indeed immediate and petty gains; but it is attended with dreadful abatements, which do more than overbalance them, both as it sinks a man's credit when discovered, and cramps that largeness of mind which extends to the remotest as well as the nearest interest, and takes in the most durable equally with the most transient gains. It is therefore easy to see how much a man's *credit* and *reputation*, and consequently his success, depend on his honesty and virtue.

223 On one's peace and security.

With regard to *security* and *peace* with his neighbours, it may be thought, perhaps, that the man of a quiet forgiving temper, and a flowing benevolence and courtesy, is much exposed to injury and affronts from every proud or peevish mortal, who has the power or will to do mischief. If we suppose, indeed, the *quietness* and *gentleness* of nature accompanied with *cowardice* and *pusillanimity*, this may often be the case; but in reality the good man is bold as a lion, and so much the bolder for being the calmer. Such a person will hardly be a butt to mankind. The ill natured will be afraid to provoke him, and the good-natured will not incline to do it. Besides, *true virtue*, which is conducted by reason, and exerted gracefully and without parade, is a most insinuating and commanding thing; if it cannot disarm malice and resentment at once, it will wear them out by degrees, and subdue them at length. How many have, by favours and prudently yielding, triumphed over an enemy, who would have been inflamed into tenfold rage by the fiercest opposition! In fine *goodness* is the most universally popular thing that can be.

To conclude; the good man may have some enemies, but he will have more friends; and, having given so many marks of private friendship or public virtue, he can hardly be destitute of a patron to protect, or a sanctuary to entertain him, or to protect or entertain his children when he is gone. Though he should have little else to leave them, he bequeaths them the fairest and generally the most unenvied, inheritance of a *good name*, which, like good seed sown in the field of futurity, will often raise up unsolicited friends, and yield a benevolent harvest of unexpected charities. But should the fragrance of the parent's virtue prove offensive to a perverse or envious age, or even draw persecution on the friendless orphans, there is *one* in heaven who will be more than a father to them, and recompense their parent's virtues by showering down blessings on them. 224 On one's family.

Chap. III. *Motives to* Virtue *from the* Being *and* Providence *of* God.

Besides the interesting motive mentioned in the last Chapter, there are two great motives to *virtue*, strictly connected with *human life*, and resulting from the very *constitution* of the *human mind*. The first is the Being and Providence of God: the second is the Immortality of the Soul, with *future rewards* and *punishments*. 225 Two external motives to virtue.

It appears from Chap. iv. of Part II. that *man*, by the *constitution* of his nature, is designed to be a Religious Creature. He is intimately connected with the *Deity*, and necessarily dependent on him. From that *connection* and necessary *dependence* result various *obligations* and *duties*, without fulfilling which, some of his sublime powers and affections would be incomplete and abortive. If he be likewise an Immortal creature, and if his *present conduct* shall affect his *future happiness* in *another* state as well as in the *present*, it is evident that we take only a *partial view* of the *creature* if we leave out this important property of his nature, and make a *partial estimate of human life*? if we strike out of the account, or overlook, that part of his duration which runs out into eternity. 226 Their importance.

It is evident from the above-mentioned Chapter, that "to have a respect to the *Deity* in our temper and conduct, to *venerate* and *love* his *character*, to *adore* his *goodness*, to *depend upon* and *resign* ourselves to his *providence*, to *seek* his *approbation*, and *act* under a *sense* of his *authority*, is a *fundamental part* of *moral virtue*, and the *completion* of the *highest destination* of *our nature*." 227 Piety.

But as *piety* is an essential part of virtue, so likewise it is a *great support* and *enforcement* to the practice of it. To contemplate and admire a Being of such transcendent dignity and perfection as God, must naturally and necessarily open and enlarge the mind, give a freedom and ampleness to its powers, and a grandeur and elevation to its aims. For, as an excellent *divine* observes, "the greatness of an object, and the excellency of the act of any agent about a transcendent 228 A support to virtue.

object

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object, doth mightily tend to the enlargement and improvement of his faculties." Little objects, mean company, mean cares, and mean business, cramp the mind, contract its views, and give it a creeping air and deportment. But when it soars above mortal cares and mortal pursuits into the regions of divinity, and converses with the greatest and best of Beings, it spreads itself into a wider compass, takes higher flights in reason and goodness, becomes godlike in its air and manners. *Virtue* is, if one may say so, both the *effect* and *cause* of largeness of mind. It requires that one think freely, and act nobly. Now what can conduce more to freedom of thought and dignity of action, than to conceive worthily of GOD, to reverence and adore his unrivalled excellency, to imitate and transcribe that excellency into our own nature, to remember our relation to him, and that we are the images and representatives of his glory to the rest of the creation? Such feelings and exercises must and will make us scorn all actions that are base, unhandsome, or unworthy our state; and the relation we stand in to GOD will irradiate the mind with the light of wisdom, and ennoble it with the liberty and dominion of virtue.

229 A guard and enforcement to virtue

The influence and efficacy of *religion* may be considered in another light. We all know that the presence of a friend, a neighbour, or any number of spectators, but especially an august assembly of them, uses to be a considerable check upon the conduct of one who is not lost to all sense of honour and shame, and contributes to restrain many irregular sallies of passion. In the same manner as we imagine that the awe of some superior mind, who is supposed privy to our secret conduct, and armed with full power to reward or punish it, will impose a restraint on us in such actions as fall not under the controul or animadversion of others. If we go still higher, and suppose our inmost thoughts and darkest designs, as well as our most secret actions, to lie open to the notice of the supreme and universal mind, who is both the *spectator* and *judge* of human actions, it is evident that the belief of so august a presence, and such awful inspection must carry a restraint and weight with it proportioned to the strength of that belief, and be an additional motive to the practice of many duties which would not have been performed without it.

230 Exercises of piety improving to virtue.

It may be observed farther, that "to live under an habitual sense of the *Deity* and his great *administration*, is to be conversant with *wisdom, order*, and *beauty*, in the highest subjects, and to receive the delightful reflections and benign feelings which these excite while they irradiate upon him from every scene of nature and providence." How improving must such views be to the mind, in dilating and exalting it above those puny interests and competitions which agitate and inflame the bulk of mankind against each other!

CHAP. IV. *Motive to* VIRTUE *from the* IMMORTALITY *of the* SOUL, &c.

231 Metaphysical arguments for its immortality.

THE other motive mentioned was the *immortality* of the soul, with *future rewards* and *punishments*. The *metaphysical* proofs of the soul's immortality are commonly drawn from—its *simple uncompounded*, and *indivisible* nature; from whence it is concluded, that it cannot be corrupted or extinguished by a dissolution or destruction of its parts:—from its having a *beginning* of *motion* within itself; whence it is inferred, that it cannot discontinue and lose its motion:—from the different properties of *matter* and *mind*, the *sluggishness* and *inactivity of one*, and the immense *activity* of the *other*; its prodigious flight of *thought* and *imagination*; its *penetration*, *memory*, *foresight*, and *anticipations* of *futurity*: from whence it is concluded, that a being of so divine a nature cannot be extinguished. But as these metaphysical proofs depend on intricate reasonings concerning the *nature*, *properties*, and *distinctions* of *body* and *mind*, with which we are not very well acquainted, they are not obvious to ordinary understandings, and are seldom so convincing even to those of higher reach, as not to leave some doubts behind them. Therefore perhaps it is not so safe to rest the proof of such an important article on what many may call the subtilties of school-learning. Those proofs which are brought from *analogy*, from the *moral constitution* and *phænomena* of the *human mind*, the *moral attributes* of God, and the *present course of things*, and which therefore are called the *moral* arguments, are the plainest, and generally the most satisfying. We shall select only one or two from the rest.

From the Immortality of the soul.

232 Moral proof from analogy.

In tracing the *nature* and *destination* of any being, we form the surest judgment from his *powers* of *action* and the scope and *limits* of these, compared with his *state*, or with that *field* in which they are exercised. If this being passes through different states, or fields of action, and we find a *succession* of powers adapted to the different periods of his progress, we conclude that he was destined for those successive states, and reckon his nature *progressive*. If, besides the immediate set of powers which fit him for action in his present state, we observe another set which appear superfluous if he were to be confined to it, and which point to another or higher one, we naturally conclude, that he is not designed to remain in his present state, but to advance to that for which those supernumerary powers are adapted. Thus we argue, that the *insect*, which has wings forming or formed, and all the apparatus proper for flight, is not destined always to creep on the ground, or to continue in the torpid state of adhering to a wall, but is designed in its season to take its flight in air. Without this farther destination, the admirable mechanism of wings and the other apparatus would be useless and absurd. The same kind of reasoning may be applied to man, while he lives only a sort of *vegetative* life in the womb. He is furnished even there with a beautiful apparatus of organs, eyes, ears, and other delicate senses, which receive nourishment indeed, but are in a manner folded up, and have no proper exercise or use in their present confinement *. Let us suppose some intelligent spectator, who never had any connection with man, nor the least acquaintance with human affairs, to see this odd phenomenon, a creature formed after such a manner, and placed in a situation apparently unsuitable to such various machinery: must he not be strangely puzzled about the use of this complicated structure, and reckon such a profusion of art and admirable workmanship lost on the subject; or reason by way of anticipation, that a creature endued with such various yet unexerted capacities, was destined for a more enlarged

* Vide Ludov. Viv. de Relig. Christ. Lib. II. de Vita Uteri, &c.

ſphere of action, in which thoſe latent capacities ſhall have full play? The vaſt variety and yet beautiful ſymmetry and proportions of the ſeveral parts and organs with which the creature is endued, and their apt coheſion with and dependence on the curious receptacle of their life and nouriſhment, would forbid his concluding the whole to be the birth of chance, or the bungling effort of an unſkilful artiſt; at leaſt would make him demur a while at ſo harſh a ſentence. But if, while he is in this ſtate of uncertainty, we ſuppoſe him to ſee the babe, after a few ſucceſsful ſtruggles, throwing off his fetters, breaking looſe from his little dark priſon, and emerging into open day, then unfolding his recluſe and dormant powers, breathing in air, gazing at light, admiring colours, ſounds, and all the *fair variety*, of nature; immediately his doubts clear up, the propriety and excellency of the workmanſhip dawn upon him with full luſtre, and the whole myſtery of the firſt period is unravelled by the opening of this new ſcene. Though in this *ſecond* period the creature lives chiefly a kind of *animal*-life, i. e. of *ſenſe* and *appetite*, yet by various trials and obſervations he gains experience, and by the gradual evolution of the powers of *imagination* he ripens apace for an *higher* life, for exerciſing the arts of *deſign* and *imitation*, and of thoſe in which ſtrength or dexterity are more requiſite than acuteneſs or reach of judgment. In the ſucceeding *rational* or *intellectual* period, his *underſtanding*, which formerly crept in a lower, mounts into an higher ſphere, canvaſſes the natures, judges of the relations of things, forms ſchemes, deduces conſequences from what is paſt, and from preſent as well as paſt collects future events. By this ſucceſſion of ſtates, and of correſpondent culture, he grows up at length into a *moral*, a *ſocial*, and a *political* creature. This is the laſt period at which we perceive him to arrive in this his mortal career. Each *period* is introductory to the next ſucceeding one; each *life* is a field of exerciſe and improvement for the next higher one; the life of the *fœtus* for that of the *infant*, the life of the *infant* for that of the *child*, and all the lower for the higheſt and beſt*.—But is this the laſt period of nature's progreſſion? Is this the utmoſt extent of her plot, where ſhe winds up the drama, and diſmiſſes the actor into eternal oblivion? Or does he appear to be inveſted with ſupernumerary powers, which have not full exerciſe and ſcope even in the laſt ſcene, and reach not that maturity or perfection of which they are capable; and therefore point to ſome higher ſcene where he is to ſuſtain another and more important character than he has yet ſuſtained? If any ſuch there are, may we not conclude by analogy, or in the ſame way of anticipation as before, that he is deſtined for that after part, and is to be produced upon a more auguſt and ſolemn ſtage, where his ſublimer powers ſhall have proportioned action, and his nature attain its completion?

* See Butler's Analogy, Part I.

233 Powers in man which point to an after-life.

234 Intellectual.

If we attend to that *curioſity*, or prodigious *thirſt* of *knowledge*, which is natural to the mind in every period of its progreſs, and conſider withal the endleſs round of buſineſs and care, and the various hardſhips to which the bulk of mankind are chained down; it is evident, that in this preſent ſtate it is impoſſible to expect the gratification of an appetite at once ſo inſatiable and ſo noble. Our *ſenſes*, the ordinary organs by which knowledge is let into the mind, are always imperfect, and often fallacious; the advantages of aſſiſting or correcting them are poſſeſſed by few; the difficulties of finding out truth amidſt the various and contradictory opinions, intereſts, and paſſions of mankind, are many; and the wants of the creature, and of thoſe with whom he is connected, numerous and urgent: ſo that it may be ſaid of moſt men, that their *intellectual* organs are as much ſhut up and ſecluded from proper nouriſhment and exerciſe in that little circle to which they are confined, as the bodily organs are in the womb. Nay, thoſe who to an aſpiring genius have added all the aſſiſtances of art, leiſure, and the moſt liberal education, what narrow proſpects can even they take of this unbounded ſcene of things from that little eminence on which they ſtand? and how eagerly do they ſtill graſp at new diſcoveries, without any ſatisfaction or limit to their ambition?

235 Moral powers.

But ſhould it be ſaid, that man is made for *action* and not for *ſpeculation*, or fruitleſs ſearches after knowledge, we aſk, For what kind of action? Is it only for bodily exerciſes, or for *moral*, *political*, and *religious* ones? Of all theſe he is capable; yet, by the unavoidable circumſtances of his lot, he is tied down to the *former*, and has hardly any leiſure to think of the *latter*, or if he has, wants the proper inſtruments of exerting them. The *love of virtue*, *of one's friends* and *country*, the *generous ſympathy with mankind*, and *heroic zeal of doing good*, which are all ſo *natural* to great and good minds, and ſome traces of which are found in the loweſt, are ſeldom united with proportioned means or opportunities of exerciſing them: ſo that the *moral* ſpring, the noble energies and impulſes of the mind, can hardly find proper ſcope even in the moſt fortunate condition; but are much depreſſed in ſome and almoſt entirely reſtrained in the generality, by the numerous clogs af an indigent, ſickly, or embaraſſed life. Were ſuch mighty powers, ſuch god-like affections, planted in the human breaſt to be folded up in the narrow womb of our preſent exiſtence, never to be produced into a more *perfect* life, nor to expatiate in the ample career of immortality?

236 Unſatisfied deſires of exiſtence and happineſs.

Let it be conſidered, at the ſame time, that no poſſeſſion, no enjoyment, within the round of mortal things, is commenſurate to the deſires, or adequate to the capacities, of the mind. The moſt exalted condition has its abatements; the happieſt conjuncture of fortune leaves many wiſhes behind; and, after the higheſt gratifications, the mind is carried forward in purſuit of new ones without end. Add to all, the fond *deſire* of *immortality*, the ſecret *dread* of *non-exiſtence*, and the high unremitting *pulſe* of the ſoul beating for *perfection*, joined to the improbability or the impoſſibility of attaining it *here*; and then judge whether this elaborate ſtructure, this magnificent apparatus of inward powers and organs, does not plainly point out an *hereafter, and intimate eternity to man*? Does nature give the finiſhing touches to the leſſer and ignobler inſtances of her ſkill, and raiſe every other creature to the maturity and perfection of his being; and ſhall ſhe leave her principal workmanſhip unfiniſhed? Does ſhe carry the *vegetative* and *animal* life in *man* to their full vigour and higheſt deſtination: and ſhall ſhe ſuffer his *intellectual*, his *moral*, his *divine* life to

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to fade away, and be for ever extinguished? Would such abortions in the *moral* world be congruous to that *perfection of wisdom and goodness* which upholds and adorns the *natural?*

237 Therefore man is immortal.

We must therefore conclude from this detail, that the *present state*, even at its best, is only the WOMB of man's being, in which the noblest principles of his nature are in a manner fettered, or secluded from a correspondent sphere of action; and therefore destined for a future and unbounded state, where they shall emancipate themselves, and exert the fulness of their strength. The most accomplished mortal, in this low and dark apartment of nature, is only the *rudiments* of what he shall be when he takes his ethereal flight, and puts on immortality. Without a reference to that state, *man* were a mere abortion, a rude unfinished embryo, a monster in nature. But this being once supposed, he still maintains his rank of the masterpiece of the creation; his latent powers are all suitable to the *harmony* and *progression* of nature; his noble aspirations, and the pains of his dissolution, are his efforts towards a *second* birth, the pangs of his delivery into light, liberty, and perfection; and *death*, his discharge from gaol, his separation from his fellow-prisoners, and introduction into the assembly of those heroic spirits who are gone before him, and of their great eternal Parent. The fetters of his mortal coil being loosened, and his prison-walls broke down, he will be bare and open on every side to the admission of *truth* and *virtue*, and their fair attendant *happiness;* every *vital* and *intellectual* spring will evolve itself with a divine elasticity in the free air of heaven. He will not then peep at the universe and its glorious Author through a dark grate or a gross medium, nor receive the reflections of his glory through the strait openings of sensible organs; but will be *all eye, all ear, all ethereal and divine feeling**. Let one part, however, of the analogy be attended to: That as in the womb we receive our original constitution, form, and the essential *stamina* of our being, which we carry along with us into the light, and which greatly affect the succeeding periods of our life; so our temper and condition in the *future* life will depend on the conduct we have observed, and the character we have formed, in the *present* life. We are *here* in *miniature* what we shall be at *full length hereafter*. The first *rude sketch* or *out-lines* of *reason* and *virtue* must be drawn at present, to be afterwards enlarged to the *stature* and *beauty* of angels.

* Vide Religion of Nature, §9.

238 Immortality a guard and incentive to virtue.

This, if duly attended to, must prove not only a *guard*, but an admirable *incentive* to virtue. For he who faithfully and ardently follows the light of knowledge, and pants after higher improvements in virtue, will be wonderfully animated and inflamed in that pursuit by a full conviction that the scene does not close with life—that his struggles, arising from the weakness of nature and the strength of habit, will be turned into triumphs—that his career in the tract of wisdom and goodness will be both swifter and smoother—and those generous ardours with which he glows towards *heaven*, i. e. the *perfection* and *immortality of virtue*, will find their adequate object and exercise in a sphere proportionably enlarged, incorruptible, immortal. On the other hand, what an inexpressible damp must it be to the good man, to dread the total extinction of that *light* and *virtue*, without which *life*, nay, *immortality* itself, were not worth a single wish?

From the Immortality of the Soul.

239 Proof from the inequality of present distributions.

Many writers draw their proofs of the immortality of the soul, and of a future state of rewards and punishments, from the unequal distribution of these here. It cannot be dissembled that wicked men often escape the *outward* punishment due to their crimes, and do not feel the *inward* in that measure their demerit seems to require, partly from the callousness induced upon their nature by the habits of vice, and partly from the dissipation of their minds abroad by pleasure or business—and sometimes good men do not reap all the natural and genuine fruits of their virtue, through the many unforeseen or unavoidable calamities in which they are involved. To the smallest reflection, however, it is obvious, that the natural tendency of virtue is to produce happiness; that if it were universally practised, it would, in fact, produce the greatest sum of happiness of which human nature is capable; and that this tendency is defeated only by numerous individuals, who, forsaking the laws of virtue, injure and oppress those who steadily adhere to them. But the natural tendency of virtue is the result of that constitution of things which was established by God at the creation of the world. This being the case, we must either conclude, that there will be a future state, in which all the moral obliquities of the present shall be made straight; or else admit, that the designs of infinite wisdom, goodness, and power, can be finally defeated by the perverse conduct of human weakness.—But this last supposition is so extravagantly absurd, that the reality of a future state, the only other possible alternative, may be pronounced to have the evidence of perfect demonstration.

240 Belief of immortality, &c. a great support amidst trials.

Virtue has present rewards, and *vice* present punishments annexed to it; such rewards and punishments as make *virtue*, in most cases that happen, far more eligible than *vice:* but, in the infinite variety of human contingencies, it may sometimes fall out, that the inflexible practice of virtue shall deprive a man of considerable advantages to himself, his family, or friends, which he might gain by a well-timed piece of roguery; suppose by betraying his trust, voting against his conscience, selling his country, or any other crime where the security against discovery shall heighten the temptation. Or, it may happen, that a strict adherence to his honour, to his religion, to the cause of liberty and virtue, shall expose him, or his family, to the loss of every thing, nay, to poverty, slavery, death itself, or to torments far more intolerable. Now what shall secure a man's virtue in circumstances of such trial? What shall enforce the obligations of conscience against the allurements of so many interests, the dread of so many and so terrible evils, and the almost unsurmountable aversion of human nature to excessive pain! The conflict is the greater, when the circumstances of the crime are such as easily admit a variety of alleviations from *necessity*, *natural affection, love to one's family* or *friends*, perhaps in indigence: these will give it even the air of virtue. Add to all, that the crime may be thought to have few bad consequences,—may be easily concealed,—or imagined possible to be retrieved in a good measure by future good conduct. It is obvious to which side most men will lean in such a case; and how much need there is of a balance in the

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the opposite scale, from the consideration of a *God*, of a *Providence*, and of an *immortal state of retribution*, to keep the mind firm and uncorrupt in those or like instances of singular trial or distress.

241 In the general course of life.

But without supposing such peculiar instances, a sense of a governing Mind, and a persuasion that virtue is not only befriended by him here, but will be crowned by him hereafter with rewards suitable to its nature, vast in themselves, and immortal in their duration, must be not only a mighty support and incentive to the practice of virtue, but a strong barrier against vice. The thoughts of an Almighty Judge, and of an impartial future reckoning, are often alarming, inexpressibly so, even to the stoutest offenders. On the other hand, how supporting must it be to the good man, to think that he acts under the eye of his friend, as well as judge! How improving, to consider the *present state* as connected with a *future* one, and every relation in which he stands as a *school* of *discipline* for his *affections*; every *trial* as the *exercise* of some *virtue*; and the virtuous deeds which result from both, as introductory to higher scenes of *action* and *enjoyment*! Finally, how transporting is it to view *death* as his *discharge* from the *warfare* of *mortality*, and a triumphant *entry* into a state of the freedom, security, and perfection, in which knowledge and wisdom shall break upon him from every quarter; where each faculty shall have its proper object; and his virtue, which was often damped or defeated here, shall be enthroned in undisturbed and eternal empire!

On reviewing this short *system* of *morals*, and the *motives* which support and enforce it, and comparing both with the CHRISTIAN *scheme*, what *light* and *vigour* do they borrow from thence! How clearly and fully does CHRISTIANITY lay open the *connections* of our nature, both *material* and *immaterial*, and *future* as well as *present*! What an ample and beautiful detail does it present of the *duties* we owe to *God*, to *society*, and *ourselves*, promulgated in the most simple, intelligible, and popular manner; divested of every partiality of sect or nation; and adapted to the general state of mankind! With what bright and alluring *examples* does it illustrate and recommend the practice of those duties; and with what mighty *sanctions* does it enforce that practice! How strongly does it describe the *corruptions* of our nature; the *deviations* of our life from the *rule* of *duty*, and the *causes* of both! How marvellous and benevolent a plan of *redemption* does it unfold, by which those corruptions may be remedied, and our *nature* restored from its *deviations* to transcendent heights of *virtue* and *piety*! Finally, what a fair and comprehensive prospect does it give us of the *administration* of *God*, of which it represents the *present state* only as a *small period*, and a *period* of *warfare* and *trial*! How solemn and unbounded are the scenes which it opens beyond it! the *resurrection* of the *dead*, and *general judgment*, the *equal distribution* of *rewards* and *punishments* to the *good* and the *bad*; and the full *completion* of *divine wisdom* and *goodness* in the *final establishment* of *order*, *perfection*, and *happiness*! How glorious then is that SCHEME of RELIGION, and how worthy of *affection* as well as of *admiration*, which, by making such *discoveries*, and affording such *assistances*, has disclosed the unfading fruits and triumphs of VIRTUE, and secured its interests beyond the power of TIME and CHANCE.

From the Immortality of the Soul.

242 Advantages of the Christian scheme, and its connection with natural religion or morality.

Moral ‖ Moraut.

MORAL Sense, that whereby we perceive what is good, virtuous, and beautiful, in actions, manners, and characters. See *Moral Philosophy*.

MORALITY. See *Moral Philosophy*.

MORANT (Philip), a learned and indefatigable antiquary and biographer, son of Stephen Morant, was born at St Saviour's in the isle of Jersey, October 6, 1700: and, after finishing his education at Abingdon school, was entered December 16th, 1717 at Pembroke college Oxford, where he took the degree of B. A. June 10th, 1721, and continued till midsummer 1722; when he was preferred to the office of preacher of the English church at Amsterdam, but never went to take possession. He took the degree of M. A. in 1724, and was presented to the rectory of Shellow Bowels, April 20th 1733; to the vicarage of Bromfield, January 17th 1733-4; to the rectory of Chicknal Smeley, September 19th, 1735; to that of St Mary's, Colchester, March 9th, 1737; to that of Wickham Bishop's, January 21st, 1742-3; and to that of Aldham, September 14th, 1745. All these benefices are in the county of Essex. In 1748 he published his History of Colchester, of which only 200 copies were printed. In 1751 he was elected F. S. A; and in February 1768 he was appointed by the lords sub-committees of the house of peers to succeed Mr Blyke in preparing for the press a copy of the rolls of parliament; a service to which he diligently attended till his death, which happened November 25th, 1770. Besides the above work, and many useful translations, abridgements, and compilations, &c. he wrote, all the Lives in the *Biographia Britannica* marked C; also the life of Stillingfleet, which has no mark at the end: The History of Essex, 1760, 1768, 2 vols folio: The life of King Edward the Confessor, and about 150 sermons. He prepared the rolls of parliament as far as the 16th of Henry IV. The continuation of the task devolved upon Thomas Astle, Esq; who had married his only daughter.

Morant ‖ Morat.

MORANT-Point, the most easterly point or promontory of the island of Jamaica, in America. W. Lon. 75. 56. N. Lat. 17. 56.

MORASS, a marsh, fen, or low moist ground, which receives the waters from above without having any descent to carry them off again. Somner derives the word from the Saxon *merse*, "lake;" Salmasius from *mare*, "a collection of waters;" others from the German *marast*, "a muddy place;" and others from *Maresc*, of *maricetum*, *à mariscis*, i. e. rushes. See BOG, FEN, and DRAINING.

In Scotland, Ireland, and the north of England, they have a peculiar kind of morasses called *mosses* or *peat-mosses*, whence the country people dig their peat or turf for firing. See MOSS.

MORAT, or MURTEN, a rich trading, and considerable

Morat, Morata. siderable town of Swisserland, capital of a bailiwick of the same name, belonging to the cantons of Bern and Friberg, with a castle where the bailiff resides. It is seated on the lake Morat, on the road from Avenche to Bern, 10 miles west of Bern and 10 miles north-east of Friburg. The lake is about six miles long and two broad, the country about it being pleasant and well cultivated. The lakes of Morat and Neufchatel are parallel to each other, but the latter is more elevated, discharging itself by means of the river Broye into the lake of Neufchatel. According to M. de Luc, the former is 15 French feet above the level of Neufchatel lake; and both these lakes, as well as that of Bienne, seem formerly to have extended considerably beyond their present limits, and from the position of the country appear to have been once united. Formerly the large fish named *silurus glanis*, or the saluth, frequented these lakes, but has not been caught in them for a long time past. The environs of this town and lake were carefully examined by Mr Coxe during his residence in Switzerland, who made several excursions across the lake to a ridge of hills situated betwixt it and Neufchatel. Here are many delightful prospects; particularly one from the top of mount Vuilly, which, he says, is perhaps the only central spot from which the eye can at once comprehend the vast amphitheatre formed on one side by the Jura stretching from the environs of Geneva as far as Basle, and, on the other, by that stupendous chain of snowy Alps which extend from the frontiers of Italy to the confines of Germany, and is lost at each extremity in the horizon. Morat is celebrated for the obstinate defence it made against Charles the Bold, duke of Burgundy, and for the battle which afterwards followed on the 22d of June 1476, where the duke was defeated, and his army almost entirely destroyed*. Not far from the town, and adjoining to the high road, there still remains a monument of this victory. It is a square building, filled with the bones of Burgundian soldiers, who were slain at the siege and in the battle; the number of which appears to have been very considerable. There are several inscriptions in the Latin and German languages commemorating the victory.

* See History of France.

MORATA (Olympia Fulvia), an Italian lady, distinguished for her learning, was born at Ferrara, in 1526. Her father, after teaching the belles lettres in several cities of Italy, was made preceptor to the two young princes of Ferrara, the sons of Alphonsus I. The uncommon abilities he discovered in his daughter determined him to give her a very extraordinary education. Meanwhile the princess of Ferrara studying polite literature, it was judged expedient that she should have a companion in the same pursuit; and Morata being called, she was heard by the astonished courtiers to declaim in Latin, to speak Greek, and to explain the paradoxes of Cicero. Her father dying, she was obliged to return home to take upon her the management of family-affairs, and the education of her brother and three sisters; both which she executed with the greatest diligence and success. In the mean time Andrew Grunthler, a young German, who had studied physic, and taken his doctor's degree at Ferrara, fell in love with her, and married her. She now went with her husband to Germany, taking her little brother with her, whom she instructed in the Latin and Greek tongues: and after staying a short time at Augsburg, went to Schweinfort in Franconia, where her husband was born: but they had not been there long before that town was unhappily besieged and burnt; however, escaping the flames, they fled in the utmost distress to Hamelbur. This place they were also obliged to quit, and were reduced to the last extremities, when the elector palatine invited Grunthler to be professor of physic at Heidelberg, and he entered on his new office in 1544; but they no sooner began to taste the sweets of repose, than a disease, occasioned by the distresses and hardships they had suffered, seized upon Morata, who died in 1555, in the 29th year of her age; and her husband and brother did not long survive her. She composed several works, great part of which were burnt with the town of Schweinfort; the remainder, which consist of orations, dialogues, letters, and translations, were collected and published under the title of *Olympiæ Fulviæ Moratæ, fœminæ doctissimæ, et plane divinæ, opera omnia quæ hactenus inveniri potuerint; quibus Cœlii secundi curionis epistolæ ac orationes accesserunt;* which has had several editions in octavo.

Moravia. MORAVIA, a river of Turky in Europe, which rises in Bulgaria, runs north through Servia by Nissa, and falls into the Danube at Semendria, to the eastward of Belgrade.

MORAVIA, a marquisate of Germany, derives the name of *Mahern*, as it is called by the Germans, and of *Morawa*, as it is called by the natives, from the river of that name which rises in the mountains of the county of Glatz, and passes through the middle of it. It is bounded to the south by Austria, to the north by Glatz and Silesia, to the west by Bohemia, and to the east by Silesia and Hungary; being about 120 miles in length and 100 in breadth.

A great part of this country is over-run with woods and mountains, where the air is very cold, but much wholesomer than in the low grounds which are full of bogs and lakes. The mountains, in general, are barren; but the more champaign parts tolerably fertile, yielding corn, with plenty of hemp and flax, good saffron and pasture. Nor is it altogether destitute of wine, red and white, fruits and garden-stuff. Moravia also abounds in horses, black cattle, sheep, and goats. In the woods and about the lakes there is plenty of wild fowl, game, venison, bees, honey, hares, foxes, wolves, beavers, &c. In this country are likewise quarries of marble, bastard diamonds, amethysts, alum, iron, sulphur, salt-petre, and vitriol, with wholesome mineral-waters, and warm springs; but salt is imported. Its rivers, of which the March, Morawa, or Morau, are the chief, abound with trout, crayfish, barbels, eels, perch, and many other sorts of fish.

The language of the inhabitants is a dialect of the Sclavonic, differing little from the Bohemian; but the nobility and citizens speak German and French.

Moravia was anciently inhabited by the Quadi, who were driven out by the Sclavi. Its kings, who were once powerful and independent, afterwards became dependent on, and tributary to, the German emperors and kings. At last, in the year 908, the Moravian kingdom was parcelled out among the Germans, Poles, and Hungarians. In 1086, that part of it properly called *Moravia* was declared a marquisate by the German king Henry IV. and united with Bohemia, to whose dukes and kings it hath ever since been subject. Though it is not very populous, it contains about 42 greater or walled towns, 17 smaller or open towns, and 198 market-towns, besides villages, &c. The states of the country consist of the clergy, lords, knights, and burgesses; and the diets, when summoned by the regency, are held at Brun. The marquisate is still governed by its own peculiar constitutions, under the *directorium in publicis & cameralibus*, and the supreme judicatory at Vienna. It is divided into six circles, each of which has its captain, and contributes to its sovereign about one-third of what is exacted of Bohemia. Towards the expences of the military establishment of the whole Austrian hereditary countries, its yearly quota is 1,856,490 florins. Seven regiments of foot, one of cuirassiers, and one of dragoons, are usually quartered in it.

Christianity was planted in this country in the 9th century; and the inhabitants continued attached to the church of Rome till the 15th, when they espoused the doctrine of John Huss, and threw off Popery: but after the defeat of the elector Palatine, whom they had chosen king, as well as the Bohemians, the emperor Ferdinand II. established popery; though there are still some Protestants in Moravia. The bishop of Olmutz, who stands immediately under the pope, is at the head of the ecclesiastics in this country. The supreme ecclesiastical jurisdiction, under the bishop, is vested in a consistory.

The commerce of this country is inconsiderable. Of what they have, Brunn enjoys the principal part. At Iglau and Trebitx are manufactures of cloth, paper, gun-powder, &c. There are also some iron-works and glass-houses in the country.

The inhabitants of Moravia in general are open-hearted, not easy to be provoked or pacified, obedient to their masters and true to their promises; but credulous of old prophecies, and much addicted to drinking, though neither such sots or bigots as they are represented by some geographers. The boors, indeed, upon the river Hank, are said to be a thievish, unpolished, brutal race. The sciences now begin to lift up their heads a little among the Moravians, the university of Olmutz having been put on a better footing; and a riding academy, with a learned society, have been lately established there.

MORAVIAN BRETHREN. See HERNHUTTERS, and UNITAS *Fratrum*.

MORAW, or MORAVA, a large river of Germany, which has its source on the confines of Bohemia and Silesia. It crosses all Moravia, where it waters Olmutz and Hradisch, and receiving the Taya from the confines of Lower Hungary and Upper Austria, separates these two countries as far as the Danube, into which it falls.

MORBID, among physicians, signifies "diseased or corrupt;" a term applied either to an unsound constitution, or to those parts or humours that are affected by a disease.

MORBUS COMITIALIS, a name given to the epilepsy; because if on any day when the people were assembled in *comitia* upon public business, any person suddenly seized with this disorder should fall down, the assembly was dissolved, and the business of the *comitia*, however important, was suspended. See COMITIA.

MORBUS *Regius*, the same with the JAUNDICE. See MEDICINE *Index*.

MORBUS, or *Disease*, in botany. See VARIETAS.

MORDAUNT (Charles), earl of Peterborough, a celebrated commander both by sea and land, was the son of John Lord Mordaunt viscount Avalon, and was born about the year 1658. In 1675 he succeeded his father in his honours and estate. While young he served under the admirals Torrington and Narborough in the Mediterranean against the Algerines; and in 1680 embarked for Africa with the earl of Plymouth, and distinguished himself at Tangier when it was besieged by the Moors. In the reign of James II. he voted against the repeal of the test act; and disliking the measures of the court, obtained leave to go to Holland to accept the command of a Dutch squadron in the West Indies. He afterwards accompanied the prince of Orange into England; and upon his advancement to the throne, was sworn of the privy-council, made one of the lords of the bedchamber to his majesty, also first commissioner of the treasury, and advanced to the dignity of earl of Monmouth. But in November 1690 he was dismissed from his post in the treasury. On the death of his uncle Henry earl of Peterborough in 1697, he succeeded to that title; and, upon the accession of Queen Anne, was invested with the commission of captain-general and governor of Jamaica. In 1705 he was sworn of the privy-council; and the same year declared general and commander in chief of the forces sent to Spain, and joint admiral of the fleet with Sir Cloudsley Shovel, of which the year following he had the sole command. His taking Barcelona with a handful of men, and afterwards relieving it when greatly distressed by the enemy; his driving out of Spain the duke of Anjou, and the French army, which consisted of 25,000 men, though his own troops never amounted to 10,000; his gaining possession of Catalonia, of the kingdoms of Valencia, Arragon, and the isle of Majorca, with part of Murcia and Castile, and thereby giving the earl of Galway an opportunity of advancing to Madrid without a blow; are astonishing instances of his bravery and conduct. For these important services his Lordship was declared general in Spain by Charles III. aftewards emperor of Germany; and on his return to England he received the thanks of the House of Lords. His Lordship was afterwards employed in several embassies to foreign courts, installed knight of the garter, and made governor of Minorca. In the reign of George I. he was general of all the marine forces in Great Britain, in which post he was continued by King George II. He died in his passage to Lisbon, where he was going for the recovery of his health, in 1735.—His Lordship was distinguished by his possessing various shining qualities: for, to the greatest personal courage and resolution, he added all the arts and address of a general; a lively and penetrating genius; and a great extent of knowledge upon almost every subject of importance within the compass of

Mordella. More. of ancient and moderate literature; hence his familiar letters, inserted among those of his friend Mr Pope, are an ornament to that excellent collection.

Plate CCCXV. MOREDELLA, in zoology, a genus of insects of the coleoptera order. The antennæ are thread-shaped and serrated; the head is deflected under the neck; the pappi are clavated, compressed, and obliquely blunted; and the elytra are bent backwards near the apex. There are six species, all natives of different parts of Europe.

MORE (Sir Thomas), lord high chancellor of England, the son of Sir John More, knight, one of the judges of the King's-bench, was born in the year 1480, in Milk-street, London. He was first sent to a school at St Anthony's in Thread-needle street; and afterwards introduced into the family of cardinal Moreton who in 1497 sent him to Canterbury college in Oxford. During his residence at the university he constantly attended the lectures of Linacre and Grocinus, on the Greek and Latin languages. Having in the space of about two years made considerable proficiency in academical learning, he came to New inn in London, in order to study the law; whence, after some time, he removed to Lincoln's-inn, of which his father was a member. Notwithstanding his application to the law, however being now about 20 years old, he was so bigotted to monkish discipline, that he wore a hair-shirt next his skin, frequently fasted, and often slept on a bare plank. In the year 1503, being then a burgess in parliament, he distinguished himself in the house, in opposition to the motion for granting a subsidy and three fifteenths for the marriage of Henry VII.'s eldest daughter, Margaret, to the king of Scotland. The motion was rejected; and the king was so highly offended at this opposition from a beardless boy, that he revenged himself on Mr More's father, by sending him on a frivolous pretence to the Tower, and obliging him to pay 100 l. for his liberty. Being now called to the bar, he was appointed law-reader at Furnival's inn, which place he held about three years; but about this time he also read a public lecture in the church of St Lawrence, Old Jewry, upon St Austin's treatise *De civitate Dei*, with great applause. He had indeed formed a design of becoming a Franciscan friar, but was dissuaded from it; and, by the advice of Dr Colet, married Jane, the eldest daughter of John Colt, Esq; of Newhall in Essex. In 1508 he was appointed judge of the sheriffs's court in the city of London, was made a justice of the peace, and became very eminent at the bar. In 1516 he went to Flanders in the retinue of Bishop Tonstal and Dr Knight, who were sent by King Henry VIII. to renew the alliance with the archduke of Austria, afterwarks Charles V. On his return, Cardinal Wolsey would have engaged Mr More in the service of the crown, and offered him a pension, which he refused. Nevertheless, it was not long before he accepted the place of master of the requests, was created a knight, admitted of the privy council, and in 1520 made treasurer of the exchequer. About this time he built a house on the bank of the Thames, at Chelsea, and married a second wife. This wife, whose name was *Middleton*, and a widow, was old, ill tempered, and covetous: nevertheless Erasmus says he was as fond of her as if she were a young maid.

More. In the 14th year of Henry VIII. Sir Thomas More was made speaker of the house of commons: in which capacity he had the resolution to oppose the then powerful minister, Wolsey, in his demand of an oppressive subsidy; notwithstanding which, it was not long before he was made chancellor of the duchy of Lancaster, and was treated by the king with singular familarity. The king having once dined with Sir Thomas at Chelsea, walked with him near an hour in the garden, with his arm round his neck. After he was gone, Mr Roper, Sir Thomas's son-in-law, observed how happy he was to be so familiarly treated by the king: to which Sir Thomas replied, "I thank our lord, son Roper, I find his grace my very good lord indeed, and believe he doth as singularly favour me as any subject within this realm: howbeit, I must tell thee, I have no cause to be proud thereof; for if my head would win him a castle in France, it would not fail to go off." From this anecdote it appears, that Sir Thomas knew his grace to be a villain.

In 1526 he was sent with Cardinal Wolsey and others, on a joint embassy to France, and in 1529 with Bishop Tonstal to Cambray. The king, it seems, was so well satisfied with his services on these occasions, that in the following year, Wolsey being disgraced, he made him chancellor; which seems the more extraordinary, when we are told that Sir Thomas had repeatedly declared his disapprobation of the king's divorce, on which the great *defensor fidei* was so positively bent. Having executed the office of chancellor about three years, with equal wisdom and integrity, he resigned the seals in 1533, probably to avoid the danger of his refusing to confirm the king's divorce. He now retired to his house at Chelsea; dismissed many of his servants; sent his children with their respective families to their own houses (for hitherto he had, it seems, maintained all his children, with their families, in his own house, in the true style of an ancient patriarch); and spent his time in study and devotion: but the capricious tyrant would not suffer him to enjoy this tranquility. Though now reduced to a private station, and even to indigence, his opinion of the legality of the king's marriage with Anne Boleyn was deemed of so much importance, that various means were tried to procure his approbation: but all persuasion proving ineffectual, he was, with some others, attainted in the house of lords of misprision of treason, for encouraging Elizabeth Barton, the nun of Kent, in her treasonable practices. His innocence in this affair appeared so clearly, that they were obliged to strike his name out of the bill. He was then accused of other crimes, but with the same effect; till, refusing to take the oath enjoined by the act of supremacy, he was commited to the Tower; and, after 15 months imprisonment, was tried at the bar of the King's-bench, for high treason, in denying the king's supremacy. The proof rested on the sole evidence of Rich the solicitor-general, whom Sir Thomas, in his defence sufficiently discredited; nevertheless the jury brought him in guilty, and he was condemned to suffer as a traitor. The merciful Harry, however indulged him with simple decollation; and he was accordingly beheaded on Tower-hill, on the 5th of July 1535. His body which was first interred in the Tower, was begged by his daughter Margaret, and

and deposited at the chancel of the church at Chelsea, where a monument, with an inscription written by himself, had been some time before erected. This monument with the inscription is still to be seen in that church. The same daughter, Margaret, also procured his head after it had remained 14 days upon London-bridge, and placed it in a vault belonging to the Roper's family, under a chapel adjoining to St Dunstan's church in Canterbury. Sir Thomas More was a man of some learning, and an upright judge; a very priest in religion, yet cheerful, and even affectedly witty (A). He wanted not sagacity, where religion was out of the question; but in that his faculties were so enveloped. as to render him a weak and credulous enthusiast. He left one son and three daughters; of whom MARGARET, the eldest, was very remarkable for her knowledge of the Greek and Latin languages. She married a Mr Roper of Well-hall in Kent, whose life of Sir Thomas More was published by Mr Hearne at Oxford in 1716. Mrs Roper died in 1544; and was buried in the vault of St Dunstan's in Canterbury, with her father's head in her arms.

Sir Thomas was the author of various works, though his *Utopia* is the only performance that has survived in the esteem of the world; owing to the rest being chiefly of a polemic nature; his answer to Luther has only gained him the credit of having the best knack of any man in Europe, at calling bad names in good Latin. His English works were collected and published by order of Queen Mary, in 1557; his Latin, at Basil, in 1563, and at Louvain in 1566.

MORE (Sir Antonio), an eminent painter, was born at Utrecht in 1519. He became a scholar of John Schorel, but seems to have studied the manner of Holbein, to which he approached nearer than to the freedom of design in the works of the great masters that he saw at Rome. Like Holbein he was a close imitator of nature, but did not arrive at his extreme delicacy of finishing; on the contrary, Antonio sometimes struck into a bold and masculine style, with a good knowledge of the chiaro scuro. In 1542, he drew Philip II. and was recommended by cardinal Granvelle to Charles V. who sent him to Portugal, where he painted John III. the king, Catherine of Austria his queen, and the infanta Mary first wife of Philip. For these three pictures he received 600 ducats, besides a gold chain of 1000 florins, and other presents. He had 100 ducats for his common portraits. But still ampler rewards were bestowed on him when sent into England, to draw the picture of queen Mary, the intended bride of Philip. They gave him 100l. a gold chain, and a pension of 100l. a quarter as painter to their majesties. He made various portraits of the queen; one was sent by cardinal Granvelle to the emperor, who ordered 200 florins to Antonio. He remained in England during the reign of Mary, and was much employed; but having neglected, as is frequent, to write the names on the portraits he drew, most of them have lost part of their value, by our ignorance of the persons represented. On the death of the queen, More followed Philip in to Spain, where he was indulged in so much familiarity, that one day the king slapping him pretty roughly on the shoulder, More returned the sport with his hand-stick; a strange liberty (Mr Walpole observes), to be taken with a Spanish monarch, and with such a monarch! A grandee interposed for his pardon, and he was ordered to retire to the Netherlands; but a messenger was dispatched to recal him before he had finished his journey. The painter, however, sensible of the danger he had escaped, modestly excused himself, and proceeded. At Utrecht he found the duke of Alva, and was employed by him to draw several of his mistresses, and was made receiver of the revenues of West Flanders; a preferment with which they say he was so elated, that he burned his Casel and gave away his painting tools. More was a man of a stately and handsome presence; and often went to Brussels, where he lived magnificiently. At what time or where he was knighted, is uncertain. He died at Antwerp in 1575, in the 56th year of his age. His portrait, painted by himself, is in the chamber of painters at Florence, with which the great duke, who bought it, was so pleased, that he ordered a cartel with some Greek verses, written by Antonio Maria Salvini his Greek professer, to be affixed to the frame. Another picture of himself, and one of his wife, were in the collection of Sir Peter Lely. King Charles had five pictures painted by this master. Mr Walpole mentions a number of others that are in England. But More did not always confine himself to portaits. He painted several historic pieces, particularly one much esteemed of the resurrection of Christ with two angels, and another of Peter and Paul. A painter, who afterwards sold it to the prince of Condé, got a great deal of money by showing it at the foire St Germaine. He made a fine copy of Titian's Danae for the king; and left unfinished the Circumcision designed for the altar in the church of our Lady at Antwerp.

MORIN (Henry), an eminent English divine and philosopher, in the 17th century, was educated at Eton school, and in Christ-college in Cambridge, of which he became a fellow, and spent his life in a retired way, publishing a great number of excellent works. He refused Bishopricks both in Ireland and England. He was an open-hearted sincere Christian philosopher, who studied to establish men in the belief of providence against atheism. Mr Hobbes was used to say, that if his own philosophy was not true, there was none

(A) This last disposition, we are told, he could not restrain even at his execution. The day being come, he ascended the scaffold, which seemed so weak that it was ready to fall; whereupon, "I pray (said he) see me safe up, and for my coming down let me shift for myself." His prayers being ended, he turned to the executioner, and with a cheerful countenance said, "Pluck up thy spirits, man, and be not affraid to do thy office, my neck is very short, take heed therefore thou strike not awry for saving thy honesty." Then laying his head upon the block, he bid him stay until he had put aside his beard, saying, "That had never committed any treason."

More. | Moreelse.

none that he should sooner like than our philosopher's His writings have been published together in Latin and English, folio.

More (Alexander), was born at Castros in 1616. His father was a Scotsman, and principal of the college which the Calvinists had in that city. Alexander was sent to Geneva, where he was made professor of Greek and of Theology, and at the same time discharged the office of a pastor. His violent love of women, and the irregularity of his conduct, excited a great number of enemies against him. Saumaise, informed of his disagreeable situation, invited him to Holland, where he was first appointed professor of Theology at Middleburgh, and afterwards professor of history at Amsterdam. The duties of these stations he discharged with great ability: and in 1655 he went to Italy, where he remained a considerable time, It was during his travels in Italy that he published his beautiful poem on the defeat of the Turkish fleet by the Venetians; and this work procured him the present of a golden chain from the republic. Having taken a dislike to Holland, he was translated to Charenton. There his sermons attracted a numerous audience, not so much for their eloquence as for the satirical allusions and witticisms with which they abounded. This kind of style succeeded with him, because it was natural; but in his imitators it appeared altogether ridiculous. The impetuosity of his character brought him into new quarrels, especially with Daillé, who had greatly the better of him in the dispute.— This singular man died at Paris September 20th, 1670, aged 54, in the house of the duchess de Rohan. He was never married. His works are, 1. A Collection of Controversial Tracts. 2. Beautiful Orations and Poems, in Latin. 3. An answer to Milton, intitled, *Alexandri, Mori fides publica*. Milton has attacked him with great severity in his writings. Those sermons of his which are published, by no means justify the reputation which he had acquired for that kind of composition.

MOREA, formerly called the *Peloponnesus*, is a peninsula to the south of Greece, to which it is joined by the isthmus of Corinth. Its form resembles a mulberry-leaf, and its name is derived from the great number of mulbery-trees which grow there. It is about 180 miles in length, and 130 in breadth. The air is temperate, and the land fertile, except in the middle, where it is full of mountains, and is watered by a great number of rivers. It is divided into three provinces; Scania, Belvedera, and Brazzo-di-Maina. It was taken from the Turks by the Venetians in 1687; but they lost it again in 1715. The sangiac of the Morea resides at Modon. See Greece and Peloponnesus.

MOREAU (James), an eminent French physician, born at Chalons-sur-Saone, was the disciple and friend of the famous Guy Patin. He drew upon himself the jealousy and hatred of the old physicians by the public theses he maintained, and afterwards vindicated in his writings. He died in a very advanced age in 1729. He wrote in French, 1. Consultations on the Rheumatism. 2. A chemical treatise on Fevers. 3. A physical dissertation on the Dropsy; and other works which are esteemed.

MOREELSE (Paul), an eminent painter, was born at Utrecht in 1575, and studied painting under Michael Mirevelt. He was very successful, not only in portraits, but historical subjects and architecture, particularly after he had improved his taste by his studies in Italy. We have some excellent wood cuts in chiaro-scuro by this artist, who died in 1638.

Morel.

MOREL, the name of several celebrated printers to the kings of France, who, like the Stephenses, were also men of great learning.

Frederic Morel, who was interpreter in the Greek and Latin tongues, as well as printer to the king, was heir to Vascosan, whose daughter he had married.— He was born in Champagne, and he died in an advanced age at Paris 1513. His sons and grandsons trode in his steps; they distinguished themselves in literature, and maintained also the reputation which he had acquired by printing. The edition of *St Gregory of Nyssa*, by his son Claude Morel, is held in great estimation by the learned.

Morel (Frederic), son of the preceeding, and still more celebrated than his father, was professor and interpreter to the king, and printer in ordinary for the Hebrew, Greek, Latin, and French languages. He was so devoted to study, that when he was told his wife was at the point of death, he would not stir till he had finished the sentence which he had begun. Before it was finished, he was informed that she was actually dead; *I am sorry for it* (replied he coldly) *she was an excellent woman.* This printer acquired great reputation from the works which he published, which were very numerous and beautifully executed. From the manuscripts in the king's library, he published several treatises of St Basil, Theodoret, St Cyrille; and he accompanied them with a translation. His edition of the works of Œcumenius and Aretas. in 2 vols folio, is much esteemed. In short, after distinguishing himself by his knowledge in the languages, he died June 27, 1630, at the age of 78. His sons and grandsons followed the same profession.

Morel (William), regius professor of Greek, and director of the king's printing house at Paris, died 1564. He composed a *Dictionaire Grec-Latin-François*, which was published in quarto in 1622, and some other works which indicate very extensive learning. His editions of the Greek authors are exceedingly beautiful. This great scholar, who was of a different family from the preceding, had a brother named John, who died in prison (where he had been confined for heresy) at the age of 20, and whose body was dug out of the grave, and burnt Feb. 27, 1559. They were of the parish of Tilleul, in the county of Mortein, in Normandy.

Morel (Dom Robert), a benedictine monk of the society of Saint-Maur, was born at Chaise-Dieu in Auvergne, A. D. 1653. He was appointed keeper of the library of Saint-Germain des Pres in 1680. He was afterwards superior of different religious houses. In 1699 he disengaged himself from every care, and retired to Saint Denys, where he spent his time in composing works of practical religion. This learned monk, who enjoyed from nature a lively and fruitful imagination, excelled chiefly in subjects of piety, in a knowledge of the christian character, and of the rules which regard the conduct of the Christian life. His conversation was sprightly and refined, his answers were prompt and ingenious, his temper was gentle,

 equable,

Morel.

equable, and full of gaiety mingled with discretion. His slovenly appearance did not debase the beauty of his mind. All his words breathed charity, piety, uprightness, sincerity, and innocence of manners. Great simplicity and modesty, the limits of which he never transgressed, concealed his excellencies from the vulgar, but made him rank higher in the estimation of the wise and sensible part of mankind. Dom Morel died A. D. 1731, aged 79. His principal works are, 1. *Effusions de cœur sur chaque verse des Pseaumes et des Cantiques de l'Eglise;* Paris, 1716, in 5 vols. 12mo. P. de Tournemine, a Jesuit, esteemed this book (which abounds in pious and affecting thoughts and expressions) so much, that he perused it constantly; and when he was obliged to go to the country he always carried a volume of it along with him. He earnestly sought to be introduced to the author, and intreated on his knees that he would grant him his benediction (*Histoire litteraire de la congregation de Saint Maur, p.* 504) 2. *Entretiens spirituels sur les Evangiles des Dimanches et des Mysteres de toute l'anneé, distribués pour tous les jours de l'Avent,*1720, 4 vols 12mo, 3. *Entretiens spirituels, pour servir de preparation á la Mort,* 12mo, 1721. 4. *Imitation de N. S-I. C.* a new translation, with a pathetic prayer, or an effusion of the heart, at the conclusion of every chapter, in 12mo, 1723. 5. *Meditations Chretiennes sur les Evangiles de toute l'anneé,* 2 vols. 12mo, 1726. 6. *De l'Esperance Chretienne et de la Confiance en la misericorde de Dieu,* 12mo, 1728. The greater part of Morel's works are devotional; and his observations are drawn chiefly from the scriptures, and from the practical writings of the fathers. This circumstance greatly raised the reputation of his works, and at the same time excited the envy and ill-will of his enemies. By them he was considered as a Jansenist; and in this light he is represented in in the *Dictionnaire des livres Jansenistes.*

Morel (Andreas), a very eminent antiquary, born at Berne in Switzerland. Having a strong passion for the study of medals, he travelled through several countries, and made large collections: in 1683 he published at Paris, in 8vo, *Specimen universæ rei nummariæ antiquæ*: and the great work of which this was the specimen was to be a complete collection of all ancient medals, of which he had at that time 20,000 exactly designed. Soon after this essay appeared, Louis XIV. gave him a place in his cabinet of antiques, in which capacity he brought himself into great danger by speaking too freely of M. Louvois on account of the neglect in paying his salary, or on some other private account, as he was committed to the Bastile, where he lay for three years; nor was he released until the death of Louvois, nor till the canton of Berne had interceded in his favour. He afterward accepted an invitation from the count of Schwartzburg at Arnstadt, in Germany, with whom he lived in the capacity of antiquary, and was furnished with every thing necessary for carrying on his grand work. In 1703 he died; and in 1734 came out at Amsterdam part of this collection, in 2 vols. folio, under the title of *Thesaurus Morellianus, sive familiarum Romanorum numismata omnia, diligentissime undique conquisita,* &c. *Nunc primum edidit & commentario perpetuo illustravit Sigibertus Havercampus.* These volumes contain an explication of 3539 medals, engraved, with their reverses.

Morena || Morgagni.

MORENA, (anc. geog.), a district or division of Mysia, in the Hither Asia. A part of which was occupied by Cleon, formerly at the head of a band of robbers, but afterward priest of Jupiter Abrettenus, and enriched with possessions, first by Antony, and then by Cæsar.

MORESBY, a harbour a little above Whitehaven, in Cumberland; in and about which many remains of antiquity have been dug up, such as altars and stones, with inscriptions on them; and several caverns have been found called Pict's Holes. Here is supposed to have been a Roman fortification.

MORESQUE, Moresk, or *Morisko*, a kind of painting, carving, &c. done after the manner of the Moors; consisting of several grotesque pieces and compartments promiscuously intermingled, not containing any perfect figure of a man, or other animal, but a wild resemblance of birds, beasts, trees, &c. These are also called *arabesques*, and are particularly used in embroideries, damask-work, &c.

Moresque-dances vugarly called *Morrice-dances* are those altogether in imitation of the Moors, as sarabands, chacons, &c. and are usually performed with castanets, tambours, &c.

There are few country places in England where the morrice-dance is not known. It was probably introduced about, or a little before the reign of Henry VIII. and is a dance of young men in their shirts, with bells at their feet, and ribbands of various colours tied round their arms and flung across their shoulders.

MORETON, a town of Devonshire, with a market on Saturdays, seated on a hill, near Dartmore, and is a pretty large place, with a noted market for yarn. It is 14 miles south-west of Exeter, and 185 west by south of London. W. Long. 3. 46. N. Lat. 50. 39.

Moreton, a town in Gloucestershire, whose market is disused. It is a good thoroughfare, and seated on the Fosseway, 29 miles east-south-east of Worcester, and 83 west-north-west of London. W. Long. 3. 36. N. Lat. 52. 0.

MORGAGNA. See Fata.

MORGAGNI (John Baptist), doctor of medicine first professor of anatomy in the university of Padua, and member of several of the most eminent societies of learned men in Europe, was born in the year 1682, at Forli, a town in the district of *La Romagna* in Italy. His parents, who were in easy circumstances, allowed him to follow that course in life his genious dictated. He began his study at the place of his nativity; but soon after removed to Bologna, where he obtained the degree of Doctor of Medicine, when he had but just reached the 16th year of his age. Here his peculiar taste for anatomy found an able preceptor in Valsalva, who bestowed on him the utmost attention; and such was the progress he made under this excellent master, that at the age of 20 he himself taught anatomy with high reputation. Soon, however, the fame of his prelections, and the number of his pupils excited the jealousy of the public professors, and gave rise to invidious persecutions. But his abilities and prudence gained him a complete triumph over his enemies; and all opposition to him was finally terminated from his being appointed by the senate of Bologna to fill a medical chair, which soon became vacant. But the duties of this office, although important, neither occupied the whole of his time, nor satisfied his anxious desire to afford instruction. He still continued to labour in secret on his favourite subject, and soon after communicated the fruits of these labours to the public in his *Adversaria Anatomica*, the first of which was published in the year 1706, the second and third in 1717, and the three others in 1719. The publication of this excellent work spread the fame of Morgagni far beyond the limits of the state of Bologna. Such was his reputation, that the wise republic of Venice had no hesitation in making him an offer of the second chair of the theory of medicine in the university of Padua, then vacant by the death of M. Molinetti; and, to ensure his acceptance, they doubled the emoluments of that appointment. While he was in this department he published his treatise, entitled *Nova institutionum medicarum idea*, which first appeared at Padua in the year 1712. From this work his former reputation suffered no diminution. And soon after he rose, by different steps, to be first professor of anatomy in that celebrated university. Although Morgagni was thus finally settled at Padua, yet he gave evident proofs of his gratitude and attachment to Bologna, which he considered as his native country with respect to the sciences. He exerted his utmost efforts in establishing the academy of Bologna, of which he was one of the first associates; and he enriched their publications with several valuable and curious papers. Soon after this, the Royal societies of London and Paris received him among their number. Not long after the publication of his *Adversaria Anatomica*, he began, much upon the same plan, his *Epistolæ Anatomicæ*, the first of which is dated at Padua in the beginning of April 1726. The works of Morgagni which have already been mentioned, are to be considered, in a great measure, as strictly anatomical: but he was not more eminent as an anatomist, than as a learned and successful physician. In the year 1760, when he was not far distant from the 80th year of his age, he published his large and vuluable work *De causis et sedibus morborum per anatomen indagatis*. This last and most important of all his productions will afford convincing evidence of his industry and abilities to latest posterity. Besides these works, he published, at different periods of his life, several miscellaneous pieces, which were afterwards collected into one volume, and printed under his own eye at Padua, in the year 1765. It does not appear that he had in view any favourite publications; but he intended to have favoured the world with a complete edition of all his works, which would probably have been augmented with many new observations. In this he was engaged when, on the 5th of December 1771, after he had nearly arrived at the 90th year of his age, death put a period to his long and glorious career in the learned world.

MORGANA, or MORGAGNA, *Fata*. See FATA.

MORGES, a handsome and rich town of Swisserland, in the canton of Bern, and capital of a bailiwick, with a castle where the bailiff resides. It is a place of some trade on account of a canal, from which they transport merchandizes from the lake of Geneva to other parts. There is a fine prospect from it, and it is seated on the lake of Geneva, five miles from Lausanne. E. Long. 6. 42. N. Lat. 46. 29.

MORGO, anciently *Amorgos*, an island in the Archipelago, fertile in wine, oil, and corn. It is well cultivated, and the inhabitants are affable, and generally of the Greek church. The best parts belong to a monastery. The greatest inconvenience in this island is the want of wood. It is 30 miles in circumference. E. Long. 26. 15. N. Lat. 36. 30.

MORHANGE, a town of Germany, in Lorrain, whose lord has the title of Rhinegrave, and depends on the empire. It is 24 miles north-east of Nanci, and 200 east of Paris, E. Long. 6. 42. N. Lat. 48. 51.

MORHOFF (Daniel George), a very learned German, born at Wismar in the duchy of Mecklenburgh, in 1639. The duke of Holstein, when he founded an university at Kiel, made him professor of eloquence and poetry there in 1665; to which was afterwards added the professorship of history, and in 1680 the office of librarian to the university. He was the author of many works of a small kind; as orations, dissertations, theses, and poems: but his chief work was his *Polyhistor, sive de notitia auctorum et rerum commentarii*, first published at Lubec in 1688: which has been greatly enlarged since his death in 1691, and gone through several successive editions,

MORIAH, one of the eminences of Jerusalem; on which Abraham went to offer his son, and David wanted to build the temple, which was afterwards executed by Solomon; the threshing-floor of Araunah; originally narrow, so as scarce to contain the temple, but enlarged by means of ramparts; and surrounded with a triple wall, so as to add great strength to the temple, (Josephus). It may be considered as a part of Mount Sion, to which it was joined by a bridge and gallery. *(Id.)*

MORILLES, a kind of mushroom, about the bigness of a walnut, pierced with holes like a honeycomb, and said to be good for creating an appetite. They are also accounted restorative, and frequently used in sauces and ragouts.

MORILLOS, (Bartholomew), of Seville in Spain, was born A. D. 1613. After having cultivated painting with success in his own country, he travelled into Italy, where he was greatly admired for a manner peculiar to himself, and capable of producing a wonderful effect. The Italians, astonished at the excellence of his genius and the freshness of his colouring, did not hesitate to compare him to the celebrated Paul Veronese. On his return to Spain, Charles II. brought him to court, with the intention of making him his first painter: but Morillos declined the offer, pretending, as an excuse, that his age would not permit him to accept of an employment of such importance. His extreme modesty, however, was the sole cause of his refusal. He died in 1685, aged 72 years.

MORIN (John Baptist), physician and regius professor of mathematics at Paris, was born at Villefranch in Beausolois, in 1583. After commencing Doctor at Avignon, he went to Paris, and lived with Claude Dormi bishop of Boulogne, who sent him to examine the mines of Hungary; and thereby gave occasion to his *Mundus sublunaris anatomia*, which was his first production, and published in 1619. Upon his return to his patron the bishop, he contracted an attachment to judicial astrology, concerning which he furnished the world with many ridiculous stories, and wrote a great number of books not worth enumerating. He died in 1656 before he had finished the favourite labour of his life, which was his *Astrologia Gallica*. Louisa Maria de Gonzaga queen of Poland gave 2000 crowns to carry on the edition, at the recommendation of one of her secretaries, who was a lover of astrology; and it appeared at the Hague in 1661, in one vol. folio, with two dedications, one to Jesus Christ, and another to the queen of Poland.

Morin (John), a very learned Frenchman, born at Blois, of Protestant parents, in 1591; but converted by cardinal du Perron to the catholic religion. He published, in 1626, some Exercitations upon the original of Patriarchs and Primates, and the ancient usage of ecclesiastical censures; dedicated to pope Urban VIII. In 1628 he undertook the edition of the Septuagint Bible, with Nobilus's version; and placed a preface before it, in which it treats of the authority of the Septuagint, and prefers the version in the edition made at Rome by order of Sixtus V. to the present Hebrew text, which he affirms has been corrupted by the Jews. About the same time he gave a French History of the deliverance of the church by the emperor Constantine, and of the temporal greatness conferred on the Roman church by the kings of France. He afterwards published Exercitations upon the Samaritan Pentateuch; and took the care of the Samaritan Pentateuch, for the Polyglot then preparing at Paris. He was greatly caressed at Rome; where after living nine years at the invitation of cardinal Barbarini, he was recalled by Cardinal Richelieu, and died at Paris in 1659. His works are very numerous; and some of them as much valued by Protestants as Papists for the oriental learning they contain.

Morin (Simon), a celebrated fanatic of the 17th century, was born at Richemont, near Aumale, and had been clerk to Mr Charron, general paymaster of the army. He was very ignorant and illiterate; and therefore it is no wonder if, meddling in spiritual matters, he fell into great errors. He was not content with broaching his whimsies in conversation, but wrote them down in a book, which he caused to be privately printed in 1647, under the title of *Pensées de Morin dediées au Roi.* This book is a medley of conceit and ignorance, and contains the most remarkable errors which were afterwards condemned in the Quietists; only that Morin carries them to a greater length than any one else had done; for he affirms, "that the most enormou sins do not remove a sinner from the state of grace, but serve on the contrary to humble the pride of man." He says, "that in all sects and nations God has a number of the elect, true members of the church; that there would soon be a general reformation, all nations being just about to be converted to the true faith; and that this great reformation was to be effected by the second coming of Jesus Christ, and Morin incorporated with him."—He was in prison at Paris, at the time when Gassendi's friends were writing against the astrologer John Baptist Morin, whom they upbraided (but, as he replied, falsely) with being the brother of this fanatic. This was about 1650; after which Simon Morin was set at liberty as a visionary; and suffered to continue so till 1661, when Des Marets de St Sorlin, who, though a fanatic and visionary himself, had conceived a violent aversion to him, discovered his whole scheme and had him taken up. The means Des Marets made use of for this discovery was by pretending to be one of his disciples; and he carried his treachery and dissimulation so far, as to acknowledge him for "the Son of man risen again." This acknowledgment so pleased Morin, that he conferred upon him, as a particular grace the office of being his harbinger, calling him *a real John the Baptist revived.* Then Des Marets impeached him, and became his accuser; upon which Morin was brought to a trial, and condemned to be burnt alive. This sentence was executed on him at Paris, March 14th, 1663, in the form and manner following: After having made the *amende honourable* in his shirt with a cord about his neck and a torch in his hand, before the principal gate of the church of Notre Dame, he was carried to the place of execution, and there tied to a stake to be burnt alive together with his book intituled *Pensées de Morin*, as also all his papers and his trial. Afterwards his ashes were thrown into the air, as a punishment for his having assumed the title of the Son of God. His accomplices, too, were condemned to assist at his execution, and then to serve in the galleys for life, after having been whipped by the hangman, and marked with a burning iron with *fleurs de lis* upon the right and left shoulders. Morin gave out that he would rise again the third day; which made many of the mob gather together at the place where he was burnt.—It is said, that when the president de Lamoignon asked him, whether it was written in any part of Scripture, that the great prophet or new Messiah should pass through the fire? he cited this text by way of answer; *Igne me examinasti, et non est inventa in me iniquitas;* that is, "Thou hast tried me with fire, and no wickedness hath been found in me." Morin died with remarkable resolution; and it was then thought the judges had been too rigorous in their sentence, and that sending him to a mad-house would have been sufficient. They replied in defence of themselves, that Morin had owned many impious tenets; and that not in sudden starts and fits of heat, but in cool blood, and with deliberate obstinacy. But then a question will arise, whether a fool, any more than a madman, ought to be capitally punished for any opinion or degree of stubborness?

Morin (Peter), was born at Paris, A. D. 1531: he went into Italy, and was employed by the learned Paulus Manucius in his printing-house at Venice.—He afterwards taught Greek and cosmography at Vicencia whence he was called to Ferrara by the duke of that name. St Charles Borromeus, informed of his profound knowledge in ecclesiastical antiquities, of his disinterestedness, of his zeal and piety, offered him his friendship, and engaged him to go to Rome in 1575. The popes Gregory XIII. and Sixtus V. employed him in an edition of the Septuagint, 1587, and in one of the Vulgate, 1590, in folio. He also spent much of his time on an edition of the Bible translated from the Septuagint, and published at Rome, 1588, in folio; on an edition of the Decretals to the

time

Morin.

the time of Gregory VII. publiſhed at Rome, 1591; and on a Collection of General Councils, likewiſe publiſhed at Rome, 1608, 4 vols. This learned critic died at Rome, 1608, aged 77. His character was open, ſimple, ſincere, gentle, and honeſt; his temper was equal and agreeable. He was an enemy to artifice and cunning; he deſpiſed riches and honours; and he ſeemed to have a paſſion for nothing but ſtudy.—He ſpoke Italian with as much eaſe and propriety as the moſt intelligent native. He left behind him *Un Traité du bon uſage des Sciences*, and ſome other writings, publiſhed by Father Quetif, a Dominican friar, in 1675. His works diſplay great reſearch and excellent principles; and the author appears to have been well acquainted with the belles lettres and the languages. His edition of the Septuagint, printed at Rome, 1687, in folio, is now very ſcarce.

Morin (Stephen), miniſter of the Proteſtant reformed religion at Caen, the place of his birth, was admitted a member of the Academy of Belles Lettres in that city, notwithſtanding an expreſs law which excluded Proteſtants. His great learning gained him this mark of diſtinction. After the revocation of the edict of Nantes, he retired to Leyden in 1685, and from that to Amſterdam, where he was appointed profeſſor of Oriental languages. He died in 1700, at the age of 75, after being long ſubject to infirmities both of body and mind. He publiſhed eight diſſertations in Latin relating to ſubjects of antiquity, which are extremely curious. The Dordrecht edition of 1700, 8vo, is the beſt, and preferable to that publiſhed at Geneva in 1683, 4to. He wrote likewiſe the life of Samuel Bochart.

Morin (Henry), ſon to the preceding, was born at Saint-Pierre-Sur-Dive, in Normandy, and became a Roman Catholic after he had been a Proteſtant miniſter. He is the author of ſeveral diſſertations which are to be found in the Memoirs of the Academy of Inſcriptions, of which he was a member. He died at Caen, on the 16th of July 1728, aged 60, as much eſteemed as his father.

Morin (Lewis), was born at Mans in 1635. He went on foot to Paris to ſtudy philoſophy, and collected herbs during the whole journey. He afterwards ſtudied phyſic, and lived in the manner of an anchorite, on bread and water, or at moſt but a few fruits, being his whole ſubſiſtence. Paris was to him a hermitage; with this exception, that it furniſhed him with books, and with the converſation and acquaintance of the learned. He received the degree of doctor of medicine in 1662; and, after ſeveral years practice, he was expectant at the Hotel-Dieu. His reputation made Mademoiſelle de Guiſe chooſe him for her firſt phyſician, and the Academy of Sciences for one of its members. He died A. D. 1715, aged 80. A long and vigorous life, with a gentle and eaſy death, were the rewards of his temperance. The exerciſes of religion and the duties of his ſtation occupied his whole time. No part of it was ſpent in paying or receiving viſits. "Thoſe who come to ſee me (ſaid he) do me honour; thoſe who do not come, lay me under an obligation." "It was only an Anthony (ſaid Fontenelle) who could viſit this Paul." He left a library valued at 20,000 crowns, an herbal together with a cabinet of medals; and this ſeems to have been his whole fortune. His mental enjoyments had been much more expenſive than thoſe of the body. An index to Hippocrates, in Greek and Latin, much more copious and better finiſhed than that of Pinus, was found among his papers.

Morin || Moriſon.

Morin (John), was born at Meung near Orleans in 1705, and in 1732 he was appointed profeſſor of philoſophy at Chartres. In 1750 the biſhop of Chartres rewarded his long and aſſiduous attention to claſſical learning by a canonry in the cathedral. At the age of 38, Morin publiſhed his *Mechaniſme Univerſel*, one volume 12mo, which contains a great deal of information, but much more conjecture. His next work was a Treatiſe on Electricity, publiſhed in 1748. His third and laſt performance was an anſwer to the Abbé Nollet, who had attacked his opinions concerning electricity. His reputation was not limited to the province in which he lived: he was well known to the academies of ſciences at Paris and Rouen, with whom he frequently correſponded. He continued his application to the ſciences, and diſplayed the virtues of the prieſt and the philoſopher to the laſt hour of his life. This valuable man died at Chartres, on the 28th of March 1764, at the age of 59.

MORINA, in botany: A genus of the monogynia order, belonging to the diandria claſs of plants; and in the natural method ranking under the 48th order, *Aggregatæ*. The corolla is unequal; the calyx of the fruit is monophyllous and dented; the calyx of the flower bifid; there is one ſeed under the calyx of the flower.

MORINORUM Castellum (anc. geog.), ſimply Caſtellum (Antoine); ſituated on an eminence, with a ſpring of water on its top, in the territory of the Morini. Now *Mont Caſſel*, in Flanders.

MORINDA, 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, *Aggregatæ*. The flowers are aggregate and monopetalous; the ſtigmata bifid; the fruit plums aggregate, or in cluſters.

MORISON (Robert), a phyſician and profeſſor of botany at Oxford, was born at Aberdeen in 1620, bred at the univerſity there, and taught philoſophy for ſome time in it; but having a ſtrong inclination to botany, made great progreſs in it. The civil wars obliged him to leave his country; which, however, he did not do till he had firſt ſignalized his zeal for the intereſt of the king, and his courage, in a battle fought between the inhabitants of Aberdeen, and the Preſbyterian troops on the bridge of Aberdeen, in which he received a dangerous wound on the head. As ſoon as he was cured of it, he went into France; and fixing at Paris, he applied aſſiduouſly to botany and anatomy. He was introduced to the duke of Orleans, who gave him the direction of the royal gardens at Blois. He exerciſed the office till the death of that prince, and afterwards went over to England in 1660. Charles II. to whom the duke of Orleans had preſented him at Blois, ſent for him to London, and gave him the title of his *phyſician*, and that of *profeſſor royal of botany*, with a penſion of 200 l. *per annum*. The *Præludium Botanicum*, which he publiſhed in 1669, procured him ſo much reputation, that the univerſity of Oxford invited him to the profeſſorſhip of botany in 1669;

which

Morisonia, Morlachia.

which he accepted, and acquitted himself in it with great ability. He died at London in 1683, aged 63. He published a second and third part of his History of Plants, in 2 vols. folio; with this title, *Plantarum Historia Oxoniensis Universalis*. The first part of this excellent work has not been printed: and it is not known what has become of it.

MORISONIA, in botany: A genus of the polyandria order, belonging to the monadelphia class of plants and in the natural method ranking under the 25th order, *putamineæ*. The calyx is single and bifid; the corolla tetrapetalous; there is one pistil; the berry has a hard bark, is unilocular, polyspermous, and pedecellated.

MORLACHIA, a mountainous country of Dalmatia. The inhabitants are called *Morlacks*, or *Morlahi;* they inhabit the pleasant valleys of Koter, along the rivers Kerha, Cettina, Marenta, and among the inland mountains of Dalmatia. The inhabitants are by some said to be of Walachian extraction, as (according to these authors) is indicated even by their name; Morlachia being a contraction of *Mauro-walachia*, that is, *Black Walachia:* and the Walachians are said to be descendants of the ancient Roman colonies planted in these countries. This, however, is denied by the Abbé Fortis, who hath published a volume of travels into that country. He informs us, that the origin of the Morlacchi is involved in the darkness of barbarous ages, together with that of many other nations, resembling them so much in customs and language, that they may be taken for one people, dispersed in the vast tracks from the adriatic sea to the frozen ocean. The emigrations of the various tribes of the Slavi, who, under under the names of *Scythians*, *Geti*, *Goths*, *Hunns*, *Slavini*, *Croats*, *Avari*, and *Vandals*, invaded the Roman empire, and particularly the Illyrian provinces during the decline of the empire, must have strangely perplexed the genealogies of the nations which inhabited it, and which perhaps removed thither in the same manner as at more remote periods of time. The remainder of the Ardiæi, Autariati, and other Illyrian people anciently settled in Dalmatia who probably could not reconcile themselves to a dependance on the Romans, might nevertheless naturally enough form an union with foreign invaders not unlike themselves in dialect and customs; and, according to our author, it seems no ill-founded conjecture, that many families driven out of Hungary by the irruption of the Moguls under Jenghiz Khan and his successors might people the deserted valleys between the mountains of Dalmatia. This conjecture is also somewhat confirmed by the traces of the Calmuck Tartars, which are still to be found in a part of that country called *Zara*.

With regard to the etymology of the name, the Abbé observes, that the Morlacchi generally call themselves, in their own language, *Vlassi;* a national term, of which no vestige is found in the records of Dalmatia till the 13th century. It signifies *powerful men or men of authority;* and the denomination of *Moro Vlassi*, corruptly *Morlacchi*, as they are now called, may perhaps point out the original of the nation. This word may possibly signify the *conquerors that came from the sea; Moor*, in all the dialects of the Sclavonian language, signifying the *sea*.

The Morlacchi are so different from the inhabitants of the sea-coasts in dialect, dress, dispositions, and customs, that they seem clearly to be of a different original, or at least the colonies must have settled at such distant periods from each other, that they have had time to alter in a great measure their national character. There is also a remarkable diversity among the Morlacchi themselves in several districts, probably on account of the different countries from whence they came.

With regard to the character of these people, we are informed that they are much injured by their maritime neighbours. The inhabitants of the sea-coast of Dalmatia tell many frightful stories of their avarice and cruelty; but these, in our author's opinion, are all either of an ancient date, or if any have happened in latter times, they ought rather to be ascribed to the corruption of a few individuals, than to the disposition of the nation in general; and though thievish tricks are frequent among them, he informs us, that a stranger may travel securely through their country, where he is faithfully escorted, and hospitably treated. The greatest danger is from the *Haiduks* or *Banditti*, of whom there are great numbers among the woods and caves of these dreadful mountains on the confines. There, says our author, a man ought to get himself escorted by a couple of these "honest fellows;" for they are not capable of betraying him although a banditti; and their situation is commonly more apt to raise compassion than diffidence. They lead their life, among the wolves, wandering from one precipice to another, exposed to the severity of the seasons, and frequently languish in want of the necessaries of life, in the most hideous and solitary caverns. Yet they very seldom disturb the tranquility of others, and prove always faithful guides to travellers; the chief objects of their rapine being sheep and oxen, to supply themselves with food and shoes. Sometimes it happens, that in their extreme necessity the Haiduks go in parties to the shepherds cottages, and rudely demand something to eat; which they do not fail to take immediately by force if the least hesitation is made. It is seldom indeed they meet with a refusal, or with resistance, as their resolution and fury are well known to be equal to the savage life they lead. Four Haiduks are not afraid to assault a caravan of 15 or 20 Turks, and generally plunder and put them to flight. The greatest part of the Haiduks look upon it as a meritorious action to shed the blood of the Turks; to which cruelty they are easily led by their natural ferocity, inflamed by a mistaken zeal for religion, and the discourses of their fanatic priests.

As to the Morlacchi themselves, they are represented as open and sincere to such a degree, that they would be taken for simpletons in any other country; and by means of this quality they have been so often duped by the Italians, that *the faith of an Italian* and *the faith of a dog*, are synonymous among the Morlacchi. They are very hospitable to strangers; and their hospitality is equally conspicuous among the rich and poor. The rich prepares a roasted lamb or sheep, and the poor with equal cordiality offers whatever he has; nor is this generosity confined to strangers, but generally extends itself to all who are in want.

When

Morlachia. When a Morlack is on a journey, and comes to lodge at a friend's house, the eldest daughter of the family, or the new-married bride if there happens to be one, receives and kisses him when he alights from his horse or at the door of the house: but a foreigner is rarely favoured with these female civilities; on the contrary, the women, if they are young, hide themselves, and keep out of his way.

The Morlacchi in general have little notion of domestic œconomy, and readily consume in a week as much as would be sufficient for several months, whenever any occasion of merriment presents itself. A marriage, the holiday of the saint, protector of the family, the arrival of relations or friends, or any other joyful incident, consumes of course all that there is to eat and to drink in the house. Yet the Morlack is a great œconomist in the use of his wearing-apparel; for rather than spoil his new cap, he takes it off let it rain ever so hard, and goes bareheaded in the storm. In the same manner he treats his shoes, if the road is dirty and they are not very old. Nothing but an absolute impossibility hinders a Morlack from being punctual; and if he cannot repay the money he borrowed at the appointed time, he carries a small present to his creditor, and requests a longer term. Thus it happens sometimes, that, from term to term, and present to present, he pays double what he owed, without reflecting on it.

Friendship, that among us is so subject to change on the slightest motives, is lasting among the Morlacchi. They have even made it a kind of religious point, and tie the sacred bond at the foot of the altar. The Sclavonian ritual contains a particular benediction for the solemn union of two male or two female friends in the presence of the congregation. The male friends thus united are called *Pobratimi*, and the female *Posestreme*, which mean half-brothers and half-sisters. Friendships between those of different sexes are not at this day bound with so much solemnity, though perhaps in more ancient and innocent ages it was also the custom.

From these consecrated friendships among the Morlacchi and other nations of the same origin, it should seem that the *sworn brothers* arose; a denomination frequent enough among the common people of Italy and in many parts of Europe. The difference between these and the Probratimi of Morlacchia consist not only in the want of the ritual ceremony, but in the design of the union itself. For, among the Morlacchi, the sole view is reciprocal service and advantage; but such a brotherhood among the Italians is generally commenced by bad men, to enable them the more to hurt and disturb society. The duties of the Pobratimi are, to assist each other in every case of need or danger, to revenge mutual wrongs, and such like. The enthusiasm is often carried so far as to risk and even to lose their life for the Pobratimi, although these savage friends are not celebrated like a Pylades. If discord happens to arise between two friends, it is talked of over all the country as a scandalous novelty; and there has been some examples of it of late years, to the great affliction of the old Morlacchi, who attribute the depravation of their countrymen to their intercourse with the Italians. Wine and strong liquors, of which the nation is beginning to make daily abuse, will of course produce the same bad effects as Morlachia. among others.

But as the friendships of the Morlacchi are strong and sacred, so their quarrels are commonly unextinguishable. They pass from father to son; and the mothers fail not to put their children in mind of their duty to revenge their father if he has had the misfortune to be killed, and to show them often the bloody skirt and arms of the dead. And so deeply is revenge rooted in the minds of this nation, that all the missionaries in the world would not be able to eradicate it. A Morlack is naturally inclined to do good to his fellow-creatures, and is full of gratitude for the smallest benefit; but implacable if injured or insulted.

A Morlack who has killed another of a powerful family, is commonly obliged to save himself by flight, and to keep out of the way for several years. If during that time he has been fortunate enough to escape the search of his pursuers, and has got a small sum of money, he endeavours to obtain pardon and peace; and, that he may treat about the conditions in person, he asks and obtains a safe conduct, which is faithfully maintained, though only verbally granted. Then he finds mediators; and, on the appointed day, the relations of the two hostile families are assembled, and the criminal is introduced, dragging himself along on his hands and feet, the musket, pistol, or cutlass, with which he committed the murder, hung about his neck; and while he continues in that humble posture, one or more of the relations recites a panegyric on the dead, which sometimes rekindles the flames of revenge, and puts the poor prostrate in no small danger. It is the custom in some places for the offended party to threaten the criminal, holding all kinds of arms to his throat, and, after much intreaty, to consent at last to accept of his ransom. These pacifications cost dear in Albania; but the Morlacchia make up matters sometimes at a small expence; and every-where the business is concluded with a feast at the offender's charge.

The Morlacks, whether they happen to be of the Roman or of the Greek church, have very singular ideas about religion; and the ignorance of their teachers daily augments this monstrous evil. They are as firmly persuaded of the reality of witches, fairies, enchantments, nocturnal apparitions, and sortiliges, as if they had seen a thousand examples of them. Nor do they make the least doubt about the existence of vampires; and attribute to them, as in Transylvania, the sucking the blood of infants. Therefore, when a man dies suspected of becoming a vampire, or *vukodlak*, as they call it, they cut his hams, and prick his whole body with pins; pretending, that after this operation he cannot walk about. There are even instances of Morlacchi, who, imagining that they may possibly thirst for childrens blood after death, intreat their heirs, and sometimes oblige them to promise, to treat them as vampires when they die.

The boldest Haiduk would fly trembling from the apparation of a spectre, ghost, phantom, or such like goblins as the heated imaginations of credulous and prepossessed people never fail to see. Nor are they ashamed, when ridiculed for this terror; but answer, much in the words of Pindar; "Fear that proceeds from

from spirits, causes even the sons of the gods to fly." The women, as may be naturally supposed, are a hundred times more timorous and visionary than the men, and some of them by frequently hearing themselves called *witches*, actually believe they are so.

A most perfect discord reigns in Morlachia, as it generally does in other parts, between the Latin and Greek communion, which their respective priests fail not to foment, and tell a thousand little scandalous stories of each other. The churches of the Latins are poor, but not very dirty: those of the Greeks are equally poor, and shamefully ill kept. Our author has seen the curate of a Morlack village sitting on the ground in the church yard, to hear the confession of women on their knees by his side: a strange posture indeed! but a proof of the innocent manners of those good people, who have the most profound veneration for their spiritual pastors, and a total dependence upon them; who, on their part, frequently make use of a discipline rather military, and correct the bodies of their offending flock with the cudgel. Perhaps this particular is carried to an abuse as well as that of public penance, which they pretend to inflict after the manner of the ancient church. They moreover, thro' the silly credulity of those poor mountaineers, draw illicit profits, by selling certain superstitious scrolls and other scandalous merchandise of that kind. They write in a capricious manner on the scrolls called *zapiz*, sacred names which ought not to be trifled with, and sometimes adding others very improperly joined. The virtues attributed to these zapiz are much of the same nature as those which the Basilians attributed to their monstrously cut stones. The Morlacchi used to carry them sewed to their caps, to cure or to prevent diseases; and they also tie them for the same purpose to the horns of their oxen. The composers of this trumpery take every method to maintain the credit of their profitable trade, in spite of its absurdity, and the frequent proofs of its inutility. And so great has their success been, that not only the Morlacchi, but even the Turks near the borders, provide themselves plentifully with zapiz from the Christian priests, which not a little increases their income, as well as the reputation of the commodity. The Morlacchi have also much devotion, and many of the ignorant people in Italy have little less, to certain copper and silver coins of the low empire; or to Venetian cotemporary pieces, which pass among them for medals of St Helen; and they think they cure the epilepsy and such like. They are equally fond of an Hungarian coin called *petizza*, which has the virgin and child on the reverse; and one of these is a most acceptable present to a Morlack.

The bordering Turks not only keep with devotion the superstitious zapiz, but frequently bring presents and cause masses to be celebrated to the images of the Virgin; which is doubtless in contradiction to the alcoran: yet when saluted, in the usual manner in that country, by the name of *Jesus*, they do not answer. Hence, when the Morlacchi, or other travellers, meet them on the confines, they do not say, *Huaglian Issus.* "Jesus be praised;" but, *Huaglian Bog*, "God be praised."

Innocence, and the natural liberty of pastoral ages, are still preserved among the Morlacchi, or at least many traces of them remain in the places farthest distant from our settlements. Pure cordiality of sentiment is not there restrained by other regards, and displays itself without any distinction of circumstances. A young handsome Morlack girl, who meets a man of her district on the road, kisses him affectionately, without the least malice or immodest thought; and our author has seen all the women and girls, all the young men and old, kissing one another as they came into the church-yard on a holiday: so that they looked as if they had been all belonging to one family. He hath often observed the same thing on the road, and at the fairs in the maritime towns, where the Morlacchi come to sell their commodities. In times of feasting and merriment, besides the kisses, some other little liberties are taken with the hands, which we would not reckon decent, but are not minded among them; and when they are told it, they answer, It is only toying, and means nothing. From this toying, however, their amours often take their beginning, and frequently end seriously when the two lovers are once agreed. For it very rarely happens, in places far distant from the coast, that a Morlack carries off a girl against her will, or dishonours her; and were such attempts made, the young woman would, no doubt, be able to defend herself; the women in that country being generally very little less robust than the men. But the custom is for the woman herself to appoint the time and place of being carried off; and she does so in order to extricate herself from other suitors, from whom she may have received some love-token; such as a brass ring, a little knife, or such like trifles. The Morlack women keep themselves somewhat neat till they get a husband; but after marriage they abandon themselves totally to a loathsome dirtiness, as if they intended to justify the contempt with which they are treated. Indeed it cannot be said that even the young women have a grateful odour, as they are used to anoint their hair with butter, which soon becoming rancid exhales no agreeable effluvia.

The dress of the unmarried women is the most complex and whimsical, in respect to the ornaments of the head; for when married they are not allowed to wear any thing else but a handkerchief, either white or coloured, tied about it. The girls use a scarlet cap, to which they commonly hang a veil falling down on the shoulders, as a mark of their virginity. The better sort adorn their caps with strings of silver coins, among which are frequently seen very ancient and valuable ones; they have moreover ear-rings of very curious work, and small silver chains with the figures of half moons fastened to the ends of them. But the poor are forced to content themselves with plain caps; or if they have any ornaments, they consist only of small exotic shells, round glass beads, or bits of tin. The principal merit of these caps, which constitue the good taste as well as vanity of the Morlack young ladies, is to attract and fix the eyes of all who are near them by the multitude of ornaments, and the noise they make on the least motion of their heads. Hence half-moons of silver, or of tin, little chains and hearts, false stones and shells, together with all kinds of splendid trumpery, are readily admitted into their head dress. In some districts, they fix tufts of various coloured feathers resembling two horns on their caps: in in others, tremulous plumes of glaſs: and in others, artificial-flowers, which they purchaſe in the ſea-port towns; and in the variety of thoſe capricious and barbarous ornaments, ſometimes a fancy not inelegant is diſplayed. Their holiday-ſhifts are embroidered with red ſilk, and ſometimes with gold, which they work themſelves while they attend their flocks; and it is ſurpriſing to ſee how nicely this work is executed.—Both old and young women wear about their necks large ſtrings of round glaſs-beads, of various ſize and colour; and many rings of braſs, tin, or ſilver, on their fingers. Their bracelets are of leather covered with wrought tin or ſilver; and they embroider their ſtomachers, or adorn them with beads or ſhells. But the uſe of ſtays is unknown, nor do they put whalebone or iron in the ſtomacher. A broad woollen girdle ſurrounds their petticoat, which is commonly decked with ſhells, and of blue colour, and therefore called *modrina*. Their gown, as well as petticoat, is of a kind of ſerge; and both reach near to the ankle; the gown is bordered with ſcarlet, and called *ſadak*. They uſe no modrina in ſummer, and only wear the ſadak without ſleeves over a linen petticoat or ſhift.—The girls always wear red ſtockings; and their ſhoes are like thoſe of the men, called *opanke*. The ſole is of undreſſed ox-hide, and the upper part of ſheeps-ſkin thongs knotted, which they call *apute;* and theſe they faſten above the ankles, ſomething like the ancient cothurnus.

The unmarried women, even of the richeſt females, are not permitted to wear any other ſort of ſhoes; though after marriage they may, if they will, lay aſide the opanke, and uſe the Turkiſh ſlippers. The girls keep their hair treſſed under their caps, but when married they let it fall diſhevelled on the breaſt; ſometimes they tie it under the chin; and always have medals, beads, or bored coins, in the Tartar or American mode twiſted amongſt it. An unmarried woman, who falls under the imputation of want of chaſtity, runs the riſk of having her red cap torn off her head publickly in church by the curate, and her hair cut by ſome relation, in token of infamy. Hence, if any of them happen to have fallen into an illicit amour, they commonly of their own accord lay aſide the badge of virginity, and remove into another part of the country.

Nothing is more common among the Morlacchi than marriages concluded between the old people of the reſpective families, eſpecially when the parties live at a great diſtance and neither ſee nor know each other: and the ordinary motive of theſe alliances is the ambition of being related to a numerous and powerful family, famous for having produced valiant men. The father of the future bridegroom, or ſome other near relation of mature age, goes to aſk the young woman, or rather a young woman of ſuch a family, not having commonly any determinate choice. Upon this all the girls of the houſe are ſhown to him, and he chooſes which pleaſes him beſt, though generally reſpecting the right of ſeniority. A denial in ſuch caſes is very rare; nor does the father of the maid inquire much into the circumſtances of the family that aſks her. Sometimes a daughter of the maſter is given in marriage to the ſervant or tenant, as was uſual in patriarchal times; ſo little are the women regarded in this country. On theſe occaſions, however, the Morlacchi girls enjoy a privilege which ours would alſo wiſh to have, as in juſtice they certainly ought. For he who acts by proxy, having obtained his ſuit, is obliged to go and bring the bridegroom; and if, on ſeeing each other, the young people are reciprocally content, the marriage is concluded, but not otherwiſe. In ſome parts it is the cuſtom for the bride to go to ſee the houſe and family of the propoſed huſband, before ſhe gives a definitive anſwer; and if the place or perſons are diſagreeable to her, ſhe is at liberty to annul the contract. But if ſhe is contented, ſhe returns to her father's houſe, eſcorted by the bridegroom and neareſt relations. There the marriage day is appointed: on which the bridegroom comes to the bride's houſe, attended by all his friends, of greateſt note, who on this occaſion are called *ſvati*, and are all armed, and on horſeback, in their holiday-cloaths with a peacock's feather in their cap, which is the diſtinctive ornament uſed by thoſe who are invited to weddings. The company goes armed, to repulſe any attack or ambuſh that might be intended to diſturb the feaſt; for in old times theſe encounters were not unfrequent according to the records of many national heroic ſongs.

The bride is conducted to a church veiled, and ſurrounded by the ſvati on horſeback: and the ſacred ceremony is performed amidſt the noiſe of muſkets, piſtols, barbaric ſhouts and acclamations, which continue till ſhe returns to her father's houſe, or to that of her huſband, if not far off. Each of the ſvati has his particular inſpection, as well during the cavalcade as at the marriage-feaſt, which begins immediately on their return from church. The parvinaz precedes all the reſt, ſinging ſuch ſongs as he thinks ſuitable to the occaſion. The bariactar brandiſhes a lance with a ſilken banner faſtened to it, and an apple ſtuck on the point; there are two bariactars, and ſometimes four at the more noble marriages. The ſtari-ſvat is the principal perſonage of the brigade; and the moſt reſpectable relation is commonly inveſted with this dignity. The ſtacheo's duty is to receive and obey the orders of the ſtari-ſvat. The two diveri, who ought to be the bridegroom's brothers when he has any, are appointed to ſerve the bride. The knum correſponds to our ſponſors; and the komorgia, or ſekſana, is deputed to receive and guard the dowry. A ciaous carries the mace, and attends to the order of the march, as maſter of the ceremonies; he goes ſinging aloud, *Brcberi*, *Davori*, *Dobrăfrichia*, *Jari*, *Pico*; names of ancient propitious deities. Buklia is the cup-bearer of the company, as well on the march as at table; and all theſe offices are doubled, and ſometimes tripled; in proportion to the number of the company.

The firſt day's entertainment is ſometimes made at the bride's houſe, but generally at the bridegroom's, whither the ſvati haſten immediately after the nuptial benediction: and at the ſame time three or four men run on foot to tell the good news; the firſt who gets to the houſe has a kind of towel, embroidered at the ends, as a premium. The domachin, or head of the houſe, comes out to meet his daughter-in-law; and a child is handed to her, before ſhe alights, to careſs it; and if there happens to be none in the houſe, the child is borrowed from one of the neighbours. When ſhe

 alights,

Morlachia.

alights, she kneels down, and kisses the threshold.— then the mother-in-law, or in her place some other female relation, presents a corn-sieve, full of different kinds of grain, nuts, almonds, and other small fruit, which the bride scatters upon the svati, by handfuls, behind her back. The bride does not sit at the great table the first day, but has one apart for herself, the two diveri, and the stacheo. The bridegroom sits at table with the svati; but in all that day, consecrated to the matrimonial union, he must neither unloosen or cut any thing whatever. The knum carves his meat, and cuts his bread. It is the domachin's business to give the toasts; and the stari-svat is the first who pledges him. Generally the bukkara, a very large wooden cup, goes round, first to the saint protector of the family; next to the prosperity of the holy faith; and sometimes to a name the most sublime and venerable. The most extravagant abundance reigns at these feasts; and each of the svati contributes, by sending a share of provisions. The dinner begins with fruit and cheese; and the soup comes last, just contrary to our custom. All sorts of domestic fowls, kid, lamb, and sometimes venison, are heaped in prodigal quantities upon their tables; but very rarely a Morlacco eats veal, and perhaps never, unless he has been persuaded to do it out of his own country. This abhorrence to calves flesh is very ancient among the Morlacchi. St Jerom, against Jovinian, takes notice of it; and Tomeo Marnavich, a Bosnian writer, who lived in the beginning of the last age, says, that the Dalmatians, uncorrupted by the vice of strangers, abstained from eating calves flesh as an unclean food, even to his days. The women relations, if they are invited, never dine at table with the men, it being an established custom for them to dine by themselves. After dinner, they pass the rest of the day in dancing, singing ancient songs, and in games of dexterity, or of wit and fancy; and in the evening, at a convenient hour after supper, the three ritual healths having first gone round, the knum accompanies the bridegroom to the matrimonial apartment, which commonly is the cellar or the stable, whither the bride is also conducted by the diveri and the stacheo; but the three last are obliged to retire, and the knum remains alone with the new-married couple. If there happens to be any bed prepared better than straw, he leads them to it: and having untied the bride's girdle, he causes them both to undress each other reciprocally. It is not long since the knum was obliged to undress the bride entirely; but that custom is now out of use; and, instead of it, he has the privilege of kissing her as often as he pleases, wherever he meets her; which privilege may possibly be agreeable for the first months, but must soon become very disgustful. When they are both undressed, the knum retires, and stands listening at the door, if there be a door. It is his business to announce the consummation of the marriage, which he does by discharging a pistol, which is answered by many of the company. The next day the bride, without her veil and virginal cap, dines at table with the svati, and is forced to hear the coarse equivocal jests of her indelicate and sometimes intoxicated company.

These nuptial-feasts, called *sdrave* by the ancient Huns, are by our Morlacchi called *sdravize*, from whence our Italian word *stravizzo* is undoubtedly derived. They continue three, six, eight, or more days, according to the ability or prodigal disposition of the family where they are held. The new-married wife gets no inconsiderable profit in these days of joy; and it usually amounts to much more than all the portion she brings with her, which often consists of nothing but her own clothes and perhaps a cow; nay, it happens sometimes that the parents, instead of giving money with the daughter, get something from the bridegroom by way of price. The bride carries water every morning to wash the hands of her guests as long as the feasting lasts; and each of them throws a small piece of money into the bason after performing that function, which is a very rare one among them, excepting on such occasions. The brides are also permitted to raise other little contributions among the svati, by hiding their shoes, caps, knives, or some other necessary part of their equipage, which they are obliged to ransom by a piece of money, according as the company rates it. And, besides all these voluntary or extorted contributions already mentioned, each guest must give some present to the new married wife at taking leave the last day of the sdravise: and then she also distributes some trifles in return, which commonly consist in shirts, caps, handkerchiefs, and such like.

The nuptial-rites are almost precisely the same thro' all the vast country inhabited by the Morlacchi; and those in use among the peasants and common people of the sea-coast of Dalmatia, Istria, and the islands, differ but little from them. Yet among these particular varieties, there is one of the island Zlarine, near Sebenico, remarkable enough; for there the starisvat (who may naturally be supposed drunk at that hour) must at one blow with his naked broad sword, strike the bride's crown of flowers off her head, when she is ready to go to bed. And in the island of Pago, in the village of Novoglia (probably the Gissa of ancient Geographers) there is a custom more comical, and less dangerous, but equally savage and brutal. After the marriage contract is settled, and the bridegroom comes to conduct his bride to church, her father or mother, in delivering her over to him, makes an exaggerated enumeration of her ill qualities: "Know, since thou wilt have her, that she is good for nothing, ill-natured, obstinate, &c." On which the bridegroom, affecting an angry look, turns to the young woman, with an "Ah! since it is so, I will teach you to behave better:" and at the same time regales her with a blow or a kick, or some piece of similar galantry, which is by no means figurative. And it seems in general, that the Morlack women, and perhaps the greatest part of the Dalmatians, the inhabitants of the cities excepted, do not dislike a beating either from their husbands or lovers.

In the neighbourhood of Dernish, the women are obliged, during the first year after marriage, to kiss all their national acquaintances who come to the house; but after the first year they are dispensed from that compliment: and indeed they become so intolerably nasty, that they are no longer fit to practice it. Perhaps the mortifying manner in which they are treated by their husbands and relations is, at the same time, both

both the cause and effect of their shameful neglect of their persons. When a Morlack husband mentions his wife, he always premises, by your leave, or begging your pardon. And when the husband has a bedstead, the wife must sleep on the floor near it. Our author often lodged in Morlack houses, and observed that the female sex is universally treated with contempt; it is true, that the women are by no means amiable in that country; they even deform and spoil the gifts of nature.

The pregnancy and births of those women would be thought very extraordinary among us, where the ladies suffer so much, notwithstanding all the care and circumspectiou used before and after labour. On the contrary, a Morlack woman neither changes her food nor interrupts her daily fatigue on account of her pregnancy; and is frequently delivered in the fields, or on the road, by herself; and takes the infant, washes it in the first water she finds, carries it home and returns the day after to her usual labour, or to feed her flock.

The little creatures, thus carelessly treated in their tenderest moments, are afterwards wrapt in miserable rags, where they remain three or four months, under the same ungentle management: and when that term is elapsed, they are set at liberty, and left to crawl about the cottage and before the door, till they learn to walk upright by themselves; and at the same time acquire that singular degree of strength and health with which the Morlacchi are endowed, and are able, without the least inconvenience, to expose their naked breasts to the severest frost and snow. The infants are allowed to suck their mother's milk while she has any, or till she is with child again; and if that should not happen for three, four, or six years, they continue all that time to receive nourishment from the breast. The prodigious length of the breasts of the Morlacchian women is somewhat extraordinary; for it is very certain, that they can give the teat to their children over their shoulders, or under their arms. They let the boys run about, without breeches, in a shirt that reaches only to the knee, till the age of 13 or 14, following the custom of Bossnia, subject to the Porte, where no haraz or capitation-tax is paid for the boys till they wear breeches, they being considered before that time as children, not capable of labouring, or of earning their bread. On the occasion of births, and especially of the first, all the relations and friends send presents of eatables to the woman in childbed, or rather to the woman delivered; and the family makes a supper of all those presents together. The women do not enter the church till 40 days after child-birth.

The Morlacchi pass their youth in the woods, attending their flocks and herds; and in that life of quiet and leisure they often become dexterous in carving with a simple knife; they make wooden cups, and whistles adorned with fanciful basse-reliefs, which are not void of merit, and at least show the genius of the people.

MORLEY (George), bishop of Winchester, was the son of Francis Morley, Esq; and was born at London in 1597. He was educated at Christ-church, Oxford, of which he had the canonry in 1641, and the next year was made doctor of divinity. He had also several church-preferments, of which he was deprived by the parliament visitors in the beginning of the year 1648. After this, king Charles I. sent for him to assist at the treaty of the Isle of Wight. After the king's death he attended the lord Capel at his execution, and then retired to Charles II. at the Hague, on whom he constantly waited till his majesty went to Scotland, when he retired to Antwerp, where he read the service of the church of England, as he afterwards did at Breda. At the Restoration he was first made dean of Christ-church, and in 1660 was consecrated bishop of Worcester, and soon after was made dean of the royal chapel. In 1662 he was translated to the bishopric of Winchester, when he bestowed considerable sums on that see, in repairing Farnham-castle and his palace at Westminster, and in purchasing Winchester house at Chelsea. He died at Farnham-castle in 1684. He was a Calvinist, and before the wars was thought a friend to the Puritans; but after his promotion he took care to free himself from all suspicions of that kind. He was a pious and charitable man, of a very exemplary life, but extremely passionate. He published, 1. *Epistola apologetica et paranetica ad theologum quendam Belgam scripta*, in 4to, 2. The sum of a short conference between Father Darcey a Jesuit and Dr Morley at Brussels. 3. An argument drawn from the evidence and certainty of sense against the doctrine of Transubstantiation. 4. A letter to Anne duchess of York. 5. Several sermons, and other pieces.

MORNAY (Philippe de), seigneur du Plessis-Marly, was born at Buhy or Bishuy in Upper Normandy, November 5th, 1549, and educated at Paris. What was then thought a prodigy in a gentleman, he made a rapid progress in the belles lettres, in the learned languages, and in theology. He was at first destined for the church; but the principles of Calvinism, which he had imbibed from his mother, effectually excluded him from the ecclesiastical preferments to which he was entitled by his interest, abilities, and birth. After the horrible massacre of St Bartholomew, Philippe de Mornay made the tour of Italy, Germany, England, and the Low Countries; and he was equally improved and delighted by his travels. Mornay afterwards joined the king of Navarre, at that time leader of the Protestant party, and so well known since by the name of Henry IV. This prince sent Mornay, who employed his whole abilities, both as a soldier and a writer, in defence of the Protestant cause, to conduct a negociation with Elisabeth queen of England; and left him wholly to his own discretion in the management of that business. He was successful in almost every negociation, because he conducted them like an able politician, and not with a spirit of intrigue. He tenderly loved Henry IV. and spoke to him on all occasions as to a friend. When he was wounded at Aumale, he wrote to him in these words: "Sire, you have long enough acted the part of Alexander, it is now time you should act that of Cæsar. It is your duty to die for your majesty, &c. It is glorious for you, Sire, and I dare venture to tell you it is your duty, to live for us." This faithful subject did every thing in his power to raise Henry to the throne. But when he deserted the Protestant faith, he reproached him in the bitterest manner, and

retired

Mornay. retired from court. Henry still loved him; and was extremely affected with an insult which he received in 1597 from one Saint-Phal, who beat him with a cudgel, and left him for dead. Mornay demanded justice from the king; who gave him the following answer, a proof as well of his spirit as of his goodness of heart. "Monsieur Duplessis, I am exceedingly offended at the insult you have received; and I sympathize with you both as your sovereign and your friend. In the former capacity, I shall do justice to you and to myself; and had I sustained only the character of your friend, there are few perhaps who would have drawn their sword or sacrificed their life more cheerfully in your cause. Be satisfied, then, that I will act the part of a king, a master, and a friend, &c." Mornay's knowledge, probity, and valour, made him the soul of the Protestant party, and procured him the contemptuous appellation of the *Pope of the Huguenots*. He defended their doctrines both by speech and writing. One of his books on the Iniquity of the Mass, having stirred up all the Catholic divines, he refused to make any reply to their censures and criticisms except in a public conference. This was accordingly appointed to be held A. D. 1600, at Fountainbleau, where the court then was. The two champions were, du Perron bishop of Evreux, and Mornay. After a great many arguments and replies on both sides, the victory was adjuged to du Perron. He had boasted that he would point out to the satisfaction of every one five hundred errors in his adversary's book, and he partly kept his word. The Calvinists did not fail to claim the victory on this occasion, and they still continue to do so. This conference, instead of putting an end to the differences, was productive of new quarrels amongst the controversialists, and of much profane wit among the libertines. A Huguenot minister, who was present at the conference, observed with great concern to a captain of the same party,—"The bishop of Evreux has already driven Mornay from several strong holds." "No matter (replied the soldier), provided he does not drive him from Saumur." This was an important place on the river Loire, of which Duplessis was governor. Hither he retired, his attention being constantly occupied in defending the Huguenots, and in making himself formidable to the Catholics. When Louis XIII. was making preparations against the Protestants, Duplessis wrote him a letter, dissuading him against such a measure. After employing the most plausible arguments, he concludes in the following manner: "To make war on the subject, is an indication of weakness in the government. Authority consists in the quiet submission of the people, and is established by the prudence and justice of the governor. Force of arms ought never to be employed except in repelling a foreign enemy. The late king would have sent the new ministers of state to learn the first elements of politics, who like unskilful surgeons would apply violent remedies to every disease, and advise a man to cut off an arm when his finger aches." These remonstrances produced no other effect than the loss of the government of Saumur, of which he was deprived by Louis XIII. in 1621. He died two years after, November 11th, 1623, aged 74, in his barony *de la Foret-sur-Seure* in Poitou. The Protestant cause never had an abler supporter, or one who did it more credit by his virtues and abilities.

Censeur des courtisans, mais à la cour aimé;
Fier ennemi de Rome, et de Rome estimé. HENRIADE.

The following is a list of his works: 1. *Un Traité de l'Eucharisse*, 1604, in folio. 2. *Un Traité de la verité de la Religion Chretienne*, 8vo. 3. A book entitled *La Mystere d'iniquité*, 4to. 4. *Un discours sur le droit pretendu par ceux de la maison de Guise*, 8vo. 5. Curious and interesting *Memoirs* from the year 1572 to 1629, 4 vols 4to. valuable. 6. *Letters;* which are written with great spirit and good sense. David des Liques has given us his life in quarto; a book more interesting for the matter than the manner.

Morne-garou. MORNE-GAROU, a very remarkable volcanic mountain on the island of St Vincent's in the West Indies. It was visited by Mr James Anderson surgeon in the year 1784, who is the only person that ever ascended to the top of it, and from whose account, in the Philosophical Transactions, Vol. LXXV. the following is taken.

The mountain in question is situated on the north-west part of the island, and is the highest in it. It is constantly reported to have emitted volcanic eruptions; and the ravins at the bottom seem to corroborate the traditions of the inhabitants in this respect. The structure of it, when viewed at a distance, appears different from that of any other mountain in the island, or that Mr Anderson had seen in the West Indies. He could perceive it divided into many different ridges, separated by deep chasms, and its summit appeared quite destitute of every vegetable production. Several ravins, that run from the bottom a great way up the mountain, were found quite destitute of water, and pieces of pumice-stone, charcoal, and several earths and minerals of a particular quality, found in them, plainly indicated some very great singularity in this mountain. Some very old men also informed our author, that they had heard it related by the captain of a ship, that between this island and St Lucia he saw flames and smoke rising from the top of the mountain, and next morning his decks were covered with ashes and small stones.

Mr Anderson's curiosity was so much excited by these circumstances, that he formed a resolution of going up to the top; but was informed that this was impossible, nor could he find either white man, Caribbee, or negro, who would undertake to show him the way. Having observed the basis as well as he could, with a view to discover the most proper place for attempting an ascent, he found several dry ravins that seemingly ran a great way up, though he could not be certain that they were not intersected by rocks or precipices lying across. Having examined the mountain with a good glass, he thought he perceived two ridges by which there was a possibility of getting up; and though they appeared to be covered for a great way with wood, he hoped by a little cutting to open a way through it.

On the 26th of February 1784, our author began his journey, having been furnished by a Mr Maloune, who lives within a mile of the foot of the mountain, with two stout negroes, and having another boy who waited on himself. They arrived at the bottom of the

Morne-garou. the mountain a little before ſeven in the morning, having each a good cutlaſs to cut through the woods, or to defend themſelves in caſe of an attack from the Caribbees or runaway negroes. Before they could get at either of the ridges, however, they had a rock to climb upwards of 40 feet high. Having ſcrambled up this with great difficulty, they found themſelves in the bottom of a deep and narrow ravin, which having aſcended a little way, they arrived at the habitation of Mr Gaſco a Frenchman. Mr Anderſon expreſſes his ſurpriſe, that a young and healthy man, and a good mechanic, ſhould ſequeſtrate himſelf from the world among woods and precipices, where he was beſides in continual danger of being ſwept away with his whole habitation by the torrents occaſioned by the rains. He found him, however, an intelligent man, and was hoſpitably entertained by him.

"The difficulty (ſays Mr Anderſon) in going thro' woods in the Weſt Indies, where there are no roads or paths, is far beyond any thing an European can conceive. Beſides tall trees and thick underwood, there are hundreds of different climbing plants twiſted together like ropes, and running together in all directions to a great extent, and even to the tops of the higheſt trees. They cannot be broken by puſhing on; and many of them are not to be cut without difficulty. Beſides theſe, a ſpecies of graſs, the *ſchœnus lithoſpermos*, with ſerrated leaves, cuts and tears the hands and face terribly."

By reaſon of theſe obſtructions, it was upwards of two hours before they got upon the ridge; but here they found their paſſage more difficult than before. They were now ſurrounded by a thick foreſt, rendered more impracticable by the large piles of trees blown down by the hurricanes; which obliged them in many places to creep on their hands and feet to get below them, while in others it was neceſſary to climb to a conſiderable height to get over them; at the ſame time that by the trunks being frequently rotten, they often tumbled headlong from a great height, and could not extricate themſelves without great difficulty.

The fatigue of cutting their way through the woods ſoon became intolerable to the negroes; ſo that about four in the afternoon he could not prevail on them to go any farther. Mr Anderſon therefore perceiving it was impoſſible to get to the ſummit that night, and his water being totally expended, returned to Mr Gaſco's, where he ſpent the night, determining to try another route next morning. The hoſpital Frenchman entertained him in the beſt manner he could; but though he parted with his own hammock to him, and ſlept on a board himſelf, Mr Anderſon found it impoſſible to ſhut his eyes the whole night by reaſon of the cold. "His hut (ſays he) was built of *roſeaux* or large reeds, between each two of which a dog might creep through, and the top was covered with dry graſs. It is ſituated in the bottom of a deep gully, where the ſun does not ſhine till nine in the morning nor after four in the afternoon. It is ſurrounded by thick wood; and during the night the whole of the mountain is covered with thick clouds, from which it frequently rains, and which makes the night air exceedingly cold."

Early next morning Mr Anderſon ſet out in company with the negro boy, who continued very faithful to him during the whole of the journey. He now determined to take his courſe up the ravin, and proceeded for about a mile and a half without any conſiderable obſtruction. It now, however, began to narrow faſt: there were numbers of rocks and precipices to climb over, with many buſhes and vines which could ſcarcely be got through. At laſt the ravin terminated at the bottom of a very high precipice. It was impoſſible to know the extent of this, as the top was covered with thick wood; but from the bottom upward, as far as he could ſee, was looſe ſand with ferns and tufts of graſs, which as ſoon as he took hold of them came up by the roots. Though the aſcent was plainly at the riſk of his life, Mr Anderſon reſolved to attempt it; and therefore telling the boy to keep at ſome diſtance behind, leſt he ſhould tumble and drive him down, he began to aſcend, digging holes with his cutlaſs to put his feet in, and taking hold of the tufts of graſs as lightly as poſſible. Notwithſtanding all his care, however, he frequently ſlipped down a conſiderable way; but as it was only looſe ſand, he could eaſily puſh his cutlaſs into it up to the handle, and thus by taking hold of it recover himſelf again. At laſt he got up to ſome wild plantains, which continued all the way to the place where the trees began to grow. Here he reſted for ſome time, waiting for the boy, who got up with much leſs difficulty than he had done. On getting up to the top of the precipice, he found himſelf on a very narrow ridge, covered with wood, and bounded by two ravins, the bottoms of which he could not ſee, the deſcent to them appearing to be nearly perpendicular, though all the way covered with thick wood. Proceeding onwards, they found the ridge exceedingly narrow, in many places not ſix feet broad; with a tremendous gulf on each ſide, into which they were every moment in danger of falling; ſo that Mr Anderſon was obliged to lie down on his belly with great caution, in order to ſee through the buſhes how the ridge tended.

Here a ſulphureous ſmell, or rather one like gunpowder, began to be perceived; which, Mr Anderſon knew, muſt proceed from the top of the mountain, as the wind then blew that way; and as it plainly grew ſtronger as he advanced, he was in hopes that the top could not be very far diſtant. Perceiving a riſing before him, he imagined, that, by getting upon it, he might have a view of the top of the mountain; but when this was done, he could only ſee a peak on the north-weſt ſide of the mountain, to which, by appearance, he judged himſelf very little nearer than when at the bottom.

The woods now became very difficult, great quantities of fallen trees lying buried among the graſs; and being rotten, he was frequently buried very deep among them when he thought himſelf walking upon firm ground. About noon he was alarmed with a ruſtling among the buſhes, and ſomething like a human voice behind him; but as he was preparing to defend himſelf againſt Carribbees or run-away negroes, he was agreeably ſurpriſed with the ſight of thoſe who had formerly left him, with three others, ſent by Mr Maloune with plenty of proviſions. Encouraged by this aſſiſtance, after refreſhing themſelves, they renewed their labours with freſh vigour, and Mr Anderſon thought himſelf ſure of reaching the top before night.

In

Morne-garou.

In a little time he had a fair view of the ravin on the left, which was of prodigious depth, and ran from near the top of the mountain to the sea. Its bottom seemed to be a rock nearly resembling lava in colour, and it seemed as if there had been vast torrents of sulphureous matter running upon it for some time.—He now regretted much that he knew not of this ravin before he commenced his excursion, as, by passing a headland in a canoe, and getting into it, he might have gained the summit without all those delays and difficulties he had encountered.

About four in the afternoon he had no prospect of the top of the mountain, but imagined that if he could get into the ravine before night, he might easily reach it next morning. After cutting through wild plantains for a great way, however, he found himself at sunset on the brink of a precipice, over which he prevented himself from falling by catching hold of some shrubs. They were now about half way down, but all the rest of the way seemed a perpendicular precipice, which it was impossible to pass; the top of the mountain was yet a great way off, and there was no other resource than to attempt the ridge they had left. The evening was now so far advanced, that they were obliged to take up their residence where they were; and there was only time to place two or three sticks against the stump of a tree, and slightly to cover them with plantain leaves for a night's habitation.—Their situation, however, was extremely uncomfortable: it began to rain and blow violently, which prevented them from getting a fire made, so that they were almost chilled with cold. As soon as they could see, they renewed their work with great alacrity, and in a short time had the satisfaction to perceive that the woods became thin. About eleven o'clock they obtained a full view of the top, about a mile distant. It seemed to be composed of six or seven ridges, very much broken in the sides, as if they had suffered great convulsions; and they were divided by excessively deep ravins without any water in them. Mr Anderson directed his course towards a high peak that overlooked a large excavation where the ridges met, and which he supposed to be the crater of the volcano. In his way, he found the last wood composed of a most beautiful species of trees. After that he entered into a thick long grass intermixed with fern, which branched and ran in every direction. Thro' this they were obliged to cut their way with almost as much difficulty as they had done through the woods, and it seemed to continue very near to the top of the mountain. The fatigue of this work soon reduced them to such a situation, that they were scarce able to stand; and they were obliged to quench their thirst, which was excessive, by chewing the leaves of the begonia obliqua, there being no water to be had in the place. Two of the negroes returned, and the rest refused to proceed any farther; so that Mr Anderson himself was obliged to abandon the enterprise, and they all began to descend about half an hour after twelve; and as there was now a clear path all the way down, they arrived at Mr Gasco's by sunset; and notwithstanding his extreme weariness, Mr Anderson continued his journey to Mr Maloune's, where he arrived between six and seven at night.

Our traveller having refreshed himself to the 4th of March, in order to sustain the fatigues of his journey the better, set out about four that morning in company with a Mr Fraser, who had resolved to accompany him. They met with little difficulty till they came to the place whence they had formerly returned. Here, however, they were obliged for a quarter of a mile to cut their way through the grass and ferns already mentioned; which being done, they met with no further obstruction. When they came within a quarter of a mile of the top, they found the climate suddenly altered, the air very cold, and the vegetable productions changed, the whole summit of the mountain being barren. On the confines of the grassy and barren regions, however, he found some beautiful plants; and he observes, that this is the only place in the West Indies where he ever found moss: but here it grows in such plenty, that he frequently sunk in it up to the knees. About noon they reached the summit, and were instantly surprised with the sight of a most extraordinary cavity. It is situated in the very centre of the mountain, at the place where all the ridges meet. Its diameter is something more than a mile, and its circumference to appearance a perfect circle. Its depth from the surrounding margin is above a quarter of a mile, and it narrows a little, but very regularly, to the bottom. Its sides are very smooth, and for the most part covered with short moss, except towards the south, where there are a number of small holes and rents. This is the only place where it is possible to go down to the bottom; and the descent is very dangerous on account of the numberless small chasms. On the west side is a section of a red rock like granite, cut very smooth, and having the same declivity with the other parts. All the rest of the surrounding sides seem to be composed of sand, which has undergone the action of an intense fire. It has a crust quite smooth, and about an inch thick, almost as hard as rock; on breaking thro' which we met with nothing but loose sand. In the centre stands a burning mountain about a mile in circumference, of a conic form, "but quite level." Out of the middle of the summit rises a small eminence eight or ten feet high, and perfectly conical; from the apex of which a column of smoke constantly issues. It is composed of large masses of red granite-like rock, of various shapes and sizes, which appear to have been split into their present form by some terrible convulsion of nature; and are piled up very regular. Great quantities of smoke issue from most parts of the mountain, especially on the north side, which appears to be burning from top to bottom; and the heat is so intense, that it is impossible to ascend it. It is even very dangerous to go round the base, as large masses of rock are constantly splitting with the heat and tumbling down. At the bottom, on the north side, is a very large rock split in two. Each of these halves, which are rent in all directions, are separated to a considerable distance from each other, and the crevices have glossy efflorescences tasting like vitriol. There are also beautiful crystallisations of sulphur; and on all parts of the mountain are great quantities of sulphur, also alum, vitriol, &c.

From the external appearance of this mountain, Mr Anderson conjectures that it had but lately begun to burn; as on several parts of it he saw small shrubs and

Moroc. and graſs which looked as if they had been but lately ſcorched and burnt. There were alſo ſeveral holes on the ſouth from which ſmoke iſſued, that appeared to have broken out but lately, the adjacent buſhes being but lately burnt. On two oppoſite ſides, the eaſt and weſt, of the burning mountain, are two lakes of water, about a ſtone's throw in breadth. They appear to be deep in the middle, and have a bottom of a kind of clay. The water is a chalybeate, and has a pleaſant taſte. Theſe lakes probably derive their exiſtence in a great meaſure, if not totally, from the rain-water running down the ſides of the crater. On the north ſide Mr Anderſon obſerved the traces of great torrents, that to appearance had conveyed vaſt quantities of water to theſe lakes; and by the ſtones at the bottom he could perceive that abſorption or evaporation, or both, went on very faſt. The greater part of the bottom of the crater is very level; and on the ſouth ſide are ſome ſhrubs and ſmall trees. Some pieces of pumice-ſtone were met with, and many ſtones about the ſize of a man's fiſt, rough, and blue upon one ſide, are ſcattered all over the mountain.

The motion of the clouds, on the top of this mountain was very ſingular. Though there were ſeveral parts higher than the crater, yet the clouds ſeemed always to be attracted by the latter. After entering on its eaſt or windward ſide, they ſunk a conſiderable way into it; then mounting the oppoſite ſide, and whirling round the north-weſt ſide, they ran along a ridge which tended nearly north-eaſt, and afterwards ſunk into a deep ravin dividing this ridge from another on the north-weſt corner of the mountain, and the higheſt on it, lying in a direction nearly north and ſouth. They keep in this ridge to the ſouth end, and then whirl off in their natural direction.

From the ſituation of theſe iſlands to one another, and to the continent of South America, Mr Anderſon conjectures, that there are ſubmarine communications between the volcanoes in each of them, and from them to thoſe in the high mountains of South America. He obſerves, that the crater in this iſland lies nearly in a line with Soufriere in St Lucia and Morne Pelee in Martinico; and probably from thence to a place of the ſame kind in Dominique, and from thence to the other iſlands; there being ſomething of the kind in each, Barbadoes and Tobago excepted.

MOROC, or Maroc, a beautiful bird of Abyſſinia deſcribed by Mr Bruce, who thinks its name is derived from *mar* "honey," though he ſays that he never heard it was further concerned in the honey than deſtroying bees. It ſeems to purſue thoſe inſects out of enmity or diverſion as well as for food, leaving great numbers dead on the ground, beſides thoſe which it devours for food. In conſequence of this property, the maroc is never found any where but in thoſe parts where the honey is very plentiful, tho' the Abyſſinians never take any notice of the ravages they commit among their ſtocks of bees.

The moroc reſembles the cuckoo in ſize and ſhape, but differs in other reſpects. Its mouth is very wide, the opening reaching almoſt to his eyes; the inſide of the mouth and throat yellow, the tongue ſharp-pointed, and capable of being drawn almoſt half its length out of the mouth beyond the point of its beak, and is very flexible. The head and neck are brown, without any mixture of other colours; there are likewiſe a number of very ſmall and ſcarcely viſible hairs at the root of the beak. The eyebrows are black; the beak pointed, and very little crooked; the pupil of the eye black, and ſurrounded with an iris of a dull and duſky red: The fore-part of the neck is light yellow, darker on each ſide than in the middle, where it is partly white; the yellow on each ſide reaches near the ſhoulder, or round part of the wing; and from this the whole breaſt and belly is of a dirty white to the under part of the tail; and from this the feathers begin to be tipt with white, as are all thoſe that cover the outſide of the wing. The wing has eight feathers of the largeſt ſize and ſix of the ſecond: the tail conſiſts of twelve feathers, the longeſt three being in the middle: they are placed cloſely together; and the tail is of an equal breadth from top to bottom, the feathers being alſo tipt with white. The thighs are covered with feathers of the ſame colour as thoſe of the belly, reaching more than half way down the legs, which are black, as well as the feet, and marked diſtinctly with ſcales. There are two toes before and behind, each of which has a ſharp and crooked claw. It makes a ſharp ſnapping noiſe when it catches the bees, evidently from cloſing its beak; but Mr Bruce never could diſcover that it had any ſong.

This ſeems to be the creature mentioned by Dr Sparman under the name of *cuculus indicator*, which (he ſays) has the ſingular property of diſcovering the neſts of wild bees, and leading travellers by a certain cry to the place where the treaſure is depoſited. According to Sparman's account, it makes known theſe diſcoveries by the ſame cry to foxes as well as to the human ſpecies; but Jerome Lobo, who mentions the Abyſſinian bird, does not take notice of the foxes, though he mentions its ſinging melodiouſly when it arrives at the place where the honey is depoſited. Both theſe accounts are ſeverely criticiſed by Mr Bruce, "I cannot (ſays he), for my own part, conceive, in a country where there are ſo many thouſand hives, that there was any uſe for giving to a bird a peculiar inſtinct or faculty of diſcovering honey, when, at the ſame time, nature had deprived him of the power of availing himſelf of any advantage from the diſcovery: for man ſeems in this caſe to be made for the ſervice of the moroc, which is very different from the common and ordinary courſe of things; man certainly needs him not, for on every tree, and on every hillock, he may ſee plenty of honey at his own deliberate diſpoſal. I cannot then but think, with all ſubmiſſion to theſe natural philoſophers, that the whole of this is an improbable fiction; nor did I ever hear a ſingle perſon in Abyſſinia ſuggeſt, that either this or any other bird had ſuch a property. Sparman ſays it was not known to any inhabitant of the Cape, any more than that of the moroc was in Abyſſinia; it was a ſecret of nature, hid from all but theſe two great men; and I moſt willingly leave it among the catalogue of their particular diſcoveries."

Moroc, Morning.

MORNING, the beginning of the day, or the time of the ſun-riſing. The aſtronomers reckon morning, *mane*, from the time of midnight to that of mid-day. Thus an eclipſe is ſaid to begin at 11 o'clock in the morning, &c.

Morning ſtar, is the planet Venus, when a little to

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to the westward of the sun; that is, when she rises a little before. In this situation she is called by the Greeks *phosphorus*; by the Latins *Lucifer*, &c.

1 Situation and boundaries.

MOROCCO, an empire of Africa, comprehending a considerable part of the ancient Mauritania, is bounded on the west by the Atlantic Ocean; on the east by the river of Mulvya, which separates it from Algiers; on the north by the Mediterranean; and on the south by Mount Atlas, or rather by the river Sus, which divides it from the kingdom of Tafilet. Its greatest length is from the north east to the south-west, amounting to above 590 miles; its breadth is not above 260 where broadest, and in the most narrow places is not above half that breadth.

2 History.

The ancient history of Morocco has been already given under the article MAURITANIA. It continued under the dominion of the Romans upwards of 400 years. On the decline of that empire it fell under the Goths, who held it till about the year 600, when the Goths were driven out by the Vandals, the Vandals by the Greeks, and they in their turn by the Saracens, who conquered not only this empire, but we may say the whole continent of Africa; at least their religion, one way or other, is to be found in all parts of it. The Saracen empire did not continue long united under one head, and many princes set up for themselves in Africa as well as else where, through whose dissensions the Almoravides were at length raised to the sovereignty, as related under the article ALGIERS, n° 2. Yusef, or Joseph, the second monarch of that line, built the city of Morocco, conquered the kingdom of Fez, and the Moorish dominions in Spain: all which were lost by his grandson Abbu Hali, who was defeated and killed by the Spaniards. On this prince's death the crown passed to the Mohedians, or Almohedes, with whom it had not continued above three generations, when Mohammed the son of Al Mansur lost the famous battle of Sierra Morena, in which 200,000 Moors were slain, and in consequence of which Alphonso X. retook a great many of the Moorish conquests immediately after.

Mohammed died soon after this disgrace, and left several sons, between whom a civil war ensued, during which the viceroys of Fez, Tunis, and Tremesen, found means to establish themselves as independent princes. At length one of the princes of the royal blood of Tremesen having defeated the Almohedes, made himself master of the kingdoms of Morocco and Fez, and entailed them on his own family. In a short time, however, this famiily was expelled by the Merini; the Merini by the Oatazes, and these by the Sharifs of Hascen, who have kept the government ever since.

This happened about the year 1516; and since that time, what we have under the name of history is little else than a catalogue of the enormous vices and excesses of the emperors. They have been in general a set of bloody tyrants; though they have had among them some able princes, particularly Muley Moluc who defeated and killed Don Sebastian king of Portugal. — See the article PORTUGAL, n° 26. They have lived in almost a continual state of warfare with the kings of Spain and other Christian princes ever since; nor does the crown of Great Britain sometimes disdain, as in the year 1769, to purchase their friendship with presents.

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3 Government.

Nothing can be conceived more unjust and despotic than the government of Morocco; and nothing more degenerated than the character of the people. The emperor is allowed to have not only an uncontrollable power over the lives and fortunes of his subjects, but in a great measure over their consciences, such as they are; in as much as he is the only person who, as the successor of the prophet, has a right to interpret the Koran; and appoints all the judges under him, of whom those of Morocco and Fez are the chief, whose business it is to explain and dispense all matters relating to their religion; and who, being his creatures and dependents dare not steer otherwise than as he directs. Whenever therefore the laws are enacted by him, and proclaimed by his governors in all the provinces, as is commonly done, that none may plead ignorance, they are everywhere received with an implicit and religious submission. On the other hand, the subjects are bred up with a notion, that those who die in the execution of his command are entitled to an immediate admittance into paradise, and those who have the honour to die by his hand to a still greater degree of happiness in it. After this we need not wonder at finding so much cruelty, oppression, and tyranny on the one side, and so much submission, passiveness, and misery on the other.

4 Account of the black troops.

This latter, however, extends no farther than the Moors; for as to the mountaineers, the subjection and tribute they pay to those tyrants was always involuntary, and altogether forced; and as for the negroes, their zeal and attachment is owing merely to the great sway and power which they have gained in the government, on various accounts. They were first introduced, or rather their importation increased, by the policy of Muley Ishmael, a late emperor, at a period when there was a great decrease of population in the empire, occasioned in some degree by the enormous cruelties exercised by its former sovereigns, who have been known not unfrequently, through a slight disgust, to abandon a whole town or province to the sword. In the character of Muley Ishmael, were found the most singular inconsistencies; for it is certain, that although a tyrant of the same class, yet in other respects, as if to repair the mischief which he committed, he left nothing undone for the encouragement of population.— He introduced, as above-mentioned, large colonies of negroes from Guinea; built towns for them, many of which are still remaining: assigned them portions of land, and encouraged their increase by every possible means. He soon initiated them in the Mahometan faith; and had his plan been followed, the country by this time would have been populous, and probably flourishing. As the negroes are of a more lively, active, and enterprising disposition than the Moors, they might soon have been taught the arts of agriculture and their singular ingenuity might have been directed to other useful purposes. It is true, Muley Ishmael, when he adopted this plan, had more objects in view than that of merely peopling his dominions. He saw plainly that his own subjects were of too capricious a disposition to form soldiers calculated for his tyrannical purposes. They had uniformly manifested an inclination to change their sovereigns, though more from the love of variety than to reform the government, or restrain the abuses of tyranny. In short, whatever

revolution

revolutions took place in the country, conſiſted merely in a change of one tyrant for another. Muley Iſhmael had diſcernment enough to ſee, therefore, that by forming an army of ſlaves, whoſe ſole dependence ſhould reſt upon their maſter, he could eaſily train them in ſuch a manner as to act in the ſtricteſt conformity to his wiſhes. He ſoon learnt that the great object with the negroes was plenty of money and liberty of plunder; in theſe he liberally indulged them, and the plan fully anſwered his expectations. Though, however, Muley Iſhmael had no great merit in introducing ſubjects for the purpoſes of tyranny, yet the good effects of this new colonization were very generally experienced. By intermarrying among themſelves, and intermixing among the Moors (for the Moors will keep negro women as concubines, though they ſeldom marry them), a new race of people ſtarted up, who became as uſeful ſubjects as the native inhabitants, and brought the empire into a much more flouriſhing ſtate than it had ever been in ſince their great revolution.

Sidi Mahomet, his grandſon and ſucceſſor, had different views, and was actuated by different motives. From his inordinate avarice, he ceaſed to act towards his black troops in the generous manner which had diſtinguiſhed his predeceſſor Muley Iſhmael; and they ſoon ſhowed themſelves diſcontented with his conduct. They frequently threatened to revolt, and ſupport thoſe of his ſons who were in oppoſition, and who promiſed them the moſt liberal rewards. They offered to place his eldeſt ſon Muley Ali, who is ſince dead, on the throne; but this prince, not unmindful of the duty which he owed his father and ſovereign, declined their offer. They next applied to Muley Yazid, the late emperor, who at firſt accepted of the aſſiſtance they tendered, but in a ſhort time relinquiſhed the plan. Sidi Mahomet, diſguſted with this conduct of the negroes, determined to curb their growing power, by diſbanding a conſiderable part of theſe troops, and baniſhing them to diſtant parts of the empire. This important mode of population has therefore been of late years neglected, while no better ſyſtem has been ſubſtituted in its room; for though the late emperor indulged in cruelty much leſs frequently than his predeceſſors, yet population has, perhaps, been more completely impeded by the general poverty which he has introduced into the country by his ſevere exactions, than if he had made a liberal uſe of the ſword or of the bow-ſtring.

5 Deſpotiſm of the emperors. A moſt flagrant ſpecies of deſpotiſm, which renders the emperors ſtill more formidable to their ſubjects, is their making themſelves their ſole heirs, and, in virtue of that, ſeizing upon all their effects, and making only ſuch proviſion for their families as they think proper; and often, on ſome frivolous pretence, leaving them deſtitute of any, according to the liking or diſlike they bear to the deceaſed; ſo that, upon the whole, they are the only makers, judges, and interpreters, and in many inſtances likewiſe the executioners, of their own laws, which have no other limits than their own arbitrary will. To preſerve, however, ſome ſhow or ſhadow of juſtice, they allow their mufti a kind of ſuperiority in ſpirituals, and a ſort of liberty to the meaneſt ſubject to ſummon them before his tribunal. But the danger which ſuch an attempt would bring upon a plaintiff, perhaps no leſs than death and deſtruction, is of itſelf ſufficient to deter any man from it; eſpecially conſidering the little probability there is that the judges of it would run the riſk of declaring themſelves againſt a monarch whoſe creatures they are, and on whom their lives and fortunes ſo abſolutely depend. The titles which the emperors of Morocco aſſume, are thoſe of *Moſt glorious, mighty, and noble emperor of Afric, king of Fez and Morocco, Taphilet, Suz, Darha, and all the Algarbe, and its territories in Afric; grand Scharif* (or, as others write it, *Xarif*, that is, "ſucceſſor, or vicegerent,") *of the great prophet Mohammed, &c.*

The judges or magiſtrates that act immediately under the emperor are either ſpiritual or temporal, or rather 6 Adminiſtration of juſtice. eccleſiaſtical and military. The mufti and the kadis are judges of all religious and civil affairs; and the baſhaws, governors, alcaides, and other military officers, of thoſe that concern the ſtate or the army: all of them the moſt obſequious creatures and ſlaves of their prince, and no leſs the rapacious tyrants of his ſubjects, and from whom neither juſtice nor favour can be obtained but by mere dint of money and extortionate bribery, from the higheſt to the loweſt. Neither can it indeed be otherwiſe in ſuch an arbitrary government, where the higheſt poſts muſt not only be bought of the prince at a moſt extravagant price, and kept only by as exorbitant a tribute, which is yearly paid to him, but where no one is ſure to continue longer than he can bribe ſome of the courtiers to inſinuate to the monarch that he pays to the utmoſt of his power, and much beyond what was expected from him. Add to this, that thoſe baſhaws, governors, &c. are obliged to keep their agents and ſpies in conſtant pay at court, to prevent their being ſupplanted by higher bidders, ſlanderers, or other underminers. In ſhort, power and weakneſs, rank and meanneſs, opulence and indigence, are here equally dependent, equally uncertain. There are inſtances of the ſultan elevating at once a common ſoldier to the rank of a baſhaw, or making him a confidential friend; the following day he would perhaps impriſon him, or reduce him again to the ſtation of a private ſoldier. It is ſurpriſing that men under theſe circumſtances ſhould be ambitious of rank, or deſirous of riches and power. Yet ſuch is the diſpoſition of theſe people, that they have an unbounded thirſt for rank and power with all their uncertainties; and what is more extraordinary, when they have obtained a high ſtation, they ſeldom fail to afford their ſovereign a plea for ill treating them, by abuſing in ſome way or other their truſt.

From what has been ſaid, it may be reaſonably 7 Royal revenues. concluded that the revenue ariſing to the emperor from the laſt mentioned ſource, that of bribery, extortion, and confiſcation, muſt be very conſiderable, though there is no poſſibility to make any other conjecture of its real amount than that it muſt be an immenſe one. Another conſiderable branch is the piratical trade, which brings the greater income into his treaſury, as he is not at any expence either for fitting of corſair veſſels out, or maintaining their men; and yet has the tenth of all the cargo and of all the captives; beſides which, he appropriates to himſelf all the reſt of them, by paying the captors 50 crowns *per* head, by which means he engroſſes all the ſlaves to his own ſervice and advantage. This article is indeed a

Morocco. very con iderable addition to his revenue, not only as he ſells their ranſom at a very high rate, but likewiſe as he has the profit of all their labour, without allowing them any other maintenance than a little bread and oil, or any other aſſiſtance when ſick than what medicines a Spaniſh convent, which he tolerates there, gives them gratis; and which, nevertheleſs, is forced to pay him an annual preſent for that toleration, beſides furniſhing the court with medicines, and the ſlaves with lodging and diet when they are not able to work. Another branch of his revenue conſiſts in the tenth part of all cattle, corn, fruits, honey, wax, hides, rice, and other products of the earth, which is exacted of the Arabs and Brebes, as well as of the natives; and theſe are levied, or rather farmed, by the baſhaws, governors, alcaides, &c. with all poſſible ſeverity. The Jews and Chriſtians likewiſe pay an income or capitation, the former of ſix crowns *per* head on all males from 15 years and upwards, beſides other arbitrary impoſts, fines, &c. That on the Chriſtians, for the liberty of trading in his dominions, riſes and falls according to their number, and the commerce they drive; but which, whatever it may bring yearly into his coffers, is yet detrimental to trade in general, ſeeing it diſcourages great numbers from ſettling there, notwithſtanding the artful invitation which the emperors and their miniſters make uſe of to invite them to it; for, beſides thoſe arbitrary exactions, there is ſtill another great hardſhip attending them, viz. that they cannot leave the country without forfeiting all their debts and effects to the crown. The duties on all imports and exports is another branch of his income, the amount of which, *communibus annis*, no author has yet given us any account of; only conſul Hatfield has computed the whole yearly revenue, including ordinaries and extraordinaries, to amount to 500 quintals of ſilver, each quintal, or 100 lb. weight, valued at ſomewhat above 330 l. Sterling: ſo that the whole amounts to no more, according to him, than 165,000 l.; a ſmall revenue indeed for ſo large an empire, if the calculation may be depended upon. But St Olan, though he does not pretend ſo much as to gueſs at the yearly amount of it, in general repreſents it as ſo conſiderable, that Muley Iſhmael was reckoned to have amaſſed out of it a treaſure in gold and ſilver of about 50 effective millions; but whether of crowns or livres he does not tell us, nor how he came by his knowledge of it; becauſe that politic prince, even by his own confeſſion, not only cauſed all his riches to be buried in ſundry places under-ground, his gold and ſilver to be melted into great lumps, and laid in the ſame privacy underground, but likewiſe all thoſe whom he entruſted with the ſecret to be as privately murdered.

8 Climate of Morocco. The climate of the empire of Morocco is in general ſufficiently temperate, healthy, and not ſo hot as its ſituation might lead us to ſuppoſe. The chain of mountains which form Atlas, on the eaſtern ſide, defends it from the eaſt winds, that would ſcorch up the earth were they frequent. The ſummit of theſe mountains is always covered with ſnow; and their abundant deſcending ſtreams ſpread verdure through the neighbourhood, make the winter more cold, and temper the heats of ſummer. The ſea on the weſt ſide, which extends along the coaſt from north to ſouth, alſo refreſhes the land with regular breezes, that ſeldom vary according to their ſeaſons. At a diſtance from the ſea, within land, the heat is ſo great that the rivulets become dry in ſummer; but as in hot countries dews are plentiful, the nights are there always cool. The rains are tolerably regular in winter: and are even abundant, though the atmoſphere is not loaded with clouds as in northern latitudes. Thoſe rains which fall by intervals are favourable to the earth, and increaſe its fecundity. In January the country is covered with verdure, and enamelled with flowers. Barley is cut in March, but the wheat harveſt is in June, All fruits are early in this climate; and in forward years the vintage is over in the beginning of September. Though in general there is more uniformity and leſs variation in hot than in northern climates, the firſt are nevertheleſs expoſed to the intemperance of weather; too heavy rains often impede the harveſt; and drought has ſtill greater inconveniences, for it inſures the propagation of locuſts. Theſe fatal inſects, which have ſo often laid deſolate hot countries, ſometimes commit the moſt dreadful ravages in the empire of Morocco. They come from the ſouth, ſpread themſelves over the lands, and increaſe to infinity when the rains of ſpring are not ſufficiently heavy to deſtroy the eggs they depoſit on the earth. The large locuſts, which are near three inches long, are not the moſt deſtructive: as they fly, they yield to the current of wind, which hurries them into the ſea, or into ſandy deſerts, where they periſh with hunger or fatigue. The young locuſts, that cannot fly, are the moſt ruinous; they creep over the country in ſuch multitudes, that they leave not a blade of graſs behind; and the noiſe of their feeding announces their approach at ſome diſtance. The devaſtations of locuſts increaſe the price of proviſions, and often occaſion famines: but the Moors find a kind of compenſation in making food of theſe inſects; prodigious quantities of which are brought to market ſalted and dried like red herrings. They have an oily and rancid taſte, which habit only can render agreeable: they are eat here, however, with pleaſure. The winters in Morocco are not ſevere, nor is there an abſolute need of fire. In the coldeſt weather the thermometer ſeldom ſinks to more than five degrees above the freezing point. The longeſt days in Morocco are not more than 14 hours, and the ſhorteſt conſequently not leſs than ten.

The ſoil of Morocco is exceedingly fertile. It is moſt ſo in the inland provinces. On the weſtern coaſt it is in general light and ſtony, and is better adapted to the vine and olive than the culture of wheat. They annually burn, before the September rains, the ſtubble, which is left rather long; and this and the dung of cattle, every day turned to paſture, form the ſole manure the land receives. The ſoil requires but little labour, and the ploughing is ſo light that the furrows are ſcarcely ſix inches deep; for which reaſon, in ſome provinces, wooden ploughſhares are uſed for cheapneſs. 9 Soil, and

The empire of Morocco might ſupply itſelf with all neceſſaries, as well from the abundance and nature of its products, as from the few natural or artificial wants of the Moors occaſioned by climate or education. Its wealth conſiſts in the fruitfulneſs of its ſoil: its corn, fruits, flocks, flax, ſalt, gums, and wax, would not only ſupply its neceſſities, but yield a ſuperflux, which might become

Morocco. become an object of immenſe trade and barter with other nations. Such numerous exports might return an inexhauſtible treaſure, were its government fixed and ſecure, and did ſubjects enjoy the fruits of their labour and their property in ſafety. The increaſe of corn in Morocco is often as ſixty to one, and thirty is held to be but an indifferent harveſt. The exportation of this corn is burdened by the laws, and by the prejudices of an intolerant religion, which permits them not to ſell their ſuperabundance to infidels. The property of land is beſides entirely precarious; ſo that each individual grows little more than ſufficient for his own wants. Hence it happens, when the harveſt fails from the ravages of locuſts or the intemperance of ſeaſons, theſe people are expoſed to miſery, ſuch as Europeans have no conception of, who enjoy a ſtable adminiſtration, which obviates and provides for all their wants.

10 Productions.

The Moors, naturally indolent, take little care of the culture of their fruits. Oranges, lemons, and thick-ſkinned fruits, the trees of which require little nurture, grow in the open fields; and there are very large plantations of them found, which they take the trouble to water in order to increaſe their product. Their vines, which yield excellent grapes, are planted as far as the 33d degree, as in the ſouthern provinces of France, and are equally vigorous. But at Morocco, where they yield a large and delicious grape, they are ſupported by vine-poles five and ſix feet above the ground; and as they are obliged to be watered, the little wine made there is ſeldom preſerved. Figs are very good in ſome parts of the empire, but toward the ſouth they are ſcarcely ripe before they are full of worms; the heats and night dews may, perhaps, contribute to this ſpeedy decay. Melons, for the ſame reaſon, are rarely eatable; they have but a moment of maturity; which paſſes ſo rapidly that it is with difficulty ſeized. Water-melons are every where reared, and in ſome provinces are excellent. Apricots, apples, and pears, are in tolerable plenty in the neighbourhood of Fez and Mequinez, where water is leſs ſcarce and the climate more temperate. But in the plain, which extends along the weſtern coaſt, theſe delicate fruits are very indifferent, have leſs juice or taſte, and the peaches there do not ripen, The tree called the prickly pear, or the Barbary fig, is plentifully found in the empire of Morocco; and is planted round vineyards and gardens, becauſe its thick and thorny leaves, which are wonderfully prolific, form impenetrable hedges. From theſe leaves a fruit is produced, covered with a thorny ſkin, that muſt be taken off with care. This fruit is mild, and full of very hard, ſmall, kernels. The olive is every where found along the coaſt, but particularly to the ſouth. The trees are planted in rows, which form alleys the more agreeable becauſe the trees are large, round, and high in proportion. They take care to water them, the better to preſerve the fruit. Oil of olives might here be plentifully extracted, were taxation fixed and moderate; but ſuch has been the variation it has undergone, that the culture of olives is ſo neglected as ſcarcely to produce oil ſufficient for internal conſumption. In 1768 and 1769 there were near 40,000 quintals of oil exported from Modogore and Santa-Cruz to Marſeilles, and ten years after it coſt 15 d. per pound. Thus do the vices of government expoſe nations to dearth and famine who live in the very boſom of abundance.

From the province of Duquella to the ſouth of the empire, there are foreſts of the arga tree, which is thorny, irregular in its form, and produces a ſpecies of almond exceedingly hard, with a ſkin as corroſive as that of walnuts. Its fruit conſiſts of two almonds, rough and bitter, from which an oil is produced very excellent for frying. In order to uſe this oil, it muſt be purified by fire, and ſet in a flame which muſt be ſuffered to die away of itſelf; the moſt greaſy and corroſive particles are conſumed, and its acrid qualities are thus wholly deſtroyed. When the Moors gather theſe fruits, they bring their goats under the trees; and as the fruit falls the animals carefully nibble off the ſkins. In the ſame province alſo is found the tree which produces gum ſandarac; alſo that which yields the tranſparent gum; but the latter is moſt productive, and affords the beſt gum the farther we proceed ſouthward, where the heat and night-dews may perhaps render the vegetable ſecretion more pure and copious.

In the province of Suz, between the 25th and 30th degrees, the inhabitants have an almond harveſt, which varies, little becauſe of the mildneſs of the climate; but the fruit is ſmall for which reaſon they take little care of the trees, and they degenerate with time. The palm tree is common on the ſouthern provinces of Morocco; but dates ripen there with difficulty, and few are good except in the province of Suz and towards Tafilet. On the coaſt of Salle and Mamora there are foreſts of oak, which produce acorns near two inches long. They taſte like cheſnuts, and are eat raw and roaſted. This fruit is called *Bellote*, and is ſent to Cadiz where the Spaniſh ladies hold it in great eſtimation. The empire of Morocco alſo produces much wax: but ſince it has been ſubjected by the emperor to the payment of additional duties, the country people have very much neglected the care of their hives. Salt abounds in the empire, and in ſome places on the coaſt requires only the trouble of gathering. Independent of the ſalt-pits formed by the evaporation of the ſoft water, there are pits and lakes in the country whence great quantities are obtained. It is carried even as far as Tombut, whence it paſſes to the interior parts of Africa.

The Moors cultivate their lands only in proportion to their wants; hence two-thirds of the empire at leaſt lie waſte. Here the *doum*, that is, the fan or wild palm tree, grows in abundance; and from which thoſe people, when neceſſity renders them induſtrious, find great advantage. The ſhepherds, mule-drivers, camel-drivers, and travellers, gather the leaves, of which they make mats, fringes, baſkets, hats, *ſhoaris* or large wallets to carry corn. twine, ropes, girths, and covers for the pack-ſaddles. This plant, with which alſo they heat their ovens, produces a mild and reſinous fruit that ripens in September and October. It is in form like the raiſin, contains a kernel, and is aſtringent and very proper to temper and counteract the effects of the watery and laxative fruits, of which theſe people in ſummer make an immoderate uſe.

11 Mines.

Unacquainted with the ſources of wealth of which their anceſtors were poſſeſſed, the Moors pretend there are gold and ſilver mines in the empire, which the em-

perors

perors will not permit to be worked, left their subjects should thus find means to shake off their yoke. It is not improbable but that the mountains of Atlas may contain unexplored riches; but there is no good proof that they have ever yielded gold and silver. There are known iron mines in the south; but the working of them has been found so expensive, that the natives would rather use imported iron, notwithstanding the heavy duty it pays, by which its price is doubled. There are copper mines in the neighbourhood of Santa Cruz, which are not only sufficient for the small consumption of the empire, where copper is little used, but are also an object of exportation, and would become much more so were the duties less immoderate.

12 Animals.

Neither the elephant nor the rhinocerous is to be found either in this or the other states of Barbary; but their desarts abound with lions, tigers, leopards, hyænas, and monstrous serpents. The Barbary horses were formerly very valuable, and thought equal to the Arabian. Though their breed is now said to be decayed, yet some very fine ones are occasionally imported into England. Camels and dromedaries, asses, mules, and kumrahs (a most serviceable creature, begot by an ass upon a cow), are their beasts of burden. Their cows are but small, and barren of milk. Their sheep yield but indifferent fleeces, but are very large, as are their goats. Bears, porcupines, foxes, apes, hares, rabbits, ferrets, weasels, moles, cameleons, and all kinds of reptiles, are found here. Patridges and quails, eagles, hawks, and all kinds of wild-fowl, are frequent on the coast.

13 Mountains, &c.

As to mountains, the chief are that chain which goes under the name of *Mount Atlas*, and runs the whole length of Barbary from east to west, passing through Morocco, and abutting upon that ocean which separates the eastern from the western continent, and is from this mountain called the *Atlantic Ocean*. See Atlas. The principal rivers, besides the Malva or Mulvia abovementioned, which rises in the desarts, and running from south to north divides Morocco from the kingdom of Algiers, are the Suz, Ommirabih, Rabbata, Larache, Darodt, Sebon, Gucron, and Tensift, which rise in Mount Atlas, and fall into the Atlantic Ocean. The chief capes are Cape Threeforks on the Mediterranean, Cape Spartel at the entrance of the straits, Cape Cantin, Cape None, and Cape Rajador, on the Atlantic Ocean. Of the bays the most considerable are, the bay of Tetuan in the Mediterranean, and the bay of Tangier in the straits of Gibraltar.

14 Inland traffic.

The traffic of the empire by land is either with Arabia or Negroland: to Mecca they send caravans, consisting of several thousand camels, horses, and mules, twice every year, partly for traffic, and partly on a religious account; for numbers of pilgrims take that opportunity of paying their devotions to their great prophet. The goods they carry to the east are woollen manufactures, leather, indigo, cochineal, and ostrich feathers; and they bring back from thence, silk, muslins, and drugs. By their caravans to Negroland, they send salt, silk, and woollen manufactures, and bring back gold and ivory in return, but chiefly negroes.

15 Traffic.

The caravans always go strong enough to defend themselves against the wild Arabs in the desarts of Africa and Asia; though, notwithstanding all their vigilance, some of the stragglers and baggage often fall into their hands: they are also forced to load one half of their camels with water, to prevent their perishing with drought and thirst in those inhospitable desarts. And there is still a more dangerous enemy, and that is the sand itself: when the winds rise, the caravan is perfectly blinded with dust; and there have been instances both in Africa and Asia, where whole caravans, and even armies, have been buried alive in the sands. There is no doubt also, but both men and cattle are sometimes surprised by wild beasts, as well as robbers, in those vast desarts; the hot winds also, blowing over a long tract of burning sand, are equal almost to the heat of an oven, and destroy abundance of merchants and pilgrims. If it was not for devotion, and in expectation of very great gains, no man would undertake a journey in these desarts; great are the hazards and fatigues they must of necessity undergo; but those that go to Mecca assure themselves of paradise if they die, and have uncommon honours paid them at home if they survive. People crowd to be taken into the eastern caravans; and the gold that is found in the south make them no less eager to undertake that journey.

The natives have hardly any trading vessels, but are seldom without some corsairs. These, and European merchant-ships, bring them whatever they want from abroad; as linen and woollen cloth, stuffs, iron wrought and unwrought, arms, gunpowder, lead, and the like: for which they take in return, copper, wax, hides, Morocco leather, wool (which is very fine), gums, soap, dates, almonds, and other fruits. The duties paid by the English in the ports of Morocco are but half those paid by other Europeans. It is a general observation, that no nation is fond of trading with these states, not only on account of their capricious despotism, but the villainy of their individuals, both natives and Jews, many of whom take all opportunities of cheating, and when detected are seldom punished. 16 Foreign commerce.

The land-forces of the emperor of Morocco consist principally of the black troops already mentioned, and some few white; amounting altogether to an army of about 36,000 men upon the establishment, two thirds of which are cavalry. This establishment, however, upon occasion admits of a considerable increase, as every man is supposed to be a soldier, and when called upon is obliged to act in that capacity. About 6000 of the standing forces form the emperor's body guard, and are always kept near his person; the remainder are quartered in the different towns of the empire, and are under the charge of the bashaws of the provinces. They are all clothed by the emperor, and receive a trifling pay; but their chief dependence is on plunder, which they have frequent opportunities of acquiring. The soldiers have no distinction in dress from the other Moors; and are only marked by their accoutrements, which consist of a sabre, a very long musket, a small red leathern box to hold their balls, which is fixed in front by means of a belt, and a powder-horn slung over their shoulders. The army is under the direction of a commander in chief, four principal bashaws, and alcaides who command distinct divisions. 17 Land-forces.

The black troops are naturally of a very fiery disposition,

poſition, capable of enduring great fatigue, hunger, thirſt, and every difficulty to which a military life is expoſed. They appear well calculated for ſkirmiſhing parties, or for the purpoſe of harraſſing an enemy; but were they obliged to undergo a regular attack, from their total want of diſcipline they would ſoon be routed. In all their manœuvres they have no notion whatever of order and regularity, but have altogether more the appearance of a rabble than of an army. Though theſe troops are ſuppoſed to be the ſtrongeſt ſupport of deſpotiſm, yet from their avarice and love of variety they frequently prove the moſt dangerous enemies to their monarchs; they are often known to excite ſedition and rebellion, and their inſolence has ſometimes proceeded to ſuch exceſſes as nearly to overturn the government. Their conduct is governed only by the paſſions. Thoſe who pay them beſt, and treat them with the greateſt attention, they will always be moſt ready to ſupport. This circumſtance, independent of every other, makes it the intereſt of the monarch to keep his ſubjects in as complete a ſtate of poverty as poſſible. The Moors are indeed remarkable for inſincerity in their attachments, and for their love of variety; a military force, in this kingdom eſpecially, is therefore the only means which a deſpotic monarch can employ for ſecuring himſelf in the poſſeſſion of the throne. Ignorant of every principal of rational liberty, whatever conteſts this devoted people may engage in with their tyrants, are merely conteſts for the ſucceſſion; and the ſole object for which they ſpend their lives and their property, is to exchange one mercileſs deſpot for another.

18 Navy.

The emperor's navy conſiſts of about 15 ſmall frigates, a few zebecks, and between 20 and 30 rowgalleys. The whole is commanded by one admiral; but as theſe veſſels are principally uſed for the purpoſes of piracy, they ſeldom unite in a fleet. The number of the ſeamen in ſervice are computed at 6000.

19 Coins.

The coins of this empire are a fluce, a banquil, and ducat. The fluce is a ſmall copper coin, twenty whereof make a blanquil, of the value of two pence Sterling. The blanquil is of ſilver, and the ducat of gold, not unlike that of Hungary, and worth about nine ſhillings. Both theſe pieces are ſo liable to be clipped and filed by the Jews, that the Moors always carry ſcales in their pockets to weigh them; and when they are found to be much diminiſhed in their weight, they are recoined by the Jews, who are maſters of the mint, by which they gain a conſiderable profit; as they do alſo by exchanging the light pieces for thoſe that are full weight. Merchants accounts are kept in ounces, ten of which make a ducat; but in payments to the government, it is ſaid they will reckon ſeventeen and one-half for a ducat.

20 Religion and

With reſpect to religion, the inhabitants of Morocco are Mohammedans, of the ſect of Ali; and have a mufti or high-prieſt, who is alſo the ſupreme civil magiſtrate, and the laſt reſort in all cauſes eccleſiaſtical and civil. They have a great veneration for their hermits, and for idiots and madmen; as well as for

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thoſe who by their tricks have got the reputation of wizzards: all of whom they look upon as inſpired perſons, and not only honour as ſaints while they live, but build tombs and chapels over them when dead; which places are not only religiouſly viſited by their devotees far and near, but are eſteemed inviolable ſanctuaries for all ſorts of criminals except in caſes of treaſon.

Notwithſtanding the natives are zealous Mohammedans, they allow foreigners the free and open profeſſion of their religion, and their very ſlaves have their prieſts and chapels in the capital city; though it muſt be owned that the Chriſtian ſlaves are here treated with the utmoſt cruelty. Here, as in all other Mohammedan countries, the alcoran and their comments upon it are their only written laws; and though in ſome inſtances their cadis and other civil magiſtrates are controlled by the arbitrary determinations of their princes, baſhaws, generals, and military officers, yet the latter have generally a very great deference and regard for their laws. Murder, theft, and adultery, are commonly puniſhed with death: and their puniſhments for other crimes, particularly thoſe againſt the ſtate, are very cruel; as impaling, dragging the priſoner through the ſtreets at a mule's heels till all his fleſh is torn off; throwing him from a high tower upon iron hooks; hanging him upon hooks till he die; crucifying him againſt a wall; and, indeed, the puniſhment and condemnation of criminals is in a manner arbitrary. The emperor, or his baſhaws, frequently turn executioners; ſhoot the offender, or cut him to pieces with their own hands, or command others to do it in their preſence.

21 Laws.

22 Inhabitants of the empire of Morocco.

The inhabitants of the empire of Morocco, known by the name of *Moors*, are a mixture of Arabian and African nations formed into tribes; with the origin of whom we are but imperfectly acquainted. Theſe tribes, each ſtrangers to the other, and ever divided by traditional hatred or prejudice, ſeldom mingle. It ſeems probable that moſt of the caſts who occupy the provinces of Morocco have been repulſed from the eaſtern to the weſtern Africa, during thoſe different revolutions by which this part of the world has been agitated; that they have followed the ſtandard of their chiefs, whoſe names they have preſerved; and that by theſe they, as well as the countries they inhabit, are diſtinguiſhed. At preſent theſe tribes are called *caſiles* or *cabiles*, from the Arabic word *kobeila;* and they are ſo numerous, that it is impoſſible to have a knowledge of them all. In the northern provinces are enumerated Beni-Garir, Beni-Guernid, Beni-Manſor, Beni-Oriegan, Beni-Chelid, Beni-Juſeph, Beni-Zarnol, Beni-Razin, Beni-Gebara, Beni-Buſeibet, Beni-Gualid, Beni-Yeder, Beni-Gueiaghel, Beni-Guaſeval, Beni-Guamud, &c. Towards the eaſt are, Beni-Sayd, Beni-Teuſin, Beni-Ieſſetin, Beni-Buhalel, Beni-Telid, Beni-Soffian, Beni-Becil, Beni-Zequer, &c.—and to the ſouth, thoſe of Beni-Fonſecara, Beni-Aros, Beni-Haſſen, Beni-Mager, Beni-Baſil, Beni-Seba, with an infinite number of others (A). The people

(A) The word *Ben*, that is to ſay "Son," is uſually employed to ſignify "family deſcendants;" thus, *Beni-Haſſen*, and *Beni-Juſeph*, ſignify, "the children or deſcendents of Haſſen and of Joſeph." The Moors, as a more extenſive generic term, call men *Ben-Adam;* that is, "the deſcendants or ſons of Adam."

people who depend on Algiers, Tunis, and Tripoli, are in like manner divided into an infinite number of these tribes, who are all so ancient that they themselves have not the least idea of their origin.

The native subjects of the empire of Morocco may be divided into two principal classes; the *Brebes* and the *Moors*.

23 The Brebes, or Mountaineers.

The etymology of the name, and the origin of the people, of the first class, are equally unknown. Like the Moors, at the time of the invasion by the Arabs, they may have adopted the Mahometan religion, which is consonant to their manners and principal usages; but they are an ignorant people, and observe none of the precepts of that religion, but the aversion it enjoins against other modes of worship.—Mahometanism has not obliterated the customs and ancient prejudices of these people, for they eat the wild boar; and in places where there are vineyards, they drink wine, *provided* (say they) *that it is of our own making*. In order to preserve it in the southern parts of Mount Atlas, they put it in earthen vessels, and in barrels made of the hollowed trunk of a tree, the upper end of which is done over with pitch; and these are deposited in cellars, or even in water. In the northern province of Rif they boil it a little, which renders it less apt to inebriate, and perhaps they think that in this state they may reconcile the use of it with the spirit of their law.

Confined to the mountains, the Brebes preserve great animosity against the Moors, whom they confound with the Arabs, and consider as usurpers.—They thus contract in their retreats a ferocity of mind, and a strength of body, which makes them more fit for war and every kind of labour than the Moors of the plain in general are. The independence they boast of gives even a greater degree of expression to their countenance. The prejudices of their religion make them submit to the authority of the emperors of Morocco; but they throw off the yoke at their pleasure, and retire into the mountains, where it is difficult to attack or overcome them. The Brebes have a language of their own, and never marry but among each other. They have tribes or cafiles among them who are exceedingly powerful both by their number and courage. Such are those of Gomera on the borders of Rif, of Gayroan toward Fez, of Timoor extending along mount Atlas from Mequinez to Tedla, of Shavoya from Tedla to Duquella, and of Mishboya, from Morocco to the south. The emperor of Morocco keeps the children of the chiefs of these tribes at court as hostages for their fidelity. The Brebes have no distinction of dress; they are always clothed in woollen like the Moors; and, though they inhabit the mountains, they rarely wear any thing on their heads. These mountaineers, as well as their wives, have exceedingly fine teeth; and possess a degree of vigour and intrepidity which distinguishes them from the inhabitants of the plains. It is common for them to hunt lions and tigers; and the mothers have a custom of decorating their children with a tiger's claw or the remnant of a lion's hide on the head, thinking that by this means they will acquire strength and courage; and from a similar superstition, young wives are in use to give their husbands the same as a sort of amulets.

The Brebes and the Shellu having a language common to themselves, and unknown to the Moors, both must have had the same origin, notwithstanding the difference there is in their mode of life. The *Shellu* live on the frontiers of the empire toward the south; their population is by no means so great as that of the Brebes, nor are they so ferocious; they do not marry with other tribes; and though they practice many superstitious rites, they are faithful observers of their religion.

The *Moors* of the plains may be distinguished into those who lead a pastoral life, and those who inhabit the cities.

24 The Moors of the country.

The former live in tents; and that they may allow their ground a year's rest, they annually change the place of their encampments, and go in search of fresh pasturage; but they cannot take this step without acquainting their governor. Like the ancient Arabs, they are entirely devoted to a pastoral life: their encampments, which they call *douhars*, are composed of several tents, and form a crescent; or they are ranged in two parallel lines, and their flocks, when they return from pasture, occupy the centre. The entrance of the douhar is sometimes shut with faggots of thorns; and the only guard is a number of dogs, that bark incessantly at the approach of a stranger. Each douhar has a chief, subordinate to an officer of the highest rank, who has under his administration a number of camps; and several of these subordinate divisions are united under the government of a pacha, who has often 1000 douhars in his department.

The tents of the Moors, viewed in front, are of a conical figure; they are from 8 to 10 feet high, and from 20 to 25 feet long; like those of high antiquity, they resemble a boat reversed. They are made of cloth composed of goats' and camels' hair, and the leaves of the wild palm, by which they are rendered impervious to water; but at a distance their black colour gives them a very disagreeable look.

25 Their simple way of life.

The Moors, when encamped, live in the greatest simplicity, and exhibit a faithful picture of the inhabitants of the earth in the first ages of the world. The nature of their education, the temperature of the climate, and the rigour of the government, diminish the wants of the people, who find in their plains, in the milk and wool of their flocks, every thing necessary for food and cloathing. Polygamy is allowed among them; a luxury so far from being injurious to a people who have few wants, that is a great convenience in the economy of those societies, because the women are intrusted with the whole care of the domestic management.

26 Occupations of the women, &c.

In their half-closed tents, they are employed in milking the cows for daily use; and when the milk abounds, in making butter, in picking their corn, their barley, and pulse, and grinding their meal, which they do daily in a mill composed of two stones about 18 inches in diameter, the uppermost having a handle, and turning on an axis fixed in the under one; they make bread likewise every day, which they bake between two earthen plates, and often upon the ground after it has been heated by fire. Their ordinary food is the coofcoofoo; which is a paste made with their meal in the form of small grains like Italian paste. This coofcoofoo is drest in the vapour of boiling soup, in a hollow dish perforated with many small holes in the bottom, Morocco. tom, and the diſh is incloſed in a kettle where meat is boiled; the cooſcooſoo, which is in the hollow diſh, grows gradually ſoft by the vapour of the broth, with which it is from time to time moiſtened. This ſimple food is very nouriſhing, and even agreeable when one has got the better of the prejudices which every nation entertains for its own cuſtoms. The common people eat it with milk or butter indifferently; but thoſe of higher rank, ſuch as the governors of provinces and lieutenants, who live in the centre of the encampments, add to it ſome ſucculent broth, made with a mixture of mutton, poultry, pigeons, or hedgehogs, and then pour on it a ſufficient quantity of freſh butter. Theſe officers receive ſtrangers in their tents with the ſame cordiality that Jacob and Laban ſhowed to their gueſts. Upon their arrival a ſheep is killed and immediately dreſſed; if they are not provided with a ſpit, they inſtantly make one of wood; and this mutton roaſted at a briſk fire, and ſerved up in a wooden diſh, has a very delicate colour and taſte.

The women in their tents likewiſe prepare the wool, ſpin it, and weave it into cloth on looms ſuſpended the whole length of the tent. Each piece is about five ells long and one and an half broad; it is neither dreſſed nor dyed, and it has no ſeam; they waſh it when it is dirty; and as it is the only habit of the Moors, they wear it night and day. It is called *Haick*, and is the true model of the ancient draperies.

27 Dreſs, &c. The Moors of the plain wear nothing but their woollen ſtuff; they have neither ſhirts nor drawers. Linen among theſe people is a luxury known only to thoſe of the court or the city. The whole wardrobe of a country Moor in eaſy circumſtances conſiſts in a haick for winter, another for ſummer, a red cap, a hood, and a pair of ſlippers. The common people both in the country and in towns wear a kind of tunick of woollen cloth, white, grey, or ſtriped, which reaches to the middle of the leg, with great ſleeves and a hood; it reſembles the habit of the Carthuſians.

The womens dreſs in the country is likewiſe confined to a haick, which covers the neck and the ſhoulders, and is faſtened with a ſilver claſp. The ornaments they are fondeſt of are ear-rings, which are either in the form of rings or creſcents, made of ſilver, bracelets, and rings for the ſmall of the leg; they wear theſe trinkets at their moſt ordinary occupations; leſs out of vanity than becauſe they are unacquainted with the uſe of caſkets or cabinets for keeping them. They alſo wear necklaces made of coloured glaſs-beads or cloves ſtrung on a cord of ſilk.

Beſides theſe ornaments, the women, to add to their beauty, imprint on their face, their neck, their breaſt, and on almoſt every part of their body, repreſentations of flowers and other figures. The impreſſions are made with a piece of wood ſtuck full of needles; with the points of which they gently puncture the ſkin, and then lay it over with a blue-coloured ſubſtance or gunpowder pulveriſed, and the marks never wear out. This cuſtom, which is very ancient, and which has been practiſed by a variety of nations, in Turkey, over all Aſia, in the ſouthern parts of Europe, and perhaps over the whole globe, is, however, not general among the Mooriſh tribes.

The Moors conſider their wives leſs in the light of companions than in that of ſlaves deſtined to labour. Morocco. Except in the buſineſs of tillage, they are employed in every ſervile operation; nay, to the ſhame of humanity, it muſt be owned, that in ſome of the poorer quarters a woman is often ſeen yoked in a plough along with a mule, an aſs, or ſome other animal. When the Moors remove their douhars, all the men ſeat themſelves in a circle on the ground; and with their elbows reſting on their knees, paſs the time in converſation, while the women ſtrike the tents, fold them up into bundles, and place them on the backs of their camels or oxen. The old women are then each loaded with a parcel, and the young carry the children on their ſhoulders ſuſpended in a cloth girt round their bodies. In the more ſouthern parts, the women are likewiſe employed in the care of the horſes, in ſaddling and bridling them; the huſband, who in theſe climates is always a deſpot, iſſues his orders, and ſeems only made to be obeyed.

The women travel without being veiled; they are accordingly ſun-burnt, and have no pretenſions to beauty. There are, however, ſome quarters where they put on a little rouge: they every where ſtain their hair, their feet, and the ends of their fingers, with an herb called *henna*, which gives them a deep ſaffron colour; a cuſtom that muſt be very ancient among the people of Aſia. Abu Becre dyed his eye-brows and beard with the ſame colour, and many of his ſucceſſors imitated him. The cuſtom may have originally been a religious ceremony, which the women have turned into an ornament; but it is more probable that the cuſtom of painting the beard and hair, and that of ſhaving the head and uſing depilatories in other parts of the body, has been at firſt employed from motives of cleanlineſs in warm countries. 28

The marriage ceremonies of the Moors that live in tents pretty much reſemble thoſe of the ſame people that live in the cities. In the douhars they are generally moſt brilliant and gay; the ſtrangers that paſs along are invited, and made to contribute to the feaſt; but this is done more from politeneſs than from any mercenary motive. Marriages, &c.

The tribes of the plain generally avoid mixing by marriage with one another: the prejudices that divide theſe people are commonly perpetuated; or, if they are partially healed, they never fail to revive upon trifling occaſions, ſuch as a ſtrayed camel, or the preference of a paſture or a well. Marriages have ſometimes taken place among them, that, ſo far from cementing their differences, have occaſioned the moſt tragical ſcenes. Huſbands have been known to murder their wives, and women their huſbands, to revenge national quarrels.

Parents are not incumbered with their children, however numerous they may be, for they are very early employed in domeſtic affairs; they tend the flocks, they gather wood, and they aſſiſt in ploughing and reaping. In the evening, when they return from the field, all the children of the douhar aſſemble in a common tent, where the Iman, who himſelf can hardly ſpell, makes them read a few ſentences from the Koran written on boards, and inſtructs them in their religion by the light of a fire made of ſtraw, of buſhes, and cow-dung dried in the ſun. As the heat is very great

Morocco.

great in the inland parts of the country, children of both sexes go quite naked till the age of nine or ten.

29 Entertainment of travellers.

The douhars dispersed over the plains are always in the neighbourhood of some rivulet or spring, and they are a kind of inns for the reception of travellers. There is generally a tent erected for their use, if they have not brought one along with them. They are accommodated with poultry, milk, and eggs, and with whatever is necessary for their horses. Instead of wood for fuel, they have the cow-dung, which, when mixed with charcoal, makes a very brisk fire. The salts that abound in the vegetables of warm countries give this dung a consistence which it has not perhaps in northern regions. A guard is always set on the tents of travellers, especially if they are Europeans, because the opinion of their wealth might tempt the avidity of the Moors, who are naturally inclined to thieving.

With respect to the roads, a very judicious policy is established; which is adapted to the character of the Moors, and to their manner of life. The douhars are responsible for robberies committed in their neighbourhood and in sight of their tents: they are not only obliged to make restitution, but it gives the sovereign a pretence for exacting a contribution proportioned to the abilities of the douhar. In order to temper the rigour of this law, they are made responsible only for such robberies as are committed during the day; those that happen after sun-set are not imputed to them, as they could neither see nor prevent them: on this account, people here travel only from sun rising to sun-setting.

30 Markets.

To facilitate the exchange of necessaries, there is in the fields every day except Friday, which is a day of prayer, a public market in the different quarters of each province. The Moors of the neighbourhood assemble to sell and buy cattle, corn, pulse, dried fruits, carpets, haicks, and in short all the productions of the country. This market which is called *Soc*, resembles our fairs. The bustle of the people who go and come, gives a better idea of the manner of life of the Moors than can be had in the cities. The Alcaides, who command in the neighbourhood, always attend these markets with soldiers to keep the peace; as it frequently happens that the grudges which these tribes harbour against one another break out upon such occasions into open violence. The dissolution of the soc is always the presage of some seditious squabble. The skirts of these markets are commonly occupied by merry Andrews, singers, dancers, and other buffoons, who make apes dance to amuse the idle. On one side are barbers and surgeons, to whom the sick are brought to be cured.

31 Of the Moors who dwell in cities.

The Moors who inhabit the cities differ from the others only in having a little more urbanity and a more easy deportment. Though they have the same origin with those of the plains, they affect to decline all intercourse with them. Some writers, without any foundation, have given the name of *Arabs* to the inhabitants of the towns, and that of *Moors* to those of the plains. But the greater part of the cities of this empire are more ancient than the invasion of the Arabs, who themselves lived in tents.

32 Their houses and furniture.

The houses in most of the towns in this empire appear at a little distance like vaulted tombs in a church-yard; and the entrance into the best of them has but a mean appearance. The rooms are generally on the ground floor, and whitened on the outside. As the roofs are quite flat, they serve as *verandos*, where the Moorish women commonly sit for the benefit of the air; and in some places it is possible to pass nearly over the whole town without having occasion to descend into the street.

As the best apartments are all backwards, a stable, or perhaps something worse, is the place to which visitors are first introduced. Upon entering the house, the stranger is either detained in this place or in the street till all the women are dispatched out of the way; he is then allowed to enter a square court into which four narrow and long rooms open by means of large folding doors, which as they have no windows, serve likewise to introduce light into the apartments. The court has generally in its centre a fountain; and if it is the house of a Moor of property, it is floored with blue and white chequered tiling. The doors are usually painted of various colours in a chequered form, and the upper parts of them are frequently ornamented with very curious carved work. None of the chambers have fire-places; and their victuals are always dressed in the court-yard in an earthen stove heated with charcoal. When the visitor enters the room where he is received by the master of the house, he finds him sitting cross-legged and barefooted on a mattress, covered with fine white linen, and placed on the floor or else on a common mat. This, with a narrow piece of carpeting, is in general the only furniture he will meet with in Moorish houses, though they are not destitute of other ornaments. In some, for instance, he will find the walls decorated with looking-glasses of different sizes; in others, watches and clocks in glass-cases; and in some the apartments are hung with the skins of lions or tigers, or adorned with a display of muskets and sabres. In the houses of those who live in the very first style, an European mahogany bedstead, with one or two matresses, covered with fine white linen, is sometimes placed at each end of the room. These, however, are only considered as ornaments, as the Moors always sleep on a mattress or a mat placed upon the floor, and covered only with their *haick* or perhaps a quilt.

As the law of Mahomet strictly proscribes the use of pictures of every description, this delightful species of ornament finds no place in the houses of the Moors.

33 Dress of the men.

The wardrobe of the inhabitants of cities is but little different from that of those who live in tents.— Like the latter, they have a haick, and a hood more or less fine, and have also a hood of coarse European cloth of dark blue for the winter. What farther distinguishes them from the country Moors is, that they wear a shirt and linen drawers, and an upper garment of cotton in summer, and of cloth in winter, which they call a *caftan*. The white or blue hood, the purpose of which seems to be to guard against bad weather, and which is called *bernus*, is likewise a ceremonial part of dress; without which, together with sabre and canjer (or dagger) worn in a bandelier, persons of condition never appear before the emperor.— Obliged as they are to conceal their riches, the Moors wear no jewels; very few have so much as a ring, a watch, or a silver snuff-box. They frequently carry a

rosary

Morocco. rosary in their hand, but without annexing any ideas of devotion to the practice, although they use it to recite the name of God a certain number of times in the day. After these momentary prayers they play with their rosary much the same as the European ladies do with their fans. The Moorish women seldom leave the house, and when they do, are always veiled. The old very carefully hide their faces, but the young and handsome are somewhat more indulgent, that is to say toward foreigners, for they are exceedingly cautious with the Moors. Being veiled, their husbands do not know them in the street, and it is even impolite to endeavour to see the faces of the women who pass; so different are the manners and customs of nations. There are very fine women found among the Moors, especially up the country; those of the northern parts by no means possess the same degree of grace and beauty. As females in warm countries sooner arrive at puberty, they are also sooner old; and this perhaps may be the reason why polygamy has been generally adopted in such climates. Women there sooner lose the charms of youth, while men still preserve their passions and the powers of nature. The Moorish women are not in general very reserved. Climate has a vast influence on the temperament of the body; and licentiousness is there more general and less restrained, tho' as in other places its disorderly pleasures incur its attendant pains; not but that the disease attending illicit amours is less poisonous, and slower in its operations, among the Moors than in Europe because of the heat of the climate, and the great temperance of their mode of living. The women of the south are in general the handsomest, and are said to be so reserved, or so guarded, that their very relations do not enter their houses nor their tents. Yet such is the contradictory custom of nations, that there are tribes in these same provinces among whom it is held to be an act of hospitality to present a woman to a traveller. It may be there are women who dedicate themselves to this species of devotion as to an act of benevolence; for it is impossible to describe all the varieties of opinion among men, or the whims to which the human fancy is subject.

34 Dress of the ladies. The Moorish women who live in cities are, as in other nations, more addicted to shew and finery in dress than those of the country; but as they generally leave the house only one day in the week, they seldom dress themselves. Not allowed to receive male visitors, they remain in their houses employed in their families, and so totally in dishabille that they often wear only a shift, and another coarser shift over the first, tied round their waist, with their hair plaited, and sometimes with, though often without, a cap. When dressed, they wear an ample and fine linen shift, the bosom embroidered in gold; a rich caftan of cloth, stuff, or velvet, worked in gold; and one or two folds of gauze, streaked with gold and silk, round the head, and tied behind so as that the fringes, intermingled with their tresses descend as low as the waist; to which some add a ribband of about two inches broad, worked in gold or pearls, that encircles the forehead in form of a diadem. Their caftan is bound round their waist by a crimson velvet girdle, embroidered in gold with a buckle of gold or silver, or else a girdle of tamboured stuff, manufactured at Fez.

The women have yellow slippers, and a custom of wearing a kind of stocking of fine cloth somewhat large, which is tied below the knee and at the ancle, over which it falls in folds. This stocking is less calculated to show what we call a handsome leg, than to make it appear thick; for to be fat is one of the rules of beauty among the Moorish women. To obtain this quality, they take infinite pains, feed when they become thin on a diet somewhat like forced-meat balls, a certain quantity of which is given them daily; and, in fine, the same care is taken among the Moors to fatten young women as is in Europe to fatten fowls. The reason of a custom like this may be found in the nature of the climate and the quality of the aliments, which make the people naturally meagre. Our slender waists and fine turned ankles would be imperfections in this part of Africa, and perhaps over all that quarter of the globe; so great is the contrast of taste, and so various the prejudices of nations.

The Moors present their wives with jewels of gold, silver, or pearl, but very few wear precious stones; this is a luxury of which they have little knowledge. They have rings in silver or gold; also ear-rings in the form of a crescent, five inches in circumference, and as thick as the end of the little finger. They first pierce their ears, and introduce a small roll of paper, which they daily increase in thickness, till at length they insert the kernel of the date, which is equal in size to the ear-ring. They wear bracelets in gold and solid silver, and silver rings at the bottom of their legs, some of them considerably heavy. The use of white paint is unknown among the Moorish women, and that of red but little. It is much more common to see them dye their eye-brows and eye-lashes, which dye does not add to the beauty of the countenance, but considerably to the fire of the eyes. They trace regular features with henna, of a saffron colour, on their feet, the palm of the hand, and the tip of their fingers.—On their visiting day they wrap themselves in a clean fine haick, which comes over the head, and surrounds the face so as to let them see without being seen.—When they travel, they wear straw hats to keep off the sun; and in some parts of the empire the women wear hats on their visits; which is a fashion peculiar to the tribes coming from the south, who have preserved their customs; for the Moors do not change modes they have once adopted.

The *Negroes*, who constitute a large proportion of the emperor's subjects, and the occasion of whose introduction to this empire has been already mentioned, are better formed than the Moors; and as they are more lively, daring, and active, they are entrusted with an important share in the executive part of government. They constitute in fact the most considerable part of the emperor's army, and are generally appointed to the command of provinces and towns. This circumstance naturally creates a jealousy between them and the Moors, the latter considering the negroes as usurpers of a power which they have no right to assume. Besides those negroes which form the emperor's army, there are a great many others in the country, who either are or have been slaves to private Moors: every Moor of consequence, indeed, has his proportion of them in his service. To the disgrace of Europe, the Moors treat their slaves with humanity, em- 35 Negroes.

 ploying

ploying them in looking after their gardens, and in the domeſtic duties of their houſes. They allow them to marry among themſelves; and after a certain number of years, ſpontaneouſly preſent them with the invaluable boon of liberty. They ſoon are initiated in the Mahometan perſuaſion, though they ſometimes intermix with it a few of their original ſuperſtitious cuſtoms. In every other reſpect they copy the dreſs and manners of the Moors.

36 Renegadoes.

Among the inhabitants of Morocco there is another claſs, of whom we muſt not omit to make mention. Theſe are the *Renegadoes*, or foreigners who have renounced their religion for the faith of Mahomet. Of theſe there are a great number who have been originally Jews: they are held in little eſtimation by the Moors; and would be held in abhorrence by the Jews, if they durſt freely expreſs their averſion. The families of theſe apoſtates are called *Toornadis:* not having at any time married with the Moors, they ſtill preſerve their ancient characteriſticks, and are known almoſt at ſight to be the progeny of thoſe who formerly embraced the Mahometan religion. The Chriſtian renegadoes are but few; and generally are fugitive peculators of Spain, or men fallen from power, who becauſe of their miſconduct, or in deſpair, quit one unfortunate ſituation for another much more deplorable.

37 Jews.

The *Jews* were formerly very numerous in this empire. After being proſcribed in Spain and Portugal, multitudes of them paſſed over to Morocco, and ſpread themſelves through the towns and over the country. By the relations they themſelves give, and by the extent of the places aſſigned them to dwell in, it would appear there were more than 30,000 families, of whom at preſent there is ſcarcely a reſidue of one-twelfth; the remainder either having changed their religion, ſunk under their ſufferings, or fled from the vexations they endured, and the arbitrary taxes and tolls impoſed upon them. The Jews poſſeſs neither lands nor gardens, nor can they enjoy their fruits in tranquillity; they muſt wear only black; and are obliged, when they paſs near moſques or through ſtreets in which there are ſanctuaries, to walk barefoot. The loweſt among the Moors imagines he has a right to ill-treat a Jew: nor dares the latter defend himſelf, becauſe the koran and the judge are always in favour of the Mahometan.—Notwithſtanding this ſtate of oppreſſion, the Jews have many advantages over the Moors; they better underſtand the ſpirit of trade; they act as agents and brokers, and profit by their own cunning and the ignorance of the Moors. In their commercial bargains many of them buy up the commodities of the country to ſell again. Some have European correſpondents; and others are mechanics, ſuch as goldſmiths, tailors, gunſmiths, millers, and maſons. More induſtrious, artful, and better informed than the Moors, the Jews are employed by the emperor in receiving the cuſtoms, coining the money, and in all affairs and intercourſe which the monarch has with the European merchants, as well as in all his negociations with the various European governments.

38 State of knowledge among the Jews.

The Moors, who derive their language and religion from the Arabs, ſeem not in any manner to have participated of their knowledge. United and confounded as thoſe of Morocco have been with the Moors of Spain, the latter of whom cultivated the arts and gave birth to Averroes, and many other great men, the Moors of this empire have preſerved no traces of the genius of their anceſtors. They have no conception of the ſpeculative ſciences. Education conſiſts merely in learning to read and write; and as the revenues of the learned are derived from theſe talents, the prieſts and talbes among them are the ſole depoſitories of this much knowledge; the children of the Moors are taught in their ſchools to read and repeat ſome ſixty leſſons, ſelected from the Koran, which for the ſake of œconomy are written upon ſmall boards. Theſe leſſons being once learned, the ſcholar is ſuppoſed to have obtained ſufficient knowledge to leave ſchool; on this occaſion he rides on horſeback through the city, followed by his comrades, who ſing his praiſes: this to him is a day of triumph; to the ſcholars an incitement to emulation, a feſtival for the maſter, and a day of expence for the parents: for in all countries, wherever there are feſtivals and proceſſions, there alſo are eating and drinking. At Fez there is ſome ſmall degree more of inſtruction to be obtained in the ſchools; and the Moors who are a little wealthy ſend their children thither to have them inſtructed in the Arabic language, and in the religion and laws of their country. Here ſome of them alſo acquire a little taſte for poetry.

The Moors who formerly inhabited Spain gave great application to phyſic and aſtronomy; and they have left manuſcripts behind them which ſtill remain monuments of their genius. The modern Moors are infinitely degenerate; they have not the leaſt inclination to the ſtudy of Science; they know the properties of ſome ſimples; but as they do not proceed upon principle, and are ignorant of the cauſes and effects of diſeaſes, they generally make a wrong application of their remedies. Their moſt uſual phyſicians are their talbes, their fakirs, and their ſaints, in whom they place a ſuperſtitious confidence. Aſtronomy is entirely or almoſt unknown to the Moors: for though they likewiſe wander from place to place, there are few if any among them who have a knowledge of the motion of the heavens, or who are capable from principle to direct their own courſe by obſerving the courſe of the ſtars. They are therefore neceſſarily wholly unable to calculate the eclipſes, which they always interpret to portend evil.

Superſtitious people, indeed, have every where ſuppoſed eclipſes were ſent to preſage ſome calamity.—The Moors being unable to reaſon on the cauſes of ſuch an appearance, imagine the ſun or the moon are in the power of a dragon that ſwallows them; and they offer up prayers that theſe luminaries may be delivered from an enemy ſo cruel and voracious.

Notwithſtanding the Moors have occupied themſelves little in the ſtudy of aſtronomy they have been eager after aſtrology. This imaginary ſcience, which made ſo rapid a progreſs at Rome in deſpite of the edicts of the emperors, may be conceived to make ſtill greater advances among a people wholly ſtupid and ignorant, and ever agitated by the dread of preſent evils, or the hope of a more happy futurity. Magic, the companion of aſtrology, has here alſo found its followers, and is particularly ſtudied by the talbes in the ſouthern parts, who ſucceſsfully uſe it in impoſing upon

 Moriſh credulity with ſtrange dreams and ambiguous forebodings and propheſies.

In ſhort, arts and ſciences ſeem to be almoſt unknown in Morocco; or if at all cultivated, it is the only by the Jews, who indeed are the only induſtrious and ingenious people in the country. The Moors in general may be conſidered as exiſting in the paſtoral ſtate, following only a few mechanical trades, and leaving every thing that requires invention to the Jews, who have likewiſe the principal management of their commercial and pecuniary matters; and even thoſe few of the Moors who are merchants, are obliged to have Jew agents, for the purpoſe of tranſacting their buſineſs.

39 Manufactures and trades.

The Mooriſh manufactures are—The haick, which, as was before obſerved, is a long garment compoſed of white wool and cotton, or cotton and ſilk woven together, and is uſed by the Moors for the purpoſe of covering their under dreſs when they go abroad, which they do by totally wrapping themſelves in it in a careleſs but eaſy matter; ſilk handkerchiefs of a particular kind, prepared only at Fez; ſilks chequered with cotton; carpeting, little inferior to that of Turkey; beautiful matting, made of the palmetto or wild palm tree; paper of a courſe kind; cordovan, commonly called *Morocco leather;* gunpowder of an inferior nature; and long-barrelled muſkets, made of Biſcay iron. The Moors are unacquainted with the mode of caſting cannon; and therefore thoſe few which are now in the country are obtained from Europeans.—The manufacture of glaſs is likewiſe unknown to them; as indeed they make great uſe of earthen ware, and have few or no windows to their houſes, this commodity may be of leſs importance to them than many others. They make butter, by putting the milk into a goat-ſkin, with its ontward coat turned inwards, and ſhaking it till the butter collects on the ſides, when it is taken out for uſe. From this operation it proves always full of hairs, and has an inſipid flavour. Their cheeſe conſiſts merely of curds hardened and dried, and has uniformly a diſagreeable taſte. The bread in ſome of the principal towns, particularly at Tangier and Sallee, is remarkably good, but in many other places it is coarſe, black, and heavy.

The Moors, agreeably to the Jewiſh cuſtom, cut the throats of all the animals they eat, at the ſame time turning their heads towards Mecca, in adoration of their prophet. After ſuffering them to bleed freely, they carefully waſh all the remaining blood away, and divide the meat in ſmall pieces, of about one or two pounds in weight. As they are unacquainted with the invention of pumps, and have but few ſprings, it affords employment to a number of indigent people, who would probably be idle otherwiſe, to carry water in ſkins from the neareſt river or reſervoir, and ſell it to the inhabitants. From their being obliged to tar the ſkins to prevent them from leaking, the water is frequently rendered very unpleaſant.

Their looms, forges, ploughs, carpenters tools, &c. are much upon the ſame conſtruction with the unimproved inſtruments of the ſame kind which are uſed at this time in ſome parts of Europe, only ſtill more clumſily finiſhed. In their work, they attend more to ſtrength than neatneſs or convenience; and, like all other ignorant people, they have no idea that what they do is capable of improvement. It is probable, indeed, that the Moors have undergone no very material change ſince the revolution in their arts and ſciences, which took place ſoon after their expulſion from Spain. Previous to that period, it is well known they were an enlightened people, at a time when the greater part of Europe was involved in ignorance and barbariſm; but owing to the weakneſs and tyranny of their princes, they gradually ſunk into the very oppoſite extreme, and may now be conſidered as but a few degrees removed from a ſavage ſtate.

They uſe no kind of wheel-carriage; and therefore all their articles of burden are tranſported from one place to another on camels, mules, or aſſes. Their buildings, though by no means conſtructed on any fixed principle of architecture, have at leaſt the merit of being very ſtrong and durable. The manner of preparing tabby, of which all their beſt edifices are formed, is the only remains of their ancient knowledge at preſent exiſting. It conſiſts of a mixture of mortar and very ſmall ſtones, beaten tight in a wooden caſe, and ſuffered to dry, when it forms a cement equal to the ſolid rock. There are always unaccountable diſcrepancies and inconſiſtencies in the arts of uncivilized nations. The apartments are, if poſſible, even more inconvenient than thoſe of their neighbours, the Spaniards; but the carved wood-work with which many of them are ornamented, is equal to any in Europe.

Their moſques or places of public worſhip are uſually large ſquare buildings, compoſed of the ſame materials as the houſes. The building conſiſts of broad and lofty piazzas, opening into a ſquare court, in a manner in ſome degree ſimilar to the Royal Exchange of London. In the centre of the court is a large fountain, and a ſmall ſtream ſurrounds the piazzas, where the Moors perform the ceremony of ablution. The court and piazzas are floored with blue and white checquered tiling, and the latter are covered with matting, upon which the Moors kneel while repeating their prayers. In the moſt conſpicuous part of the moſque, fronting the eaſt, ſtands a kind of pulpit, where the talbe or prieſt occaſionally preaches. The Moors always enter this place of worſhip bare-footed, leaving their ſlippers at the door. On the top of the moſque is a ſquare ſteeple with a flag-ſtaff, whither at ſtated hours the talbe aſcends, hoiſts a white flag, and calls the people to prayers, for they have no bells. From this high ſituation the voice is heard at a conſiderable diſtance; and the talbes have a monotonous mode of enunciation, the voice ſinking at the end of every ſhort ſentence, which in ſome meaſure reſembles the ſound of a bell. The moment the flag is diſplayed, every perſon forſakes his employment, and goes to prayers. If they are near a moſque, they perform their devotions within it, otherwiſe immediately on the ſpot where they happen to be, and always with their faces towards the eaſt, in honour of their prophet Mahomet, who it is well known was buried at Medina. The prayer which is generally repeated on theſe occaſions, is a chapter from the Koran, acknowledging the goodneſs of God and Mahomet; and it is accompanied with various geſtures, such as lifting the hands above the head, bowing twice, performing two genuflexions,

40 Religious ceremonies.

nuflexions, bowing again twice, and kiffing the ground. The whole of this ceremony they repeat three times.

Their fabbath is on our Friday, and commences from fix o'clock the preceding evening. On this day they ufe a blue flag inftead of the white one. As it has been prophefied that they are to be conquered by the Chriftians on the fabbath-day, the gates of all the towns and of the emperor's palaces are fhut when at divine fervice on that day, in order to avoid being furprifed during that period. Their talbes are not diftinguifhed by any particular drefs.

The Moors have three folemn devotional periods in the courfe of the year. The firft, which is named *Aid de Cabier*, is held in commemoration of the birth of Mahomet. It continues feven days; during which period, every perfon who can afford the expence kills a fheep as a facrifice, and divides it among his friends. The fecond is the *Ramadan*. This is held at the feafon when Mahomet difappeared in his flight from Mecca to Medino. Every man is obliged at that period to faft (that is, to abftain from animal-food from funrife to fun-fet each day) for 30 days; at the expiration of which time a feaft takes place, and continues a week. The third is named *Llafhare*, and is a day fet apart by Mahomet for every perfon to compute the value of his property, in order for the payment of *zakat*, that is, one-tenth of their income to the poor, and other pious ufes. Although this feaft only lafts a fingle day, yet it is celebrated with far greater magnificence than either of the others.

The Moors compute time by lunar months, and count the days of the week by the firft, fecond, third, &c. beginning from our Sunday. They ufe a common reed for writing, and begin their manufcripts from right to left.

41 Language of the Moors.

The moors of the empire of Morocco, as well as thofe to the northern limits of Africa, fpeak Arabic; but this language is corrupted in proportion as we retire farther from Afia, where it firft took birth; the intermixture which has happened among the African nations, and the frequent tranfmigrations of the Moors, during a fucceffion of ages, have occafioned them to lofe the purity of the Arabic language; its pronunciation has been vitiated, the ufe of many words loft, and other foreign words have been introduced without thereby rendering it more copious: the pronunciation of the Africans, however, is fofter to the ear and lefs guttural than that of the Egyptians. The language, when written, is in effect much the fame at Morocco as at Cairo, except that there are letters and expreffions among the Moors which differ from thofe of the Oriental Arabs, who, however, underftand the Moors in converfation, notwithftanding their vitiated manner of pronouncing. They mutually read each others writings with fome difficulty.

There is a very fenfible difference among the Moors between the Arabic of the learned and the courtiers, and that fpoken by the people in general; and this difference is felt ftill more in the provinces of the fouth or of the eaft, and among the Moors who live in the defarts, where the Arabic is yet farther disfigured by a mixture of foreign tribes,

The Brebes and the Shellu, who appear to have had the fame origin, for they have preferved the fame dialect, fpeak a language which the Moors do not underftand, and which feems to have no analogy with that of the latter. It has been conjectured to be the Punic, or the Numidian; but thefe people write it in Arabic characters. The Brebes count the days of the week like the Moors, and both of them employ Arabic words. The Shellu enumerate the days after the fame method, but in their own language. Both the Bredes and the Shellu denote the months of the year in the fame manner as do the Moors and Arabs, and date from the fame æra; that is to fay, from the year of the Hegira.

The Koran and books of prayer of the Brebes and Shellu are in Arabic; as likewife are their acts and title-deeds, which are written by their talbes or learned men.

42 Their temper and difpofition.

The Moors are naturally of a grave and penfive difpofition, fervid in profeffions of friendfhip, but very infincere in their attachments. They have no curiofity, no ambition of knowledge; an indolent habit, united to the want of mental cultivation, renders them perhaps even more callous than other unenlightened people to every delicate fenfation; and they require more than ordinary excitement to render them fenfible of pleafure or of pain. This languor of fentiment is, however, unaccompanied with the fmalleft fpark of courage or fortitude. When in adverfity, they manifeft the moft abject fubmiffion to their fuperiors; and in profperity their tyranny and pride is infupportable, They frequently fmile, but feldom are heard to laugh loud. The moft infallible mark of internal tranquillity and enjoyment is when they amufe themfelves with ftroking or playing with their beard. When roufed by refentment, their difputes rarely proceed further than violently to abufe each other in the moft opprobrious language. They never fight or box with their fifts like our peafantry; but when a quarrel proceeds to great extremities, they collar each other, and fometimes terminate a difpute by affaffination.

43 Mode of living, manners, &c.

Perfonal cleanlinefs has been confidered as one of thofe circumftances which ferve to mark and determine the civilization of a people. It was in vain that Mahomet enjoined the frequency of ablution as a religious duty to the Moors. Their drefs, which fhould be white, is but feldom wafhed; and their whole appearance evinces that they perform this branch of their religious ceremonies in but a flovenly manner. With this degree of negligence as to their perfons, we may be juftly furprifed to find united a moft fcrupulous nicety in their inhabitations and apartments. They enter their chambers barefooted, and cannot bear the flighteft degree of contamination near the place where they are feated. This delicacy again is much confined to the infides of their houfes. The ftreets receive the whole of their rubbifh and filth; and by thefe means the ground is fo raifed in moft parts the city of Morocco, that the new buildings always ftand confiderably higher than the old.

When a Moor receives his guefts, he never rifes from his feat, but fhakes hands, inquires after their health, and defires them to fit down, either on a carpet or a cufhion placed on the floor for that purpofe. Whatever be the time of day, tea is then brought in on a tea-board with fhort feet. This is the higheft com-

Morocco. compliment that can be offered by a Moor; for tea is a very expenfive and fcarce article in Barbary, and is only drank by the rich and luxurious. Their manner of preparing it is by putting fome green tea, a fmall quantity of tanfey, the fame portion of mint, and a large proportion of fugar (for the Moors drink their tea very fweet) into the tea-pot at the fame time, and filling it up with boiling water. When thefe articles are infufed a proper time, the fluid is then poured into remarkably fmall cups of the beft India china, the fmaller the more genteel, without any milk; and accompanied with fome cakes or fweetmeats, it is handed round to the company. From the great efteem in which this beverage is held by the Moors, it is generally drank by very fmall and flow fips, that its flavour may be the longer enjoyed; and as they ufually drink a confiderable quantity when ever it is introduced, this entertainment is feldom finifhed in lefs time than two hours.

The other luxuries of the Moors are fnuff, of which they are uncommonly fond, and fmoking tobacco, for which the greater part ufe wooden pipes about four feet in length, with an earthen bowl; but the princes or emperor generally have the bowls made of folid gold. Inftead of the indulgence of opium, which, from the heavy duty impofed upon that article by the emperor, is too expenfive to be ufed by the Moors, they fubftitute the *achicha*, a fpecies of flax. This they powder and infufe in water in fmall quantities. The Moors affert, that it produces agreeable ideas; but own that when it is taken to excefs it moft powerfully intoxicates. In order to produce this effect, they likewife mix with their tobacco an herb named in this country *khaf*, which by fmoking, occafions all the inebriating effects of the *achicha*. The ufe of fpirits as well as wine is ftrictly forbidden by the Koran; there are, however, very few among the Moors who do not joyfully embrace every private opportunity of drinking both to excefs.

With refpect to the hours for eating, the people of this country are remarkably regular. Very foon after day-break they take their breakfaft, which is generally a compofition of flour and water boiled thin, together with an herb which gives it a yellow tinge. The male part of the family eat in one apartment and the female in another. The children are not permitted to eat with their parents, but take their meals afterwards with the fervants; indeed in moft other refpects they are treated exactly as fervants or flaves by their parents. The mefs is put into an earthen bowl, and brought in upon a round wooden tray. It is placed in the centre of the guefts, who fit crofs-legged either on a mat or on the floor, and who form a circle for the purpofe. Having previoufly wafhed themfelves, a ceremony always performed before and after meals, each perfon with his fpoon attacks vigoroufly the bowl, while they diverfify the entertainment by eating with it fruit or bread. At 12 o'clock they dine; performing the fame ceremonies as at breakfaft. For dinner, from the emperor down to the peafant, their difh is univerfally *coofcoofco*, the mode of preparing which has been already defcribed. The difh is brought in upon a round tray and placed upon the floor, round which the family fit as at breakfaft, and with their fingers commit a violent affault on its contents: they are at the fame time, however, attended by a flave or domeftic, who prefents them with water and a towel occafionally to wafh their hands. From the want of the fimple and convenient invention of knives and forks, it is not uncommon in this country to fee three or four people pulling to pieces the fame piece of meat, and afterwards with their fingers ftirring up the pafte or *coofcoofoo*, of which they often take a whole handful at once into their mouth. At fun-fet they fet upon the fame difh; and indeed fupper is their principal meal.

Such is the general mode of living among the principal people in towns. There are confiderable multitudes, however, who do not fare fo well, but are obliged to content themfelves with a little bread and fruit inftead of animal food, and to fleep in the open ftreets. This kind of exiftence feems ill calculated to endure even in an active ftate; far more fevere muft it therefore be to thofe who exercife the laborious employment of couriers in this country, who travel on foot a journey of 300 or 400 miles at the rate of between 30 or 40 miles a-day, without taking any other nourifhment than a little bread, a few figs, and water, and who have no better fhelter at night than a tree. It is wonderful with what alacrity and perfeverance thefe people perform the moft fatiguing journeys at all feafons of the year. There is a regular company of them in every town, who are ready to be difpatched at a moment's warning to any part of the country their employers may have occafion to fend them. They conftitute in this empire the only mode of conveyance for all public and private difpatches; and as they are well known in the place to which they belong, they are very punctual in delivering every thing that is put into their hands. From their fteady pace in travelling, at the rate of about four miles an hour, and from their being able to pafs over parts which from the mountainous ftate of the country, and from the want of good roads, perfons on horfeback would find inacceffible, they are indeed by far the moft expeditious meffengers that could be employed.

As none but the very vulgar go on foot in this country, for the purpofe of vifiting, mules are confidered as more genteel than horfes; and the greateft pride of a Moor is to have fuch as walk remarkably faft, and to keep his footmen, of which the number is proportionable to the rank and confequence of the mafter, on a continued run.

As the Moors are not fond of admitting men into their houfes except upon particular occafions, if the weather is fine they place a mat, and fometimes a carpet, on the ground before their door, feat themfelves upon it crofs-legged, and receive their friends, who form a circle, fitting in the fame manner, with their attendance on the outfide of the groupe. Upon thefe occafions they either drink tea or fmoke and converfe. The ftreets are fometimes crowded with parties of this kind; fome engaged in playing at an inferior kind of chefs or drafts, at which they are very expert; but the majority in converfation. The people of this country, indeed, are fo decidedly averfe to ftanding up, or walking about, that if only two or three

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three people meet, they squat themselves down in the first clean place they can find, if the conversation is to hold but for a few minutes.

The manner of salutation among the Moors is when two equals meet, by a quick motion they shake hands, and afterwards kiss each other's hand. When an inferior meets a superior, such as an officer of rank, a judge, or governor, he kisses that part of his haick which covers the arm; and sometimes, as a higher mark of respect, he will kiss his feet. But the compliment due to the emperor, or any of the princes of the blood, is to take off the cap or turban, and to prostrate the head to the ground. When two particular friends or relations meet, they anxiously embrace and kiss each other's faces and beards for a few minutes, make a number of enquiries about the health of each party, as well as that of their families, but seldom allow time for a reply.

44 Their amusements

The Moors have in general but few amusements; the sedentary life they lead in cities is little variegated except by the care they take of their gardens, which are rather kept for profit than pleasure. Most of these gardens are planted with the orange, the lemon tree, and the cedar, in rows, and in such great quantities, that the appearance is rather that of a forest than that of a garden. The Moors sometimes, though rarely, have music in these retreats: a state of slavery but ill agrees with the love of pleasure: the people of Fez alone, either from a difference in education, or because their organs and sensibility are more delicate, make music a part of their amusements. There are not in Morocco, as in Turkey, public coffee-houses, where people meet to enquire the news of the day; but instead of these, the Moors go to the barbers shops, which in all countries seem to be the rendezvous of Newsmongers. These shops are surrounded by benches; on which the customer, the inquisitive, and the idle, seat themselves; and when there are no more places vacant, they crouch on the ground like monkeys.

Showmen and dancers come often into the towns; round whom the people assemble and partake of the amusement for a very trifle. There are also a kind of wandering historians: the vulgar, who cannot read, and who every where are eager to hear extraordinary relations, are the more assiduous in attending these narrators, as want of more extensive information prevents the tale-teller remaining above a week in a place.

A common diversion in the towns where there are soldiers, as well as in the country, is what the Moors call the game of gun-powder; a kind of military exercise that is the more pleasing to these people, inasmuch as, by the nature of their government, they all are, or are liable to become, soldiers, therefore all have arms and horses. By explosions of powder, too, they manifest their festivity on their holidays. Their game of gun-powder consists in two bodies of horse, each at a distance from the other, galloping in successive parties of four and four, and firing their pieces charged with powder. Their chief art is in galloping up to the opposite detachment, suddenly stopping, firing their muskets, facing about, charging and returning to the attack; all which manœuvers are imitated by their opponents. The Moors take great pleasure in this amusement, which is only an imitation of their military evolutions.

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The common topics for conversation among the Moors, are the occurrences of the place, religion, their women, but above all their horses. This last topic, indeed, appears to occupy by far the greatest portion of their attention. These animals are seldom kept in stables in Morocco. They are watered and fed only once a-day, the former at one o'clock at noon, and the latter at sun-set; and the only mode which they use to clean them is by washing them all over in a river two or three times a week, and suffering them to dry themselves.

45 Management of horses.

Notwithstanding the attachment which the Moors manifest to their horses, they most certainly use them with great cruelty. Their highest pleasure, and one of their first accomplishments, is, by means of long and sharp spurs, to make the horse go full speed, and then to stop him instantaneously; and in this they certainly manifest uncommon dexterity. The iron-work of their bridles is so constructed, that by its pressure on the horse's tongue and lower jaw, with the least exertion of the rider, it fills his mouth full of blood; and if not used with the utmost caution, throws him inevitably on his back. The bridle has only a single rein, which is so very long, that it serves the purpose of both whip and bridle. The Moorish saddle is in some degree similar to the Spanish, but the pummel is still higher and more peaked. Their stirrups, in which they ride very short, are so formed as to cover the whole of the foot. They either plate or gild them according to the dignity, opulence or fancy of the possessor. Their saddles which are covered with red woollen cloth, or if belonging to a person of consequence with red satin or damask, are fastened with a strong girth round the body in the European style, and another round the shoulders. The Moors frequently amuse themselves by riding with the utmost apparent violence against a wall; and a stranger would conceive it impossible for them to avoid being dashed to pieces, when just as the horse's head touches the wall, they stop him with the utmost accuracy.

Like all other barbarous nations, the Moors are passionately fond of music, and some few have a taste for poetry. Their slow airs for want of that variety which is introduced when the science has attained a degree of perfection, have a very melancholy sameness; but some of their quick tunes are beautiful and simple, and partake in some degree of the characteristic melody of the Scotch airs. The poetry of their songs, the constant subject of which is love, though there are few nations perhaps who are less sensible of that passion, has certainly less merit than the music.

46 Love of music.

Their instruments are a kind of hautboy, which differs from ours only in having no keys; the mandoline, which they have learnt to play upon from their neighbours the Spaniards; another instrument, bearing some resemblance to a violin, and played upon in a similar manner, but with only two strings; the large drum, the common pipe, and the tabor. These united, and accompanied with a certain number of voices, upon many occasions form a band, though solo music is more common in this unsocial country. Upon all days of rejoicing, this kind of music, repeated volleys of musketry, either by men on horseback or on foot and

Morocco. and in the evening a grand attack upon the coofcoofo, conftitute the principal part of the public entertainments.

The Moors marry very young, many of their females not being more than 12 years of age at their nuptials. As Mahometans, it is well known that their religion admits of polygamy to the extent of four wives, and as many concubines as they pleafe: but if we except the very opulent, the people feldom avail themfelves of this indulgence, fince it entails on them a vaft additional expenfe in houfe-keeping, and in providing for a large family. In contracting marriage, the parents of both parties are the only agents:
47 Marriage ceremonies and the intended bride and bridegroom never fee each other till the ceremony is performed. The marriage-fettlements are made before the cadi, and then the friends of the bride produce her portion, or if not the hufband agrees to fettle a certain fum upon her in cafe he fhould die, or divorce her on account of barrennefs, or any other caufe. The children of the wives have all an equal claim to the effects of the father and mother, but thofe of the concubines can each only claim half a fhare.

When the marriage is finally agreed upon, the bride is kept at home eight days, to receive her female friends, who pay congratulatory vifits every day. At the fame time a talbe attends upon her, to converfe with her relative to the folemn engagement on which fhe is about to enter; on thefe occafions he commonly accompanies his admonitions with finging a pious hymn which is adapted to the folemnity. The bridegroom, on the other hand, receives vifits from his male friends in the morning, and in the evening rides through the town accompanied by them, fome playing on hautboys and drums, while others are employed in firing volleys of mufketry. In all their feftivals, the difcharge of mufketry indeed forms a principal part of the entertainment. Contrary to the European mode, which particularly arms at firing with exactnefs, the Moors difcharge their pieces as irregulary as poffible, fo as to have a continual fucceffion of reports for a few minutes.

On the day of the marriage, the bride in the evening is put into a fquare or octagonal cage about 12 feet in circumference, which is covered with fine white linen and fometimes with gauzes and filks of various colours. In this vehicle, which is placed on a mule, fhe is paraded round the ftreets, accompanied by her, relations and friends fome carrying lighted torches, others playing on the hautboys, and a third party again firing volleys of mufketry. In this manner fhe is carried to the houfe of her intended hufband, who returns about the fame time from performing fimilar ceremonies. On her arrival fhe is placed in an apartment by herfelf, and her hufband is introduced to her alone for the firft time, who finds her fitting on a filk or velvet cufhion, fuppofing her to be a perfon of confequence, with a fmall table before her, upon which are two wax candles lighted. Her fhift, or more properly fhirt, hangs down like a train behind her, and over it is a filk or velvet robe with clofe fleeves, which at the breaft and wrifts is embroidered with gold; this drefs reaches fomething lower than the calf of the leg. Round her head is tied a black filk fcarf, which hangs behind as low as the ground. Thus attired, the bride fits with her hands over her eyes, when her hufband appears and receives her as his wife without any further ceremony; for the agreement made by the friends before the cadi, is the only fpecific contract which is thought neceffary.

If the hufband fhould have any reafon to fufpect that his wife has not been ftrictly virtuous, he is at liberty to divorce her and take another. For fome time after marriage, the family and the friends are engaged in much feafting, and a variety of amufements, which laft a longer or fhorter time according to the circumftances of the parties. It is ufually cuftomary for the man to remain at home eight days and the woman eight months after they are firft married; and the woman is at liberty to divorce herfelf from her hufband, if fhe can prove that he does not provide her with a proper fubfiftence. If he curfes her, the law obliges him to pay her, for the firft offence eight ducats; for the fecond, a rich drefs of ftill greater value; and the third time fhe may leave him entirely. He is then at liberty to marry again in two months.

Women fuffer but little inconvenience in this country from child-bearing; they are frequently up the next day, and go through all the duties of the houfe with the infant upon their backs. In celebrating the rite of circumcifion, the child is dreffed very fumptuoufly; and carried on a mule, or, if the parents are in poor circumftances, on an afs, accompanied with flags flying and muficians playing on hautboys and beating drums. In this manner they proceed to the mofque, where the ceremony is performed. Children as foon as they can be made in the leaft degree ufeful, are put to the various kinds of labour adapted to their age and ftrength. Others, whofe parents are in better circumftances, are fometimes fent to fchool: and thofe who are intended for the church, ufually continue their ftudies till they have nearly learnt the Koran by rote. In that cafe, they are enrolled among the talbes, or learned men of the law; and upon leaving fchool are paraded round the ftreets on a horfe, accompanied by mufic, and a large concourfe of people.

48 Circumcifion.

49 Education of children.

When any perfon dies, a certain number of women are hired for the purpofe of lamentation; in the performance of which, nothing can be more grating to the ear, or more unpleafant, than their frightful moans, or rather howlings; at the fame time, thefe mercenary mourners beat their heads and breafts, and tear their cheeks with their nails. The bodies are ufually buried a few hours after death. Previous to interment, the corpfe is wafhed very clean, and fewed up in a fhroud, with the right hand under the head, which is pointed towards Mecca, it is carried on a bier, fupported upon mens fhoulders, to the burying place, which is always, with great propriety, on the outfide of the town, for they never bury their dead in the mofques, or within the bounds of an inhabited place. The bier is accompanied by numbers of people, two a breaft, who walk very faft, calling upon God and Mahomet, and finging hymns adapted to the occafion. The grave is made very wide at the bottom and narrow at the top, and the body is depofited without any other ceremony than finging and praying in the fame manner as on their way to the grave. They have no tombs in this country, but long and plain ftones; and it is frequently cuftomary for the female friends

50 Funeral rites.

friends of the departed to weep over their graves for several days after their funeral.

51
Absurd conduct of the European powers towards Morocco.

It has often been thought surprising, that the Christian powers should suffer their marine to be insulted by those barbarians, who take the ships of all nations with whom they are not at peace, or rather who do not pay them a subsidy either in money or commodities. This forbearance has been accounted for no otherwise than by supposing, first, that a breach with them might provoke the Porte, who pretends to be their lord paramount; secondly, that no Christian power would be fond of seeing Algiers, and the rest of that coast, in possession of another; and, thirdly, that nothing could be got by a bombardment of any of their towns, as the inhabitants would instantly carry their effects to their deserts and mountains, so that the benefit resulting from the conquest must be tedious and uncertain.

The first reason is so obviously absurd as to require no answer; in regard to the second and third suppositions, it may be observed, that there is no necessity for taking possession of those coasts by any European power whatever. The object ought to be, not to conquer, but to render impotent, those piratical states; not to profit by plundering them, but to quash their piracies, and prevent them from being longer the nuisances and pests of the Mediteranean. Than which according to the best informed travellers, there can be nothing more easy. Hardly any force of armament would be necessary for the purpose; would the Europeans merely leave them to their own resources, and with-hold those supplies with which they have been in use to furnish them, contrary as well to good policy as to the interests of humanity. M. Lempriere †, speaking of the emperor of Morocco (1790) observes, that "nothing but gross neglect or inexcusable ignorance could induce the European princes in general to remain in a kind of tributary state to a prince who had neither an army nor a fleet which deserved the name, and a people whose disposition is less united to enterprise than perhaps any other. What had they to fear from him? His whole fleet consisted only of a few small frigates and row-boats, ill managed and worse manned, the whole of which might have been destroyed in one day by two or three well appointed European frigates. The entrances of those ports where he laid up his shipping, if we except Tangier and Larache, are so continually choaking up with sand, that in a short time they will only admit fishing-boats, or the very smallest craft. The towns are none of them regularly fortified except Mogodore, and that hardly produces half a dozen of men who understand the least of working the guns. And yet this contemptible power gives laws to all the coasts of Portugal and Spain, and may be said in some measure to command the entrance of the Mediterranean.

† Tour, p. 233.

"It may be said, he was too trifling a power to notice; if so, why lavish immense presents for the purpose of keeping him in temper? Those who imagined they secured his friendship by these means, were much mistaken; on the contrary, they only added fuel to that flame of avarice which was not to be extinguished. If he was one day presented with a frigate, he asked for two the next; and the more his requests were indulged, the more his inordinate desires were increased. It is well known to those who have been conversant with the Moors, that to secure their friendship, you must first assert your own superiority; and then if you make them a trifling present, its value, is trebled in their estimation. The same disposition would have been found in the late emperor as in the common Moor. So far from courting an alliance, it would rather have been good policy at once to quarrel with him; the loss of a few towns, and particularly Mogodore, to which he was much attached, from its being raised under his own auspices, would soon have reduced him to good humour and submission."

Shipwreck of M. Brisson.

Another intelligent traveller, M. Brisson*, observes how extraordinary it is, that a prince so little to be dreaded as the emperor of Morocco should oblige the different powers of Europe to send ambassadors to him, and that he should even dictate laws to them. There is not a single sovereign who dares to send a representative to his court without making him at the same time considerable presents; and what envoy would present himself without having his hands full? How happens it that the consuls have not by common consent, represented to their respective sovereigns, that the emperor of Morocco becomes every day more and more powerful by the supplies which they themselves furnish him? Twenty years ago this prince was absolutely destitute of resources. He had neither materials nor any place for casting cannons; and he was equally in want of wood for building ships, of ropes, of nails, and even of workmen. It is France and other European powers that assist him, else the emperor of Morocco would be of little consideration. His superb batteries of brass cannons, 24, 36, and 48 pounders, were furnished by Holland, Spain, England, and France. England has done more than other nations, by selling him those beautiful cannons which were taken on the floating batteries. Mogodore is built in an advantageous situation, its batteries are well disposed, and there are cannon at each embrasure; but they are there only in a manner for show, as they have no carriages, and are supported only by brick-work. There are no workmen in the country capable of mounting them on carriages, nor is there wood proper for making them. Did a few vessels only wait for the sailing of those small frigates, which are almost all unfit for sea except only two, nothing would be easier than to prevent them from returning, and to block up the ports of Mogodore, Rabat, and Sallee. What would become of his commerce, and above all his marine, did the Christian princes cease to assist him, contrary to the interests of humanity? Would England and Spain unite only for a moment, Tangiers, his most beautiful port, would soon be so far ruined, that it could not afford shelter to his subjects, who, destitute of ships, would soon be obliged to give over their piracies. If the consuls of different nations have never made these observations, and if they have never pointed out the means of curbing the insolence of the emperor of Morocco, it is because they are at the head of the commerce which these different powers carry on in that part of the world. I can positively assert, that these representatives, instead of furnishing their courts with the means of diminishing the power of the emperor, never cease to add to his strength, and to incite him to make new

52
Avarice and intrigues of their consuls.

new pretensions. How much we assist these pirates, to hurt the advantageous trade which we might carry on? Their situation renders them very dangerous; but if we leave them only their situation, it would be impossible for them to profit much by it. Let impartial people pay a visit to that country, let them speak with the same sincerity as I do; and they will no doubt be convinced, that the emperor of Morocco, of all the princes in the world, would be the least able to do mischief, did the sovereigns of Europe cease to furnish him with succours."

53 Description of the city of Morocco.

Morocco, a city of the kingdom of Morocco in Barbary, lying about 120 miles to the north of Tarudant, 90 to the east of Mogodore, and 350 to the south of Tangier. It is situated in a beautiful valley, formed by a chain of mountains on the northern side, and those of the Atlas, from which it is distant about 20 miles on the south and east. The country which immediately surrounds it is a fertile plain, beautifully diversified with clumps of palm trees and shrubs, and watered by small and numerous streams which descend from Mount Atlas. The emperor's out-gardens, which are situated at the distance of about five miles to the south of the city, and are large plantations of olives walled in, add considerably to the beauty of the scene.

Morocco, though one of the capitals of the empire (for there are three, Morocco, Mequinez, and Fez), has nothing to recommend it but its great extent and the royal palace. It is enclosed by remarkably strong walls built of tabby, the circumference of which is about eight miles. On these walls there are no guns mounted; but they are flanked with square towers, and surrounded by a wide and deep ditch. The city has a number of entrances, consisting of large double porches of tabby in the Gothic style, the gates of which are regularly shut every night at certain hours. As polygamy is allowed by the Mahometan religion, and is supposed in some degree to affect population, it would be difficult to form any computation near the truth with respect to the number of inhabitants which this city may contain. The mosques, which are the only public buildings, except the palace worth noticing at Morocco, are more numerous than magnificent; one of them is ornamented with a very high and square tower, built of cut stone, which is visible at a considerable distance from the city. The streets are very narrow, dirty and irregular, and many of the houses are uninhabited and falling to ruin. Those which are decent and respectable in their appearance are built of tabby, and enclosed in gardens. That of the effendi or prime minister (according to Mr Lempriere, from whose *Tour* * this account is transcribed), was among the best in Morocco. This house, which consisted of two stories, had elegant apartments both above and below, furnished in a style far superior to any thing our author ever saw in that country. The court, into which the lower apartments opened, was very neatly paved with glazed blue and white tiling, and had in its centre a beautiful fountain. The upper apartments were connected together by a broad gallery, the ballusters of which were painted of different colours. The hot and cold baths were very large, and had every convenience which art could afford. Into the garden, which was laid out in a tolerably neat style, opened a room adjoining to the house, which had a broad arched entrance but no door, beautifully ornamented with chequered tiling; and at both ends of the apartment the walls were entirely covered with looking-glasses. The flooring of all the rooms was covered with beautiful carpeting, the walls ornamented with large and valuable looking glasses, intermixed with watches and clocks in glass-cases. The ceiling was carved woodwork, painted of different colours; and the whole was in a superior style of Moorish grandeur. This and a few others are the only decent habitations in Morocco. The generality of them serve only to impress the traveller with the idea of a miserable and deserted city.

* Published in 1791.

The Elcaisseria is a particular part of the town where stuffs and other valuable articles are exposed to sale. It consists of a number of small shops, formed in the walls of the houses, about a yard from the ground, of such an height within as just to admit a man to sit in one of them cross-legged. The goods and drawers are so arranged round him, that when he serves his customers, who are standing all the time out in the street, he can reach down any article he wants without being under the necessity of moving. These shops, which are found in all the other towns of the empire, are sufficient to afford a striking example of the indolence of the Moors. There are three daily markets in different parts of the town of Morocco where provisions are sold, and two weekly fairs or markets for the disposal of cattle. The city is supplied with water by means of wooden pipes connected with the neighbouring streams, which empty themselves into reservoirs placed for the purpose in the suburbs, and some few in the centre of the town.

The castle is a large and ruinous building, the outer walls of which enclose a space of ground about three miles in circumference. It has a mosque on the top of which are three large balls, formed, as the Moors allege, of solid gold. The castle is almost a town of itself; it contains a number of inhabitants, who in some department or other are in the service of the emperor, and all under the direction of a particular alcaide, who is quite independent of the governor of the town. On the outside of the castle, between the Moorish town and the Jewdry are several small distinct pavilions, inclosed in gardens of orange trees, which are intended as occasional places of residence for such of the emperor's sons or brothers as happen to be at Morocco. As they are covered with coloured tiling, they have at a small distance rather a neat appearance; but upon approaching or entering them, that effect in a great measure ceases.

The Jews, who are at this place pretty numerous, have a separate town to themselves, walled in, and under the charge of an alcaide, appointed by the emperor. It has two large gates, which are regularly shut every evening about nine o'clock; after which time no person whatever is permitted to enter or go out of the Jewdry till they are opened again the following morning. The Jews have a market of their own; and when they enter the Moorish town, castle, or palace, they are always compelled to be bare footed.

The palace, is an ancient building, surrounded by a square wall, the height of which nearly excludes from the view of the spectator the other buildings. Its principal gates are constructed with Gothic arches, composed of cut stone, which conduct to several open and spacious courts; through these it is necessary to pass before we reach any of the buildings. These open courts were used by the late emperor for the purposes of transacting public business and exercising his troops. The habitable part consists of several irregular square pavilions, built of tabby, and whitened over; some of which communicate with each other, others are distinct, and most of them receive their names from the different towns of the empire. The principal pavillion is named by the Moors the *douhar*, and is more properly the palace or seraglio than any of the others. It consists of the emperor's place of residence and the Harem, forming altogether a building of considerable extent. The other pavilions are merely for the purposes of pleasure or business, and are quite distinct from the douhar. The *Mogodore* pavilion so named from the late emperor's partiality to that town, has by far the fairest claim to grandeur and magnificence. This apartment was the work of Sidi Mahomet, and is lofty and square. It is built of cut stone, handsomely ornamented with windows, and covered with varnished tiles of various colous; and its elegance and neatness, contrasted altogether with the simplicity and irregularity of the other buildings, produce a most striking effect. In the inside, besides several other apartments, we find in the pavilion a spacious room floored with blue and white chequered tiling, its ceiling covered with curiously carved and painted wood, and its stuccoed walls variously ornamented with looking-glasses and watches, regularly disposed in glass-cases. To this pavilion the late emperor manifested an exclusive preference, frequently retiring to it both for the purposes of business and of recreation. The apartments of the emperor have in general a much smaller complement of furniture than those of the Moors in the inferior walks of life. Handsome carpeting, a matress on the ground covered with fine linen, a couch, and a couple of European bedsteads, are the principal articles they contain. The gardens within the walls of the palace, of which he has several, are very neat; they contain orange and olive trees, variously disposed and arranged, and intersected with streams of water, fountains, and reservoirs. Those on the outside are nothing more than large tracts of ground, irregularly planted with olives; having four square walks, and surrounded by walls.

Morocco or *Marroquin*, the skin of a goat, or some other animal resembling it, dressed in sumac or galls, and coloured of any colour at pleasure; much used in bookbinding, &c. The name is ordinarily derived from the kingdom of Morocco, whence it is supposed the manner of preparing these skins was first borrowed. There are Morocco skins brought from the Levant, Barbary, Spain, Flanders, and France; red black, yellow, blue, &c. For the manner of preparing them, see Leather.

MOROCHTHUS, in natural history, an indurated clay called by us *French chalk;* serving taylors and others to mark with. The ancients esteemed it as an astringent, prescribing it in the cholic, hæmorrhagies, and other fluxes.

MORON, a town of Spain, in Andalusia, seated in a pleasant fertile plain, and in the neighbourhood is a mine of precious stones. It is 30 miles south-east of Seville. W. Long. 5. 20. N. Lat. 37. 0.

MORPETH, a handsome town of Northumberlond, 14 miles from Newcastle, 286 miles from London, is an ancient borough by prescription, with a bridge over the Wansbeck. It had once an abbey and a castle, now in ruins, situated about a quarter of a mile south of the town and river Wansbeck, on an eminence which overlooks them both. The market-place is conveniently situated near the centre of the town; and an elegant town-house was built by the Carlisle family in 1714, in which the quarter-sessions is held for the county. It it built of hewn-stone, with a piazza. The church being a quarter of a mile distant from the town, a tower containing a good ring of bells stands near the market-place. Near the bridge is the county gaol, a modern structure. Here are a free grammar-school, a chapel near the river on the scite of a chantry that was granted for the support of the foundation of the school, which was part of the old structure, and an hospital for infirm people. In 1215, the townsmen themselves burnt their town, out of pure hatred to king John, that he migh find no shelter there. Here is a good market on Saturday for corn, cattle, and all necessary provisions; and there is another on Wednesday, the greatest in England except Smithfield, for live cattle. This is a post town and a thoroughfare, with many good inns, and plenty of fish; and here are several mills.—The earl of Carlisle's steward holds a court here twice a-year, one of them the Monday after Michaelmas, when four persons are chosen by the free burgesses, who are about 107, and presented to the steward, who names two of them to the bailiffs, who, with seven aldermen, are its governors for the year ensuing. Its fairs are on Wednesday, Thursday, and Friday before Whitsunday, and the Wednesday before July 22. It sends two members to parliament.

MORPHEUS, in fabulous history, the god of sleep, or, according to others, one of the ministers of Somnus. He caused sleepiness, and represented the forms of dreams. Ovid styles him the kindest of the deities; and he is usually described in a recumbent posture, and crowned with poppies.

MORRERI (Lewis), author of the Historical Dictionary, was born at Barge-mont in Provence, 1643. He learned rhetoric and philosophy at Aix, and divinity at Lyons. At 18 years of age he wrote a small piece, intitled *Le pays d'Amour*, and a collection of the finest French poems intitled *Doux plaisirs de la Poesie.* He learned Spanish and Italian; and translated out of Spanish into French the book intitled *La Perfection Chretienne de Rodriguez.* He then refined the Saints Lives to the purity of the French tongue. Being ordained priest, he preached at Lyons, and undertook, when he was but 30 years of age, a new Historical Dictionary, printed at Lyons in one vol. folio, 1673. But his continual labour impaired his health; so that he died in 1680, aged 37. His second volume was published after his death; and four more volumes have since been added. He left some other works behind him.

MORRHINA vasa, were a sort of cups or vases made use of by the ancients for drinking out of, and other

other purposes. Authors are not agreed as to the substance of which they were made. Some say it was a stone; some assert that it was a fluid condensed by being buried under ground. All that we know concerning it is, that it was known by the name of *Murrha*, and that Heliogabalus's chamber pot was made of it. The word is sometimes written *myrrhina*.

MORRISE-DANCES. See *Moresque-Dances*.

MORS, DEATH, one of the infernal deities, born of Night without a father. She was worshipped by the ancients with great solemnity. She was not represented as an actually existing power, but as an imaginary being. Euripides introduces her in one of his tragedies on the stage. The moderns represent her as a skeleton armed with a scythe and a scymetar.

MORSE, in zoology. See TRICHECUS.

MORTALITY, a term frequently used to signify a contagious disease, which destroys great numbers of either men or beasts.

Bills of MORTALITY, are accounts or registers specifying the numbers born, married, and buried in any parish, town or district. In general they contain only these numbers; and, even when thus limited, are of great use, by showing the degrees of healthiness and prolificknefs, and the progress of population in the places where they are kept. It is therefore much to be wished, that such accounts had been always correctly kept in every kingdom, and regularly published at the end of every year. We should then have had under our inspection the comparative strength of every kingdom, as far as it depends on the number of inhabitants, and its increase or decrease at different periods. But such accounts are rendered more useful, when they include the ages of the dead, and the distempers of which they have died. In this case they convey some of the most important instructions, by furnishing us with the means of ascertaining the law which governs the waste of human life, the values of annuities dependent on the continuance of any lives, or any survivorships between them, and the favourableness or unfavourableness of different situations to the duration of human life. There are but few registers of this kind; nor has this subject, though so interesting to mankind, ever engaged much attention till lately. The first bills containing the ages of the dead were those for the town of Breslaw in Silesia. It is well known what use has been made of these by Dr Halley, and after him by De Moivre. A table of the probabilities of the duration of human life at every age, deduced from them by Dr Halley, has been published in the Philosophical Transactions, (see the Abridgement, vol. iii. p. 669.) and is the first table of this sort that has ever been published. Since the publication of this table, similar bills have been established in a few towns of Great Britain, particularly in London, in the year 1728, and at Northampton in 1735.

Two improvements of these registers have been proposed: the first is, that the sexes of all that die in every period of life should be specified in them, under the denomination of *boys, married men, widowers*, and *bachelors;* and of *girls, married women, widows*, and *virgins*. The second is, that they should specify the numbers of both sexes dying of every distemper in every month, and at every age. See the end of the 4th essay in Dr Price's Treatise on Reversionary Payments. Registers of mortality thus improved, when compared with records of the seasons, and with the circumstances that discriminate different situations, might contribute greatly to the increase of medical knowledge; and they would afford the necessary data for determining the difference between the duration of human life among males and females; for such a difference there certainly is much in favour of females, as will appear from the following facts.

At Northampton, though more males are born than females, and nearly the same number die; yet the number of living females appeared, by an account taken in 1746, to be greater than the number of males, in the proportion of 2301 to 1770, or 39 to 30.

At Berlin it appeared, from an accurate account which was taken of the inhabitants in 1747, that the number of female citizens exceeded the number of male citizens in the proportion of 459 to 391. And yet out of this smaller number of males, more had died for 20 years preceding 1751, in the proportion of 19 to 17.

At Edinburgh, in 1743, the number of females, was to the number of males as 4 to 3. (See Maitland's History of Edinburgh, p. 220.) But the females that died annually from 1749 to 1758, were to the males in no higher proportion than $3\frac{1}{5}$ to 3.

He that will take the pains to examine the accounts in Phil. Transf. abr. vol. vii. part iv. p. 46, &c. will find, that though in the towns there enumerated, the proportion of males and females born is no higher than 19 to 18, yet the proportion of boys and girls that die is 8 to 7; and that, in particular, the still-born and chrysom males are to the still-born and chrysom females as 3 to 2.

In 39 parishes of the district of Vaud in Switzerland, the number of males that died during ten years before 1766 was 8170; of females 8167; of whom the numbers that died under one year of age were 1817 males and 1305 females; and under ten years of age, 3099 males and 2598 females. In the beginning of life, therefore, and before any emigrations can take place, the rate of mortality among males appears to be greater than among females. And this is rendered yet more certain by the following accounts. At Vevey, in the district of Vaud just mentioned, there died in the course of 20 years, ended at 1764, in the first month after birth, of males 135 to 89 females; and in the first year 225 to 162. To the same effect it appears from a table given by Susmilch, in his Gottliche Ordnung, vol. ii. p. 317, that in Berlin 203 males die in the first month, and but 168 females; and in the first year, 489 to 395; and also, from a table of Struycks, that in Holland 396 males die in the first year to 306 females.

The authorities for the facts here mentioned, and much more on this subject, may be found in the 4th essay in Dr Price's Treatise on Reversionary Payments, and in the supplement at the end of that treatise.

We shall here only add the following table, taken from a memoir of Mr Wargentin's, published in the collection of the Memoirs of the Royal Academy of Sciences at Stockholm, printed at Paris in 1772.

In

Mortality.

In all Sweden for nine years, ended in 1763, the proportion of females to males that died out of a given number living, was

Under the age of one year	—	1000 to	1099
From 1 to 3 years of age	—	1000	1022
3 5	——	——	1042
5 10	——	——	1074
10 15	——	——	1080
15 20	——	——	1097
20 25	——	——	1283
25 30	——	——	1161
30 35	——	——	993
35 40	——	——	1159
40 45	——	——	1115
45 50	——	——	1340
50 55	——	——	1339
55 60	——	——	1292
60 65	——	——	1115
65 70	——	——	1080
70 80	——	——	1022
80 90	——	——	1046
Above 90	——	——	1044

Regiſters of mortality on the improved plan before mentioned, were eſtabliſhed in 1772 at Cheſter, and alſo in 1773 at Warrington in Lancaſhire; and they are ſo comprehenſive and correct, that there is reaſon to expect they will afford much inſtruction on the ſubject of human mortality, and the value of lives.

But the country moſt diſtinguiſhed in this reſpect is Sweden: for in that kingdom exact accounts are taken of the births, marriages, and burials, and of the numbers of both ſexes that die at all ages in every town and diſtrict, and alſo at the end of every period of five years, of the numbers living at every age: and at Stockholm a ſociety is eſtabliſhed, whoſe buſineſs it is to ſuperintend and regulate the enumerations, and to collect from the different parts of the kingdom the regiſters, in order to digeſt them into tables of obſervations. Theſe regulations were begun in Sweden in 1755; and tables, containing the reſult of them from 1755 to 1763, have been publiſhed in Mr Wargentin's memoir juſt referred to; and the moſt material parts of them may be found in an eſſay by Dr Price on the Difference between the Duration of Human Life in Towns and in Country Pariſhes, printed in the 65th volume of the Philoſoph. Tranſ. Part ii.

In the fourth eſſay in Dr Price's Treatiſe on Reverſionary Payments and Life-Annuities, the following account is given of the principles on which tables of obſervation are formed from regiſters of mortality; and of the proper method of forming them, ſo as to render them juſt repreſentations of the number of inhabitants, and the probabilities of the duration of human life in a town or country.

In every place which juſt ſupports itſelf in the number of its inhabitants, without any recruits from other places; or where, for a courſe of years, there has been no increaſe or decreaſe; the number of perſons dying every year at any particular age, and above it, muſt be equal to the number of the living at that age. The number, for example, dying every year at all ages from the beginning to the utmoſt extremity of life, muſt, in ſuch a ſituation, be juſt equal to the whole number born every year. And for the ſame reaſon, the number dying every year at one year of age and upwards, at two years of age and upwards, at three and upwards, and ſo on, muſt be equal to the numbers that attain to thoſe ages every year; or, which is the ſame, to the numbers of the living at thoſe ages. It is obvious, that unleſs this happens, the number of inhabitants cannot remain the ſame. If the former number is greater than the latter, the inhabitants muſt decreaſe; if leſs, they muſt increaſe. From this obſervation it follows, that in a town or country where there is no increaſe or decreaſe, bills of mortality which give the ages at which all die, will ſhow the exact number of inhabitants, and alſo the exact law according to which human life waſtes in that town or country.

In order to find the number of inhabitants, the mean numbers dying annually at every particular age and upwards muſt be taken as given by the bills, and placed under one another in the order of the ſecond column of the following tables. Theſe numbers will, it has appeared, be the numbers of the living at 1, 2, 3, &c. years of age; and conſequently the ſum diminiſhed by half the number born annually will be the whole number of inhabitants.

This ſubtraction is neceſſary for the following reaſon. In a table formed in the manner here directed, it is ſuppoſed that the numbers in the ſecond column are all living together at the beginning of every year. Thus the number in the ſecond column oppoſite to 0 in the firſt column, the table ſuppoſes to be all juſt born together on the firſt day of the year. The number, likewiſe, oppoſite to 1, it ſuppoſes to attain to one year of age juſt at the ſame time that the former number is born. And the like is true of every number in the ſecond column. During the courſe of the year, as many will die at all ages as were born at the beginning of the year; and conſequently, there will be an exceſs of the number alive at the beginning of the year above the number alive at the end of the year, equal to the whole number of the annual births; and the true number conſtantly alive together, is the arithmetical mean between theſe two numbers; or agreeably to the rule here given, the ſum of the numbers in the ſecond column of the table leſſened by half the number of annual births.

In ſuch a ſeries of numbers, the exceſs of each number above that which immediately follows it, will be the number dying every year out of the particular number alive at the beginning of the year; and theſe exceſſes ſet down regularly as in the third column of the table to which we have referred, will ſhow the different rates at which human life waſtes through all its different periods, and the different probabilities of life at all particular ages.

It muſt be remembered, that what has been now ſaid goes on the ſuppoſition, that the place whoſe bills of mortality are given, ſupports itſelf, by procreation only, in the number of its inhabitants. In towns this very ſeldom happens on account of the luxury and debauchery which generally prevail in them. They are, therefore, commonly kept up by a conſtant acceſſion of ſtrangers, who remove to them from country pariſhes and villages. In theſe circumſtances, in order to find the true number of inhabitants, and probabilities

Mortality. babilities of life, from bills of mortality containing an account of the ages at which all die, it is neceſſary that the proportion of the annual births to the annual ſettlers ſhould be known, and alſo the period of life at which the latter remove. Both theſe particulars may be diſcovered in the following method.

If for a courſe of years there has been no ſenſible increaſe or decreaſe in a place, the number of annual ſettlers will be equal to the exceſs of the annual burials above the annual births. If there is an increaſe, it will be greater than this exceſs. If there is a decreaſe, it will be leſs.

The period of life at which theſe ſettlers remove, will appear in the bills by an increaſe in the number of deaths at that period and beyond it. Thus in the London bills the number of deaths between 20 and 30 is generally above double; and between 30 and 40 near triple the number of deaths between 10 and 20; and the true account of this is, that from the age of 18 or 20 to 35 or 50, there is an afflux of people every year to London from the country, which occaſions a great increaſe in the number of inhabitants at theſe ages; and conſequently raiſes the deaths for all ages above 20 conſiderably above their due proportion, when compared with the number of deaths before 20. This is obſervable in all the bills of mortality for towns with which we are acquainted, not excepting even the Breſlaw bills. Dr Halley takes notice, that theſe bills give the number of deaths between 10 and 20 too ſmall. This he conſidered as an irregularity in them owing to chance; and, therefore, in forming his table of obſervations, he took the liberty ſo far to correct it, as to render the proportion of thoſe who die to the living in this diviſion of life nearly the ſame with the proportion which, he ſays, he had been informed die annually of the young lads in Chriſt-Church Hoſpital. But the truth is, that this irregularity in the bills was derived from the cauſe we have juſt aſſigned. During the five years for which the Breſlaw bills are given by Dr Halley, the births did indeed a little exceed the burials; but it appears that this was the effect of ſome peculiar cauſes that happened to operate juſt at that time; for during a complete century from 1633 to 1734, the annual medium of births was 1089, and of burials 1256. This town, therefore, muſt have been all along kept up by a number of yearly recruits from other places, equal to about a ſeventh part of the yearly births.

It appears from the account in the Philoſophical Tranſactions (Abridgment, vol. vii. n° 380, p. 46, &c.), that from 1717 to 1725, the annual medium of births at Breſlaw was 1252, of burials 1507; and alſo that much the greateſt part of the births died under 10 years of age. From a table in Suſmilch's works, vol. i. p. 38. it appears, that in reality the greater part of all that die in this town are children under five years of age.

What has been now obſerved concerning the period of life at which people remove from the country to ſettle in towns, would appear ſufficiently probable were there no ſuch evidence for it as has been mentioned; for it might be well reckoned that theſe people in general muſt be ſingle perſons in the beginning of mature life, who, not having yet obtained ſettlements in the places where they were born, migrate to towns in queſt of employments. Mortality.

Having premiſed theſe obſervations, it will be proper next to endeavour to explain diſtinctly the effect which theſe acceſſions to towns muſt have on tables of obſervation formed from their bills of mortality. This is a ſubject proper to be inſiſted on, becauſe miſtakes have been committed about it; and becauſe alſo the diſcuſſion of it is neceſſary to ſhow how near to truth the values of lives come as deduced from ſuch tables.

The following general rule may be given on this ſubject. If a place has for a courſe of years been maintained in a ſtate nearly ſtationary, as to number of inhabitants, by recruits coming in every year, to prevent the decreaſe that would ariſe from the exceſs of burials above the births, a table formed on the principle, "that the number dying annually after every particular age, is equal to the number living at that age," will give the number of inhabitants, and the probabilities of life, too great, for all ages preceding that at which the recruits ceaſe; and after this it will give them right. If the acceſſions are ſo great as to cauſe an increaſe in the place, ſuch a table will give the number of inhabitants and the probabilities of life too little after the age at which the acceſſions ceaſe; and too great if there is a decreaſe. Before that age it will in both caſes give them too great; but moſt conſiderably ſo in the former caſe, or when there is an increaſe.

Agreeably to theſe obſervations, if a place increaſes not in conſequence of acceſſions from other places, but of a conſtant exceſs of the births above the deaths, a table conſtructed on the principle that has been mentioned will give the probabilities of life too low through the whole extent of life; becauſe in ſuch circumſtances the number of deaths in the firſt ſtages of life muſt be too great, in compariſon of the number of deaths in the latter ſtages; and more or leſs ſo as the increaſe is more or leſs rapid. The contrary in all reſpects takes place where there is a decreaſe ariſing from the exceſs of the deaths above the births.

For example: Let us ſuppoſe that 244 of thoſe born in a town attain annually to 20 years of age, and that 250 more, all likewiſe 20 years of age, come into it annually from other places, in conſequence of which it has for a courſe of years been juſt maintained in the number of its inhabitants, without any ſenſible increaſe or decreaſe: in theſe circumſtances, the number of the living in the town of the age of 20 will be always 244 natives and 250 ſettlers, or 494 in all; and ſince theſe are ſuppoſed all to die in the town, and no more recruits are ſuppoſed to come in, 494 will be likewiſe the number dying annually at 20 and upwards. In the ſame manner it will appear, on theſe ſuppoſitions, that the number of the living, at every age ſubſequent to 20, will be equal to the number dying annually at that age and above it; and conſequently that the number of inhabitants and the decrements of life, for every ſuch age will be given exactly by the table. But for all ages before 20, they will be given much too great. For let 280 of all born in the town reach 10; in this caſe, 280 will be the true number of the living in the town at the age of 10; and the recruits not coming in till 20, the number given

Mortality. given by the bills as dying between 10 and 20 will be the true number dying annually of the living in this division of life. Let this number be 36; and it will follow that the table ought to make the numbers of the living at the ages between 10 and 20, a series of decreasing means between 280 and (280 diminished by 36, or) 244. But in forming the table on the principle just mentioned, 250 (the number above 20 dying annually in the town who where not born in it) will be added to each number in this series; and therefore the table will give the numbers of the living and the probabilities of life in this division of life, almost twice as great as they really are. This observation, it is manifest, may be applied to all the ages under 20.

It is necessary to add, that such a table will give the number of inhabitants and the probabilities of life equally wrong before 20, whether the recruits all come in at 20, agreeably to the suppositionj ust made, or only begin then to come in. In this last case, the table will give the number of inhabitants and probabilities of life too great throughout the whole extent of life, if the recruits come in at all ages above 20. But if they cease at any particular age, it will give them right only from that age; and before, it will err all along on the side of excess; but less consideraby between 20 and that age than before 20. For example: if, of the 250 supposed to come in at 20, only 150 then come in, and the rest at 30; the number of the living will be given 100 too high at every age between 20 and 30; but, as just shown, they will be given 250 too high at every age age before 20. In general, therefore, the number of the living at any particular age must be given by the supposed table as many too great as there are annual settlers after that ago; and if these settlers come in at all ages indiscriminately, during any certain interval of life, the number of inhabitants and the probabilities of life will be continually growing less and less wrong the nearer any age is to the end of that interval. These observations prove, that tables of observation formed in the common way, from bills of mortality for places where there is an excess of the burials above the births, must be erroneous for a great part of the duration of life, in proportion to the degree of that excess. They show likewise at what parts of life the errors in such tables are most considerable, and how they may be in a great measure corrected.

All this shall be exemplified in the particular case of London.

The number of deaths between the ages of 10 and 20 is always so small in the London bills, that it seems certain few recruits come to London under 20, or at least not so many as before this age are sent out for education to schools and universities. After 20 great numbers come in till 30, and some perhaps till 40 or 50: but at every age after 50, it is probable that more retire from London than come to it. The London tables of observation therefore, being formed on the principle already mentioned, cannot give the probabilities of life right till 40. Between 30 and 40 they must be a little too high; but more so between 20 and 30, and most of all so before 20. It follows also, that these tables must give the number of inhabitants in London much too great.

The first of the following tables is formed in the manner here explained, from the London bills for 10 years, from 1759 to 1768, and adapted to 1000 born as a radix. The sum of the numbers in the second column, diminished by half the number born, is 25,757. According to this table then, for every 1000 deaths in London there are $25\frac{3}{4}$ as many inhabitants; or, in other words, the expectation of a child just born is $25\frac{3}{4}$; and inhabitants are to the annual burials as $25\frac{3}{4}$ to 1. But it has appeared, that the numbers in the second column, being given on the supposition that all those who die in London were born there, must be too great; and we have from hence a demonstration, that the probabilities of life are given in the common tables of London observations too high for at least the first 30 years of life; and also, that the number of inhabitants in London must be less than $25\frac{3}{4}$ multiplied by the annual burials. The common tables therefore, of London observations. undoubtedly need correction, as Mr Simpson suggested, and in some measure performed; though too imperfectly, and without going upon any fixed principles, or showing particularly how tables of observation ought to be formed, and how far in different circumstances, and at different ages, they are to be depended on. The way of doing this, and in general the right method of forming genuine tables of observation for towns, may be learned from the following rule:

"From the sum of all that die annually, after any given age, subtract the number of annual settlers after that age; and the remainder will be the number of the living at the given time."

This rule can want no explication or proof after what has been already said,

If, therefore, the number of annual settlers in a town at every age could be ascertained, a perfect table of observations might be formed for that town from bills of mortality, containing an account of the ages at which all die in it. But no more can be learned in this instance, from any bills, than the whole number of annual settlers, and the general division of life in which they enter. This, however, may be sufficient to enable us to form tables that shall be tolerably exact. For instance: Suppose the annual deaths in a town which has not increased or decreased, to have been for many years in the proportion of 4 to 3 to the annual births. It will hence follow, that $\frac{1}{4}$ of the persons who die in such a town are setlers, or emigrants from other places, and not natives; and the sudden increase in the deaths after 20 will also show, agreeably to what was before observed, that they enter after this age. In forming, therefore, a table for such a town, a quarter of all that dies at all ages throughout the whole extent of life must be deducted from the sum of all that die after every given age before 20; and the remainder will be the true number living at that given age. And if at 20, and every age above it, this deduction is omitted, or the number of the living at every such age is taken the same with the sum of all that die after it, the result will be (supposing most of the settlers to come in before 30, and all before 40) a table exact till 20; too high between 20 and 30; but nearly right for some years before 40; and after 40 exact again. Such a table,

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Mortality. table, it is evident, will be the same with the table last described at all ages above 20, and different from it only under 20. It is evident also, that on account of its giving the probabilities of life too great for some years after 20, the number of inhabitants deduced from it may be depended on as somewhat greater than the truth; and more or less so, as the annual recruits enter in general later or sooner after 20.

Let us now consider what the result of these remarks will be, when applied particularly to the London bills.

It must be here first observed, that at least one quarter of all that die in London are supplies or settlers from the country, and not natives. The medium of annual burials for 10 years, from 1759 to 1768, was 22,956; of births 15710. The excess is 7246, or near a third of the burials. The same excess during 10 years before 1750 was 10,500, or near half the burials. London was then decreasing. For the last 12 or 15 years it has been increasing. This excess, therefore, agreeably to the foregoing observations, was then greater than the number of annual settlers, and it is now less. It is however here supposed, that the number of annual settlers is now no more than a quarter of the annual burials, in order to allow for more emissions in the births than the burials; and also, in order to be more sure of obtaining results that shall not exceed the truth.

Of every 1000 then who die in London only 750 are natives, and 250 are recruits who come to it after 18 or 20 years of age; and, consequently, in order to obtain from the bills a more correct table than the first of the following tables, 250 must be subtracted from every one of the numbers in the second column till 20; and the numbers in the third column must be kept the same, the bills always giving these right. After 20, the table is to be continued unaltered; and the result will be, a table which will give the numbers of the living at all ages in London much nearer the truth, but still somewhat too high. Such is the second of the following tables. The sum of all the numbers in the second column of this table, diminished by 500, is 20,750. For every 1000 deaths, therefore, in London, there are, according to this table, 20,750 living persons in it; or for every single death $20\frac{3}{4}$ inhabitants. It was before shown, that the number of inhabitants in London could not be so great as 25 times $\frac{3}{4}$ the deaths. It now appears, (since the numbers in the second column of this table are too high) that the number of inhabitants in London cannot be so great as even 20 times $\frac{3}{4}$ the deaths. And this is a conclusion which every one who will bestow due attention on what has been said, will find himself forced to receive. It will not be amiss, however, to confirm it by the following fact, the knowledge of which is derived from the particular enquiry and information of Mr Harris, the late ingenious master of the royal mathematical school in Christ-Church hospital. Mortality. The average of lads in this school has, for 30 years past, been 831. They are admitted at all ages between 7 and 11; and few stay beyond 16: they are therefore in general, lads between the ages of 8 and 16. They have better accommodations than it can be supposed children commonly have; and about 300 of them have the particular advantage of being educated in the country. In such circumstances, it may be well reckoned, that the proportion of children dying annually must be less than the general proportion of children dying annually at the same ages in London. The fact is, that for the last 30 years $11\frac{4}{5}$ have died annually, or one in $70\frac{2}{5}$.

According to Table II. one in 73 dies between 10 and 20, and one in 70 between 8 and 16. That table, therefore, probably gives the decrements of life in London, at these ages, too little, and the numbers of the living too great: and if this is true of these ages, it must be true of all other ages under 20; and it follows demonstrably, in conformity to what was before shown, that more people settle in London after 20 than the fourth above supposed; and that from 20 to at least 30 or 35, the numbers of the living are given too great, in proportion to the decrements of life.

In this table the numbers in the second column are doubled at 20, agreeably to what really happens in London; and the sum of the numbers in this column diminished by half the whole number of deaths, gives the expectation of life, not of a child just born, as in other tables, but of all the inhabitants of London at the time they enter it, whether that be at birth or at 20 years of age. The *expectations*, therefore, and the *values* of London lives under 20, cannot be calculated from this table. But it may be very easily fitted for this purpose, by finding the number of births which, according to the given decrements of life, will leave 494 alive at 20; and then adapting the intermediate numbers in such a manner to this radix, as to preserve all along the number of the living in the same proportion to the numbers of the dead. This is done in the third of the following tables; and this table may be recommended as better adapted to the present state of London than any other table. The values of lives, however, deduced from it, are in general nearly the same with those deduced by Mr Simpson from the London bills as they stood forty years ago; the main difference is, that after 52, and in old age, this table gives them somewhat lower than Mr Simpson's table. The fourth and fifth of the following tables, compared with the two last, will give a distinct and full view of the difference between the rate of human mortality in great towns and in country parishes and villages.

TABLE I.

Showing the Probabilities of life in London, on the supposition that all who die in London were born there. Formed from the bills for 10 years, from 1759 to 1768.

Ages.	Persons living.	Decr. of Life.	Ages.	Persons living.	Decr. of Life.	Ages.	Persons living.	Decr. Life.
0	1000	240	31	404	9	62	132	7
1	760	99	32	395	9	63	125	7
2	661	42	33	386	9	64	118	7
3	619	29	34	377	9	65	111	7
4	590	21	35	368	9	66	104	7
5	569	11	36	359	9	67	97	7
6	558	10	37	350	9	68	90	7
7	548	7	38	341	9	69	83	7
8	541	6	39	332	10	70	76	6
9	535	5	40	322	10	71	70	6
10	530	4	41	312	10	72	64	6
11	526	4	42	302	10	73	58	5
12	522	4	43	292	10	74	53	5
13	518	3	44	282	10	75	48	5
14	515	3	45	272	10	76	43	5
15	512	3	46	262	10	77	38	5
16	509	3	47	252	10	78	33	4
17	506	3	48	242	9	79	29	4
18	503	4	49	233	9	80	25	3
19	499	5	50	224	9	81	22	3
20	494	7	51	215	9	82	19	3
21	487	8	52	206	8	83	16	3
22	479	8	53	198	8	84	13	2
23	471	8	54	190	7	85	11	2
24	463	8	55	183	7	86	9	2
25	455	8	56	176	7	87	7	2
26	447	8	57	169	7	88	5	1
27	439	8	58	162	7	89	4	1
28	431	9	59	155	8	90	3	1
29	422	9	60	147	8			
30	413	9	61	139	7			

TABLE II.

Showing the true probabilities of life in London till the age of 19.

Ages.	Persons living.	Decr. of Life.	Ages.	Persons liv'ng.	Decr. of Life.
0	750	240	12	272	4
1	510	99	13	268	3
2	411	42	14	265	3
3	369	29	15	262	3
4	340	21	16	259	3
5	319	11	17	256	3
6	308	10	18	253	4
7	298	7	19	249	
8	291	6	20	494	
9	285	5	21	487	
10	280	4	&c.	&c.	
11	276	4			

The numbers in the second column to be continued as in the last table.

TABLE III.

Showing the true probabilities of life in London for all ages. Formed from the bills for 10 years, from 1759 to 1768.

Ages.	Persons living.	Decr. of Life.	Ages.	Persons living.	Decr. of Life.	Ages.	Persons living.	Decr. Life.
0	1518	486	31	404	9	62	132	7
1	1032	200	32	395	9	63	125	7
2	832	85	33	386	9	64	118	7
3	747	59	34	377	9	65	111	7
4	688	42	35	368	9	66	104	7
5	646	23	36	359	9	67	97	7
6	623	20	37	350	9	68	90	7
7	603	14	38	341	9	69	83	7
8	589	12	39	332	10	70	76	6
9	577	10	40	322	10	71	70	6
10	567	9	41	312	10	72	64	6
11	558	9	42	302	10	73	58	5
12	549	8	43	292	10	74	53	5
13	541	7	44	282	10	75	48	5
14	534	6	45	272	10	76	43	5
15	528	6	46	262	10	77	38	5
16	522	7	47	252	10	78	33	4
17	515	7	48	242	9	79	29	4
18	508	7	49	233	9	80	25	3
19	501	7	50	224	9	81	22	3
20	494	7	51	215	9	82	19	3
21	487	8	52	206	8	83	16	3
22	479	8	53	198	8	84	13	2
23	471	8	54	190	7	85	11	2
24	463	8	55	183	7	86	9	2
25	455	8	56	176	7	87	7	2
26	447	8	57	169	7	88	5	1
27	439	8	58	162	7	89	4	1
28	431	9	59	155	8	90	3	1
29	422	9	60	147	8			
30	413	9	61	139	7			

All the bills, from which the following tables are formed, give the numbers dying under 1 as well as under 2 years; and in the numbers dying under 1 are included, in the country parish in Brandenberg and at Berlin, all the still-borns. All the bills also give the numbers dying in every period of five years.

TABLE IV.

Showing the Probabilities of Life in the District of Vaud, Switzerland, formed from the Registers of 43 Parishes, given by Mr Muret, in the First Part of the Bern Memoirs for the year 1766.

Age.	Living.	Decr.	Age.	Living.	Decr.	Age.	Living.	Decr.
0	1000	189	31	558	5	62	286	12
1	811	46	32	553	5	63	274	12
2	765	30	33	548	4	64	262	12
3	735	20	34	544	5	65	250	14
4	715	14	35	539	6	66	236	16
5	701	13	36	533	6	67	220	18
6	688	11	37	527	7	68	202	18
7	677	10	38	520	7	69	184	16
8	667	8	39	513	7	70	168	15
9	659	6	40	506	6	71	153	13
10	653	5	41	500	6	72	140	11
11	648	5	42	494	6	73	129	10
12	643	4	43	488	6	74	119	10
13	639	4	44	482	6	75	109	11
14	635	4	45	476	7	76	98	13
15	631	5	46	469	8	77	85	14
16	626	4	47	461	10	78	71	13
17	622	4	48	451	10	79	58	12
18	618	4	49	441	10	80	46	10
19	614	4	50	431	9	81	36	7
20	610	4	51	422	8	82	29	5
21	606	4	52	414	8	83	24	4
22	602	5	53	406	9	84	20	3
23	597	5	54	397	9	85	17	3
24	592	5	55	388	11	86	14	3
25	587	5	56	377	13	87	11	2
26	582	5	57	364	16	88	9	2
27	577	5	58	348	17	89	7	2
28	572	5	59	331	17	90	5	1
29	567	4	60	314	15			
30	563	5	61	299	13			

TABLE V.

Showing the Probabilities of Life in a Country Parish in Brandenburg, formed from the Bills for 50 Years, from 1710 to 1759, as given by Mr Susmilch in his Gottliche Ordnung.

Age	Living	Decr.	Age.	Living.	Decr.	Age.	Living.	Decr.
0	1000	225	31	482	5	62	260	12
1	775	57	32	477	5	63	248	12
2	718	31	33	472	5	64	236	12
3	687	23	34	467	5	65	224	11
4	664	22	35	462	6	66	213	11
5	642	20	36	456	6	67	202	12
6	622	15	37	450	6	68	190	12
7	607	12	38	444	6	69	178	12
8	595	10	39	438	6	70	166	13
9	585	8	40	432	5	71	153	15
10	577	7	41	427	5	72	138	16
11	570	6	42	422	5	73	122	15
12	564	5	43	417	5	74	107	14
13	559	5	44	412	6	75	93	13
14	554	5	45	407	6	76	80	12
15	549	5	46	400	6	77	68	9
16	544	5	47	394	6	78	59	8
17	539	4	48	388	7	79	51	7
18	535	4	49	381	7	80	44	6
19	531	4	50	374	7	81	38	6
20	527	5	51	367	8	82	32	6
21	522	5	52	359	8	83	25	6
22	517	5	53	351	8	84	21	5
23	512	5	54	343	9	85	15	4
24	507	5	55	334	10	86	11	3
25	502	4	56	324	10	87	8	2
26	498	3	57	314	10	88	6	2
27	495	3	58	304	11	89	4	1
28	492	3	59	293	11	90	3	1
29	489	3	60	282	11	91	2	1
30	486	4	61	271	11	92	1	1

TABLE VI.

Showing the Probabilities of Life at Vienna, formed from the Bills for Eight years, as given by Mr Susmilch, in his Gottliche Ordnung, page 32, Tables.

Age.	Living	Decr.	Age.	Living	Decr.	Age.	Living.	Decr.
0	1495	682	31	364	6	62	129	6
1	813	107	32	358	5	63	123	7
2	706	61	33	353	6	64	116	7
3	645	46	34	347	7	65	109	8
4	599	33	35	340	8	66	101	8
5	566	30	36	332	8	67	93	8
6	536	20	37	324	8	68	85	7
7	516	11	38	316	9	69	78	7
8	505	9	39	307	9	70	71	6
9	496	7	40	298	8	71	65	5
10	489	6	41	290	7	72	60	5
11	483	5	42	283	6	73	55	4
12	478	5	43	277	6	74	51	4
13	473	6	44	271	7	75	47	5
14	467	6	45	264	8	76	42	5
15	461	6	46	256	9	77	37	5
16	455	7	47	247	9	78	32	5
17	448	6	48	238	9	79	27	4
18	442	6	49	229	9	80	23	3
19	436	6	50	220	8	81	20	2
20	430	5	51	212	7	82	19	2
21	425	5	52	205	7	83	16	2
22	420	5	53	198	7	84	14	2
23	415	6	54	191	7	85	12	2
24	409	6	55	184	8	86	10	2
25	403	6	56	176	8	87	8	2
26	397	6	57	168	9	88	6	2
27	391	7	58	159	8	89	4	1
28	381	7	59	151	8	90	3	1
29	377	7	60	143	7	91	2	1
30	370	6	61	136	7	92	1	1

TABLE VII.

Showing the Probabilities of Life at Berlin, formed from the Bills for Four Years, from 1752 to 1755, given by Mr Susmilch in his Gottliche Ordnung, vol. ii. page 37, Tables.

Age.	Living.	Decr.	Age.	Living.	Decr.	Age.	Living.	Decr.
0	1427	524	33	361	7	65	112	6
1	903	151	34	354	7	66	106	7
2	752	61	35	347	8	67	99	7
3	691	73	36	339	9	68	92	6
4	618	45	37	330	10	69	86	6
5	573	21	38	320	10	70	80	6
6	552	15	39	310	10	71	74	6
7	536	13	40	300	10	72	68	6
8	523	9	41	290	9	73	62	5
9	514	7	42	281	8	74	57	5
10	507	5	43	274	7	75	52	5
11	502	4	44	266	7	76	47	5
12	498	4	45	259	7	77	42	5
13	494	4	46	252	7	78	37	5
14	490	4	47	245	7	79	32	4
15	486	4	48	238	7	80	28	4
16	482	5	49	231	7	81	24	3
17	477	5	50	224	7	82	21	2
18	472	5	51	217	7	83	19	2
19	467	6	52	210	7	84	17	2
20	461	6	53	203	8	85	15	2
21	455	6	54	195	8	86	13	2
22	449	6	55	187	8	87	11	2
23	443	7	56	179	8	88	9	2
24	436	8	57	171	8	89	7	1
25	428	9	58	163	9	90	6	1
26	421	9	59	154	9	91	5	1
27	412	9	60	145	8	92	4	1
28	403	9	61	137	7	93	3	1
29	394	9	62	130	6	94	2	1
30	385	9	63	124	6			
31	376	8	64	118	6			
32	368	7						

Brief *of* MORTANCESTRY, in Scots law; anciently the ground of an action at the instance of an heir, in the special case where he had been excluded from the possession of his ancestor's estate by the superior, or other person pretending right.

MORTAR, a preparation of lime and sand mixed with water, which serves as a cement, and is used by masons and bricklayers in building walls of stone and brick.

Under the article Cement, we have already given the theory of mortar, as delivered by Mr Anderson; which has now received a farther confirmation by a recent discovery, that if the lime is slaked, and the mortar made up, with lime-water instead of common water, the mortar will be much better. The reason of this is, that in common water, especially such as is drawn from wells, there is always a considerable quantity of fixed air, which, mingling with the mortar previous to its being used, spoils it by reducing the quicklime in part to an inert calcareous earth like chalk; but when it is built up in a perfectly caustic state, it attracts the air so slowly, that it hardens into a kind of stony matter as hard as was the rock from whence the limestone was taken.

Mortar, a chemical utensil very useful for the division of bodies, partly by percussion and partly by grinding. Mortars have the form of an inverted bell. The matter intended to be pounded is to be put into them,

them, and there it is to be ſtruck and bruiſed by a long inſtrument called a *peſtle*. The motion given to the peſtle ought to vary according to the nature of the ſubſtances to be pounded. Thoſe which are eaſily broken, or which are apt to fly out of the mortar, or which are hardened by the ſtroke of the peſtle, require that this inſtrument ſhould be moved circularly, rather by grinding and bruiſing than by ſtriking. Thoſe ſubſtances which are ſoftened by the heat occaſioned by rubbing and percuſſion, require to be pounded very ſlowly. Laſtly, thoſe which are very hard, and which are not capable of being ſoftened, are eaſily pounded by repeated ſtrokes of the peſtle. They require no bruiſing but when they are brought to a certain degree of fineneſs. But theſe things are better learned by habit and practice than by any directions.

As mortars are inſtruments which are conſtantly uſed in chemiſtry, they ought to be kept of all ſizes and materials; as of marble, copper, glaſs, iron, gritſtone, and agate. The nature of the ſubſtance to be pounded determines the choice of the kind of mortar. The hardneſs and diſſolving power of that ſubſtance are particularly to be attended to. As copper is a ſoft metal, ſoluble by almoſt all menſtruums, and hurtful to health, good artiſts have ſome time ago proſcribed the uſe of this metal.

One of the principal inconveniences of pulveriſation in a mortar proceeds from the fine powder which riſes abundantly from ſome ſubſtances during the operation. If theſe ſubſtances be precious, the loſs will be conſiderable; and if they be injurious to health, they may hurt the operator. Theſe inconveniences may be remedied, either by covering the mortar with a ſkin, in the middle of which is a hole, through which the peſtle paſſes; or by moiſtening the matter with a little water when this addition does not injure it; or, laſtly, by covering the mouth and noſe of the operator with a fine cloth, to exclude this powder. Some ſubſtances, as corroſive ſublimate, arſenic, calxes of lead, cantharides, euphorbium, &c. are ſo noxious, that all theſe precautions ought to be uſed, particularly when a large quantity of them is pounded.

Large mortars ought to be fixed upon a block of wood, ſo high, that the mortar ſhall be level with the middle of the operator. When the peſtle is large and heavy, it ought to be ſuſpended by a cord or chain fixed to a moveable pole, placed horizontally above the mortar: this pole conſiderably relieves the operator, becauſe its elaſticity aſſiſts the raiſing of the peſtle.

MORTAR-PIECE, in the military art, a ſhort piece of ordnance, thick and wide, proper for throwing bombs, carcaſes, ſhells, ſtones, bags filled with grape-ſhot, &c. See GUNNERY, n° 50.

Land MORTARS, are thoſe uſed in ſieges, and of late in battles, mounted on beds made of ſolid timber, conſiſting generally of four pieces, thoſe of the royal and cohorn excepted, which are but one ſingle block; and both mortar and bed are tranſported on block-carriages. There is likewiſe a kind of land-mortars, mounted on travelling carriages, invented by count Buckeburg, which may be elevated to any degree; whereas ours are fixed to an angle of 45 degrees, and firmly laſhed with ropes. The following table ſhows the weight of land-mortars and ſhells; together with the quantity of powder the chambers hold when full; the weight of the ſhells, and powder for loading them.

Diameter of mortars.	13-inch.	10-inch.	8-inch.	5-8-inch royal.	4.6-inch cohorn.
	C. qr. lb.	C. qr. lb	C. qr. lb	C. qr. lb	C. qr. lb.
Mortar's weight.	25 0 0	10 2 18	4 0 20	1 1 0	0 3 0
Shell's weight.	1 2 15	0 2 25	0 1 15	0 0 12	0 0 7
	lb. oz. gr	lb. oz. gr.	lb. oz. gr.	lb. oz. gr.	lb. oz. gr.
Shell's cont. of powder.	9 4 8	4 14 12	2 3 8	1 1 8	0 8 0
Chamber's cont. of powder.	9 1 8	4 0 0	2 0 10	1 0 0	0 8 0

Sea MORTARS, are thoſe which are fixed in the bomb-veſſels for bombarding places by ſea: and as they are generally fired at a much greater diſtance than that which is required by land, they are made ſomewhat longer and much heavier than the land-mortars. The following table exhibits the weight of the ſea-mortars and ſhells, and alſo of their full charges.

Nature of the mortar.	Powder contained in the chamber when full.	Weight of the mortar.	Weight of the ſhell when fixed.	Weight of powder contained in the ſhell.
	lb. oz.	C. qr. lb.	lb.	lb. oz.
10-inch howitzer.	12 0	31 2 26		
13-inch mortar.	30 0	81 2 1	198	7 0
10-inch mortar.	12 0	34 2 11	93	

Mortar.

To Charge or Load a Mortar, the proper quantity of gunpowder is put into the chamber, and if there be any vacant ſpace they fill it up with hay; ſome choose a wooden plug; over this they lay a turf, ſome a wooden tampion fitted to the bore of the piece; and laſtly the bomb; taking care that the fuſe be in the axis thereof, and the orifice be turned from the muzzle of the piece: what ſpace remains is to be filled up with hay, ſtraw, turf, &c. ſo as the load may not be exploded without the utmoſt violence.

The quantity of gunpowder to be uſed is found by dividing the weight of the bomb by 30; though this rule is not always to be ſtrictly obſerved.

When the proper quantity of powder neceſſary to charge a ſea-mortar is put into the chamber, it is covered with a wad, well beat down with a rammer. After this the fixed ſhell is placed upon the wad, as near the middle of the mortar as poſſible, with the fuſe-hole uppermoſt, and another wad preſſed down cloſe upon it, ſo as to keep the ſhell firm in its poſition. The officer then points the mortar according to the propoſed inclination.—When the mortar is thus fixed, the fuſe is opened; the priming-iron is alſo thruſt into the touch-hole of the mortar to clear it, after which it is primed with the fineſt powder. This done, two of the matroſſes or ſailors, taking each one of the matches, the firſt lights the fuſe, and the other fires the mortar. The bomb, thrown out by the exploſion of the powder, is carried to the place intended: and the fuſe, which ought to be exhauſted at the inſtant of the ſhell's falling, inflames the powder contained in it, and burſts the ſhell in ſplinters; which, flying off circularly, occaſion incredible miſchief whereſoever they reach.

If the ſervice of mortars ſhould render it neceſſary to uſe pound-ſhots, 200 of them with a wooden bottom are to be put into the 13 inch mortar, and a quantity of powder not exceeding 5 pounds; and 100 of the above ſhot with $2\frac{1}{2}$ pounds of powder, for the 10 inch mortar, or three pounds at moſt.

To Elevate the Mortar ſo as its axis may make any given angle with the horizon, they apply the artillery-level or gunner's quadrant. An elevation of 70 or 80 degrees is what is commonly choſen for rendering mortars moſt ſerviceable in caſting ſhells into towns, forts, &c. though the greateſt range be at 45 degrees.

All the Engliſh mortars are fixed to an angle of 45 degrees, and laſhed ſtrongly with ropes at that elevation. Although in a ſiege there is only one caſe in which ſhells ſhould be thrown with an angle of 45 degrees; that is, when the battery is ſo far off that they cannot otherwiſe reach the works: for when ſhells are thrown out of the trenches into the works of a fortification, or from the town into the trenches, they ſhould have as little elevation as poſſible, in order to roll along, and not bury themſelves; whereby the damage they do, and the terror they occaſion, are much greater than if they ſink into the ground. On the contrary, when ſhells are thrown upon magazines or any other buildings with an intention to deſtroy them, the mortars ſhould be elevated as high as poſſible, that the ſhells may acquire a greater force in their fall, and conſequently do greater execution.

If all mortar pieces were, as they ought to be, exactly ſimilar, and their requiſites of powder as the cubes of the diameters of their ſeveral bores, and if their ſhells, bombs, carcaſes, &c. were alſo ſimilar; then, comparing like with like, their ranges on the plane of the horizon, under the ſame degree of elevation, would be equal; and conſequently one piece being well proved, *i. e.* the range of the grenado, bomb, carcaſe, &c. being found to any degree of elevation, the whole work of the mortar-piece would become very eaſy and exact.

But ſince mortars are not thus ſimilar, it is required, that the range of the piece, at ſome known degree of elevation, be accurately found by meaſuring; and from hence all the other ranges may be determined.

Thus, to find the range of the piece at any other elevation required; ſay, As the ſign of double the angle under which the experiment was made, is to the ſine of double the angle propoſed, ſo is the range known to the range required.

Suppoſe, for inſtance, it be found, that the range of a piece, elevated to 30°, is 2000 yards: to find the range of the ſame piece with the ſame charge when elevated to 45°; take the ſine of 60°, the double of 30°, and make it the firſt term of the rule of three; the ſecond term muſt be the ſine of 90°, the double of 45°, and the third the given range 2000; the fourth term will be 2310, the range of the piece at 45°. If the elevation be greater than 45°, inſtead of doubling it, take the ſine of double its complement to 90°. As ſuppoſe the elevation of a piece to be 50°, take the ſine of 80°, the double of 40°. Again, if a determinate diſtance to which a ſhot is to be caſt, be given, and the angle of elevation to produce that effect be required; the range known muſt be the firſt term in the rule of three, which ſuppoſe 2000 yards; the range propoſed, which we ſuppoſe 1600 yards, the ſecond term; and the ſine of 60 double of the elevation for the range of 2000 yards, the third term. The fourth term will be found the ſine of 43° 52′, whoſe half 21° 56′ is the angle of elevation the piece muſt have to produce the deſired effect. and if 21° 56′ be taken from 90°, you will have 68° 4′ for the other elevation of the piece, with which the ſame effect will likewiſe be produced.

Note, to avoid the trouble of finding ſines of double the angles of propoſed elevations, Galileo and Torricelli give us the following table, wherein the ſigns of the angles ſought are had by inſpection.

Degrees

Degrees.	Degrees.	Ranges.	Degrees.	Degrees.	Ranges.
90	0	0	0	0	0
89	1	349	66	24	7431
88	2	698	65	25	7660
87	3	1045	64	26	7880
86	4	1392	63	27	8090
85	5	1736	62	28	8290
84	6	2709	61	29	8480
83	7	2419	60	30	8660
82	8	2556	59	31	8829
81	9	3090	58	32	8988
80	10	3420	57	33	9135
79	11	3746	56	34	9272
78	12	4067	55	35	9397
77	13	4384	54	36	9511
76	14	4695	53	37	9613
75	15	5000	52	38	9703
74	16	5299	51	39	9781
73	16	5592	50	40	9841
72	18	5870	49	41	9903
71	19	6157	48	42	9945
70	20	6428	47	43	9976
69	21	6691	46	44	9994
68	22	6947	45	45	10000
67	23	7193			

The uſe of the table is obvious. Suppoſe, for inſtance, it be known by experiment, that a mortar elevated 15°, charged with three pounds of powder, will throw a bomb to the diſtance of 350 fathoms; and it be required, with the ſame charge, to throw a bomb 100 fathoms farther; ſeek in the table the number anſwering to 15 degrees, and you will find it 5000. Then as 350 is to 450, ſo is 5000 to a fourth number, which is 6428. Find this number, or the neareſt to it, in the table, and againſt it you will find 20° or 70°; the proper angles of elevation.

MORTGAGE, in law (*mortuum vadium*, or dead-pledge), is where a man borrows of another a ſpecific ſum (*e. g.* 200 l.), and grants him an eſtate in fee, on condition that if he, the mortgager, ſhall pay the mortgagee the ſaid ſum of 200 l. on a certain day mentioned in the deed, that then the mortgager may re-enter on the eſtate ſo granted in pledge; or, as is now the more uſual way, that the mortgagee ſhall reconvey the eſtate to the mortgager: in this caſe the land which is ſo put in pledge, is by law, in caſe of nonpayment at the time limited, for ever dead and gone from the mortgager; and the mortgagee's eſtate in the lands is then no longer conditional, but abſolute. But ſo long as it continues conditional, that is, between the time of lending the money and the time allotted for payment, the mortgage is called *tenant in mortgage*. But as it was formerly a doubt, whether, by taking ſuch eſtate in fee, it did not become liable to the wife's dower, and other incumbrances of the mortgager (though that doubt has been long ago over-ruled by courts of equity), it therefore became uſual to grant only a long term of years, by way of mortgage; with condition to be void on repayment of the mortgage-money: which courſe has been ſince continued, principally becauſe on the death of the mortgagee ſuch term becomes veſted in his perſonal repreſentatives, who alone are entitled in equity to receive the money lent, or whatever nature the mortgage may happen to be.

As ſoon as the eſtate is created, the mortgagee may immediately enter on the lands; but is liable to be diſpoſſeſſed, upon performance of the condition by payment of the mortgage-money at the day limited. And therefore the uſual way is to agree that the mortgagor ſhall hold the land till the day aſſigned for payment; when, in caſe of failure, whereby the eſtate becomes abſolute, the mortgagee may enter upon it and take poſſeſſion, without any poſſibility at law of being afterwards evicted by the mortgagor, to whom the land is now forever dead. But here again the courts of equity interpoſe; and though a mortgage be thus forfeited, and the eſtate abſolutely veſted in the mortgagee at the common law, yet they will conſider the real value of the tenements compared with the ſum borrowed. And if the eſtate be of greater value than the ſum lent thereon, they will allow the mortgagor at any reaſonable time to re-call or redeem his eſtate; paying to the mortgagee his principal, intereſt, and expences: for otherwiſe, in ſtrictneſs of law, an eſtate worth 1000l. might be forfeited for non-payment of 100l. or a leſs ſum. This reaſonable advantage, allowed to mortgagors, is called the *equity of redemption*; and this enables a mortgagor to call on a mortgagee, who has poſſeſſion of his eſtate, to deliver it back, and account for the rents and profits received on payment of his whole debt and intereſt, thereby turning the *mortuum* into a kind of *vivum vadium*; (ſee VADIUM). But, on the other hand, the mortgagee may either compel the ſale of the eſtate, in order to get the whole of his money immediately; or elſe call upon the mortgagor to redeem his eſtate preſently, or, in default thereof, to be for ever foreclosed from redeeming the ſame; that is, to loſe his equity of redemption without poſſibility of recall. And alſo, in ſome caſes of fraudulent mortgages, the fraudulent mortgagor forfeits all equity of redemption whatſoever. It is not, however, uſual for mortgagees to take poſſeſſion of the mortgaged eſtate, unleſs where the ſecurity is precarious, or ſmall; or where the mortgagor neglects even the payment of intereſt: when the mortgagee is frequently obliged to bring an ejectment, and take the land into his own hands, in the nature of a pledge, or the *pignus* of the Roman law: whereas, while it remains in the hands of the mortgagor, it more reſembles their hypotheca, which was where the poſſeſſion of the thing pledged remained with the debtor. But by ſtatute 7 Geo. II. c. 20. after payment or tender by the mortgagor of principal, intereſt, and coſts, the mortgagee can maintain no ejectment; but may be compelled to re-aſſign his ſecurities. In Glanvil's time, when the univerſal method of conveyance was by livery of ſeiſin or corporal tradition of the lands, no gage or pledge of lands was good unleſs poſſeſſion was alſo delivered to the creditor; *ſi non ſequatur ipſius vadii traditio, curia domini regis hujuſmodi privatas conventiones tueri non ſolet*: for which the reaſon given is, to prevent ſubſequent and fraudulent pledges of the ſame land; *cum in tali caſu poſſit eadem res pluribus aliis creditoribus tum prius tum poſterius invadiari*. And the frauds which have ariſen, ſince the exchange of theſe public and notorious

rious conveyances for more private and secret bargains, have well evinced the wisdom of the ancient law.

MORTIER, an ensign of dignity, formerly borne by the chancellor and grand presidents of the parliament of France. That borne by the chancellor was a piece of cloth of gold, edged and turned up with ermine; and that of the first president was a piece of black velvet edged with a double row of gold-lace, while that of the other presidents was only edged with a single row. This they formerly carried on their heads in grand ceremonies, such as the entry of the king; but ordinarily they carried them in the hand.

MORTIFICATION, in medicine and surgery, a total extinction of the natural heat of the body, or a part thereof. Some define mortification a disease, wherein the natural juices of any part quite lose their proper motion; and by that means fall into a fermentative one, and corrupt and destroy the texture of the part. See SURGERY.

MORTIFICATION, in religion, any severe penance observed on a religious account. How ancient and how universal the practice of it has been, and for what reasons observed, see FAST.

MORTIMER (John), a late English artist, born in 1743. According to Mr Strutt, "he was endowed with every requisite to make a great painter; his genius fertile, and his imagination lively. There is an originality in his works which adds greatly to their value. No man perhaps touched the heads and other extremities of his figures with more spirit; and few could draw them more correctly. When he failed, it was from his haste to express his thoughts; so that at times he did not attend with that precision which historical painting requires to the proportion of his figures; and they are sometimes heavy. This defect is, however, well repaid by the lightness of his pencil, and the freedom which appears in his works." He died at his house in Norfolk-street in 1779, aged 36.—"King John granting the Magna Charta to the barons," and the "Battle of Agincourt," two of his capital pictures, have been engraved. The first was nearly finished by Mr Ryland, and completed by Mr Bartolozzi. The last, intended as a companion to the former, was published by Mrs Mortimer.

MORTISE, or MORTOISE, in carpentry, &c. a kind of joint wherein a hole of a certain depth is made in a piece of timber, which is to receive another piece called a *tenon*.

MORTMAIN, or ALIENATION *in Mortmain, (in mortua manu)*, is an alienation of lands or tenements to any corporation, sole or aggregate, ecclesiastical or temporal *: but these purchases having been chiefly made by religious houses, in consequence whereof the lands became perpetually inherent in one dead hand, this hath occasioned the general appellation of *mortmain* to be applied to such alienations, and the religious houses themselves to be principally considered in forming the statutes of mortmain: in deducing the history of which statutes, it will be matter of curiosity to observe the great address and subtle contrivance of the ecclesiastics in eluding from time to time the laws in being, and the zeal with which successive parliaments have pursued them through all their finesses: how new remedies were still the parents of new evasions; till the legislature at last, though with difficulty, hath obtained a decisive victory.

* See Corporation.

By the common law any man might dispose of his lands to any other private man at his own discretion, especially when the feodal restraints of alienation were worn away. Yet in consequence of these it was always, and is still necessary, for corporations to have a licence of mortmain from the crown, to enable them to purchase lands: for as the king is the ultimate lord of every fee, he ought not, unless by his own consent, to lose his privilege of escheats and other feodal profits, by the vesting of lands in tenants that can never be attainted or die. And such licences of mortmain seem to have been necessary among the Saxons above 60 years before the Norman conquest. But, besides this general licence from the king as lord paramount of the kingdom, it was also requisite, whenever there was a mesne or intermediate lord between the king and the alienor, to obtain his licence also (upon the same feodal principles) for the alienation of the specific land. And if no such licence was obtained, the king or other lord might respectively enter on the lands so alienated in mortmain, as a forfeiture. The necessity of this licence from the crown was acknowledged by the constitutions of Clarendon, in respect of advowsons, which the monks always greatly coveted, as being the groundwork of subsequent appropriations. Yet such were the influence and ingenuity of the clergy, that (notwithstanding this fundamental principle) we find that the largest and most considerable donations of religious houses happened within less than two centuries after the conquest. And (when a licence could not be obtained) their contrivance seems to have been this: That as the forfeiture for such alienations accrued in the first place to the immediate lord of the fee, the tenant who meant to alienate first conveyed his lands to the religious house, and instantly took them back again to hold as tenant to the monastery; which kind of instantaneous seisin was probably held not to occasion any forfeiture: and then, by pretext of some other forfeiture, surrender, or escheat, the society entered into those lands in right of such their newly acquired signiority, as immediate lords of the fee. But when these donations began to grow numerous, it was observed that the feodal services, ordained for the defence of the kingdom, were every day visibly withdrawn; that the circulation of landed property from man to man began to stagnate; and that the lords were curtailed of the fruits of their signiories, their escheats, wardships, reliefs, and the like: and therefore, in order to prevent this, it was ordained by the second of King Henry III.'s great charters, and afterwards by that printed in the common statute-books, that all such attempts should be void, and the land forfeited to the lord of the fee.

Blackst. Comment.

But as this prohibition extended only to religious houses, bishops and other sole corporations were not included therein; and the aggregate ecclesiastical bodies (who, Sir Edward Coke observes, in this were to be commended, that they ever had of their counsel the best learned men that they could get) found many means to creep out of this statute, by buying in lands that were *bona fide* holden of themselves as lords of the fee, and thereby evading the forfeiture; or by taking long

Mortmain. leafes for years, which firft introduced thofe extenfive terms, for a thoufand or more years, which are now fo frequent in conveyances. This produced the ftatute *de religiofis*, 7 Edward I.; which provided, that no perfon, religious or other whatfoever, fhould buy, or fell, or receive, under pretence of a gift, or term of years, or any other title whatfoever, nor fhould by any art or ingenuity appropriate to himfelf, any lands or tenements in mortmain; upon pain that the immediate lord of the fee, or, on his default for one year, the lords paramount, and, in default of all of them, the king, might enter thereon as a forfeiture.

This feemed to be a fufficient fecurity againft all alienations in mortmain: but as thefe ftatutes extended only to gifts and conveyances between the parties, the religious houfes now began to fet up a fictitious title to the land, which it was intended they fhould have, and to bring an action to recover it againft the tenant: who, by fraud and collufion, made no defence, and thereby judgment was given for the religious houfe, which then recovered the land by a fentence of law upon a fuppofed prior title. And thus they had the honour of inventing thofe fictitious adjudications of right, which are fince become the great affurance of the kingdom, under the name of *common* RECOVERIES. But upon this the ftatute of Weftminfter the fecond, 13 Edw. I. c. 32. enacted, that in fuch cafes a jury fhall try the true right of the demandants or plaintiffs to the land; and if the religious houfe or corporation be found to have it, they fhall ftill recover feifin; otherwife it fhall be forfeited to the immediate lord of the fee, or elfe to the next lord, and finally to the king, upon the immediate or other lords default. And the like provifion was made by the fucceeding chapter, in cafe the tenants fet up croffes upon their lands (the badges of knights templars and hofpitallers) in order to protect them from the feudal demands of their lords, by virtue of the privileges of thofe religious and military orders. And fo careful was this provident prince to prevent any future evafions, that when the ftatute of *quia emptores*, 18 Edward I. abolifhed all fub-infeudations, and gave liberty for all men to alienate their lands to be holden of their next immediate lord, a provifo was inferted that this fhould not extend to authorife any kind of alienation in mortmain. And when afterwards the method of obtaining the king's licence by writ of *ad quod damnum* was marked out by the ftatute 27 Edward I. ft. 2. it was farther provided by ftatute 34 Edward I. ft. 3. that no fuch licence fhould be effectual without the confent of the mefne or intermediate lords.

Yet ftill it was found difficult to fet bounds to ecclefiaftical ingenuity: for when they were driven out of all their former holds, they devifed a new method of conveyance, by which the lands were granted, not to themfelves directly, but to nominal feoffees to the ufe of the religious houfes; thus diftinguifhing between the poffeffion and the ufe, and receiving the actual profits, while the feifin of the land remained in the nominal feoffee; who was held by the courts of equity (then under the direction of the clergy) to be bound in confcience to account to his *ceftuy que ufe* for the rents and emoluments of the eftate. And it is to thefe inventions that our practifers are indebted for the introduction of ufes and trufts, the foundation of modern conveyancing. But, unfortunately for the inventors themfelves, they did not long enjoy the advantage of their new device; for the ftatute 15 Richard II. c. 5. enacts, that the lands which had been fo purchafed to ufes fhould be admortifed by licence from the crown, or elfe be fold to private perfons; and that for the future ufes they fhall be fubject to the ftatutes of mortmain, and forfeitable like the lands themfelves. And whereas the ftatutes had been eluded by purchafing large tracts of land adjoining to churches, and confecrating them by the name of *church-yards*, fuch fubtile imagination is alfo declared to be within the compafs of the ftatutes of mortmain. And civil or lay corporations, as well as ecclefiaftical, are alfo declared to be within the mifchief, and of courfe within the remedy provided by thofe falutary laws. And laftly, as during the times of popery lands were frequently given to fuperftitious ufes, though not to any corporate bodies; or were made liable in the hands of heirs and devifees to the charge of obits, chauntries, and the like, which were equally pernicious in a well-governed ftate as actual alienations in mortmain; therefore at the dawn of the Reformation, the ftatute 23 Hen. VIII. c. 10. declares, that all future grants of lands for any of the purpofes aforefaid, if granted for any longer term than 20 years, fhall be void.

But during all this time, it was in the power of the crown, by granting a licence of mortmain, to remit the forfeiture, fo far as related to its own rights; and to enable any fpiritual or other corporation to purchafe and hold any lands or tenements in perpetuity: which prerogative is declared and confirmed by the ftatute 18 Edw. III. ft. 3. c. 3. But as doubts were conceived at the time of the Revolution how far fuch licence was valid, fince the king had no power to difpenfe with the ftatutes of mortmain by a claufe of *non obftante*, which was the ufual courfe, though it feems to have been unneceffary; and as, by the gradual declenfion of mefne figniories through the long operation of the ftatute of *quia emptores*, the rights of intermediate lords were reduced to a very fmall compafs; it was therefore provided by the ftatute 7 & 8 W. III. c. 37. that the crown for the future at its own difcretion may grant licences to alienate or take in mortmain, of whomfoever the tenements may be holden.

After the diffolution of monafteries under H. VIII. though the policy of the next popifh fucceffor affected to grant a fecurity to the poffeffors of abbey-lands, yet, in order to regain fo much of them as either the zeal or timidity of their owners might induce them to part with, the ftatutes of mortmain were fufpended for 20 years by the ftatute 1 & 2 P. & M. c. 8. and during that time any lands or tenements were allowed to be granted to any fpiritual corporation without any licence whatfoever. And long afterwards, for a much better purpofe, the augmentation of poor livings, it was enacted by the ftatute 17 Car. II. c. 3. that appropriators may annex the great tithes to the vicarages; and that all benefices under 100l. *per annum* may be augmented by the purchafe of lands, without licence of mortmain in either cafe; and the like provifion hath been fince made in favour of the governors of queen Anne's bounty. It hath alfo been held, that the fta-

tute

Merton, Mortuary.

tute 23 Hen. VIII. before-mentioned, did not extend to any thing but superstitious uses; and that therefore a man may give lands for the maintenance of a school, an hospital, or any other charitable uses. But as it was apprehended from recent experience, that persons on their death-beds might make large and improvident dispositions even for these good purposes, and defeat the political ends of the statutes of mortmain; it is therefore enacted by the statute 9 Geo. II. c. 36. that no lands or tenements, or money to be laid out thereon, shall be given for or charged with any charitable uses whatsoever, unless by deed indented, executed in the presence of two witnesses 12 kalendar months before the death of the donor, and enrolled in the court of chancery within six months after its execution (except stocks in the public funds, which may be transferred within six months previous to the donor's death), and unless such gift be made to take effect immediately, and be without power of revocation; and that all other gifts shall be void. The two universities, their colleges, and their scholars upon the foundation of the colleges of Eton, Winchester, and Westminster, are excepted out of this act: but such exemption was granted with this proviso, that no college shall be at liberty to purchase more advowsons than are equal in number to one moiety of the fellows or students upon the respective foundations.

MORTON (Thomas), a learned English bishop in the 17th century, was bred at St John's college, Cambridge, and was logic-lecturer of the university. After several preferments he was advanced to the see of Chester in 1615, and translated to that of Litchfield and Coventry in 1618; at which time he became acquainted with Antonio de Dominis archbishop of Spalatro, whom he endeavoured to dissuade from returning to Rome. While he was bishop of Litchfield and Coventry, in which see he sat 14 years, he educated, ordained, and presented to a living, a youth of excellent parts and memory, who was born blind; and detected the imposture of the famous boy of Bilson in Staffordshire, who pretended to be possessed with a devil. In 1632 he was translated to the see of Durham, in which he sat with great reputation till the opening of the long parliament, which met in 1640; when he received great insults from the common people, and was committed twice to custody. The parliament, upon the dissolution of bishoprics, voted him 800 l. *per annum*, of which he received but a small part. He died in 1659, in the 95th year of his age and 44th of his episcopal consecration. He published *Apologia Catholica*, and several other works; and was a man of extensive learning, great piety, and temperance.

MORTUARY, in law, is a sort of ecclesiastical heriot *, being a customary gift claimed by and due to the minister in very many parishes on the death of his parishioners. They seem originally to have been only a voluntary bequest to the church; being intended, as Lyndewode informs us, from a constitution of archbishop Langham, as a kind of expiation and amends to the clergy for the personal tythes, and other ecclesiastical duties, which the laity in their life-time might have neglected or forgotten to pay. For this purpose, after the lord's heriot or best good was taken out, the second best chattel was reserved to the church as a mortuary. And therefore in the laws of king Canute, this mortuary is called *soul-scot*, or *symbolum animæ*. And, in pursuance of the same principle, by the laws of Venice, where no personal tythes have been paid during the life of the party, they are paid at his death out of his merchandise, jewels, and other moveables. So also, by a similar policy in France, every man that died without bequeathing a part of his estate to the church, which was called *dying without confession*, was formerly deprived of Christian burial; or, if he died intestate, the relations of the deceased, jointly with the bishop, named proper arbitrators to determine what he ought to have given to the church, in case he had made a will. But the parliament, in 1409, redressed this grievance.

* See Heriot.

Mortuary.

It was anciently usual in England to bring the mortuary to church along with the corpse when it came to be buried; and thence it is sometimes called a *corse-present*: a term which bespeaks it to have been once a voluntary donation. However, in Bracton's time, so early as Henry III. we find it rivetted into an established custom: insomuch that the bequests of heriots and mortuaries were held to be necessary ingredients in every testament of chattles. *Imprimis autem debet quilibet, qui testamentum fecerit, dominum suum de meliori re quam habuerit recognoscere; et postea ecclesiam de alia meliori*: the lord must have the best good left him as an heriot; and the church the second best as a mortuary. But yet this custom was different in different places: *in quibusdam locis habet ecclesia melius animal de consuetudine; in quibusdam secundum, vel tertium melius; et in quibusdam nihil: et ideo consideranda est consuetudo loci.* This custom still varies in different places, not only as to the mortuary to be paid, but the person to whom it is payable. In Wales a mortuary or corse-present was due upon the death of every clergyman to the bishop of the diocese; till abolished, upon a recompence given to the bishop, by the statute 12 Ann. st. 2. c. 6. And in the archdeaconry of Chester a custom also prevailed, that the bishop, who is also archdeacon, should have, at the death of every clergyman dying therein, his best horse or mare, bridle, saddle, and spurs; his best gown or cloak, hat, upper garment under his gown, and tippet, and also his best signet or ring. But by statute 28 Geo. II. c. 6. this mortuary is directed to cease, and the act has settled upon the bishop an equivalent in its room. The king's claim to many goods, on the death of all prelates in England, seems to be of the same nature; though Sir Edward Coke apprehends, that this is a duty upon death, and not a mortuary: a distinction which seems to be without a difference. For not only the king's ecclesiastical character, as supreme ordinary, but also the species of the goods claimed, which bear so near a resemblance to those in the archdeacony of Chester, which was an acknowledged mortuary, puts the matter out of dispute. The king according to the record vouched by Sir Edward Coke, is entitled to six things; the bishop's best horse or palfrey, with his furniture; his cloak or gown, and tippet; his cup and cover; his bason and ewer; his gold ring; and lastly, his *muta canum*, his mew or kennel of hounds.

This variety of customs with regard to mortuaries, giving frequently a handle to exactions on the one side, and frauds or expensive litigations on the other, it was thought proper by statute 21 Henry VIII. c. 6. to to reduce them to ſome kind of certainty. For this purpoſe it is enacted, that all mortuaries, or corſe-preſents to parſons of any pariſh, ſhall be taken in the following manner, unleſs where by cuſtom leſs or none at all is due: *viz.* for every perſon who does not leave goods to the value of ten marks, nothing: for every perſon who leaves goods to the value of ten marks and under 30 pounds, 3*s.* 4*d.* if above 30 pounds, and under 40 pounds, 6*s.* 8*d.* if above 40 pounds, of what value ſoever they may be, 10*s.* and no more. And no mortuary ſhall throughout the kingdom be paid for the death of any feme-covert; nor for any child; nor for any one of full age, that is not a houſekeeper; nor for any wayfaring man; but ſuch wayfaring man's mortuary ſhall be paid in the pariſh to which he belongs. And upon this ſtatute ſtands the law of mortuaries to this day.

MORUS, the MULBERRY-TREE: A genus of the tetrandria order, belonging to the monœcia claſs of plants; and in the natural method ranking under the 53d order, *Scabridæ*. The male calyx is quadripartite; and there is no corolla; the female calyx is tetraphyllous; there is no corolla; two ſtyles; the calyx like a berry with one ſeed. There are ſeven ſpecies, viz.

Species. 1. The *nigra*, or common black-fruited mulberry-tree, riſes with an upright, large, rough trunk, dividing into a branchy and very ſpreading head, riſing 20 feet high, or more. It has large, heart-ſhaped, rough leaves; and monœcious flowers, ſucceeded in the females by large ſucculent black-berries. There is a variety with jagged leaves and ſmaller fruit.—2. The *alba*, or white mulberry-tree, riſes with an upright trunk, branching 20 or 30 feet high; garniſhed with large, oblique, heart-ſhaped, ſmooth, light-green, ſhining leaves, and monœcious flowers ſucceeded by pale-whitiſh fruit. There is a variety with purpliſh fruit. 3. The *papyrifera*, or paper mulberry-tree of Japan, grows 20 or 30 feet high; having large palmated leaves, ſome trilobate, others quinquelobed; and monœcious flowers, ſucceeded by ſmall black fruit.—4. The *rubra*, or red Virginia mulberry-tree, grows 30 feet high; is garniſhed with very large, heart-ſhaped, rough leaves, hairy underneath; and has monœcious flowers, ſucceeded by large reddiſh berries. 5. The *tinctoria*, dyer's mulberry, or fuſtic, has oblong leaves more extended on one ſide at the baſe, with axillary thorns. It is a native of Braſil and Jamaica. 6. The *tartarica*, or Tartarian mulberry, has ovate oblong leaves equal on both ſides and equally ſerrated. It abounds on the banks of the Wolga and the Tanais. 7. The *indica*, or Indian mulberry, has ovate oblong leaves, equal on both ſides, but unequally ſerrated.

The laſt three ſpecies are tender plants in this country; but the four firſt are very hardy, and ſucceed in any common ſoil and ſituation. The leaves are generally late before they come out, the buds ſeldom beginning to open till the middle or towards the latter end of May, according to the temperature of the ſeaſon; and when theſe trees in particular begin to expand their foliage, it is a good ſign of the near approach of fine warm ſettled weather; the white mulberry, however, is generally forwarder in leafing than the black. The flowers and fruit come out ſoon after the leaves; the males in amentums, and the females in ſmall roundiſh heads; neither of which are very conſpicuous, nor poſſeſs any beauty, but for obſervation. The female or fruitful flowers always riſe on the extremity of the young ſhoots on ſhort ſpurs; and with this ſingularity, that the calyxes of the flowers become the fruit, which is of the berry kind, and compoſed of many tuberances, each of them furniſhing one ſeed. The fruit matures here gradually from about the firſt of Auguſt until the middle of September. In dry warm ſeaſons, they ripen in great perfection; but when it proves very wet weather, they ripen but indifferently, and prove devoid of flavour.

Uſes, &c. Conſidered as fruit-trees, the nigra is the only proper ſort to cultivate here; the trees being not only the moſt plentiful bearers, but the fruit is larger and much finer-flavoured than that of the white kind, which is the only other ſort that bears in this country. The three next ſpecies are chiefly employed to form variety in ornamental plantations; tho' abroad they are adapted to more uſeful purpoſes.

The *fruit* of the black mulberry is exceedingly grateful to the taſte, and is conſidered at the ſame time as laxative and cooling. Like the other acid-ſweet fruits, it allays thirſt (as Dr Cullen obſerves), partly by refrigerating, and partly by exciting an excretion of mucus from the mouth and fauces; a ſimilar effect is alſo produced in the ſtomach, where, by correcting putreſcency, a powerful cauſe of thirſt is removed. A ſyrup is made from the berries gathered before they are ripe, which, taken as a gargle, is excellent for allaying inflammations of the throat, and for cleanſing ulcers in the mouth. The *bark* of the *root*, which has an acrid bitter taſte, poſſeſſes a cathartic power; and has been ſucceſsfully uſed as a vermifuge, particularly in caſes of tænia: the doſe is half a dram of the powder, or a dram of the infuſion. The juice of the black mulberry is alſo employed to give a colour to certain liquors and confections. Some make from it a wine which is not diſagreeable; others employ it for giving a high colour to red wine; which it likewiſe contributes to make ſweet.—Although this juice is of no uſe in dyeing, it gives a red colour to the fingers and to linen, which it is very difficult to remove. Ver juice, ſorrel, lemon, and green mulberries, remove ſpots of this kind from the hands: but with reſpect to linen, the beſt way is to wet the part which has been ſtained, and to dry it with the vapour of ſulphur; the vitriolic acid which eſcapes from this ſubſtance during combuſtion, inſtantly takes off the ſtain.—The *wood* of the mulberry tree is yellow, tolerably hard, and may be applied to various uſes in turnery and carving: But in order to ſeparate the bark, which is rough, thick, thready, and fit for being made into ropes, it is proper to ſteep the wood in water.

Mulberry trees are noted for their *leaves* affording the principal food of that valuable inſect the ſilk-worm. The leaves of the *alba*, or white ſpecies, are preferred for this purpoſe in Europe; but in China, where the beſt ſilk is made, the worms are ſaid to be fed with thoſe of the *morus tartarica*. The advantages of *white mulberry* trees are not confined to the nouriſhment of worms: they may be cut every three or four years like ſallows and poplar trees, to make faggots;

 and

and the ſheep eat their leaves in winter, before they are burnt. This kind of food, of which they are extremely fond, is very nouriſhing; it gives a delicacy to the fleſh, and a fineneſs and beauty to the wool. In ſhort, in every climate and in moſt fields, it might be proper, as is the caſe in Spain, to wait for the firſt hoar-froſt ſhaking off the leaves, which are gathered and placed to dry in ſheds or cart-houſes, taking care always to ſtir them from time to time. In Spain, the ſheep are fed on theſe leaves during the cold and froſts. By this method no injury is done to the mulberries, which produce leaves every year; and it is thought that the beauty and fineneſs of the Spaniſh wool is in a great meaſure owing to the uſe of this kind of food. From theſe conſiderations M. Bourgeois infers, that even in countries where, from the nature of the climate, the ſcarcity of workmen and the high price of labour, or any other particular cauſes, ſilk-worms could not be raiſed to any advantage, the cultivation of mulberry trees ought not be neglected.—The fruit of the white mulberry has a ſweetiſh and very inſipid taſte. Birds, however, are very fond of it; and it is remarked that thoſe which have been fed with ſuch fruit are excellent eating.

The *papyrifera*, or paper-mulberry, is ſo called from the paper chiefly uſed by the Japaneſe being made of the bark of its branches; (ſee the article Paper.) The leaves of this ſpecies alſo ſerve for food to the ſilk worm, and it is now cultivated with ſucceſs in France. It thrives beſt in ſandy ſoils, grows faſter than the common mulberry, and at the ſame time is not injured by the cold. M. de la Bouviere affirms that he procured a beautiful vegetable ſilk from the bark of the young branches of this ſpecies of mulberry, which he cut while the tree was in ſap, and afterwards beat and ſteeped. The women of Louiſiana procure the ſame kind of production from the ſhoots which iſſue from the ſtock of the mulberry; and which are four or five feet high. After taking off the bark, they dry it in the ſun, and then beat it that the external part may fall off; and the internal part, which is fine bark, remains entire. This is again beaten, to make it ſtill finer; after which they bleach it with dew. It is then ſpun, and various fabrics are made from it, ſuch as nets and fringes; they even ſometimes weave it and make it into cloth.—The fineſt ſort of cloth among the inhabitants of Otaheite and others of the South Sea Iſlands, is made of the bark of this tree, in the manner particularly deſcribed under the article Bark.

The *tinctoria* is a fine timber-tree, and a principal ingredient in moſt of our yellow dyes, for which it is chiefly imported into Europe. The berries are ſweet and wholeſome; but not much uſed, except by the winged tribe, by whoſe care it is chiefly planted.

Culture of the Mulberry. From the nouriſhment which it affords to the ſilk-worm, that valuable inſect to which we are indebted for the materials of our fineſt ſtuffs, the method of cultivating the mulberry tree muſt be peculiarly intereſting wherever its culture can be undertaken with ſucceſs. In France and Italy, vaſt plantations of the trees are made ſolely for their leaves to feed the little animals we have mentioned, which amply reward the poſſeſſors with the ſupply of ſilk which they ſpin from their bowels. Plantations of the mulberry have at different times been recommended in England for the ſame purpoſe; though nothing has yet been done in that way to any extent, and even the expediency of any ſuch attempt has been doubted by others, upon the ground of its interfering with other branches of rural economics more productive and more congenial to the climate.

In the European ſilk-countries, a great many varieties of mulberry trees are diſtinguiſhed, ariſing from difference of climate, ſoil, method of culture, and other accidental cauſes. Among the wild mulberries, we meet with ſome whoſe leaves are roundiſh, and reſembling thoſe of a roſe: hence they have been called the *roſe-leaved* mulberry.

Mulberry trees were firſt cultivated in France in the reign of Charles IX. It has been found by experience that this tree is not ſo peculiar to warm countries, ſuch as Spain, Italy, Provence, Languedoc, and Piedmont; but it may alſo thrive very well in colder countries, ſuch as Touraine, Poitou, Maine, Anjou, Angoumois near Rochefoucault, and even in Germany, where it affords very good nouriſhment for ſilk-worms. They grow in all kinds of ſoil: they thrive beſt in ſtrong and wet lands; but it is alleged that their leaves conſtitute too coarſe food, prejudicial to the worms, and unfavourable to the quality of the ſilk.—A good light land is the beſt kind of ſoil for raiſing them. White mulberry trees have been found to grow in ſandy ſoils where heath would ſcarcely vegetate; but their leaves are too dry, and afford not ſufficient nouriſhment for the ſilk-worms.

Mulberry trees may be propagated either from ſhoots which have taken root, or by ſeed, by layers, and by ſlips. To raiſe black mulberry trees, the ſeed muſt be taken from the largeſt and moſt beautiful mulberries: in raiſing white ones, the ſeed is taken from the fineſt mulberries growing on trees with large whitiſh ſoft and tender leaves, and as little cut as poſſible. The beſt ſeed is commonly got from Piedmont, Languedoc, &c. According to M. Duhamel, that ſeed ſhould be preferred which is gathered in counties where the cold is ſometimes pretty ſevere; becauſe in that caſe the trees are better able to reſiſt the attacks of the froſt. It frequently happens in ſevere winters, as M. Bourgeois obſerves, that the ſtalks of the young mulberry trees, eſpecially during the firſt winter, are deſtroyed by the froſt; but when they are cut cloſe to the earth, they ſend forth as beautiful and vigorous ſtalks as the former. Good ſeed ought to be large, heavy, light coloured, to produce a great deal of oil when it is preſſed, and to crackle when thrown on a red hot ſhovel. This ſeed muſt be ſown in good land.

In the autumn of the ſecond year, all thoſe trees muſt be pulled up which have ſmall leaves of a very deep green, rough, and deeply indented, for they would produce no leaves proper for the ſilk worms.—In the third year, when the mulberry tree is about the thickneſs of the finger, it muſt be taken up and put in the nurſery. According to M. Bourgeois, mulberries ought to be tranſplanted in the ſpring of the ſecond year, which makes them thrive better, and ſooner attain their growth. Without this tranſplantation, they would put forth only one root like a pivot and moſt of them would be in danger of periſhing when they are taken up to be put where they are intended

Morus.

tended to remain. Some cultivators of this tree tell us, that all the young trees, whether large or ſmall, ſtraight or crooked, ought to be cut cloſe to the ground in the third year, that they may put forth a greater number of roots. Others never employ this method but with regard to thoſe which are crooked, or in a languiſhing ſtate.

White mulberries may be raiſed for the food of ſilk-worms, either in the form of a copſe, or planted in a regular order, by letting them grow to their natural ſize. Ingrafting is one of the ſureſt methods of procuring fine leaves from mulberries. Mulberries ingrafted on wild ſtocks choſen from a good kind, ſuch as thoſe which are produced from the ſeed of the Italian mulberry, commonly called the *roſe-mulberry*, or of the Spaniſh mulberry, produce, as M. Bourgeois obſerves, much more beautiful leaves, and of a much better quality for ſilk-worms, than thoſe which are ingrafted on the common or prickly ſmall-leafed wild-ſtock. The ſame obſervation has been made by a great many cultivators of mulberries, and in particular by M. Thomé of Lyons, whoſe authority has the greateſt weight in whatever regards the cultivation of mulberries and the rearing of ſilk-worms.

Encyclop. Methodique.

Ingrafted mulberries, it muſt be confeſſed, produce a greater number of leaves, and theſe more nouriſhing for ſilk-worms, than wild mulberries. The latter, however, it has been found by experience, may exiſt for two centuries; whereas the extenſion of leaves produced by ingrafting, occaſions a premature diſſipation of the ſap of the tree, and thereby accelerates its decay. In a memoir inſerted in a treatiſe on the culture of white mulberries by M. Pomier, it is recommended to ingraft white mulberries upon black ones; and there is reaſon to think that by following this plan the trees would exiſt much longer: for it is well known that the white mulberry commonly decays firſt in the root, whereas the black mulberry is not ſubject to any malady. In almoſt all the books on agriculture we find it aſſerted, that mulberries may be ingrafted on elms. "I will not affirm (ſays M. Duhamel), that this method of ingrafting has never been ſucceſsful; but I have frequently tried it in vain, and I have many reaſons for thinking that it cannot be attended with any advantage." In works of the ſame kind, we are likewiſe told, "that mulberries may be ingrafted on fig and lime trees; but in general ſuch ingrafting will not ſucceed, unleſs there is a great analogy betwixt the trees, and particularly unleſs the ſap is ſet in motion at the ſame time."

The greater care we take of mulberries, by dreſſing them, and lopping off the overgrown branches, they produce the greater plenty of good leaves. It is very prejudicial to the mulberries to ſtrip them when too young of their leaves for the purpoſe of feeding the worms, becauſe the leaves are the organs of perſpiration in trees, and likewiſe contribute greatly to nutrition by means of their abſorbing veſſels which imbibe the moiſture of the atmoſphere. Mulberry trees are ſo plentifully ſtored with ſap, that they renew their leaves ſometimes twice or thrice. When the winter is mild, mulberry trees put forth their leaves very early: but it is always dangerous to accelerate the hatching of the worms in expectation of this event; for no leaves can be depended upon till the beginning of May, thoſe which are prior to this period being in danger of being deſtroyed by the froſts.

Morus, Moſa.

In Tuſcany, eſpecially in the neighbourhood of Florence, M. Nollet tells us, that though the inhabitants do not cultivate half ſo many mulberries as the Piedmonteſe, they rear and feed double the quantity, in proportion, of ſilk-worms. For this purpoſe they cauſe the worms to hatch only at two different ſeaſons. The firſt worms which are hatched are fed on the firſt produce of the mulberry-trees; and when theſe have produced their ſilk, other worms are hatched, which are nouriſhed on the ſecond crop of the ſame trees.

We are told by M. Bourgeois, that ſeveral kinds of white mulberries are now cultivated near Bienne in Switzerland. According to this author, the prickly mulberry is the leaſt eſteemed of all the white wild mulberries. Its branches are rough with prickles; its leaves are of a ſmall ſize and few in number; and the reaping of them is difficult and expenſive. The common wild mulberry produces indented leaves, oblong, and very ſlender; but it is worth being attended to, becauſe it thrives very well when planted in a hedge, and in a favourable expoſure: it is alſo earlier in the ſpring than the other ſpecies. The wild mulberry, which is produced from the roſe or Italian ingrafted mulberry, bears a great many leaves, of a roundiſh ſhape and middling ſize, inclining to a light yellow, and of an excellent quality.

Of the white ingrafted mulberry-trees, the roſe, or Italian ingrafted mulberry, which is now the ſpecies moſt cultivated in France, Italy, and Piedmont, produces great abundance of large, thick and ſmooth leaves. It has now come into great repute, in conſequence of the recommendation of M. Thomé, who prefers it to all other ſpecies of mulberry-trees for raiſing ſilk-worms. It is extremely delicate, however, and ſuffered greatly in Switzerland from the ſevere winters of 1766 and 1767. The mulberry called *Roman leaf* is diſtinguiſhed from every other ſpecies by its very large leaves, ſome of which are frequently found equal in ſize to thoſe of a gourd. The Spaniſh mulberry greatly reſembles the wild roſe-mulberry, except that its leaves are larger and more pointed. It is by no means delicate, and can reſiſt the ſtrongeſt froſts and the ſevereſt winters in cold climates. The leaves of the mulberry called the *ſmall queen* are oblong, moderately large, and exceedingly ſmooth: This ſpecies is of an excellent quality and much eſteemed.

MOSA, (anc. geog.) a river of Belgica, riſing in mount Vogeſus on the borders of the Lingones, and which, after receiving a part of the Rhine called *Vahalis*, forms the iſland of the Batavi, and paſſes off into the ſea, at no greater diſtance than 80 miles: its mouth, which is large and broad, is that which Pliny calls *Helius*, denoting *Lower*, according to ſome German writers. Now called the *Maeſe*, or *Meuſe*; riſing in Champaign, on the borders of the county of Burgundy, or the Franche Compté, at a village called *Meuſe*, whence the appellation; and running north through Lorrain and Champaign into the Netherlands: it afterwards directs its courſe north-eaſt, and then weſt; and joining the Waal, runs to Dort, and

falls

Mosæ, Mosaic Law.

falls into the German sea, a little below the Briel.—According to Baudrand, it twice receives the Waal; by the first junction forming the island Bommel; and again receives it at Worcum, from which place proceeding to Dort, it divides into two branches, which again uniting together form one large mouth discharging itself into the German sea.

MOSÆ Pons (anc. geog.), supposed to be Maestricht, situated on the Maese. E. Long. 5. 40. N. Lat. 50 55.

MOSAIC law, or the *Law of Moses*, is the most ancient that we know of in the world, and is of three kinds; the moral law, the ceremonial law, and the judicial law. The different manner in which each of these was delivered, may perhaps suggest to us a right idea of their different natures. The moral law, or ten commandments, for instance, was delivered on the top of the mountain, in the face of the whole world, as being of universal influence, and obligatory on all mankind. The ceremonial was received by Moses in private in the tabernacle, as being of peculiar concern, belonging to the Jews only, and destined to cease when the tabernacle was down, and the vail of the temple rent. As to the judicial law, it was neither so publicly nor so audibly given as the moral law, nor yet so privately as the ceremonial; this kind of law being of an indifferent nature; to be observed or not observed, as its rites suit with the place and government under which we live. The five books of Moses called the *Pentateuch*, are frequently styled, by way of emphasis, *the Law*. This was held by the Jews in such veneration, that they would not allow it to be laid upon the bed of any sick person, lest it should be polluted by touching the dead.

Wilson's Archæol. Dict.

Mosaic Law.

A TABLE or HARMONY of the MOSAIC LAW, digested into proper Heads, with Refrences to the several Parts of the Pentateuch where the respective Laws occur.

Class I. The Moral Law written on the two Tables, containing the Ten Commandments.	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
The *first table*, which includes				
The first commandment,	20. 23.	—	—	5. 6. 13.
The second commandment,	20. 23. 34.	19. 20. 26.	—	4. 5. 6. 7. 8. 10. 11. 12. 13.
The third commandment,	20. 23.	—	—	5.
The fourth commandment,	20. 23. 31. 34. 35.	19. 23. 26.	—	—
The *second table*, including				
The fifth commandment,	20. 22.	19.	—	5.
The sixth commandment,	20.	19.	—	5.
The seventh commandment,	20.	18. 19.	—	5. 23.
The eighth commandment,	20. 23.	19.	—	5.
The ninth commandment,	20. 23.	19.	—	5.
The tenth commandment,	20.	—	—	5.
The sum of both tables,	—	19.	—	6.
Class II. The Ceremonial Law may be fitly reduced to the following heads, *viz.*				
Of the holy place,	20.	17.	—	12.
Of the matter and structure of the tabernacle,	25. 26. 27. 35.	—	—	—
Of the instruments of the same, *viz.*				
The laver of brass,	30.	—	—	—
The altar of burnt offering,	27.	—	—	—
The altar of incense,	30.	—	—	—
The candlestick of pure gold,	25.	—	—	—
The table of shew-bread,	25. 26.	—	—	—
Of the priests and their vestments for glory and beauty,	28.	—	—	—
Of the choosing of the Levites,	—	—	18. 3. 8.	—
Of the priest's office in general,	—	—	3. 18.	—
Of their office in teaching,	—	19. 10.	—	18. 12. 17. 31.
Of their office in blessing,	—	—	6.	—
Of their office in offering; which function largely spreading itself, is divided into these heads, *viz.*				
What the sacrifice ought to be,	—	22.	—	15. 17.
Of the continual fire,	—	6.	—	—
Of the manner of the burnt offerings,	—	6. 7.	—	—
——— the peace offerings,	—	3. 7.	—	—

Of

Mosaic Law.

	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
Of the manner of the sacrifices, according to their several kinds, *viz.*				
For sin committed through ignorance of the law,	—	4.	5.	—
For sin committed through ignorance of the fact,	—	5. 7.	—	—
For sin committed wittingly, yet not through impiety,	—	6.	5.	—
The special law of sacrifices for sin,	—	6. 7.	—	—
Of things belonging to the sacrifices,	—	2. 6. 7.	15.	—
Of the shew-bread,	—	24.	—	—
Of the lamps,	27.	24.	8.	—
Of the sweet incense,	30.	—	—	—
Of the use of ordinary oblations, whereof there were several kinds observed by the priests,				
Of the consecration of the high priests and other priests,	29. 30.	6. 8.	—	—
Of the consecration and office of the Levites,	—	—	8.	—
Of the dwelling of the Levites,	—	—	35.	—
Of the anointing the altar, and all the instruments of the tabernacle,	29. 30.	—	—	—
Of the continual daily sacrifices,	29.	—	28.	—
Of the continual sabbath-day's sacrifice,	—	—	28.	—
Of the solemn sacrifice for feast-days, which were diverse, and had peculiar rites, distinguished into these, *viz.*				
Of trumpets,	—	—	10.	—
Of beginning of months,	—	—	28.	—
Of the three most solemn feasts in general,	23. 34.	23.	—	16.
Of the feast of passover,	12. 13. 25. 34.	23.	9. 28.	16.
Of the feast of pentecost,	23. 24.	23.	28.	16.
Of the feast of tabernacles,	23. 34.	23.	29.	16.
Of the feast of blowing the trumpets,	—	23.	29.	—
Of the feast of expiation,	30.	16. 13.	29.	—
Of the first fruits,	22. 23. 34.	2.	15.	26.
Of tythes,	—	21.	18.	12. 14. 26.
Of fruits growing and not eaten of,	—	19.	—	—
Of the first born,	13. 22. 34.	—	—	15.
Of the sabbatical year,	23.	25.	—	—
Of the year of jubilee,	—	25.	—	—
Of vows in general,	—	27.	30.	13.
What persons ought not to make vows,	—	—	30.	—
What things cannot be vowed,	—	27.	—	23.
Of redemption of vows,	—	27.	—	—
Of the vows of the Nazarites,	—	—	6.	—
Of the laws proper for the priests, *viz.*				
Of pollutions,	—	22.	—	—
Of the high-priest's mourning,	—	21.	—	—
Of his marriage,	—	21.	—	—
Of the mourning of the ordinary priests,	—	21.	—	—
Of their marriage,	—	21.	—	—
Of their being forbid the use of wine, &c.	—	10.	—	—
Of sanctified meats,	— —	6. 17. 19. 20.	5. 18.	12. 15. 18.
Of the office of the Levites, *viz.*				
Teaching,	—	—	—	17. 27. 31.
Offering,	—	—	3. 4. 18.	10.
Other promiscuous ceremonial laws, *viz.*				
Of uncleanness in general,	—	15. 19.	5.	—
Of uncleanness in meats, *viz.*				
Of blood, Gen. ix.	23.	7. 17. 19.	—	12.
Of fat,	—	3. 7.	—	—
Of dead carcases,	22.	17.	—	14.
Other meats, and diverse living creatures,	—	11. 20.	—	14.
Of uncleanness in the issue of seed and blood,	—	15. 12.	—	23.
In the dead bodies of men,	—	—	19.	—
In the leprosy,	—	13. 14.	5.	—

Of

	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
Of circumcision, Gen. xvii.	—	12.	—	—
Of the water of expiation,	—	—	19.	—
Of the mourning of the Israelites,	—	19.	—	14.
Of mixtures,	—	19.	—	14.
Of their garments, and writing the law privately,	—	—	15.	6. 11. 22.
Of young birds not to be taken with the dam,	—	—	—	22.
Of their paddle staves,	—	—	—	23.

Class III. The Political Law.

N. B. The Magistrate is the Keeper of the Precepts of both Tables, and to have respect to human Society:—therefore the Political Laws of the Israelites are referred to both the Tables, and are to be reduced to the several Precepts of the Moral Law.

	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
Laws referred to the first table, namely,				
1st, To the first and second commandments, *viz.*				
Of idolators and apostates,	22.	20.	—	13. 17.
Of abolishing idolatry,	23. 24.	—	33.	7. 12.
Of diviners and false prophets,	22.	19. 20.	—	18.
Of covenants with other gods,	23.34.	—	—	7.
2d. To the third commandment, *viz.*				
Of blasphemies,	—	24.	15.	—
3d. To the fourth commandment, *viz.*				
Of breaking the sabbath,	31. 35.	—	15.	—
Political laws referred to the second table,				
1st. To the fifth commandment, *viz.*				
Of magistrates and their authority, Of the power of fathers,	18. 30.	—	11.	1. 13. 17. 23.
2d. To the sixth commandment, *viz.*				
Of capital punishments,	—	—	—	21. 24.
Of wilful murder,	21.	24.	35.	19.
Of manslaughter unwittingly committed, and of the cities of refuge,	21.	—	35.	19.21.22.
Of heinous injury,	21.	24.	—	25.
Of punishments not capital,	—	—	—	25.
Of the law of war,	—	—	—	25.
3d. To the seventh commandment, *viz.*				
Of unlawful marriages,	—	18. 20.	—	7. 21.
Of fornication,	—	19.	—	23.
Of whoredom,	22.	21.	—	22.
Of adultery and jealousy,	—	19. 20.	—	—
Of copulation against nature,	22.	18. 20.	—	—
Of divorcements,	—	—	—	24.
Other matrimonial laws,	21.	18. 20.	—	21.22.24. 25.
4th. To the eighth commandment, *viz.*				
Of the punishment of thefts,	22.	—	5.	—
Of sacrilege, Joshua vii.	—	—	—	—
Of not injuring strangers,	22. 23.	19.	—	10.
Of not defrauding hirelings,	—	19.	—	26. 25.
Of just weights,	—	19.	—	25.
Of removing the land-mark,	—	—	—	19.
Of lost goods,	22.	—	—	
Of stray cattle,	22. 23.	—	—	22.
Of corrupted judgments,	23.	19.	—	16. 24.
Of fire breaking out by chance,	22.	—	—	—
Of man-stealing,	—	—	—	24.
Of the fugitive servant,	—	—	—	23.

	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
Of gathering fruits,	—	19. 23.	—	23. 24.
Of contracts, *viz.*				
Borrowing,	—	—	—	15.
Of the pledge,	22.	—	—	24.
Of uſury,	22.	25.	—	23.
Of ſelling,	21.	25.	—	15.
Of the thing lent,	22.	—	—	—
Of a thing committed to be kept,				
Of heirs,				
5th. To the ninth commandment, viz.				
Of witneſſes,	—	5.	—	17. 19
The eſtabliſhing the political law,	—	—	—	4.
The eſtabliſhing the divine law in general,	—	—	—	6. 11. 29. 30. 31.
From the dignity of the lawgiver,	—	19. 20. 22.	15.	4. 5. 6. 7. 8. 10. 26. 27.
From the excellency of the laws,	—	—		4. 26.
From the promiſes,	15. 19. 23. 34.	18. 26.	—	4. 5. 6. 7. 10. 11. 12. 28.
From the threatnings,	23.	26.	—	4. 7. 11. 27. 28. 29. 30.

MOSAIC, or Mosaic-work, an aſſemblage of little pieces of glaſs, marble, precious ſtones, &c. of various colours, cut ſquare, and cemented on a ground of ſtucco, in ſuch a manner as to imitate the colours and gradations of painting. The critics are divided as to the origin and reaſon of the name. Some derive it from *moſaicum*, a corruption of *muſaicum*, as that is of *muſivum*, as it was called among the Romans. Scaliger derives it from the Greek μουσα, and imagines the name was given to this ſort of works as being very fine and ingeneous. Nebricenſis is of opinion it was ſo called, becauſe *ex illis picturis ornabantur muſea*.

1. The method of performing Moſaic work of *glaſs* is this: provide little pieces of glaſs, of as many different colours and ſizes as poſſible.

Now, in order to apply theſe ſeveral pieces, and out of them to form a picture, they in the firſt place procure a cartoon or deſign to be drawn; this is transferred to the ground or plaſter by calking, as in painting in freſco. See Fresco.

As this plaſter is to be laid thick on the wall, and therefore will continue freſh and ſoft a conſiderable time, ſo there may be enough prepared at once to ſerve for as much work as will take up three or four days.

This plaſter is compoſed of lime made of hard ſtone, with brick-duſt very fine, gum tragacanth, and whites of eggs: when this plaſter has been thus prepared and laid on the wall, and made the deſign of what is to be repreſented, they take out the little pieces of glaſs with a pair of plyers, and range them one after another, ſtill keeping ſtrictly to the light, ſhadow, different teints, and colours repreſented in the deſign before; preſſing or flatting them down with a ruler, which ſerves both to ſink them within the ground and to render the ſurface even.

Thus, in a long time, and with a great deal of labour, they finiſh the work, which is ſtill the more beautiful, as the pieces of glaſs are more uniform, and ranged at an even height.

Some of theſe pieces of moſaic-work are performed with that exactneſs, that they appear as ſmooth as a table of marble, and as finiſhed and maſterly as a painting in freſco; with this advantage, that they have a fine luſtre, and will laſt ages.

The fineſt works of this kind that have remained till our time, and thoſe by whom the moderns have retrieved the art, which was in a manner loſt, are thoſe in the church of St Agnes, formerly the temple of Bacchus, at Rome; and ſome at Piſa, Florence, and other cities of Italy. The moſt eſteemed among the works of the moderns are thoſe of Joſeph Pine and the Chevalier Lanfranc, in the church of St Peter at Rome: there are alſo very good ones at Venice.

2. The method of performing Moſaic-work of *marble* is this: The ground of Moſaic-works, wholly marble, is uſually a maſſive marble, either white or black. On this ground the deſign is cut with a chiſel, after it has been firſt calked. After it has been cut off a conſiderable depth, *i. e.* an inch or more, the cavities are filled up with marble of a proper colour, firſt faſhioned according to the deſign, and reduced to the thickneſs of the indentures with various inſtruments. To make the piece thus inſerted into the indentures cleave faſt, whoſe ſeveral colours are to imitate thoſe of the deſign, they uſe a ſtucco, compoſed of lime and marble-duſt; or a kind of maſtic, which is prepared by each workman, after a different manner peculiar to himſelf. The figures being marked out, the painter or ſculptor himſelf draws with a pencil the colours of the figures not determined by the ground, and in the ſame manner makes ſtrokes or hatchings in the place where ſhadows are to be: and after he has engraven with the chiſel all the ſtrokes thus drawn, he fills them up with a black maſtic, compoſed partly of Burgundy-pitch poured on hot; taking off afterwards what is ſuperfluous with a

Mosaic. piece of soft stone or brick, which together with water and beaten cement, takes away the mastic, polishes the marble, and renders the whole so even that one would imagine it only consisted of one piece. This is the kind of Mosaic-work that is seen in the pompous church of the invalids at Paris, and the fine chapel at Versailles, with which some entire apartments of that palace are incrustated.

3. As for Mosaic-work of precious stones, other and finer instruments are required than those used in marble; as drills, wheels, &c. used by lapidaries and engravers on stone. As none but the richest marbles and stones enter this work, to make them go the farther, they are sawn into the thinnest leaves imaginable, scarce exceeding half a line in thickness; the block to be sawn is fastened firmly with cords on the bench, and only raised a little on a piece of wood, one or two inches high. Two iron pins, which are on one side the block and which serve to fasten it, are put into a vice contrived for the purpose; and with a kind of saw or bow, made of fine brass-wire, bent on a piece of spongy wood together with emery steeped in water, the leaf is gradually fashioned by following the stroke of the design, made on paper, and glued on the piece. When there are pieces enough fastened to form an entire flower, or some other part of the design, they are applied to the ground.

The ground which supports this Mosaic-work is usually of free-stone. The matter with which the stones are joined together is a mastic, or kind of stucco, laid very thin on the leaves as they are fashioned; and this being done, the leaves are applied with plyers.

If any contour, or side of a leaf, be not either squared or rounded sufficiently, so as to fit the place exactly into which it is to be inserted, when it is too large, it is to be brought down with a brass file or rasp; and if it be too little, it is managed with a drill and other instruments used by lapidaries.

Mosaic-work of marble is used in large works, as in pavements of churches, basilics, and palaces; and in the incrustation and vaneering of the walls of the same edifices.

As for that of precious stones, it is only used in small works, as ornaments for altar pieces, tables for rich cabinets, precious stones being so very dear.

4. Manner of performing Mosaic-work of *gypsum*. Of this stone calcined in a kiln beaten in a mortar, and sifted, the French workmen made a sort of artificial marbles, imitating precious stones; and of these they compose a kind of Mosaic-work, which does not come far short either of the durableness or the vivacity of the natural stones; and which besides has this advantage, that it admits of continued pieces or painting of entire compartiments without any visible joining.

Some make the ground of plaster of Paris, others of free stone. If it be of plaster of Paris they spread it in a wooden frame, of the length and breadth of the work intended, and in thickness about an inch and a half. This frame is so contrived, that the tenons being only joined to the mortises by single pins, they may be taken asunder, and the frame be dismounted when the plaster is dry. The frame is covered on one side with a strong linen cloth, nailed all round; which being placed horizontally with the linen at the bottom, is filled with plaster passed through a wide sieve. When the plaster is half dry, the frame is set up perpendicularly, and left till it is quite dry; then it is taken out, by taking the frame to pieces.

Mosaic. In this Mosaic, the ground is the most important part. Now in order to the preparation of this sifted gypsum, which is to be applied on this ground, it is dissolved and boiled in the best English glue, and mixed with the colour that it is to be of; then the whole is worked up together into the usual consistence of plaster, and then is taken and spread on the ground five or six inches thick. If the work be such, as that mouldings are required, they are formed with gouges and other instruments.

It is on this plaster, thus coloured like marble or precious stone, and which is to serve as a ground to a work, either of lapis, agate, alabaster, or the like, that the design to be represented is drawn; having been first pounced or calqued. To hollow or impress the design they use the same instrumenss that sculptors do; the ground whereon they are to work not being much less hard than the marble itself. The cavities being thus made in the ground, are filled with the same gypsum boiled in glue, only differently coloured, and thus are the different colours of the original represented. In order that the necessary colours and teints may be ready at hand, the quantities of the gypsum are tempered with the several colours in pots. After the design has been thus filled and rendered visible, by half-polishing it with brick and soft stone, they go over it again, cutting such plates as are either to be weaker or more shadowed, and filling them with gypsum; which work they repeat till all the colours being aded one after the other, represent the original to the life. When the work is finished, they scour it with soft stone, sand, and water; after that, with a pumice-stone; and in the last place polish it with a wooden mullet and emery. Lastly, they give it a lustre, by smearing it over with oil, and rubbing it a long time with the palm of the hand, which gives it a lustre no ways inferior to that of natural marble.

5. In Clavigero's history of Mexico is described a curious kind of Mosaic-work made by the ancient Mexicans of the most delicate and beautiful *feathers* of birds. They raised for this purpose various species of birds of fine plumage with which that country abounds, not only in the palaces of the king, where there were all sorts of animals, but likewise in private houses; and at certain seasons they carried off their feathers to make use of them on this kind of work, or to sell them at market. They set a high value on the feathers of those wonderful little birds which they call *Huitzitzilin*, and the Spaniards *Picaflores*, on account of the smallness, the fineness, and the various colours of them. In these and other beautiful birds, nature supplied them with all the colours which art can produce, and also some which art cannot imitate. At the undertaking of every Mosaic-work several artists assembled: After having agreed upon a design, and taken their measures and proportions, each artist charged himself with the execution of a certain part of the image, and exerted himself so diligently in it with such patience and application, that he frequently spent a whole day in adjusting a feather; first trying one, then another, viewing it sometimes one way, then another

another, until he found one which gave his part that ideal perfection proposed to be obtained. When the part which each arrtist undertook was done, they assembled again to form the entire image from them. If any part was accidentally the least deranged, it was wrought again until it was perfectly finished. They laid hold of the feathers with small pincers, that they might not do them the least injury, and pasted them on the cloth with *tzauhtli*, or some other glutinous matter; then they united all the parts upon a little table, or a plate of copper, and flattened them softly until they left the surface of the image so equal and smooth that it appeared to be the work of a pencil.

These were the images so much celebrated by the Spaniards and other European nations. Whoever beheld them was at a loss whether he ought to have praised most the life and beauty of the natural colours, or the dexterity of the artist and the ingenious disposition of art. "These images (says Acosta) are deservedly admired; for it is wonderful how it was possible, with the feathers of birds, to execute works so fine and so equal, that they appear the performance of the pencil; and what neither the pencil nor the colours in painting can effect, they have, when viewed from a side, an appearance so beautiful, so lively, and animated, they give delight to the sight. Some Indians, who are able artists, copy whatever is painted with a pencil so perfectly with plumage, that they rival the best painters of Spain." These works of feathers were even so highly esteemed by the Mexicans as to be valued more than gold. Cortes, Bernal Diaz, Gomara, Torquemada, and all the other historians who saw them, were at a loss for expressions sufficient to praise their perfection. Several works of this kind, our author says, are still preserved in the museums of Europe, and many in Mexico; but few, he apprehends, belong to the sixteenth century, and still fewer, if any, are of those made before the conquest. The Mosaic-works also which the Mexicans made of broken shells was extremely curious: this art is still practised in Guatimala.

MOSAMBIQUE, a kingdom of Africa, lying south of Quiloa, and taking its name from the chief town, which is situated on an island, at the mouth of a river of the same name, in 15 deg. S. Lat. The island is 30 miles in circumference, and very populous, though the air is said to be very hot, and the soil in general dry, sandy, and barren; yet they have most of the tropical fruits, with black cattle, hogs, and sheep. There is a kind of fowl here, both the feathers and flesh of which are black, insomuch that, when they are boiled, the broth looks like ink; and yet their flesh is very delicate and good food. The town of Mosambique is regularly fortified, and has a good harbour, defended by a citadel, with several churches and monasteries. The Portuguese shipping to and from India touch here for refreshments. As the island abounds in cattle, the Portuguese slaughter and salt up a great deal of beef, which they afterwards send to the Brazils, or sell to the European shipping. They also barter European goods with the natives for gold elephants teeth, and slaves. There is another town, called *Mongale*, situated also on an island, and garrisoned by the Portuguese, being their chief magazine for European goods. The gold they receive from the natives is found near the surface of the earth, or in the sands of rivers; no gold mines, or at least very few, being at present wrought in Africa.

MOSCHION, a name common to four different writers, whose compositions, character, and native place, are unknown. Some fragments of their writings remain, some few verses, and a treatise *De Mulierum affectibus*.

MOSCHUS, a Grecian poet of antiquity, usually coupled with Bion; and they were both of them cotemporaries with Theocritus. In the time of the latter Grecians, all the ancient Idyliums were collected and attributed to Theocritus; but the claims of Moschus and Bion have been admitted to some few little pieces; and this is sufficient to make us inquisitive about their characters and story: yet all that can be known about them must be collected from their own remains. Moschus, by composing his delicate elegy on Bion, has given the best memorials of Bion's life. See Bion. Moschus and Theocritus have by some critics been supposed the same person; but there are irrefragable evidences against it: others will have him as well as Bion to have lived later than Theocritus, upon the authority of Suidas: while others again suppose him to have been the scholar of Bion, and probably his successor in governing the poetic school; which, from the elegy of Moschus, does not seem unlikely. Their remains are to be found in all the editions of the *Poetæ Minores*.

MOSCHUS, in zoology, a genus of quadrupeds of the order of pecora, having no horns. There are eight small cutting teeth in the lower jaw; in the upper, no cutting or fore teeth; but two long tusks, one on each side, projecting out of the mouth Plate CCCXV.

1. The moschiferus, or Thibet musk, has a bag or tumour on the belly near the navel, and a very short tail almost hid in the fur. The length of the male is about three feet three inches from the nose to the origin of the tail, and about two feet three inches high at the shoulder; the female is less than the male, has a sharper nose, has no tusks nor musk-bag, and is provided with two teats. The head resembles that of the roe: the fur is coarse like that of the animals of the deer hind; but softer, very smooth, erect, plentiful, thick, and long: the colour varies according to the age of the animal and time of the year; but is chiefly blackish brown on the upper, and hoary, seldom white, on the under parts of the body; the hoofs are long, black, and much divided, and the spurious hoofs of the fore feet are very long: the scrotum is of a bright red colour, and the penis very small. It inhabits the Asiatic Alps, especially the highest rocky mountains from the Altaic chain to that which divides Thibet from India; likewise in China and Tonquin, and in eastern Siberia about lake Baikal and the rivers Jenisea and Argun. It avoids mankind, dwelling solitarily in the most precipitous places of the mountains, among rocks in the small narrow valleys surrounded by these snowy hills, and the pine forests which grow in their interstices. It is a very gentle and timid animal, excepting in rutting time, when the males fight violently with their tusks for the females; it is exceedingly active in leaping, running, climbing, and swimming, and is very difficultly tamed; the flesh is eatable, and that of the younger animals is reckoned delicate. The

Moschus. chace of them is a trade equally difficult and hazardous; if pursued, they seek the highest tops of the snowy peaks, inaccessible to men or dogs. They take amazing leaps over the tremendous chasms of the alps, or from rock to rock; treading so light on the snow, with their true and false hoofs extended, as scarcely to leave a mark; while the dogs which pursue them sink in, and are forced to desist from the chase. They are so fond of liberty as never to be kept alive in captivity. They are mostly taken in snares, or shot by crossbows placed in their tracks, with a string from the trigger for them to tread on, and discharge. The Tungusi shoot them with bows and arrows. The skins are used for bonnets and winter dresses. The Russians often scrape off the hair, and have a way of preparing them for summer cloathing, so as to become as soft and shining as silk. The noted drug the musk is produced from the male. The bag or follicle that contains it is situated near the prepuce; and is of a somewhat oval figure, flat on one side and rounded on the other, having a small open orifice. In young animals this bag is empty; but in adults it is filled with a clotted, oily, friable matter, of a dark brown colour: this is the true musk, of which each bag contains from a dram and a half to two drams. The best comes from Thibet; that which is produced in Siberia having somewhat of the flavour of castor.

2. The Americanus, or Brasilian musk, of a reddish brown colour, with a black muzzle and white throat, is scarcely so large as a roe-buck. The fur is soft and short; the colour of the head and upper part of the neck is dark brown; the lower part of the neck and throat are white; the body and limbs are reddish brown; the hind legs are longer than the fore. This animal, which inhabits Guiana and Brasil, is exceedingly timid, active, and swift. Numbers are frequently seen swimming in the rivers, and at that time are easily taken. The Indians hunt them, and their flesh is esteemed very delicate. The French of Guiana call them *bitches* or does, because, notwithstanding their likeness to deer, both sexes are without horns. Gmelin suspects this animal may only be a fawn of the American roe.

3. The Indicus, or Indian musk, has short hair of a tawney colour on the upper, and whitish on the under parts of the body; the tail is short, and the feet have spurious hoofs. It inhabits India, and is much of the same size with the moschiferus, but the tail is longer and more perceptible; the legs are very slender; and the head resembles that of a horse, with erect oblong ears.

4. The pigmæus, or pigmy musk, is marked as to colour like the former, but has no spurious hoofs.—The body and head measure only nine inches and a half in length; the tail is about an inch long; and the legs are smaller than a man's finger. It inhabits the East Indies and several of the Indian islands. It is called *kant chel* by the Malayes, and *poet jang* by the inhabitants of Java. The natives catch them in great numbers, carry them in cages to market, and sell them for 2½d. a-piece.

5. The meminna, or Ceylon chevrotin, is in length 17 inches from the nose to the rump, and of a cinereous olive colour; the throat, breast, and belly, are white; the sides and haunches spotted, and barred transversely with white; and the ears are large and open: the tail is very short; and the feet have no spurious hoofs. It inhabits Ceylon and Java.

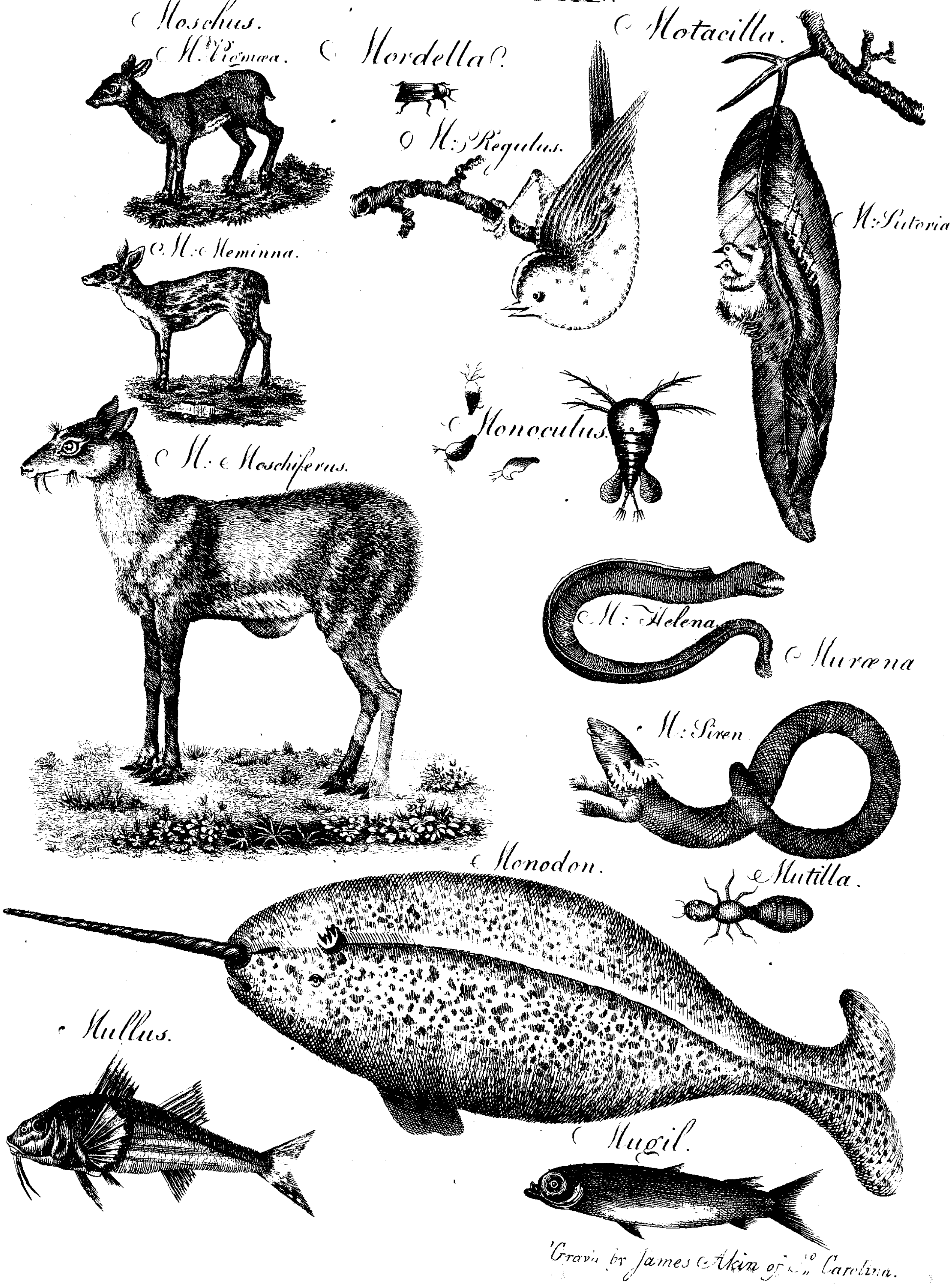
6. The javanicus, or Javan musk, is of a ferruginous colour on the upper parts of the body, and white all along the under; the tail is long and hairy, white below and at the tip; its legs are similar to those of the pigmy musk, and furnished with very small spurious hoofs. This and the meminna seem only varieties of the pigmæus.

Moscow. MOSCOW, the chief province of the empire of Russia, deriving its name from the river Muscova, or Moskva, on which the capital is situated. It was from this duchy that the czars of old took the title of *dukes of Muscovy*. The province is bounded on the north by the duchies of Twere, Rostow, Susdal, and Wolodimer; on the south by Rezan, from which it is separated by the river Occa; on the east by the principality of Cachine, and the same river Occa parting it from Nisi Novogorod; and on the west by the duchies of Rzeva, Biela, and Smolensko. It extends about 200 miles in length, and about 100 in breadth; and is watered by the Moska, Occa, and Clesma, which fall into the Wolga: nevertheless, the soil is not very fertile. The air, however, though sharp is salubrious; and this consideration, with the advantage of its being situated in the midst of the best provinces in the empire, induced the czars to make it their chief residence. In the western part of Moscow is a large forest, from whence flows the celebrated river Nieper, or Borysthenes, which, traversing the duchy of Smolensko, winds in a serpentine course to Ukraine, Lithuania, and Poland.

Moscow, the capital of the above province, and till the beginning of the present century the metropolis of all Russia, is situated in a spacious plain on the banks of the river Muskova. The Russian antiquaries differ considerably in their opinions concerning the first foundation of Moscow; the following relation, Mr Coxe says, is generally esteemed by the best authors the most probable account.

Kiof was the metropolis, when George son of Vladimir Monomaka ascended in 1154 the Russian throne. That monarch, being insulted in a progress through his dominions by a rich and powerful nobleman named Stephen Kutchko, put him to death, and confiscated his domains, which consisted of the lands now occupied by the city of Moscow and the adjacent territory. Pleased with the situation of the ground lying at the conflux of the Moskva and Neglina, he laid the foundation of a new town, which he called Moskva from the river of that name. Upon the demise of George, the new town was not neglected by his son Andrew, who transferred the seat of empire from Kiof to Vladimir; but it fell into such decay under his immediate successors, that when Daniel, son of Alexander Nevski, received, in the division of the empire, the duchy of Muscovy as his portion, and fixed his residence upon the conflux of the Moskva and Neglina, he may be said to have new founded the town. The spot now occupied by the Kremlin was at that time overspread with a thick wood and a morass, in the midst whereof was a small island containing a single wooden hut. Upon this part Daniel constructed churches and monasteries, and various buildings, and enclosed

Plate CCCXV



Grav'd by James Akin of So. Carolina.

Moscow. enclosed it with wooden fortifications; he first assumed the title of duke of Moscow, and was so attached to this situation, that when in 1304 he succeeded his brother Andrew Alexandrovich in the great duchy of Vladimir, he did not remove his court to Vladimir, but continued his residence at Moscow, which then became the capital of the Russian dominions. His successors followed his example; among whom his son Ivan considerably enlarged the new metropolis, and in 1367 his grandson Demetrius Ivanovitch Donski surrounded the Kremlin with a brick wall. These new fortifications, however, were not strong enough to prevent Tamerlane in 1382 from taking the town, after a short siege. Being soon evacuated by that desultory conqueror, it again came into the possession of the Russians; but was frequently invaded and occupied by the Tartars, who in the 14th and 15th centuries over-ran the greatest part of Russia, and who even maintained a garrison in Moscow until they were finally expelled for Ivan Vassilievitch I. To him Moscow is indebted for its principal splendor, and under him it became the principal and most considerable city of the Russian empire.

Moscow continued the metropolis of Russia until the beginning of the present century, when, to the great dissatisfaction of the nobility, but with great advantage probably to the state, the seat of empire, was transferred to Petersburgh.

Notwithstanding the predilection which Peter conceived for Petersburgh, in which all the succeeding, sovereigns excepting Peter II. have fixed their residence, Moscow, according to Mr Coxe, is still the most populous city of the Russian empire. Here the chief nobles who do not belong to the court of the empress reside: they here support a larger number of retainers; they love to gratify their taste for a ruder and more expensive magnificence in the ancient style of feudal grandeur; and are not, as at Petersburgh, eclipsed by the superior splendor of the court.

Moscow is represented as the largest town in Europe; its circumference within the rampart, which encloses the suburbs, being exactly 39 versts or 26 miles; but it is built in so straggling and disjointed a manner, that its population in no degree corresponds to its extent. Some Russian authors state its inhabitants at 500,000 souls, a number evidently exaggerated. According to a late computation, which Mr Coxe says may be depended upon, Moscow contains within the ramparts 250,000 souls, and in the adjacent villages 50,000. The streets of Moscow are in general exceedingly long and broad: some of them are paved; others, particularly those in the suburbs, are formed with trunks of trees, or are boarded with planks like the floor of a room; wretched hovels are blended with large palaces; cottages of one story stand next to the most superb and stately mansions. Many brick structures are covered with wooden tops; some of the wooden houses are painted; others have iron doors and roofs. Numerous churches present themselves in every quarter, built in a peculiar style of architecture; some with domes of copper, others of tin, gilt or painted green, and many roofed with wood. In a word, some parts of this vast city have the look of a sequestered desart, other quarters of a populous town; some of a contemptible village, others of a great capital.

Moscow may be considered as a town built upon the Asiatic model, but gradually becoming more and more European, and exhibiting in its present state a motley mixture of discordant architecture. It is distributed into the following divisions. 1. The Kremlin. This stands in the central and highest part of the city; is of a triangular form, and about two miles in circumference; and is surrounded by high walls of stone and brick, which were constructed in the year 1491, under the reign of Ivan Vassilievitch I. It contains the ancient palace of the czars, several churches, two convents, the patriarchal palace, the arsenal now in ruins, and one private house, which belonged to Boris Godunof before he was raised to the throne. 2. Khitaigorod, or the Chinese town, is inclosed on one side by that wall of the Kremlin which runs from the Moskva to the Neglina; and on the other side by a brick wall of inferior height. It is much larger than the Kremlin, and contains the university, the printing-house, and many other public buildings, and all the tradesmens shops. The edifices are mostly stuccoed or white washed, and it has the only street in Moscow in which the houses stand close to one another without any intervals between them. 3. The Bielgorod, or White Town, which runs quite round the two preceding divisions, is supposed to derive its name from a white wall with which it was formerly enclosed, and of which some remains are still to be seen. 4. Semlainogorod, which environs all the three other quarters, takes its denomination from a circular rampart of earth with which it is encompassed. These two last mentioned divisions exhibit a grotesque groupe of churches, convents, palaces, brick and wooden houses, and mean hovels; in no degree superior to peasants cottages. 5. The Sloboda, or suburbs, form a vast exterior circle round all the parts already described, and are invested with a low rampart and ditch. These suburbs contain, beside buildings of all kinds and denominations, corn fields, much oxen pasture, and some small lakes, which give rise to the Neglina. The river *Moskva*, from which the city takes its name, flows through it in a winding channel; but, excepting, in spring, is only navigable for rafts. It receives the Yausa in the Semlainogorod, and the Neglina at the western extremity of the Kremlin; the beds of both these last-mentioned rivulets are in summer little better than dry channels.

The places of divine worship at Moscow are exceedingly numerous; including chapels, they amount to above 1000; there are 484 public churches, of which 199 are of brick, and the others of wood; the former are commonly stuccoed or white-washed, the latter painted of a red colour, The most ancient churches of Moscow are generally square buildings, with a cupola and four small domes, some whereof are of copper or iron gilt; others of tin; either plain or painted green. These cupolas and domes for the most part ornamented with crosses entwined with thin chains or wires. The church of the Holy Trinity sometimes called the church of Jerusalem, which stands in the Khitaigorod, close to the gate leading into the Kremlin, has a kind of high steeple and nine or ten domes;

domes: it was built in the reign of Ivan Vassilievitch II. The inside of the churches is mostly composed of three parts: that called by the Greeks πρόναος, by the Russians trapeza; the body; and the sanctuary or shrine. Over the door of each church is the portrait of the saint to whom it is dedicated, to which the common people pay their homage as they pass along by taking off their hats, crossing themselves and occasionally touching the ground with their heads. The bells, which form no inconsiderable part of public worship in this country, as the length or shortness of their peals ascertains the greater or lesser sanctity of the day, are hung in belfreys detached from the church: they do not swing like our bells; but are fixed immoveably to the beams, and are rung by a rope tied to the clapper and pulled sideways. Some of these bells are of a stupendous size: one in the tower of St Ivan's church weighs 3551 Russian pounds, or 127,836 English pounds. It has always been esteemed a meritorious act of religion to present a church with bells: and the piety of the donor has been measured by their magnitude. According to this mode of estimation, Boris Godunof, who gave a bell of 288,000 pounds to the cathedral of Moscow, was the most pious sovereign of Russia, until he was surpassed by the empress Anne, at whose expence a bell was cast weighing 432,000 pounds, and which exceeded in bigness every bell in the known world. The height of this enormous bell is 19 feet, its circumference at the bottom 21 yards 11 inches; its greatest thickness 23 inches. The beam to which this vast machine was fastened being accidentally burnt, the bell fell down, and a fragment was broken off towards the bottom, which left an aperture large enough to admit two persons a-breast without stopping.

The palace, inhabited by the ancient czars, stands at the extremity of the Kremlin, Part of this palace is old, and remains in the same state in which it was built under Ivan Vassilievitch I. The remainder has been successively added at different intervals without any plan, and in various styles of architecture, which has produced a motley pile of building, remarkable for nothing but the incongruity of the several structures. The top is thickly set, with numerous little gilded spires and globes; and a large portion of the front is decorated with the arms of all the provinces which compose the Russian empire. The apartments are in general exceedingly small, excepting one single room called the council-chamber, in which the ancient czars used to give audience to foreign ambassadors, and which has been repeatedly described by several English travellers who visited Moscow before the imperial residence was transfered to Petersburg. The room is large and vaulted, and has in the centre an enormous pillar of stone which supports the ceiling. In this palace Peter the Great came into the world, in the year 1672. In that part called the treasury are reposited the crown, jewels, and royal robes, used at the coronation of the sovereign, besides several curiosities relative to the history of the country. Of the great number of churches contained in this city, two in particular, namely, that of St Michael and that of the Assumption of the Virgin Mary, are remarkable; the one for being the place where the sovereigns of Russia were formerly interred, and the other where they are crowned. These edifices, which are situated in the Kremlin, are both in the same style of architecture; and their exterior form, though modelled according to the ancient style of the country, is not absolutely inelegant. In the cathedral of St Michael, which contains the tombs of the Russian sovereigns, the bodies are not, as with us, deposited in vaults, or beneath the pavement, but are entombed in raised sepulchres, mostly of brick, in the shape of a coffin, and about two feet in height, When Mr Coxe visited the cathedral, the most ancient were covered with palls of red cloth, others of red velvet, and that of Peter II. with gold tissue, bordered with silver fringe and ermine. Each tomb has at its lower extremity a small silver plate, upon which is engraved the name of the deceased sovereign, and the æra of his death.

The cathedral of the Assumption of the Virgin Mary, which has long been appropriated to the coronation of the Russian sovereigns, is the most splendid and magnificent in Moscow. The screen is in many parts covered with plates of solid silver and gold richly worked. From the centre of the roof hangs an enormous chandelier of massy silver, weighing 2940 pounds; it was made in England, and was a present from Morosof, prime minister and favourite of Alexey Michaelovitch. The sacred utensils and episcopal vestments are extraordinarily rich, but the taste of the workmanship is in general rude, and by no means equal to the materials. Many of the paintings which cover the inside walls are of a Colossal size: some are very ancient, and were executed so early as in the latter end of the 15th century. It contains, amongst the rest, a head of the virgin, supposed to have been delineated by St Luke, and greatly celebrated in this country for its sanctity and the power of working miracles. Its face is almost black; its head is ornamented with a glory of precious stones and its hands and body are gilded, which gives it a most grotesque appearance. It is placed in the skreen, and enclosed within a large silver covering, which is only taken off on great festivals, or for the curiosity of stangers. In this cathedral are deposited the remains of the Russian patriarchs.

The place in the Khitaigorod, where the public archives are deposited, is a strong brick building, containing several vaulted apartments with iron floors. These archives consisting of a numerous collection of state-papers, were crowded into boxes, and thrown aside like common lumber, until the present empress ordered them to be revised and arranged. In conformity to this mandate, Mr Muller has disposed them in chronological order with such perfect regularity, than any single document may be inspected with little trouble. They are enclosed in separate cabinets with glass doors; those relative to Russia are all classed according to the several provinces which they concern; and over each cabinet is inscribed the name of the province to which it is appropriated. In the same manner the manuscripts relative to foreign kingdoms are placed in separate divisions under the respective titles of Poland, Sweden, England, France, Germany, &c.

The university of Moscow, also situated in the Khitaigorod, was founded, at the instance of Count Shuvalof, by the empress Elizabeth, for 600 students; who are clothed, Moscow. clothed, boarded, and instructed, at the expence of the crown. Besides this institution, there are two gymnasia or seminaries for the education of youth, endowed also by Elizabeth; in which are taught, by twenty-three philosophers, divinity, classics, philosophy, the Greek, Latin, Russian, German, French, Italian, and Tartar languages; history, geography, mathematics, architecture, fortification, artillery, algebra, drawing and painting, music, fencing, dancing, reading and writing.

Moscow is the centre of the inland commerce of Russia, and particularly connects the trade between Europe and Siberia. The only navigation to this city is formed by the Moskva, which falling into the Occa near Columna, communicates by means of that river with the Volga. But as the Moskva is only navigable in spring upon the melting of the snows, the principal merchandise is conveyed to and from Moscow upon sledges in winter. As to the retail commerce here, the whole of it is carried on in the Khitaigorod; where, according to a custom common in Russia, as well as in most kingdoms of the East, all the shops are collected together in one spot. The place is like a kind of fair, consisting of many rows of low brick buildings; the interval between them resembling alleys. These shops or booths occupy a considerable space; they do not, as with us, make part of the houses inhabited by the tradesmen, but are quite detached from their dwellings, which for the most part are at some distance in another quarter of the town. The tradesman comes to his shop in the morning, remains there all day, and returns home to his family in the afternoon. Every trade has its separate department; and they who sell the same goods have booths adjoining to each other. Furs and skins form the most considerable article of commerce in Moscow; and the shops which vend those commodities occupy several streets.

Among the curiosities of Moscow, the market for the sale of houses is not the least remarkable. It is held in a large open space in one of the suburbs; and exhibits a great variety of ready-made houses, thickly strewed upon the ground. The purchaser who wants a dwelling, repairs to this spot, mentions the number of rooms he requires, examines the different timbers, which are regularly numbered, and bargains for that which suits him. The house is sometimes paid for on the spot and taken away by the purchaser; or sometimes the vender contracts to transport and erect it upon the place where it is designed to stand. It may appear incredible to assert, that a dwelling may be thus bought, removed, raised, and inhabited, within the space of a week; but we shall conceive it practicable by considering that these ready-made houses are in general merely collections of trunks of trees tenanted and mortoised at each extremity into one another, so that nothing more is required than the labour of transporting and adjusting them. But this summary mode of building is not always peculiar to the meaner hovels; as wooden structures of very large dimensions and handsome appearance are occasionally formed in Russia with an expedition almost inconceivable to the inhabitants of other countries. A remarkable instance of this dispatch was displayed the last time the empress came to Moscow. Her majesty proposed to reside in the mansion of prince Galitzin, which is esteemed the completest edifice in this city; but as it was not sufficiently spacious for her reception, a temporary addition of wood, larger than the original house, and containing a magnificent suite of apartments, was begun and finished within the space of six weeks. This meteor-like fabric was so handsome and commodious, that the materials which were taken down at her majesty's departure, were to be reconstructed as a kind of imperial villa upon an eminence near the city. Mr Coxe mentions an admirable police in this city for preventing riots, or for stopping the concourse of people in case of fires, which are very frequent and violent in those parts, where the houses are mostly of wood, and the streets are laid with timber. At the entrance of each street there is a chevaux-de frize gate, one end whereof turns upon a pivot, and the other rolls upon a wheel; near it is a centry-box in which a man is occasionally stationed. In times of riot or fire the centinel shuts the gate, and all passage is immediately stopped.

Among the public institutions of Moscow, the most remarkable is the Foundling Hospital, endowed in 1764 by the present empress, and supported by voluntary contributions and legacies, and other charitable gifts. In order to encourage donations, her majesty grants to all benefactors some valuable privileges, and a certain degree of rank in proportion to the extent of their liberality. Among the principal contributors must be mentioned a private merchant named *Dimidof*, a person of great wealth, who has expended in favour of this charity above L. 100,000 The hospital, which is situated in a very airy part of the town upon a gentle ascent near the river Moskva, is an immense pile of building of a quadrangular shape, part of which was only finished when Mr Coxe (whose account we are transcribing) was at Moscow. It contained, at that time, 3000 foundlings; and, when the whole is completed, will receive 8000. The children are brought to the porter's lodge, and admitted without any recommendation. The rooms are lofty and large; the dormitories, which are separate from the work rooms, are very airy, and the beds are not crowded: each foundling, even each infant has a separate bed; the beadsteads are of iron; the sheets are changed every week, and the linen three times a-week. Through the whole rooms the greatest neatness prevails; even the nurseries being uncommonly clean, and without any unwholesome smells. No cradles are allowed, and rocking is particularly forbidden. The infants are not swaddled according to the custom of the country but loosely dressed.—The foundlings are divided into separate classes, according to their respective ages. The children remain two years in the nursery, when they are admitted into the lowest class; the boys and girls continue together until they are seven years of age, at which time they are separated. They all learn to read, write, and cast accounts. The boys are taught to knit; they occasionally card hemp, flax, and wool, and work in the different manufactures. The girls learn to knit, net, and all kinds of needle-work; they spin and weave lace; they are employed in cookery, baking, and house-work of all sorts. At the age of 14 the foundlings enter into the first class; when they have the liberty of choosing any

Mofelle, Mofes.

any particular branch of trade; and for this purpofe there are different fpecies of manufactures eftablifhed in the hofpital, of which the principal are embroidery, filk ftockings, ribbands, lace, gloves, buttons, and cabinet work. A feparate room is appropriated to each trade. Some boys and girls are inftructed in the French and German languages, and a few boys in the Latin tongue; others learn mufic, drawing, and dancing. About the age of 20, the foundlings receive a fum of money, and feveral advantages, which enable them to follow their trade in any part of the empire: a very confiderable privilege in Ruffia, where the peafants are flaves, and cannot leave their village without the permiffion of the mafter.—The girls and boys eat feparately. The dining rooms, which are upon the ground-floor are large and vaulted, and diftinct from their work-rooms. The firft clafs fit at table: the reft ftand; the little children are attended by fervants; but thofe of the firft or fecond clafs alternately wait upon eachother. Their victuals are of the moft wholefome and nourifhing kinds. Each foundling has a napkin, pewter plate, a knife, fork and fpoon: the napkin and table-cloth are clean three times in the week. They rife at fix, dine at eleven, and fup at fix. The little children have bread at feven and at four. When they are not employed in their neceffary occupations, the utmoft freedom is allowed, and they are encouraged to be as much in the air as poffible.

MOSELLE, a river of Germany, which rifes in the mountains of Vauge in Lorrain, and, running thro' that duchy and the electorate of Triers, falls into the Rhine at Coblentz.

MOSES, the fon of Amram and Jochebed, was born in the year 1571 before chrift. Pharaoh king of Egypt, perceiving that the Hebrews were become a formidable nation, iffued forth an edict commanding all the male children to be put to death. Jochebed, the mother of Mofes, having, to avoid this cruel edict, concealed her fon for three months, at length made an ark or bafket of bulrufhes, daubed it with pitch, laid the child in it, and expofed him on the banks of the Nile. Thermuthis the king's daughter, who happened to be walking by the river's fide, perceived the floating cradle, commanded it to be brought to her, and ftruck with the beauty of the child, determined to preferve his life. In three years afterwards the princefs adopted him for her own fon, called his name *Mofes*, and caufed him to be diligently inftructed in all the learning of the Egyptians. But his father and mother, to whom he was reftored by a fortunate accident, were at ftill greater pains to teach him the hiftory and religion of his fathers. Many things are related by hiftorians concerning the firft period of Mofes's life, which are not to be found in the Old Teftament. According to Jofephus and Eufebius, he made war on the Ethiopians, and completely defeated them. They add, that the city Saba, in which the enemy had been forced to take refuge, was betrayed into his hands by the king's daughter, who became deeply enamoured of him, when fhe beheld from the top of the walls his valorous exploits at the head of the Egyptian army. But as the truth of this expedition is more than doubtful, we fhall therefore confine ourfelves to the narrative of facred writ, which commences at the fortieth year of Mofes's life. He then left the court of Pharaoh, and went to vifit his countrymen the Hebrews, who groaned under the ill-ufage and oppreffion of their unfeeling mafters. Having perceived an Egyptian fmiting an Hebrew, he flew the Egyptian, and buried him in the fand. But he was obliged, in confequence of this murder, to fly into the land of Midian, where he married Zipporah, daughter of the prieft Jethro, by whom he had two fons, Gerfhom and Eliezar. Here he lived 40 years; during which time his employment was to tend the flocks of his father-in-law. Having one day led his flock towards Mount Horeb, God appeared to him in the midft of a bufh which burned with fire but was not confumed, and commanded him to go and deliver his brethren from their bondage. Mofes at firft refufed to go, but was at length prevailed on by two miracles which the Almighty wrought for his conviction. Upon his return to Egypt, he, together with his brother Aaron, went to the court of Pharaoh, and told him that God commanded him to let the Hebrews go to offer facrifices in the defert of Arabia. But the impious monarch difregarded this command, and caufed the labour of the Ifraelites to be doubled. The meffengers of the Almighty again returned to the king, and wrought a miracle in his fight, that they might move his heart, and induce him to let the people depart. Aaron having caft down his miraculous rod, it was immediately converted into a ferpent; but the fame thing being performed by the magicians, the king's heart was hardened more and more; and his obftinacy at laft drew down the judgements of the Almighty on his kingdom, which was afflicted with ten dreadful plagues. The firft was the changing of the waters of the Nile and of all the rivers into blood, fo that the Egyptians died of thirft. In confequence of the fecond plague, the land was covered with innumerable fwarms of frogs, which entered even into Pharaoh's palace. By the third plague, the duft was converted into lice, which cruelly tormented both man and beaft. The fourth plague was a multitude of deftructive flies which fpread throughout Egypt, and infefted the whole country. The fifth was a fudden peftilence, which deftroyed all the cattle of the Egyptians, without injuring thofe of the Ifraelites. The fixth produced numberlefs ulcers and fiery biles upon man and upon beaft. The feventh was a dreadful ftorm of hail, accompanied with thunder and lightning, which deftroyed every thing that was in the field, whether man or beaft, and fpared only the land of Gofhen where the children of Ifrael dwelt. By the eighth plague fwarms of locufts were brought into the country, which devoured every green herb, the fruit of the trees and the produce of the harveft. By the ninth plague thick darknefs covered all the land of Egypt, except the dwellings of the children of Ifrael. The tenth and laft plague was the death of the firft-born in Egypt, who were all in one night cut off by the deftroying angel, from the firft-born of the king to the firft-born of the flaves and of the cattle. This dreadful calamity moved the heart of the hardened Pharaoh, and he at length confented to allow the people of Ifrael to depart from his kingdom.

Profane authors who have fpoken of Mofes, feem to have been in part acquainted with thefe mighty wonders.

Moses. wonders. That he performed miracles, must have been allowed by many, by whom he was considered as a famous magician; and he could scarcely appear in any other light to men who did not acknowledge him for the messenger of the Almighty. Both Diodorus and Herodotus mention the distressed state to which Egypt was reduced by these terrible calamities. The Hebrews, amounting to the number of 600,000 men, without reckoning women and children, left Egypt on the 15th day of the month Nisan, which, in memory of this deliverance, was thenceforth reckoned the first month of their year. Scarcely had they reached the first shore of the Red Sea when Pharaoh with a powerful army set out in pursuit of them. On this occasion Moses stretched forth his rod upon the sea; and the waters thereof being divided, remained suspended on both sides till the Hebrews passed through dry-footed. —The Egyptians determined to follow the same course; but God caused a violent wind to blow, which brought back the waters to their bed, and the whole army of Pharoah perished in the waves.

After the miraculous passage of the Red Sea, the army proceeded towards Mount Sinai, and arrived at Marah, where the waters were bitter; but Moses, by casting a tree into them, rendered them fit for drinking. Their tenth encampment was at Rephidim; where Moses drew water from the rock in Horeb, by smiting it with his rod. Here likewise Amalek attacked Israel. While Joshua fought against the Amalekites, Moses stood on the top of a hill, and lifted up his hand; in consequence of which the Israelites prevailed and cut their enemies in pieces. They at length arrived at the foot of Mount Sinai on the third day of the ninth month after their departure from Egypt. Moses having ascended several times into the mount, received the law from the hand of God himself in the midst of thunders and lightnings, and concluded the famous covenant betwixt the Lord and the children of Israel. When he descended from Sinai, he found that the people had fallen into the idolatrous worship of the golden calf. The messenger of God, shocked at such ingratitude, broke in pieces the tables of the law which he carried in his hands, and put 23,000 of the transgressors to the sword. He afterwards re-ascended into the mountain, and there obtained new tables of stone on which the law was inscribed. When Moses descended, his face shone so that the Israelites dared not to come nigh unto him, and he was obliged to cover it with a veil. The Israelites were here employed in constructing the tabernacle according to a pattern shown them by God. It was erected and consecrated at the foot of the Mount Sinai on the first day of the first month of the second year after their departure from Egypt; and it served the Israelites instead of a temple till the time of Solomon, who built a house for the God of his fathers after a model shown him by David.

Moses having dedicated the tabernacle, he consecrated Aaron and his sons to be its ministers, and appointed the levites to its service. He likewise gave various commandments concerning the worship of God and the political government of the Jews. This was a *theocracy* in the full extent of the word. God himself governed them immediately by means of his servant Moses, whom he had chosen to be the interpreter of his will to the people; and he required all the honours belonging to their king to be paid unto himself. He dwelt in his tabernacle, which was situated in the middle of the camp, like a monarch in his palace. He gave answers to those who consulted him, and himself denounced punishments against the transgressors of his laws. This properly was the time of the theocracy, taken in its full extent; for God was not only considered as the divinity who was the object of their religious worship, but as the sovereign to whom the honours of supreme majesty were paid. The case was nearly the same under Joshua; who, being filled with the spirit of Moses, undertook nothing without consulting God. Every measure, both of the leader and of the people, was regulated by the direction of the Almighty, who rewarded their fidelity and obedience by a series of miracles, victories, and successes. After Moses had regulated every thing regarding the civil administration, and the marching of the troops, he led the Israelites to the confines of Canaan, to the foot of Mount Nebo. Here the Lord commanded him to ascend into the mountain; whence he showed him the promised land, whereinto he was not permitted to enter. He immediately after yielded up the ghost, without sickness or pain, in the 120th year of his age, and 1451 years before Jesus Christ.

Moses is incontestably the author of the first five books of the Old Testament, which go by the name of the *Pentateuch;* and which are acknowledged to be inspired, by the Jews and by Christians of every persuasion. Some, however, have denied that Moses was the author of these books; and have founded their opinion on this, that he always speaks of himself in the third person. But this manner of writing is by no means peculiar to Moses: it occurs also in several ancient historians; such as Xenophon, Cæsar, Josephus, &c. who, possessed of more modesty or good sense than some modern historians, whose egotism is altogether disgusting, have not like them left to posterity a spectacle of ridiculous vanity and self conceit. After all it is proper to observe that profane authors have related many falsehoods and absurdities concerning Moses, and concerning the origin and the religion of the Jews, with which they were but little acquainted. Plutarch, in his book concerning Isis and Osiris, says, that Judæus and Hierosolymus were brothers, and descended from Typhon; and that the former gave his name to the country and its inhabitants, and the latter to the capital city. Others say that they came from Mount Ida in Phrygia. Strabo is the only author who speaks any thing like reason and truth concerning them; tho' he too says that they were descended from the Egyptians, and considers Moses their legislator as an Egyptian priest. He acknowledges, however, that they were a people strictly just and sincerely religious. Other authors by whom they are mentioned, seem not to have had the smallest acquaintance either with their laws or their worship. They frequently confound them with the Christians, as is the case with Juvenal, Tacitus, and Quintilian.

Mosheim. MOSHEIM (John Laurence), an illustrious German divine, was born in 1695, of a noble family, which might seem to open to his ambition a fair path to civil promotion; but his zeal for the interests of religion,

religion, his thirst after knowledge, and particularly his taste for sacred literature, induced him to consecrate his talents to the service of the church. The German universities loaded him with literary honours; the king of Denmark invited him to settle at Copenhagen; the duke of Brunswick called him thence to Helmstadt, where he filled the academical chair of divinity; was honoured with the character of ecclesiastical counsellor to the court; and presided over the seminaries of learning in the duchy of Wolfenbuttle and the principality of Blackenburgh. When a design was formed of giving an uncommon degree of lustre to the university of Gottingen, by filling it with men of the first rank in letters, Dr Mosheim was deemed worthy to appear at the head of it, in quality of chancellor: and here he died, universally lamented, in 1755. In depth of judgment, in extent of learning, in purity of taste, in the powers of eloquence, and in a laborious application to all the various branches of erudition and philosophy, he had certainly very few superiors. His Latin translation of Cudworth's Intellectual System, enriched with large annotations, discovered a profound acquaintance with ancient learning and philosophy. His illustrations of the Scriptures, his labours in defence of Christianity, and the light he cast upon religion and philosophy, appear in many volumes of sacred and profane literature; and his Ecclesiastical History, from the birth of Christ to the beginning of the present century, is unquestionably the best that is extant. This work, written in Latin, has been translated into English, and accompanied with notes and chronological tables by Archibald Maclaine, D. D. and from this translator's preface to the second edition, 1758, in 5 vols 8vo, this short account is taken.

MOSKITO-COUNTRY, is situated in North America, between 85 and 88 degrees of west longitude, and betwen 13 and 15 degrees of north latitudé; having the north sea on the north and east, Nicaragua on the south, and Honduras on the west; and indeed the Spaniards esteem it a part of the principality of Honduras, though they have no colonies in the Moskito country. When the Spaniards first invaded this part of Mexico, they massacred the greatest part of the natives, which gave those that escaped into the inaccessible part of the country an insuperable aversion to them and they have always appeared ready to join any Europeans that come upon their coasts against the Spaniards, and particularly the English, who frequently come hither; and the Moskito men being excellent marksmen, the English employ them in striking the maratee fish, &c. and many of the Moskito Indians come to Jamaica, and sail with the English in their voyages.

These people are so situated between morasses and inaccessible mountains, and a coast full of rocks and shoals, that no attempts against them by the Spaniards whom they mortally hate, could ever succeed. Nevertheless, they are a mild inoffensive people, of great morality and virtue, and will never trust a man who has once deceived them. They have so great a veneration towards the English, that they have spontaneously put themselves and their lands under the protection and dominion of the crown of England. This was first done when the duke of Albemarle was governor of Jamaica, and the king of the Moskitos received a commission from his grace, under the seal of that island; since which time they have not only been steady in their alliance with the English, but warm in their affections, and very useful to them on many occasions.

When their king dies, the male heir goes to Jamaica, to certify that he is next in blood, and receives a commission in form from the governor of Jamaica to be king of the Moskitos, till which he is not acknowledged as such by his countrymen. So fond are these people of every thing that is English, that the common people are proud of every Christian or surname given them by our seamen, who honour their chief men with the titles of some of our nobility.

MOSQUE, a temple or place of religious worship among the Mahometans.

All mosques are square buildings, generally constructed of stone. Before the chief gate there is a square court paved with white marble; and low galleries round it, whose roof is supported by marble pillars. In these galleries the Turks wash themselves before they go into the mosque. In each mosque there is a great number of lamps; and between these hang many crystal rings, ostriches eggs, and other curiosities, which when the lamps are lighted, make a fine show. As it is not lawful to enter the mosque with stockings or shoes on, the pavements are covered with pieces of stuff sewed together, each being wide enough to hold a row of men kneeling, sitting, or prostrate. The women are not allowed to enter the mosque, but stay in the porches without. About every mosque there are six high towers, called *minarets*, each of which has three little open galleries one above another; these towers, as well as the mosques, are covered with lead, and adorned with gilding and other ornaments: and from thence, instead of a bell, the people are called to prayers by certain officers appointed for that purpose. Most of the mosques have a kind of hospital belonging to them, in which travellers of what religion soever are entertained three days. Each mosque has also a place called *tarbe*, which is the burying-place of its founders; within which is a tomb six or seven feet long, covered with green velvet or sattin; at the ends of which are two tapers, and round it several seats for those who read the koran and pray for the souls of the diseased.

MOSS (Dr Robert), dean of Ely, was eldest son of Mr Robert Moss, a gentleman in good circumstances; and was born at Gillingham in Norfolk in 1666. He was bred at Bennet-college, Cambridge; and acquired great reputation both as a disputant and a preacher. He became preacher to the society of Gray's-inn, London, in 1698; and assistant preacher to Dr Wake at St James's, Westminster, 1699. He was sworn chaplain in three succeeding reigns, to King William, Queen Anne, and George I. and being one of the chaplains in waiting when Queen Anne visited the university of Cambridge, April 5, 1705, he was then created D. D. In 1708 he was invited by the parishoners of St Lawrence Jewry, on the resignation of dean Stanhope, to accept of their Tuesday lecture, which he held till 1727, and then resigned it on account

Moss. count of his growing infirmities. In 1712, on the death of Dr Roderick, he was nominated by the queen to the deanry of Ely, which was the higheſt, but not the laſt, promotion he obtained in the church; for in 1714 he was collated, by Robinſon biſhop of London, to Gliſton, a ſmall rectory on the eaſtern ſide of Hertfordſhire. The gout deprived him of the uſe of his limbs for ſome of the laſt years of his life; and he died March 26, 1729, in his 63d year, and was buried in the preſbytery of his own cathedral, under a plain ſtone with a ſimple inſcription. His character may be ſeen in the preface to the eight volumes of his Sermons, which has uſually been attributed to Dr Snape, the editor of the ſermons; but the credit of it has lately been transferred to Dr Zachary Grey. Dean Moſs is alſo ſuppoſed to have been the author of a pamphlet printed in 1717, intitled. "The report vindicated from miſreports: being a defence of my lords the biſhops, as well as the clergy of the lower houſe of convocation; in a letter from a member of that houſe to the prolocutor concerning their late conſultations about the biſhop of Bangor's writings." He wrote alſo ſome poems, both Latin and Engliſh.

MOSS, or Mosses, in botany. See Musci.

Moss on Trees, in gardening. The growth of large quantities of moſs on any kind of tree is a diſtemper of very bad conſequence to its increaſe, and much damages the fruit of the trees of our orchards.

The preſent remedy is the ſcraping it off from the body and large branches by means of a kind of wooden knife that will not hurt the bark, or with a piece of rough hair cloth, which does very well after a ſoaking rain. But the moſt effectual cure is the taking away the cauſe. This is to be done by draining off all the ſuperfluous moiſture from about the roots of the trees, and may greatly be guarded againſt in the firſt planting of the trees, by not ſetting them too deep.

If trees ſtand too thick in a cold ground, they will always be covered with moſs; and the beſt way to remedy the fault is to thin them. When the young branches of trees are covered with a long and ſhaggy moſs, it will utterly ruin them; and there is no way to prevent it but to cut off the branches near the trunk, and even to take off the head of the tree if neceſſary; for it will ſprout again: and if the cauſe be in the mean time removed by thinning the plantation, or draining the land and ſtirring the ground well, the young ſhoots will continue clear after this.

If the trees are covered with moſs in conſequence of the ground's being too dry, as this will happen from either extreme in the ſoil, then the proper remedy is the laying mud from the bottom of a pond or river pretty thick about the root, opening the ground to ſome diſtance and depth to let it in; this will not only cool it, and prevent its giving growth to any great quantity of moſs, but it will alſo prevent the other great miſchief which fruit-trees are liable to in dry grounds, which is the falling off of the fruit too early.

The moſſes which cover the trunks of trees, as they always are freſheſt and moſt vigorous on the ſide which points to the north, if only produced on that, ſerve to preſerve the trunk of the tree from the ſeverity of the north-winds, and direct the traveller in his way, by always plainly pointing out that part of the compaſs. Moſs.

MOSS is alſo a name given by ſome to the boggy ground in many parts of England, otherwiſe called a *fen* and *bog*.

In many of theſe grounds, as well in England and Ireland as in other parts of the world, there are found vaſt numbers of trees ſtanding with their ſtumps erect, and their roots piercing the ground in a natural poſture as when growing. Many of thoſe trees are broken or cut off near the roots, and lie along, and this uſually in a north-eaſt direction. People who have been willing to account for this, have uſually reſolved it into the effect of the deluge in the days of Noah; but this is a very wild conjecture, and is proved falſe by many unanſwerable arguments. The waters of this deluge might indeed have waſhed together a great number of trees, and buried them under loads of earth; but then they would have lain irregularly and at random; whereas they all lie lengthwiſe from ſouth-weſt to north-eaſt, and the roots all ſtand in their natural perpendicular poſture, as cloſe as the roots of trees in a foreſt.

Beſide, theſe trees are not all in their natural ſtate, but many of them have the evident marks of human workmanſhip upon them, ſome being cut down with an ax, ſome ſplit, and the wedges ſtill remaining in them; ſome burnt in different parts, and ſome bored through with holes. Theſe things are alſo proved to be of a later date than the deluge, by other matters found among them, ſuch as utenſils of ancient people, and coins of the Roman emperors.

It appears from the whole, that all the trees which we find in this foſſile ſtate, originally grew in the very places where we now find them, and have only been thrown down and buried there, not brought from elſewhere. It may appear indeed an objection to this opinion, that moſt of theſe foſſile trees are of the fir-kind; and that Cæſar ſays expreſsly, that no firs grew in Britain in his time: but this is eaſily anſwered by obſerving, that theſe trees, though of the fir-kind, yet are not the ſpecies uſually called the *fir*, but pitch-tree; and Cæſar has no where ſaid that pitch-trees did not grow in England. Norway and Sweden yet abound with theſe trees; and there are at this time whole foreſts of them in many parts of Scotland, and a large number of them wild upon a hill at Wareton in Staffordſhire to this day.

In Hatfield marſh, where ſuch vaſt numbers of the foſſile trees are now found, there has evidently once been a whole foreſt of them growing. The laſt of theſe was found alive, and growing in that place within 70 years laſt paſt, and cut down for ſome common uſe.

It is alſo objected by ſome to the ſyſtem of the firs growing where they are found foſſile, that theſe countries are all bogs and moors, whereas theſe ſorts of trees grow only in mountainous places. But this is founded on an error; for though in Norway and Sweden, and ſome other cold countries, the fir kinds all grow upon barren and dry rocky mountains, yet in warmer places they are found to thrive as well on wet plains. Such are found plentifully in Pomerania, Livonia, and Courland, &c. and in the weſt parts of New

England there are vast numbers of fine stately trees of them in low grounds. The whole truth seems to be, that these trees love a sandy soil; and such as is found at the bottoms of all the mosses where these trees are found fossile. The roots of the fir-kind are always found fixed in these; and those of oaks, where they are found fossile in this manner are usually found fixed in clay: so that each kind of tree is always found rooted in the places where they stand in their proper soil; and there is no doubt to be made but that they originally grew there. When we have thus found that all the fossile trees we meet with once grew in the places where they are now buried, it is plain that in these places there were once noble forests, which have been destroyed at some time; and the question only remains how and by whom they were destroyed. This we have reason to believe, by the Roman coins found among them, was done by the people of that empire, and that at the time when they were established or establishing themselves there.

Their own historian tells us, that when their armies pursued the wild Britons, these people always sheltered themselves iu the miry woods and low watery forests. Cæsar expresly says this; and observes, that Cassibelan and his Britons, after their defeat, passed the Thames, and fled into such low morasses and woods, that there was no pursuing them: and we find that the Silures secured themselves in the same manner when attacked by Ostorius and Agricola. The same thing is recorded of Venutius king of the Brigantes, who fled to secure himself into the boggy forests of the midland part of this kingdom: and Herodian expresly, says, that in the time of the Romans pushing their conquests in these islands, it was the custom of the Britons to secure themselves in the thick forests which grew in their boggy and wet places, and when opportunity offered, to issue out thence and fall upon the Romans. The consequence of all this was the destroying of all these forests; the Romans finding themselves so plagued with parties of the natives issuing out upon them at times from these forests, that they gave orders for the cutting down and destroying all the forests in Britain which grew on boggy and wet grounds. These orders were punctually executed; and to this it is owing that at this day we can hardly be brought to believe that such forests ever grew with us as are now found buried.

The Roman histories all join in telling us, that when Suetonius Paulinus conquered Anglesea, he ordered all the woods to be cut down there, in the manner of the Roman generals in England; and Galen tells us, that the Romans, after their conquest in Britain, kept the soldiers constantly employed in cutting down forests, draining of marshes, and paving of bogs. Not only the Roman soldiers were employed in this manner, but all the native Britons made captives in the wars were obliged to assist in it: and Dion Cassius tells us, that the emperor Severus lost no less than 50,000 men in a few years time in cutting down the woods and draining the bogs of this island. It is not to be wondered at, that such numbers executed the immense destruction which we find in these buried forests. One of the greatest subterranean treasures of wood is that near Hatfield; and it is easy to prove, that these people, to whom this havock is thus attributed, were upon the spot where these trees now lie buried. The common road of the Romans out of the south into the north, was formerly from Lindum (Lincoln), to Segelochum (little Burrow upon Trent), and from thence to Danum (Doncaster), where they kept a standing garrison of Crispinian horse. A little off on the east, and north-east of their road, between the two last named towns, lay the borders of the greatest forest, which swarmed with wild Britons, who were continually making their sallies out, and their retreats into it again, intercepting their provisions, taking and destroying their carriages, killing their allies and passengers, and disturbing their garrisons. This at length so exasperated the Romans, that they were determined to destroy it; and to do this safely and effectually, they marched against it with a great army, and encamped on a great moor not far from Finningly: this is evident from their fortifications yet remaining.

There is a small town in the neighbourhood called *Osterfield;* and as the termination *field* seems to have been given only in remembrance of battles fought near the towns whose names ended with it, it is not improbable that a battle was fought here between all the Britons who inhabited this forest and the Roman troops under Ostorius. The Romans slew many of the Britons, and drove the rest back into this forest, which at that time overspread all this low country. On this the conquerors taking advantage of a strong south-west wind, set fire to the pitch-trees, of which this forest was principaliy composed; and when the greater part of the trees were thus destroyed, the Roman soldiers and captive Britons cut down the remainder, except a few large ones which they left standing as remembrances of the destruction of the rest. These single trees, however, could not stand long against the winds, and these falling into the rivers which ran through the country, interrupted their currents; and the water then overspreading the level country, made one great lake, and gave origin to the mosses or moory bogs, which were afterwards formed there, by the workings of the waters, the precipitation of earthy matter from them, and the putrefaction of rotten boughs and branches of trees, and the vast increase of water-moss and other such plants which grow in prodigious abundance in all these sorts of places. Thus were these burnt and felled trees buried under a new-formed spongy and watery earth, and afterwards found on the draining and digging through this earth again.

Hence it is not strange that Roman weapons and Roman coins are found among these buried trees; and hence it is that among the buried trees some are found burnt, some chopped and hewn; and hence it is that the bodies of the trees all lie by their proper roots, and with their tops lying north east, that is, in that direction in which a south-west wind would have blown them down: hence also it is, that some of the trees are found with their roots lying flat, these being not cut or burned down, but blown up by the roots afterwards when left single; and it is not wonderful, that such trees as these should have continued to grow even after their fall, and shoot up branches from their sides, which might easily grow into high trees. Phil. Trans. N° 275.

By this system it is also easily explained why the moor foil in the country is in fome places two or three yards thicker than in others, or higher than it was formerly, fince the growing up of peat-earth or bog-ground is well known, and the foil added by overflowing of waters is not a little.

As the Romans were the deftroyers of this great and noble foreft, fo they were probably alfo of the feveral other ancient forefts; the ruins of which furnifhes us with the bog-wood of Staffordfhire, Lancafhire, Yorkfhire, and other counties. But as the Romans were not much in Wales, in the Ifle of Man, or in Ireland, it is not to be fuppofed that forefts cut down by thefe people gave orign to the foffile wood found there; but though they did not cut down thefe forefts, others did: and the origin of the bog-wood is the fame with them and with us. Holingfhead informs us, that Edward I. being not able to get at the Welch becaufe of their hiding themfelves in boggy woods, gave orders at length that they fhould all be deftroyed by fire and by the axe; and doubtlefs the roots and bodies of trees found in Pembrokefhire under ground, are the remains of the execution of this order. The foffile wood in the bogs of the ifland of Man is doubtlefs of the fame origin, though we have not any accounts extant of the time or occafion of the forefts there being deftroyed; but as to the foffile trees of the bogs of Ireland, we are exprefsly told, that Henry II. when he conquered that country, ordered all the woods to be cut down that grew in the low parts of it, to, fecure his conquefts by cutting away the places of refort of rebels.

Moving-MOSS. We have an account in the Philofophical Tranfactions of a moving mofs near Churchtown in Lancafhire, which greatly alarmed the neighbourhood as miraculous. The mofs was obferved to rife to a furprifing height, and foon after funk as much below the level, and moved flowly towards the fouth.

A very furprifing inftance of a moving mofs is that of Solway in Scotland, which happened in the year 1771, after fevere rains which had produced terrible inundations of the rivers in many places. For the better underftanding this event, we fhall give the following defcription of the fpot of ground where it happened. Along the fide of the river Efk there is a vale, about a mile broad, lefs or more in different places. It is bounded on the fouth-eaft by the river Efk, and on the north weft by a fteep bank 30 feet in height above the level of the vale. From the top of the bank the ground rifes in an eafy afcent for about a quarter of a mile, where it is terminated by the mofs; which extends about two miles north and fouth, and about a mile and an half eaft and weft, and is bounded on the north-weft by the river Sark. It is probable that the folid ground from the top of the bank above the vale was continued in the fame direction under the mofs, before its eruption, for a confiderable fpace: for the mofs at the place where the eruption happened, was inclined towards the floping ground. From the edge of the mofs there was a gully or hollow, called by the country people *the gap*, and faid to be 30 yards deep where it entered the vale; down which ran a fmall rill of water which was often dry in fummer, having no fupply but what filtered from the mofs. The eruption happened at the head of this gap, on Saturday November 16th 1771, about ten or eleven at night, when all the neighbouring rivers and brooks were prodigioufly fwelled by the rains. A large body of the mofs was forced, partly by the great fall of rain, and partly by fome fprings below it, into a fmall beck or burn, which runs within a few yards of its border to the fouth-eaft. By the united preffure of the water behind it, and of this beck, which was then very high, it was carried down a narrow glen between two banks about 300 feet high, into a wide and fpacious plain, over part of which it fpread with great rapidity. The mofs continued for fome time to fend off confiderable quantities; which, being borne along by the torrent on the back of the firft great body, kept it for many hours in perpetual motion, and drove it ftill farther on. This night at leaft 400 acres of fine arable land were covered with mofs from 3 to 12 or 15 feet deep. Several houfes were deftroyed, a good deal of corn loft, &c. but all the inhabitants efcaped. When the waters fubfided, the mofs alfo ceafed to flow; but two pretty confiderable ftreams continued to run from the heart of it, and carried off fome pieces of moffy matter to the place where it burft. There they joined to the beck already mentioned; which, with this addition, refumed its former channel; and, with a little affiftance from the people of the neighbourhood, made its way to the Efk, through the midft of that great body of mofs which obftructed its courfe. Thus, in a great meafure drained, the new mofs fell feveral feet, when the fair weather came in the end of November, and fettled in a firmer and more folid body on the lands it had over-run. By this inundation about 800 acres of arable ground were overflowed before the mofs ftopped, and the habitations of 27 families deftroyed. Tradition has preferved the memory of a fimilar inundation in Monteith in Scotland. A mofs there altered its courfe in one night, and covered a great extent of ground.

MOSS *of* Kincardine: A remarkable tract of ground in the fhire of Perth in Scotland, which deferves particular notice, not merely as a topographical curiofity, or as a fubject of natural hiftory; but for the information, equally uncommon and important, which it affords, refpecting agricultural improvement, and the promotion of induftry and population.

The mofs of Kincardine is fituated in the parifh of the fame name, comprehended between the rivers Forth and Teith, and in that diftrict of Perthfhire called *Monteith*. The mofs begins about a mile above the confluence of thefe rivers; from thence it extends in length about four miles, and from one to two in breadth; and before the commencement of the operations (an account of which is to be given), comprehend near 2000 Scotch acres, of which about 1500 belong to the eftate of Blair Drummond, the property of Lord Kames by his marriage with Mrs Drummond of Blair Drummond.

As moffes are extremely various in their nature; before entering upon the improvements made in Kincardine mofs, it will be proper to give a fhort defcription of that mofs, and of the fubjacent foil which is the object of thofe improvements.

The mofs lies upon a field of clay, which is a continuation of thofe rich, extenfive flats in the neighbourhood

bourhood of Falkirk and Stirling, distinguished by the name of *carses*. This clay, which is one uniform homogeneous mass sinking to a great depth, is found near the surface, consists of different colours, and is disposed in layers. The uppermost is grey; the next is reddish; and the lowest, which is the most fertile, is blue. Through the whole mass not a pebble is to be found. The only extraneous bodies it contains are sea-shells, which occur in all the varieties peculiar to the eastern coast of Scotland. They are disposed sometimes in beds, sometimes scattered irregularly at different depths. By attending to these circumstances, it cannot be doubted that the sea has been the means of the whole accumulation, and that it was carried on in a gradual manner by the ordinary ebb and flow of the tide. Upon any other supposition, why should there not have been a congeries of all the different materials that compose the surface of the surrounding heights? But to whatever cause the origin of this accumulation may be ascribed, certain it is that no soil whatever is more favourable to vegetation, or carries more abundant crops of every kind.

The surface of the clay, which, upon the retreat of the sea, had been left in an almost level plane, is every where thickly covered with trees, chiefly oak and birch, many of them of a great size. These trees seem to have been the first remarkable produce of the carse; and it is probable they were propagated by dissemination from the surrounding eminences. They are found lying in all directions beside their roots, which still continue firm in the ground in their natural position; and from impressions still visible, it is evident they have been cut with an axe or some similar instrument. For the cutting of wood, the two common purposes are either to apply it to its proper use, or that the ground it occupies may be cultivated. In the present case, however, neither of these ends had been proposed, since the trees, by being left just as they were cut, were not only entirely lost, but the ground was rendered totally unfit for cultivation. Hence it is evident, that the downfal of this wood must be ascribed to some more extraordinary cause; and to none more probably than to that expedient, which, as we learn from Dion Cassius and other historians, the Romans put so extensively in practice to dislodge from their forests the ancient inhabitants of the British islands.

This hypothesis acquires no small degree of force from a circumstance that occurred in May 1768, when a large round vessel of thin brass and curious workmanship, 25 inches in diameter and 16 inches in height, was discovered upon the surface of the clay buried under the moss. This vessel, found upon the estate of John Ramsay, Esq; of Ochtertyre, was by that gentleman presented to the Antiquarian Society, of Edinburgh; in whose museum it remains deposited for preservation. And in a list of the various donations presented to that society, published by them in 1782, it is there denominated a *Roman camp kettle*.

Betwen the clay and the moss is found a stratum nine inches thick, partly dark brown and partly of a colour approaching to black. This is a vegetable mould, accumulated probably by the plants that covered the ground previous to the growth of the wood, and by leaves from the trees thereafter. The difference of colour must be owing to a difference in the vegetable substances that compose it. The brown mould is highly fertile; the other, especially in a dry season, is very unproductive. The crop that had occupied this mould when the trees were felled is found still entire. It consists chiefly of heath; but several other smaller plants are also very distinguishable.

Immediately above the stratum lies the moss, to the height, upon an average, of seven feet. It is composed of different vegetables arranged in three distinct strata. Of these the first is three feet thick. It is black and heavy, and preferable to the others for the purpose of fuel. It consists of bent-grass (*agrostis*), which seems to have grown up luxuriantly among the trees after they were felled. The second stratum also is three feet thick. It is composed of various kinds of mosses, but principally of bog-moss (*sphagnum*). It is of a sallow or iron colour, and remarkably elastic. It is commonly called *white peat;* and for fuel is considered as much inferior to that above mentioned. The third stratum is composed of heath and a little bent-grass, but chiefly of the deciduous parts of the former. It is about a foot thick, and black.

Three strata of different vegetables lying above each other, the limits of each distinctly marked, and each distinguished by a different colour, is certainly a curious natural phenomenon.

An inquiry will here occur, What has occasioned this succession in the vegetables of which the moss is composed?

Every vegetable has a particular soil, more or less moist, peculiarly adapted to its nature. Let a piece of ground be in a moist state, rushes will introduce themselves; drain the ground sufficiently, the rushes will disappear, and finer vegetables will succeed. It seems reasonable to account for the succession of the different plants that compose the moss on similar principles.

Let us imagine an extensive plain covered with trees lying in all directions, full of branches, and possibly loaded with leaves. This it is evident would produce a great stagnation of water, which, as the crops of bent grass accumulated, would still increase: and the probability is, that at length it had so increased, as to be the cause why the bent-grass and other congenial plants of the first stratum ceased to grow. But it is evident that a plant was to be found that could live in such a situation. Accordingly we see that bog-moss had established itself; a plant that loves even to swim in water.

When the accumulations of bent-grass and the mosses had, in process of time, arisen to the height of six feet above the surrounding *carse* ground, the water that fell upon the surface had by no means an opportunity to discharge itself. It had accordingly formed many channels which are often three feet deep; and the intermediate surface being wholly turned into little hillocks has become dry and firm. By this means it became unfit for mosses, and heath succeeded.

Such seems to have been the process in the formation of what is now called *a moss*.

By far the greatest part of the moss in question is, upon an average, full seven feet deep, and has in all probability lain undisturbed since its formation; this is called *High Moss*, The remainder called the *Low Moss*, lies to a considerable breadth around the extremities of the high; and is, upon an average, not above three feet in depth, Moss.

depth, to which it has been reduced by the digging of peats. These are formed of that stratum of the moss only that lies four feet below the surface and downwards; the rest is improper for the purpose, and is thrown aside.

Before the introduction of the plan which is now pursued, two methods chiefly were employed to gain land from the moss. 1st, The surrounding farmers marked off yearly a portion of the Low Moss next to their arable land, about 15 feet broad. This they removed with carts and spread upon their fields, some acres of which they for that end left unsown. Here it lay till May or June; when, being thoroughly dry, it was burnt to ashes to serve as a manure. By this means they added to their farms about half a round of land yearly. But this plan proved unsuccessful, for by the repeated application of these ashes, the soil was rendered so loose that the crops generaly failed. 2dly, Many farmers were wont to *trench down* the low moss. and to cover it *furrow deep* with clay taken out of the trench. This, though commendable as an attempt to improve, proved likewise an unavailing method; because in a dry season the superficial covering of clay retains so little moisture that the crop commonly fails.

It has been attempted to cover the moss with clay brought from the adjacent grounds. But what from necessary impoverishment of the ground from which the clay was carried, and the softness of the moss, this was soon found to be impracticable.

Hence it is evident, that all attempts to *improve* this moss must ever prove abortive; and that the object to be had in view is the acquisition of the valuable soil lying underneath; to which end nothing less is requisite than the total abolition of the the moss.

Draining has also been proposed as another mode of improvement; and it must be acknowledged, that, by means of draining, many mosses have been converted both into arable and meadow grounds, which in the end became interesting improvements. But in a moss, such as that of Kincardine, this method would be ineffectual; as for several feet deep it is of such a nature, that upon being dry and divided into parts, it would blow with the wind like chaff; and when thrown aside in the opperation of digging peats, it lies for years without producing a single vegetable, except only a few plants of sorrel.

By the methods above described from 100 to 200 acres of moss had been removed. When the present plan was introduced, there still remained covered with moss from 1300 or 1400 acres of carse clay—a treasure for which it must be ever interesting to dig.

In the year 1766 Lord Kames entered into possession of the estate of Blair Drummond. Long before that period he was well acquainted with the moss, and often lamented that no attempt had ever been made to turn it to advantage, Many different plans were now proposed; at length it was resolved to attempt, by means of water as the most powerful agent, entirely to sweep off the whole body of moss.

That moss might be floated in water, was abundantly obvious; but to find water in sufficient quantity was difficult, the only stream at hand being employed to turn a corn-mill. Convinced of the superior consequence of dedicating this stream to the purpose of floating off the moss, Lord Kames having made an agreement with the tenant who farmed the mill, and the tenants thirled consenting to pay the rent, he immediately threw down the mill, and applied the water to the above purpose.

In order to determine the best manner of conducting the operation, workmen were now employed for a considerable time upon Law Moss both by the day and by the piece, to ascertain the expence for which a given quantity of moss could be removed. It was then agreed to operate at a certain rate per acre; and in this manner several acres were removed.

But this was to be a very expensive process. The ground gained might, indeed, be afterwards let to tenants; but every acre would require an expenditure from 12l. to 15l. before it conld be ready for sowing; so that the acquisition of the whole, computing it at a medium to be 1350 acres, would sink a capital of nearly 20,000 l. sterling.

One other method still remained; namely, to attempt letting portions of the moss, as it lay, for a term of years sufficient to indemnify tenants for the expences incurred in removing it. For some time both these plans were adopted; but several reasons made the latter preferable. 1. The quantity of water to be had was small; and being also uncertain, it was very inconvenient for an undertaker; neither were there any houses near the spot, which occasioned a great loss of time in going and coming; but when a man should live upon the spot, then he could be ready to seize every opportunity. 2. The moss was an useless waste. To let it to tenants would increase the population of the estate, and afford to a number of industrious people the means of making to themselves a comfortable livelihood.

In the mean time it was determined, till as many tenants should be got as could occupy the whole water, to carry on the work by means of undertakers.

But before proceeding farther, it will be necessary to describe the manner of applying water to the purpose of floating the moss.

A stream of water sufficient to turn a common corn-mill will carry off as much moss as 20 men can throw into it, provided they be stationed at the distance of 100 yards from each other. The first step is to make in the clay, along-side of the moss, a drain to convey the water; and for this operation the carse-clay below the moss is peculiarly favourable, being perfectly free from stones and all other extraneous substances, and at the same time, when moist, slippery as soap; so that not only is it easily dug, but its lubricity greatly facilitates the progress of the water when loaded with moss. The dimensions proper for the drain are found to be two feet for the breadth, and the same for the depth. If smaller, it could not conveniently receive the spadefuls of moss; if larger, the water would escape, leaving the moss behind. The drain has an inclination of one foot in 100 yards: the more regularly this inclination is observed throughout, the less will the moss be liable to obstructions in its progress with the water. The drain being formed, the operator marks off to a convenient extent along-side of it a section of moss 10 feet broad; the greatest distance from which he can heave his spadeful into the drain. This he repeatedly does till the entire mass be removed down to the clay. He then digs a new drain at the foot of the

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the moss-bank, turns the water into it, and proceeds as before, leaving the moss to pursue its course into the river Forth, a receptacle equally convenient and capacious; upon the fortunate situation of which, happily forming for several miles the southern boundary of the estate, without the interposition of any neighbouring proprietor, depended the very existence of the whole operations.

When the moss is entirely removed, the clay is found to be encumbered with the roots of different kinds of trees standing in it as they grew, often very large: their trunks also are frequently found lying beside them. All these the tenants remove often with great labour. In the course of their operations they purposely leave upon the clay a stratum of moss six inches thick. This, in spring, when the season offers, they reduce to ashes, which in a great measure ensures the first crop. The ground thus cleared is turned over, where the dryness admits, with a plough, and, where too soft, with a spade. A month's exposure to the sun, wind, and frost, reduces the clay to a powder fitting it for the seed in March and April. A crop of oats is the first, which seldom fails of being plentiful, yielding from eight to ten bolls after one.

In the year 1767 an agreement was made with one tenant for a portion of the Low Moss. This, as being the first step towards the intended plan, was then viewed as a considerable acquisition. The same terms agreed upon with this tenant have ever since been observed with all the rest. They are as follow:

The tenant holds eight acres of moss by a tack of 38 years; he is allowed a proper quantity of timber, and two bolls of oatmeal to support him while employed in rearing a house; the first seven years he pays no rent; the eighth year he pays one merk Scots; the ninth year two merks; and so on with the addition of one merk yearly till the end of the first 19 years; during the last five years of which he also pays a hen yearly. Upon the commencement of the second 19 years, he begins to pay a yearly rent of 12s. for each acre of land cleared from moss, and 2s. 6d. for each acre not cleared, also two hens yearly: A low rent indeed for so fine a soil; but no more than a proper reward for his laborious exertions in acquiring it.

In the year 1768 another tenant was settled. These two were tradesmen; to whom the preference was always given, as having this great advantage to recommend them, that even when deprived of water they need never want employment. The motives that induced these people to become settlers were, *1st*, The prospect of an independent establishment for a number of years. *2dly*, The moss afforded them great abundance of excellent fuel; to which was added the comfortable consideration, that, while busied in providing that necessary article, they had the double advantage of promoting, at the same time, the principal object of their settlement.

Notwithstanding these inducements, still settlers offered slowly; to which two circumstances chiefly contributed; *1st*, The whole farmers surrounding the moss threw every possible obstruction in their way. *2dly*, By people of all denominations the scheme was viewed as a chimerical project, and became a common topic of ridicule. The plan however supported itself; and in the year 1769 five more tenants agreed for eight acres each; and thus 56 acres of Low Moss were disposed of. From the progress made by the first settlers, and the addition of these, the obloquy of becoming a moss-tenant gradually became less regarded; so that in the year 1772 two more were added; in 1773, three; and in 1774, one; in all 13: which disposed of 104 acres; all the Low Moss to which water could then be conveyed. As water is the main spring of the operation, every tenant, beside the attention necessary to his share of the principal stream, collected water by every possible means, making ditches round his portion of the moss, and a reservoir therein to retain it till wanted.

The tenants in the Lower Moss having now begun to raise good crops, in the year 1774 several persons offered to take possessions in the High Moss, upon condition that access to it should be rendered practicable. The High Moss wanted many advantages that the Low possessed. To the Low Moss, lying contiguous to the surrounding arable lands, the access was tolerably good; but from the arable lands the High Moss was separated by 300 or 400 yards of the Low, which, even to a man, affords but indifferent footing, and to horses is altogether impracticable. The Low Moss is in general only three feet deep; the High Moss is from six to twelve feet in depth.

It will appear at first sight, that without a road of communication the High Moss must for ever have proved unconquerable. Without delay, therefore, a road was opened to the breadth of twelve feet, for several hundred yards in length, by floating off the moss down to the clay.

This being effected, and at the same time an opening given to admit water, in the year 1775 twelve tenants agreed for eight acres of High Moss each. In consideration of the greater depth of this part of the moss, it was agreed, that during the first 19 years they should pay no rent; but for the second 19 years the terms of agreement were the same as those made with the tenants in the Low Moss. To the above-mentioned tenants every degree of encouragement was given; as upon their success depended, in a great measure, the disposal of the great quantity of moss still remaining. But their success, however problematical, was such, that next year,

1776, 6 more took 8 acres each,
1777, 1
1778, 4
1779, 3
1780, 1
1781, 1
1782, 1

In all, including those upon the Low Moss, 42 tenants, occupying 366 acres.

Though for some time the disposal of the High Moss went but slowly on, it was not for want of tenants; but the number of operators was already sufficient for the quantity of water; to have added more would evidently have been imprudent.

In the year 1783 Mr Drummond entered into possession of the estate of Blair Drummond, and went fully into the plain adopted by his predecessor for subduing the moss. At this time there still remained undisposed of about 1000 acres of High Moss. As water was the great desideratum, it was determined, that

Moss. that to obtain that necessary article neither pains nor expence should be wanting. Steps were accordingly taken to ascertain in what manner it might be procured to most advantage.

Meanwhile, to prepare for new tenants a second road parallel to the former, at the distance of half a mile, was immediately begun and cut, with what water could be got, down to the clay, 12 feet broad and 2670 yards long, quite across the moss. This opening was previously necessary, that operators might get a drain formed in the clay to direct the water; and it was to remain as a road that was absolutely necessary, and which relieved settlers from an expence they were unable to support. These preparations, the progress of the former tenants, and the prospect of a farther supply of water, induced 10 more to take possessions in the year 1783; in the year 1784, 18 more took possessions; and in 1785 no fewer than 27;—in all, 55 tenants in three years, which disposed of 440 acres more of the High Moss.

As the introduction of an additional stream to the moss was to be a work both of nicety and expence, it was necessary to proceed with caution. For this reason several engineers were employed to make surveys and plans of the different modes by which it might be procured. In one point they all agreed, that the proper source for furnishing that supply was the river Teith; a large and copious stream that passes within a mile of the moss: but various modes were proposed for effecting that purpose.

To carry a stream from the river by a cut or canal into the moss was found to be impracticable; and Mr Whitworth (A) gave in a plan of a pumping machine, which he was of opinion would answer the purpose extremely well.

Soon after this Mr George Meikle of Alloa, a very skilful and ingenious mill-wright, gave in a model of a wheel for raising water entirely of a new construction, of his own and his father's invention jointly. This machine is so exceedingly simple, and acts in a manner so easy, natural, and uniform, that a common observer is apt to undervalue the invention: But persons skilled in mechanics view machinery with a very different eye; for to them simplicity is the first recommendation a machine can possess. Accordingly, upon seeing the model set to work, Mr Whitworth, with that candour and liberality of mind that generally accompany genius and knowledge, not only gave it the greatest praise, but declared that, for the purpose required, it was superior to the machine recommended by himself, and advised it to be adopted without hesitation.

The better, to explain this machine, two sketches are annexed, to the first of which the following letters refer. The explanation of the second will be found upon the sketch.

Plate CCCXVI. *a*. Sluice through which is admitted the water that moves the wheel.

b, *b*. Two sluices through which is admitted the water raised by the wheel.

c, *c*. A part of one of two wooden troughs and an aperture in the wall, through which, the above water is conveyed into the buckets. [The other trough is hid by two stone walls that support the wheel.]

d, *d*, *d*. Buckets, of which 80 are arranged on each side of the arms of the wheel = 160.

e, *e*, *e*. A cistern, into which the water raised by the buckets is discharged.

f, *f*, *f*. Wooden barrel-pipes, through which the water descends from the cistern underground, to avoid the high road from Stirling and the private approach to the house.

Sketch second contains a plan of the cistern, and exhibits the manner in which the water is filled into the buckets.

The diameter of the wheel to the extremities of the float-boards is 28 feet; the length of the float-boards, 10 feet. The wheel makes nearly four revolutions *per* minute; in which time it discharges into the cistern 40 hogsheads of water. But this is not all the wheel is capable of performing; for by several accurate trials by Messrs Whitworth and Meikle, in the result of which, though made separately, they perfectly agreed, it was found that the wheel was able to lift no less than 60 hogsheads *per* minute; but that the diameter of the pipes through which the water descends from the cistern would not admit a greater quantity than what they already receive.

To a person at all conversant in hydraulics, the resemblance of this to the Persian wheel must be obvious: and indeed it is probable, that from the Persian wheel the first idea of this machine was derived. But admitting this, still the superiority of the present wheel is, in most respects, so conspicuous, as to entitle it to little less praise than the first invention. For, 1st, In the Persian wheel, the buckets being all moveable, must be constantly going out of order: In this wheel they are all immoveable, consequently never can be out of order. 2dly, Instead of lifting the water from the bottom of the fall as in the Persian wheel, this wheel lifts it from the top of the fall, being from four to five feet higher; by which means some additional power is gained. 3dly, By means of the three sluices (*a*, and *b*, *b*, fig. 1.) in whatever situation the river may be, the quantity of the water to be raised is so nicely adjusted to that of the moving power, as constantly to preserve the wheel in a steady and equable motion. In short, as a regulator is to a watch, so are these sluices to this wheel, whose movements would otherwise be so various, as sometimes to carry the water clear over the cistern, sometimes to drop it entirely behind, but seldom so as fully to discharge the whole contents of the buckets into the cistern.

It is however but candid to remark, that this machine labours under a small defect, which did not escape the observation of Mr Whitworth; namely, that by raising the water about $3\frac{1}{2}$ feet higher than the cistern where it is ultimately delivered, a small degree of power is lost. To this indeed he proposed a remedy; but candidly confessed, that, as it would render the machine some

(A) This gentleman is superintendant of the London water-works, and an engineer of great reputation in England. He was several years employed in Scotland in completing the great canal.

Moss. somewhat more complex, and would also increase the friction, he thought it more advisable to keep it in its present state. At the same time, he justly observed, that as the stream by which the wheel is moved is at all times copious and powerful, the small loss of power occasioned by the above circumstances was of little or no avail.

This stream is detached from the Teith at the place where that river approaches nearest to the moss. The surface of the latter is about 15 feet higher than that of the former; the cistern is therefore placed 17 feet above the surface of the stream, so as to leave a declivity sufficient to deliver the water upon the surface of the moss.

The pipes through which the water descends from the cistern are composed of wooden barrels hooped with iron 4 feet long and 18 inches in diameter within.

In these pipes, having been conveyed under ground for 354 yards from the cistern, the water at once emerges into an open aqueduct. This aqueduct, which was formed according to a plan by Mr Whitworth, is constructed wholly of earth or clay; and in order to keep the water on a level with the surface of the moss, it is for nearly two thirds of its course elevated from 8 to 10 feet above the level of the adjacent grounds; the base being 40 feet broad, the summit 18 feet, and the water-course 10 feet broad. It commences at the termination of the pipes; from whence extending above 1400 yards, it discharges the water into a canal formed for its reception on the surface of the moss.

For raising the water to this height there were two reasons. 1st, That not only where it was delivered on the moss, but even after being conveyed to the most distant corners, it might still retain sufficient power to transport the moss to the river Forth. 2dly, That reservoirs of a sufficient height might be formed in the moss to retain the water delivered during night.

In consequence of Mr Whitworth's advice, a contract was entered into with Mr Meikle in spring 1787; and by the end of October in that year, the wheel, pipes, and aqueduct, were all completely finished: and what in so complex and extensive an undertaking, is by no means common, the different branches of the work were so completely executed, and so happily adjusted to each other, that upon trial the effect answered the most sanguine expectations. The total expence exceeded L. 1000 Sterling.

To induce the proprietor to embark in this undertaking, the moss tenants had of their own accord previously come under a formal engagement to pay the interest of any sum that might be expended in procuring a supply of water. But he was determined they should not enjoy by halves the sweets of this long-wished for acquisition. With a view therefore, not only to reward their past industry, but to rouse them to future exertions, he at once set them free from their engagement; nor has any interest ever been demanded.

This new supply was a most acceptable boon to the moss tenants —In order to make an equitable distribution, the water raised through the day was allotted to one division of operators; that raised during the night to another. To retain the latter, a canal was formed, extending almost three miles through the centre of the moss. From place to place along the sides are inserted sluices to admit water to the reservoirs of the possessors; each sluice having an aperture proportioned to the number of operators to be supplied from the reservoir which it fills. For the water raised through the day no reservoirs are necessary; as it is immediately used by the division to which it is allotted. Moss.

This additional stream, though highly beneficial, yet is not more than sufficient to keep 40 men at constant work. But such a quantity as would give constant work is not necessary; the operators must be often employed in making and repairing their drains, grubbing up roots of trees, &c.; so that a quantity sufficient to give five or six hours work *per* day to the whole inhabitants is as much as would be wanted. But as the quantity procured was still insufficient for this purpose, a small stream that descended from the higher grounds was diverted from its course and brought into the moss. From want of level this stream could not be delivered to the greatest advantage; namely, upon the surface of the moss. Yet by making, at a considerable expence, a drain half a mile long, and a reservoir for the night-water, it was rendered of much importance. And during the whole winter months, as well as in summer, after every fall of rain, it keeps 15 persons fully employed.

In the year 1787 two more tenants agreed for eight acres each; in 1788, four; in 1789, eight; in 1790, four tenants, all agreed for the same number of acres.

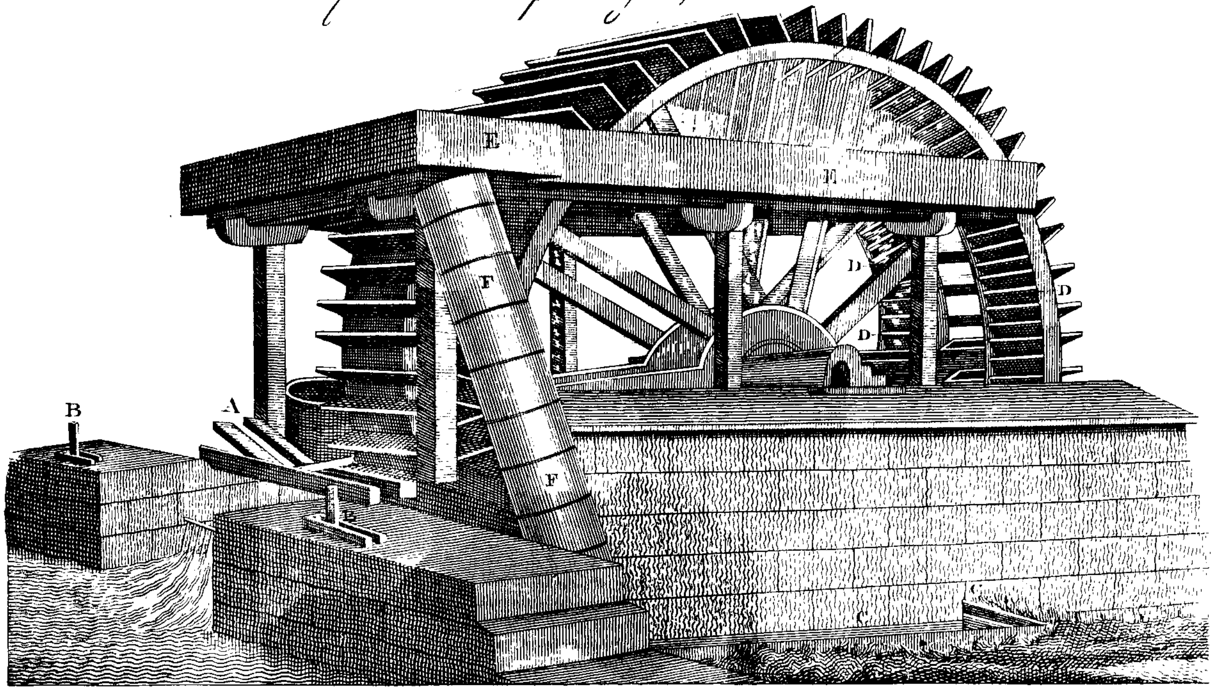
The whole moss was now disposed of, except that part called *Flow-moss*, which comprehended about 400 acres. Here it is twice the usual breadth, so fluid that a pole may be thrust with one hand to the bottom; and the interior part, for near a mile broad, is three feet above the level of all the rest of the moss. Hitherto the many and various difficulties that presented themselves had been overcome by perseverance and expence. But here the extraordinary elevation of the morass, joined to its great fluidity, seemed to exclude all possibility of admitting a stream of water; and it was the general opinion that the moss operations had now arrived to the *ne plus ultra*, and that this morass was doomed to remain a nuisance for ages to come.

But the proprietor had now advanced so far that he could not submit to retreat: and he considered himself as, in some measure, pledged to the country for the completion of this undertaking. To detail the various methods practised to introduce a stream of water into that morass, would prove tedious. It is sufficient to say, that after a thousand unsuccessful efforts, attended with much trouble and considerable expence, the point at last was gained, and a stream of water was brought in, and carried fairly across the centre of the morass.

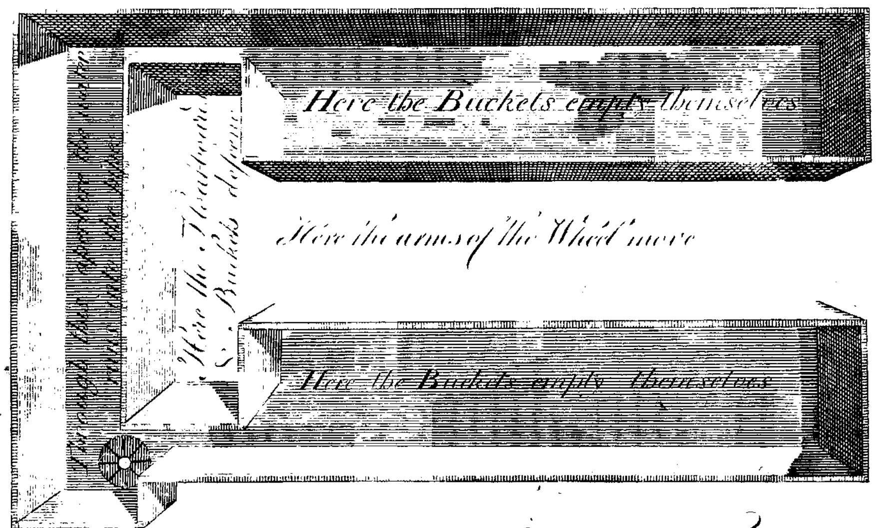
The greatest obstacle was now indeed overcome; but still another remained of no small moment, namely, the discouragement given to settlers from the total impossibility of erecting habitations upon the surface of this morass. To find a remedy for this evil was difficult. Happily a resource at last occurred. This was to bargain with a certain number of the old tenants whose habitations were nearest, to take leases of portions of the morass. But as some additional aid was here necessary, it was agreed that L. 12 Sterling should be gradually advanced to each tenant till he should accomplish the clearing of an acre, for which he or his successor is bound to pay 12s. of yearly rent,

equal

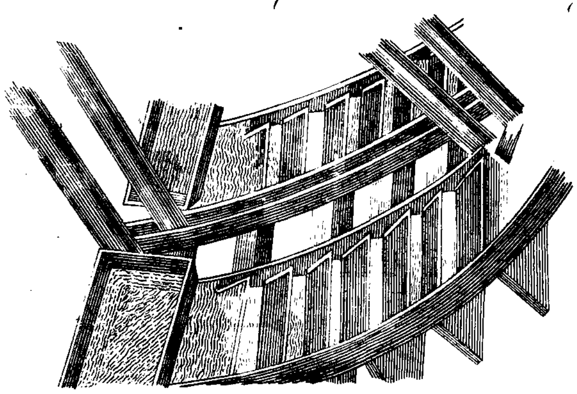
Sketch of the Wheel for raising Water at Blair Drummond



Sketch of the Cistern as seen from above



Sketch of the manner in which the water is filled from the Troughs into the Buckets



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Moss. equal to five *per cent*. upon the sum advanced. When this point shall be gained, they are bound to dispose, as most agreeable to themselves, either of their old or of their new possession; for which, when once an acre is cleared, purchasers will not be wanting.

In consequence of the above arrangement, during the year 1791, no fewer than 35 of the old tenants agreed, upon the foresaid conditions, for eight acres each of the Flow-moss. Thus 1200 acres are now disposed of to 115 tenants. But when these 35 tenants shall each have cleared their acre, then, according to agreement, 35 additional tenants will speedily be acquired; and the moss will then contain in all 150 families.

To the leases already granted to the tenants in the High Moss, it is now determined to add a further period of 19 years (making in all 57 years), during which they are to pay one guinea per acre; a rent not greater than the land is worth even at present, but greatly below its probable value at that distant period. This, it is hoped, will prove to the tenants a sufficient incitement to continue their operations till their possessions are completely cleared from moss.

Having now gone through, in detail, the whole progress of the colony since its first settlement in the year 1767, it still remains to take a general view of the effects produced by that establishment.

For several years, at first, the water was used chiefly to carry off moss, in the forming of new roads, and preparing reservoirs; which considerably retarded the principal object of gaining land. Nevertheless there have been cleared full 300 acres of excellent land producing wheat, barley, oats, and clover, yielding from six to twelve bolls after one.

From the nature of the undertaking, there is good reason to suppose that the operations will yearly advance with greater rapidity; especially as the greater number of the settlers have only of late begun to operate. Many, besides maintaining their families otherwise by occasional employments, have in the High Moss cleared in a year one rood of land; some have cleared two, some three roods, and in the Low Moss an acre.

It was a remark often made, even by persons of some observation, that by collecting together such a number of people, Kincardine would be overstocked; and the consequence would be their becoming a burden on the parish: for as the bulk of them were labourers not bred to any trade, and possessed of little stock, it was foreseen that, for some time, they could not afford to confine themselves solely to the moss, from which the return must be slow; but behoved, for immediate subsistence, to work for daily hire. Happily these predictions have proved entirely groundless; for such is the growing demand for hands in this country, that not only do the whole of these people find employment whenever they choose to look for it, but their wages have been yearly increasing from the time of their first establishment. In short, they have proved to the corner where they are set down a most useful nursery of labourers; and those very farmers who, at first, so strongly opposed their settlement, now fly to them as a sure resource for every purpose of agriculture. Still they consider the moss-operations as their principal business; none pay them so well; and when they do leave it to earn a little money, they return with cheerfulness to their proper employment. Many of them already raise from 10 to 60 bolls of grain, and have no occasion to go off to other work, which will soon be the case with the whole. Their original stock, indeed, did not often exceed L. 25, and some had not even L. 10; but what was wanting in stock is compensated by industry. Moss.

Of the whole inhabitants full nine-tenths are Highlanders, from the neighbouring parishes of Callender, Balquhidder, &c.; a sober, frugal, and industrious people, who, inured to hardships in their own country, are peculiarly qualified to encounter so arduous an undertaking. From this circumstance, too, arises a very happy consequence; that wearing a different garb and speaking a different language from the people amongst whom they are settled, they consider themselves in a manner as one family transported to a foreign land. And hence upon all occasions of difficulty, they fly with alacrity to each others relief. Neither ought it to be forgotten, that, from their first settlement to the present day, not a single instance has occurred amongst them of theft, bad neighbourhood, or of any other misdemeanor, that required the interposition of the civil magistrate. Nor, however poor in circumstances, has any one of them ever stooped to solicit assistance from the funds of the parish appropriated to that purpose.

Though few of the tenants entered with a large stock, one only has been obliged to leave the moss from incapacity to proceed. Many indeed have spent their small stocks, and even run a little in debt: but in this case they have been permitted to sell their tacks upon the following conditions: *1st*, That the purchaser shall be a good man; *2d*, That the seller shall take another possession. By this manœuvre a new inhabitant is gained; while the old one, relieved from debt, and aided by past experience, recommences his operations with double spirit upon a new possession. The monied man, again, has at once a house and a piece of ground; the want of which, chiefly, startled new beginners.

Some have even made a kind of trade of selling; insomuch, that from the year 1774 to the present year 1792, no fewer than fifty sales have taken place, producing in all the sum of L. 849 Sterling. This proved from time to time a most seasonable recruit to the colony, and gave new vigour and spirits to the whole.

The number of the settlers is productive of an excellent effect; and although some are generally absent, enough still remain to occupy the water constantly. In a favourable day there may be seen hundreds, men, women, and children, labouring with the utmost assiduity. The women declare they can make more by working at the moss than at their wheel; and such is the general attachment to that employment, that they have frequently been discovered working by moon-light.

Another happy consequence arising from their numbers is the great quantity of moss they consume for fuel. There are in all 115 families. Each family requires at an average 10 dargues (B) of peats yearly.

 Each

(B) A dargue (or darg) of peats, is the quantity that one man can cast and two can wheel in a day to the field where they are spread out to dry.

Each darg uncovers a ſpace equal to 10 ſquare yards of clay: ſo that by caſting peats, the moſs tenants gain yearly about 6 roods of land.

The advantage, too, of providing their fuel with ſo little trouble, is very great. They require yearly 1150 dargs of peats; which, as each darg when dried and ſtacked is valued at five ſhillings, are worth 287 l. 10s. ſterling; a ſum which otherwiſe muſt have been expended on the prime coſt and carriage of coals. Many of them caſt peats for ſale; and L. 100 worth are yearly diſpoſed of in the town of Sterling, the village of Down, &c.

Though moſs-work be laborious, it is at the ſame time amuſing. The operator moves the moſs five feet only at a medium; and the water, like carts in other caſes, carrying it off as faſt as it is thrown in, excites him to activity. Still he muſt ſubmit to be wet from morning to night. But habit reconciles him to this inconvenience; while his houſe and arable land fill his eye and cheer his mind. Nor is it found that the health of the inhabitants is in the ſmalleſt degree injured either by the nature of the work or the vicinity of the moſs.

The quantity of moſs that one man can move in a day is ſurpriſing; when he meets with no interruption, ſeldom leſs than 48 cubic yards, each weighing 90 ſtones. The weight, then, of moſs moved per day is no leſs than 4320 ſtones. A cubic yard is moved into the water, and of courſe carried into the river Forth for one farthing. It follows, that the expence of moving 48 cubic yards is one ſhilling. But the ſame quantity moved to the ſame diſtance by carts would coſt 24 ſhillings. Hence the advantage derived from the poſſibility of floating moſs in water, and the great importance of having water for that purpoſe.

The moſs, when contraſted with the rich lands ſurrounding, appeared, eſpecially before the improvements, a very dreary ſpot; one wide unvaried wild, totally unproductive, unfit even to furniſh ſuſtenance to any animal, except here and there a few wretched ſtraggling ſheep. Beſides, it entirely cut off all connection betwixt the farms on either ſide; amongſt which no intercourſe was practicable but by a circuit of ſeveral miles.

The ſcene is already greatly changed. The following are the numbers of the inhabitants now reſiding in the moſs; alſo of their cows and horſes, and of the acres gained by them from the moſs, together with their produce.

Men - - -	115
Women - -	113
Boys - - -	199
Girls -	193
Total	620

Number of cows, at leaſt, -	115
Ditto of horſes and carts, -	34
Ditto of acres cleared from moſs, -	300

The produce in bolls cannot be exactly aſcertained: but, conſidering the goodneſs of the ſoil, may be fairly ſtated at 8 bolls per acre, *inde* 2400 bolls.

As oats are the ſtaple commodity, the calculation ſhall be confined to that grain. According to the fiars of Stirlingſhire, crop 1790 (the laſt crop for which they have been ſtruck), carſe oats are valued at 14 s. per boll. *Inde* 2400 bolls at 14 s. is L. 1680.

A track of ground ſo conſiderable, formerly a nuiſance to the country, thus converted into a fertile field, filled with inhabitants, comfortable and happy, cannot ſurely be ſurveyed with an eye of indifference by any perſon whoſe mind is at all ſuſceptible of feeling or of public ſpirit.

An excellent gravelled road 20 feet wide and a mile and a half long, is now carried quite acroſs the moſs. By this means, in the firſt place, a ſhort and eaſy intercourſe is eſtabliſhed between two conſiderable parts of the eſtate, formerly as little connected as if ſeparated by a lake or an arm of the ſea. Secondly, the inhabitants of the Moſs, to whom, hitherto, all paſſage with carts or horſes was impracticable for at leaſt one half of the year, have now obtained the eſſential advantage of being able, with eaſe, to tranſport all their different commodities at every ſeaſon of the year. This road was entirely formed by the hands of the moſs-tenants, and gravelled by their own carts and horſes: a work which, it will not be doubted, they performed with much alacrity; when it is conſidered that, to the proſpect of procuring a laſting and material benefit to themſelves, there was joined the additional inducement of receiving an immediate ſupply of money, the whole being done at the proprietor's expence.

The poſſeſſions are laid off in the manner beſt fitted for the operations; and are divided by lanes running in ſtraight lines parallel to each other. Parallel to theſe again the drains are carried; and this ſtraight direction greatly facilitates the progreſs of the water with its load of moſs Upon the bank of moſs fronting the lanes, the operation of floating is begun; and twenty or thirty people are ſometimes ſeen heaving moſs into the ſame drain. That the water may be the more conveniently applied, the lanes include between them the breadth of two poſſeſſions only. The new houſes are erected upon each ſide of theſe lanes at the diſtance of 100 yards from each other.

Before the formation of lanes and roads, and while yet no ground was cleared, the firſt ſettlers were obliged to erect their houſes upon the ſurface of the moſs. Its ſoftneſs denied all acceſs to ſtones; which, at any rate, are at ſuch a diſtance as would render them too expenſive. Settlers, therefore, were obliged to conſtruct their houſes of other materials. Upon the Low Moſs there is found for this purpoſe great plenty of ſod or turf, which accordingly the tenants uſe for the walls of their houſes. For the rudeneſs of the fabric nature in ſome meaſure compenſates, by overſpreading the outſide with a luxuriant coating of heath and other mooriſh plants, which has a very pictureſque appearance.

But upon the High Moſs there is no ſod to be found. There the tenant muſt go differently to work. Having choſen a proper ſituation for his houſe, he firſt digs four trenches down to the clay, ſo as to ſeparate from the reſt of the moſs a ſolid maſs, containing an oblong, rectangular area, ſufficiently large for his intended houſe. This being done, he then ſcoops out the middle of the maſs, leaving on all ſides the thickneſs of three feet for walls; over which he throws a roof, Moss. roof, such as that by which other cottages are commonly covered.

Upon the softest parts of the moss, even these walls cannot be obtained. In such places the houses are built with peat dug out of the moss, and closely compressed together while in a humid state (c). It is necessary even to lay upon the surface a platform of boards to prevent the walls from sinking; which they have frequently done when that precaution was neglected. After all, to stamp with the foot will shake the whole fabric as well as the moss for fifty yards around. This, at first, startled the people a good deal; but custom soon rendered it familiar.

The colonists have now made considerable advancement in rearing better habitations for their comfort and convenience. Their huts of turf are but temporary lodgings. As soon as they have cleared a little ground, they build houses of brick; when the proprietor a second time furnishes them with timber gratis. It has also been found necessary to relieve them entirely from the payment of the burdensome tax upon bricks; a tax which surely was never intended to fall on such poor industrious adventurers; and which, without this assistance, would have proved a most effectual bar to the employment of these materials.

There are now erected in the moss 69 brick-houses, substantially built with lime. The total expence amounted to 1033 l. Sterling. And it is a very comfortable circumstance, that the money expended upon these houses is mostly kept in circulation among the inhabitants themselves: for as a number of them have learned not only to manufacture but also to build bricks, and as others who have horses and carts furnish the carriage of lime and coals, they thus interchange services with each other.

With a view to excite the exertion of the colonists, the following premiums have lately been offered: 1. To the person who shall in the space of one year remove the greatest quantity of moss down to the clay, a plough of the best construction. 2. To the person who shall remove the next greatest quantity, a pair of harrows of the best kind. 3. For the next greatest quantity, a spade of the best kind, and 10 lb. of red clover-seed. But as these premiums, if contested for by the whole inhabitants, could reach but a very few of the number, they have therefore been divided into six districts according to their situation, and the above premiums have been offered to each district.

The establishment of this colony has no doubt been attended with a very considerable share of expence and difficulty; for the undertaking was altogether new, and there were many prejudices against it, which it was necessary to overcome. At the same time it was noble and interesting: it was to make a valuable addition to private property: it was to increase the population of the country, and to give bread to a number of people; many of whom having been turned out of their farms and cottaries in the Highlands, might otherwise, by emigration, have been lost to their country; and that too at a time when, owing to the great enlargement of farms, depopulation prevails but too much even in the low countries. And it was to add to the arable lands of the kingdom, making many thousand bolls of grain to grow where none ever grew before.

Moss, || Motacilla.

These considerations have hitherto preponderated with the proprietors against the various obstacles that present themselves to the execution of so extensive an undertaking. Should their example tend in any degree to stimulate others, who both in Scotland and in England possess much ground equally useless to the country, to commence similar improvements, it would be a most grateful consideration, superadded to the pleasure already arising from the progress of the infant colony.

Moss-Troopers, a rebellious sort of people in the north of England, that lived by robbery and rapine, not unlike the tories in Ireland, the Bucaneers in Jamaica, or banditti of Italy. The counties of Northumberland and Cumberland were charged with an yearly sum, and a command of men to be appointed by justices of the peace, to apprehend and suppress them.

MOSTRA, in the Italian music, a mark at the end of a line or space, to show that the first note of the next line is in that place: and if this note be accompanied with a sharp or flat, it is proper to place these characters along with the mostra.

MOSUL, or Mousul. See Mousul.

MOTACILLA, in ornithology, the Wagtail and Warbler: A genus of birds of the order of passeres; distinguished by a straight weak bill of a subulated figure, a tongue lacerated at the end, and very slender legs. Plate CCCXV.

1. The alba, or white wagtail, frequents the sides of ponds and small streams, and feeds on insects and worms. The head, back, and upper and lower side of the neck, as far as the breast, are black; in some the chin is white, and the throat marked with a black crescent: the breast and belly are white; the quill-feathers are dusky; the coverts black, tipt and edged with white. The tail is very long, and always in motion, Mr Willoughby observes, that this species shifts its quarters in the winter; moving from the north to the south of England during that season. In spring and autumn it is a constant attendant on the plough, for the sake of the worms thrown up by that instrument. These birds make their nest on the ground, composed of dry grass, fine fibres of roots, and moss lined within with hair or feathers. The eggs are five in number, white, spotted with brown; and for the most part there is only one brood in a year.

2. The flava, or yellow wagtail, migrates in the north of England, but in Hampshire continues the whole year. The male is a bird of great beauty; the breast, belly, thighs, and vent-feathers, being of a most vivid and lovely yellow: the throat is marked with some large black spots; above the eye is a bright yellow

(c) This does not apply to the *morass*, upon the surface of which, it has already been observed, it is impossible to erect houses in any shape.

yellow line: beneath that, from the bill, crofs the eye, is another of a dufky hue; and beneath the eye is a third of the fame colour: the head and upper part of the body is of an olive-green, which brightens in the coverts of the tail; the quill-feathers are dufky; the coverts of the wings olive-coloured; but the lower rows dufky, tipt with yellowifh white; the two outmoft feathers of the tail half white; the others black, as in the former. The colours of the female are far more obfcure than thofe of the male: it wants alfo thofe black fpots on the throat. It makes its neft on the ground, in corn-fields: the outfide is compofed of decayed ftems of plants, and fmall fibrous roots; the infide is lined with hair: it lays five eggs.

3. The regulus, or gold-crefted wren, is a native of Europe, and of the correfpondent latitudes of Afia and America. It is the leaft of all the European birds, weighing only a fingle drachm. Its length is about four inches and an half; and the wings, when fpread out, meafure little more than fix inches. On the top of its head is a beautiful orange-coloured fpot called its *creft*, which it can hide at pleafure; the margins of the creft are yellow, and it ends in a pretty broad black line; the fides of the neck are of a beautiful yellowifh green; the eyes furrounded with a white circle: the neck and back of a dark green mixed with yellow; the breaft of a dirty white; the tail compofed of 12 feathers of a brown colour, an inch and an half long, but not forked. In America it affociates with the titmice, running up and down the bark of lofty oaks with them, and collecting its food in their company, as if they were all of one brood. It feeds on infects lodged in their winter dormitories in a torpid ftate. It is faid to fing very melodioufly.

4. The fialis, or blue-bird, is a native of moft parts of North America; and is about the bignefs of a fparrow. The eyes are large; the head and upper part of the body, tail, and wings, are of a bright blue, excepting that the ends of the feathers are brown. The throat and breaft are of a dirty red. The belly is white. It flies fwiftly, having very long wings; fo that the hawk generally purfues it in vain. It make its neft in holes of trees; refembles the robbin-red breaft in its difpofition, and feeds only on infects.

5. The futoria, or taylor-bird, is a native of the Eaft-Indies. It is remarkable for the art with which it makes its neft, feemingly in order to fecure itfelf and its young in the moft perfect manner poffible againft all danger from voracious animals. It picks up a dead leaf, and fews it to the fide of a living one: its flender bill is the needle, and its thread is formed of fome fine fibres; the lining is compofed of feathers, goffamer, and down. The colour of the bird is light-yellow; its length three inches; and its weight only three-fixteenths of an ounce: fo that the materials of the neft and its own fize are not likely to draw down a habitation depending on fo flight a tenure.

6. The lucinia, or nightingale, exceeds in fize the hedge-fparrow. The bill is brown: the irides are hazel: the head and back pale tawny, dafhed with olive; the tail is of a deep tawny red; the under parts pale afh-colour, growing white towards the vent; the quills are cinereous brown, with the outer margins reddifh brown: the legs cinereous brown. The male and female are very fimilar. This bird, the moft famed of the feathered tribe for the variety, length, and fweetnefs of its notes, is migratory, and fuppofed to be an inhabitant of the Afiatic regions during fuch times as it is not to be found in Europe. It is met with in Siberia, Sweden, Germany, France, Italy, and Greece; but in all thofe places it is migratory, as in England. Haffelquift fpeaks of it as being in Paleftine; and Fryer afcertains its being found about Chulminor in Perfia: it is alfo fpoken of as a bird of China, Kamtfchatka, and Japan; at which laft place they are much efteemed, and fell dear; as they are alfo at Aleppo, where they are "in great abundance kept tame in houfes, and let out at a fmall rate to fuch as choofe it in the city, fo that no entertainment is made in the fpring without a concert of thefe birds." They are not found in America, though feveral of their birds improperly bear that name; and it is uncertain whether they are found in Africa. This bird vifits Britain in the beginning of April, and leaves it in Auguft; and during its continuance there, its range is confined to but a part of the ifland: it is not found in Scotland, Ireland, or North Wales, nor in any of the northern counties except Yorkfhire; and it does not migrate fo far to the weft as Devonfhire and Cornwall. They are folitary birds, never uniting into even fmall flocks; and in refpect to the nefts, it is very feldom that two are found near each other. The female builds in fome low bufh or quickfet hedge well covered with foliage, for fuch only this bird frequents; and lays four or five eggs of a greenifh brown. The neft is compofed of dry leaves on the outfide, mixed with grafs and fibres, lined with hair or down within, though not always alike. The female alone fits on and hatches the eggs, while the male not far off regales her with his delightful fong; but as foon as the young are hatched, he commonly leaves off finging, and joins with the female in the tafk of providing for and feeding them. After the young can provide for themfelves, the old female provides for a fecond brood, and the fong of the male recommences. They have been known to have three broods in a year, and in the hot countries even four. Thefe birds are often brought up from the neft for the fake of their fong. They are likewife caught at their firft coming over; and though old birds, yet by management can be made to bear confinement, and to fing equally with thofe brought up from the neft. None but the vileft epicure, as Mr Latham remarks, would think of eating thefe charming fongfters; yet we are told that their flefh is equal to that of the ortolan, and they are fatted in Gafcony for the table. Every fchool-boy muft have read of Heliogabalus eating of nightingales tongues; and that famed difh of the Roman tragedian Æfop, which was compofed of thofe of every finging or talking bird, and is faid to have coft about L. 6843 of our money.

7. The hippolais, or pettychaps, is fomewhat lefs than a linnet. The bill is fhort; the upper mandible black, the under bluifh: above and below the eye there is a yellowifh line: the head, neck, and upper parts are of a greenifh afh-colour; the quills and tail of a moufe-colour, with greenifh edges and black fhafts; and the under wing-coverts are yellow: the belly is of a filvery white; the breaft darker, and tinged with yellow: the legs are bluifh or lead-coloured. This fpecies is frequent in feveral parts of England, and makes a neft

of an arched form, compoſed of dry bents, mixed with a little moſs, and thickly lined with feathers: it is placed on the ground under a tuft of graſs or at the bottom of a buſh. The eggs are five in number, white, ſprinkled all over with ſmall red ſpots, moſt ſo at the largeſt end. In Dorſetſhire it is known by the name of *hay-bird*. In Yorkſhire it is called the *beam-bird*, from its neſtling under beams in outbuildings.

8. The atricapilla, or blackcap, is ſmaller than the pettychaps. The bill is brown: the top of the head is black; and the upper parts of the body are of a greeniſh aſh-colour: the ſides of the head and under parts are grey, changing to very light grey, or almoſt white, towards the vent: the quills and tail are cinereous brown, margined with the ſame colour as the upper parts: the legs are lead-coloured, and the claws black. This bird is pretty common in England, and elſewhere in Europe, as far as Italy; in all which places it is known to breed; coming in ſpring, and retiring in September. In Italy it builds twice in the year; in England only once. The neſt, which is generally placed in ſome low buſh not far from the ground, is compoſed of dried ſtalks, mixed with a little wool and green moſs round the verge; the inſide lined with the fibres of roots, thinly covered with black horſe-hair. The eggs are five in number; of a pale reddiſh brown, mottled with a deeper colour, and ſprinkled with a few dark ſpots. The male and female ſit by turns during incubation; and the young very early leap out of the neſt, eſpecially if any one approaches it, and forſake it for ever. The food is chiefly inſects; but in defect of theſe they will eat the fruits of ſpurge laurel, ſervice, and ivy; and ſeem to be even fond of the laſt, as they much frequent ſuch trees as are overgrown with it. The ſong is much eſteemed, and in many things almoſt equalling the nightingale itſelf; ſcarcely deficient, except in the delightful variety of note of the laſt named bird. Hence by many it has been named the *mock nightingale*.

9. The modularis, or hedge-ſparrow, a well-known bird, has the back and wing coverts of a duſky hue edged with reddiſh brown; rump of a greeniſh brown; throat and breaſt of a dull aſh-colour; the belly a dirty white; and the legs of a dull fleſh-colour. This bird frequents hedges in England; where it makes its neſt of moſs and wool, lining it with hair; and lays four or five eggs of a fine pale blue. In England and the more northern regions it is ſeen at all ſeaſons; but in France it is migratory, coming in October and departing northward in ſpring. The note of this bird would be thought pleaſant, did it not remind us of the approach of winter; beginning with the firſt froſts, and continuing till a little time in ſpring. Its often repeating the words *tit, tit, tit,* has occaſioned its being called *titling;* a name it is known by in many places.

10. The phœnicurus, or red-ſtart, is ſomewhat leſs than the red-breaſt: the forehead is white; the crown of the head, hind part of the neck, and back, are deep blue grey; the cheeks and throat black; the breaſt, rump, and ſides, red; and the belly is white: the two middle tail-feathers are brown; the reſt red; and the legs are black. The female has the top of the head and back cinereous grey; chin white. The ſame parts are red in this ſex as in the male, but not ſo bright. The wings are brown in both ſexes. This bird is migratory; coming hither in ſpring, and departing in autumn about October. It is not ſo ſhy as many birds in reſpect to itſelf; for it approaches habitations, and frequently makes its neſt in ſome hole of a wall where numbers of people paſs by frequently: yet it is content, if no one meddles with the neſt; for the leaſt derangement of the eggs, or almoſt looking at them, eſpecially if the female is diſturbed thereby, cauſes her to forſake the neſt altogether. It frequently builds alſo in ſome hole of a tree. The neſt is compoſed chiefly of moſs, lined with hair and feathers. The eggs are blue, and four or five in number. This bird frequently wags its tail; but does it ſideways like a dog when he is pleaſed, and not up and down like the wagtail. It is with difficulty that theſe birds are kept in a cage; nor will they ſubmit to it by any means if caught old. Their ſong has no great ſtrength: yet it is agreeable enough; and they will, if taught young, imitate the note of other birds, and ſing by night frequently as well as in the day time.

11. The ſalicaria, or ſedge-bird, is about the ſize of the blackcap, but more ſlender. The head is brown, marked with duſky ſtreaks: the cheeks are brown; with a white line over each eye, and above that a black one: the upper parts of the neck and back are of a reddiſh brown; and the wing-coverts and quills duſky; the under parts are white; but the breaſt and belly have a yellow tinge: the tail is brown, and much rounded; and the legs are duſky. This bird is common in England, and frequents places where reeds and ſedges grow, among which it is ſaid to make the neſt, though it has been known to do this on the loweſt branches of trees. The neſt is compoſed of ſtraw and dried fibres of plants, lined with hair; and the eggs five in number, of a dirty white, marbled with brown. It is obſerved to imitate the note of the ſwallow, ſky-lark, houſe-ſparrow, and other birds, in a pleaſing but hurrying manner, and ſings all night.

12. The ficedula, or epicurean warbler, is in length five inches; the upper parts are grey brown; the under parts greyiſh white, with a tinge of brown on the breaſt; and the legs are blackiſh. This is a bird much eſteemed on the continent for the delicate flavour of its fleſh. Their chief food is inſects; except in autumn, when they make great havock among the figs and grapes; whence it is ſuppoſed their great delicacy in ſome meaſure ariſes. It is not found in England, but met with in moſt of the intermediate parts between Sweden and Greece; where, however, it is only a ſummer inhabitant, probably retiring ſtill more ſouth at the approach of winter. In the iſle of Cyprus and Candy they abound greatly, inſomuch as to be an article of commerce. They tranſport them in veſſels filled with vinegar and ſweet herbs: the iſle of Cyprus alone collects 1000 or 1200 of theſe pots every year.

13. The rubecula, or red-breaſt, is univerſally known: the upper parts are of a greeniſh aſh-colour; the forehead, throat, neck, and breaſt, a rufous orange; the belly and vent whitiſh; the bill, legs, and ſides of the body, duſky. It is a conſtant inhabitant of Britain, as well as of the whole European continent from Sweden to Italy. It abounds in Burgundy and Lorraine, where numbers are taken for the table, and

Motacilla.

thought excellent. It builds not far from the ground if in a bush; though it sometimes fixes on an outhouse, or retired part of some old building. The nest is composed of dried leaves, mixed with hair and moss, and lined with feathers. The eggs are of a dusky white, marked with irregular reddish spots; and are from five to seven in number. The young, when full feathered, may be taken for a different bird, being spotted all over. The first rudiments of the red break forth on the breast about the end of August; but it is quite the end of September before they come to the full colour. Insects are their general food; but in defect of these they will eat many other things. No bird is so tame and familiar as this; closely attending the heels of the gardener when he is using his spade, for the sake of worms; and frequently in winter entering houses where windows are open, when they will pick up the crumbs from the table while the family is at dinner. Its familiarity has caused a petty name to be given it in several countries. The people about Bornholm call it *Tommi-liden;* in Norway, *Peter Ronsmad;* the Germans, *Thomas Gierdet;* and we, the *Robin Red-breast.*

14. The rubicola, or stone-chatter, is in length about four inches and three quarters. The male has the upper parts of the body mixed blackish and pale rufous: on each side the neck there is a transverse streak of white: the breast is of a reddish yellow; the belly paler: and the legs are black. The female has the colours much less vivid. This bird inhabits dry places, such as heaths and commons; living on insects of all kinds. It makes its nest early, at the foot of some low bush, or under a stone; and lays five or six eggs of a bluish green, sparingly marked with faint rufous spots. It is so very crafty as not to betray the place of the nest, never alighting but at some distance, and creeping on the ground to it by the greatest stealth. It is a restless bird, incessantly flying from bush to bush; and seems to have received its English name from its note, resembling the clicking of two stones together.

15. The rubetra, or whin-chat, is somewhat bigger than the stone-chatter. The upper parts are blackish, edged with rufous: from the bill arises a streak of white, which passes over the eye on each side, almost to the hind head: beneath this the cheeks are blackish; the chin is white; the rest of the under parts rufous white: on the wing, near the shoulder, is a transverse white mark, and another smaller near the bastard wing, on the outer edge: the legs are black. The female differs in being paler, and the spots on the wings and the white trace over the eye being far less conspicuous. This is not uncommon in Britain, and is seen along with the stone-chatter on the heaths during the summer months; where it breeds, making the nest much after the manner of that bird. It lays five dirty white eggs, dotted with black. This species is common also on the continent of Europe, in France, Italy, Germany, and the more temperate parts of Russia; but it is said to be less common than the stone-chatter there, as it is also in England. Its food is chiefly insects; and is said to be as good as the ortolan, when fat and in good condition.

16. The œnanthe, or wheat-ear, is in length five inches and a half. The top of the head, hind part of the neck, and back, are of a bluish grey; and over the eye a streak of white: the under parts of the body yellowish white, changing to pure white at the vent: the breast is tinged with red; and the legs are black. This bird is met with in most parts of Europe, even as far as Greenland; and specimens have also been received from the East Indies. It visits England annually in the middle of March, and leaves it in September. It chiefly frequents heaths. The nest is usually placed under shelter of some turf, clod, stone, or the like, always on the ground, and not unfrequently in some deserted rabbit-burrow. It is composed of dry grass or moss, mixed with wool, fur of the rabbit, &c. or lined with hair and feathers. The eggs are from five to eight in number, of a light blue, with a deeper blue circle at the large end. The young are hatched in the middle of May. In some parts of England these birds are in vast plenty. About Eastbourn in Sussex they are taken in snares made of horsehair placed beneath a long turf: Being very timid birds, the motion of a cloud, or the appearance of an hawk will drive them for shelter into these traps, and so they are taken. The numbers annually ensnared in that district alone amount to about 1840 dozen, which usually sell at sixpence per dozen. Quantities of these are eaten on the spot by the neighbouring inhabitants; others are picked, and sent up to the London poulterers and many are potted, being as much esteemed in England as the ortolan on the continent. Their food is insects only; though in rainy summers they feed much on earth-worms, whence they are fattest in such seasons.

17. The cyanea, or superb warbler, a most beautiful species, is five inches and a half long. The bill is black: the feathers of the head are long, and stand erect like a full crest; from the forehead to the crown they are of a bright blue; from thence to the nape, black like velvet: through the eyes from the bill there runs a line of black; and beneath the eye springs a tuft of the same blue feathers; beneath which, and on the chin, it is of a deep blue almost black, and feeling like velvet; on the ears is another patch of blue, and across the back part of the head a band of the same; the whole giving the head a greater appearance of bulk than is natural: the hind part of the neck, and upper parts of the body and tail, are of a deep blue black; the under, pure white: the wings are dusky; the shafts of the quills chesnut: the legs are dusky brown; the claws black. It inhabits Van Diemen's Land, the most southern part of New Holland. The female of this species, of which a figure is given in Phillips's Voyage to Botany Bay, is discovered to be entirely destitute of all the fine blue colours, both pale and dark, by which the male is adorned, except that there is a very narrow circle of azure round each eye, apparently on the skin only: all the upper feathers consist of shades of brown, and the whole throat and belly is pure white. Except from the shape and size, this bird would not be suspected at first sight to belong to the same species as the male: the epithet of *superb* applies very ill to the female.

18. The troglodytes, or wren, is a very small species, in length only three inches three quarters, though some have measured four inches. The bill is very slender, and of a dusky brown colour: the head, neck, and back, are of a reddish brown; and over each eye a pale

Mote ‖ Mothe.

a pale reddish white streak; the under parts, as far as the breast, are of this last colour; the rest more inclined to brown, crossed with brown lines? the legs are pale brown. It generally carries the tail erect. The nest is of a curious construction, in shape almost oval, and has only one small entrance; it is chiefly composed of moss, well lined with feathers. In this the female lays from 10 to 16 or even 18 eggs, which are almost white, with reddish markings at the large end. She builds twice in a year, in April and June. The nest is frequently found in some corner of an out-house, stack of wood, hole in a wall, or such like, if near habitations; but in the woods often in a bush near the ground, in a stump of a tree, or on the ground itself. This minute bird is found throughout Europe; and in England it defies the severest winters. Its song is much esteemed, being, though short, a pleasing warble, and much louder than could be expected from the size of the bird: it continues throughout the year.

Above 150 other species, besides varieties, are enumerated by ornithologists.

MOTE, in law books, signifies court or convention; as a ward mote, burgh mote, swain-mote, &c.

MOTE, was also used for a fortress or castle; as *moto de Windsor*, &c.

MOTE also denoted a standing water to keep fish in: and sometimes a large ditch encompassing a castle or dwelling-house,

Mote-Bell or *Mot-Bell*, the bell so called, which was used by the English Saxons to call people together to the court. See FOLKMOTE.

MOTHE, in zoology. See PHALÆNA.

MOTHE LE VAYER (Francis de la), counsellor of state, and preceptor to the duke of Anjou, only brother to Louis XIV. was born at Paris in the year 1588. He was well educated by a learned father, whose merits and employment rendered him of consequence; and he became so eminently learned himself, and distinguished by his writings, that he was considered as one of the best members of the French academy, into which he was admitted in the year 1639. He was loved and considered by the two cardinals Richelieu and Mazarine, who governed France successively. Splendid titles and honourable posts were bestowed upon him. He was appointed preceptor to the duke of Anjou, as we have said, and would have been preceptor also to the king his brother, if the queen had not taken a particular fancy not to have that place bestowed on a married man; though Moreri in his Dictionary, and Pelisson in his History of the French Academy, both affirm that he was preceptor to his majesty for the space of one year. He was a man of a very regluar conduct, and a true philosopher in his manner; yet was suspected of having no religion, As great a philosopher as he was, however he was extremely afflicted as the loss of his only son, who died when about 35 years of age; and his grief disordered him so much that in three months after he married again, although he was above 75 years old. Le Vayer lived a long time after his second marriage, and died in the year 1672. His works, collected into a body by his son, were dedicated to cardinal Mazarine in 1653: but the best and compleatest collection of them was that of Paris 1669, dedicated to Louis XIV. and consisting of 15 volumes in 12mo.

Mother, Motion.

"There is no small advantage (says Bayle) to be made of reading this writer: and we have no French author that approaches nearer to Plutarch than he. We find beautiful thoughts and solid arguments interwoven and dispersed through all he wrote; wit and learning go hand in hand. His treatise concerning the education of the dauphin, and that of pagan philosophy, are the best which he hath written."

MOTHER, a term of relation, denoting a woman who hath born a child.

Mother of Pearl. See MYTILUS.

MOTION is now generally considered as incapable of definition, being a simple idea or notion received by the senses. The ancients, however, thought differently. Some of them defined it to be a passage out of one *state* into another; which conveys no idea to him who is ignorant of the nature of motion.—The peripatetic definition has been mentioned elsewhere, and shown to be wholly unintelligible, as well as their celebrated division of motion into some classes belonging to the three categories, *quality*, *quantity*, and *where*: (see METAPHYSICS, n° 188, 189, 190.) The Cartesians, too, among the moderns, pretend to define motion, by calling it a passage or removal of one part of matter, out of the neighbourhood of those parts to which it is immediately contiguous, into the neighbourhood of others. Borelli defines motion to be the successive passage of a body from place to place. Others say that it is the application of a body to different parts of infinite and immoveable space; and a late writer * of uncommon acuteness has given as a definition of motion—*change of place*.

1 Motion.

2 Several definitions of.

* See an Essay on the Powers and mechanism of Nature, by Robert Young.

We have elsewhere offered our opinion of every possible attempt to define motion; but as the author of the last quoted definition has endeavoured to obviate such objections as ours, candour requires that he be heard for himself. "It is said (he observes) by some, that change implies motion, and therefore cannot be a part of its definition being the very thing defined. To this I answer, We are speaking of the sensible idea of motion, as it appears to our sight; now changes do appear to our view, and to all our senses, which give us no idea of motion. Changes in heat or cold: in colour, flavour, smell, sound, hardness, softness, pain, pleasure; in these, and many other ideas, changes do not produce ideas like that produced by a ball rolling or a stone falling. We may perhaps, ultimately trace them to motion, but to insensible motions; to motions which arise only in reflection, and constitute no part of the actual idea of change. We can, therefore, conceive of change without conceiving at the same time of motion.—Change is a generic idea, including many species; motion, as a sensible idea, is a species of that genus. Change is therefore a necessary part of the definition of motion; it marks the genus of the thing defined. Motion is a change; but as there are many species of change, which of those species is motion? The answer is, It is a change of place. This marks the species; and distinguishes it from change of colour, of temperament, and figure."

This is the ablest defence of an attempt to define motion that we have ever seen; and at first view the definition itself appears to be perfect. Aristotle, the prince of definers, "considers a definition ‡ as a speech

‡ See Dr Reid's account of Aristotle's logic, in Lord Kames's Sketches of Man.

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speech declaring what a thing is. Every thing essential to the thing defined, and nothing more, must be contained in the definition. Now the essence of a thing consists of these two parts; first, what is *common* to it with other things of the same kind; and secondly, what *distinguishes* it from other things of the same kind. The first is called the *genus* of the thing; the second, its *specific difference*. The definition, therefore, consists of those two parts."

3 Shown not to declare what the thing is; and therefore to be no definition.

In obedience to this rule, the definition under consideration seems to consist of the *genus*, signified by the word *change*; and of the *specific difference*, denoted by the words *of place*. But does the speech *change of place* really declare what motion is? We cannot admit that it does; as, in our apprehension, a *change of place* is the *effect* of motion, and not *motion itself*. Suppose a lover of dialectic undertaking to define the stroke by which he saw his neighbour wounded with a bludgeon: what should we think of his art were he to call it a contusion on the head? He might say that *contusion* is a general term, as contusions may be produced on the arms, on the legs, and on various parts of the body; and as there are many species of contusion, if he were asked which of those species was the stroke to be defined, he might answer, "a contusion on the head. Here would be apparently the *genus* and *specific difference*; the former denoted by *contusion* and the latter by the words *on the head*. But would this be a definition of a stroke? No, surely: a contusion on the head may be the *effect* of a stroke; but it can no more be the *stroke itself*, than a blow can be a bludgeon, or a flesh-wound the point of a sword. Equally evident it is, that a change of place cannot be motion; because every body must have been actually moved before we can discern, or even conceive, a change of its place.

The *act of changing place* would perhaps come nearer to a definition of motion; but so far would it be from "a speech declaring what motion is," that we are confident a man who had never by any of his senses perceived a body in actual motion, would acquire no ideas whatever from the words "act of changing place." He might have experienced changes in heat, cold, smell, and sound; but he could not possibly combine the ideas of such changes with the signification of the word *place*, were he even capable of understanding that word, which to us appears to be more than doubtful. (See Metaphysics, n° 40, 41.)

4 The distinctions of motion into different kinds insignificant.

The distinctions of motion into different kinds have been no less various, and no less insignificant, than the several definitions of it. The moderns who reject the peripatetic division of motion into four classes, yet consider it themselves as either *absolute* or *relative*. Thus we are told, that "*absolute motion* is the change of absolute *place*, and that its celerity must be measured by the quantity of *absolute space* which the moving body runs through in a given time." "*Relative motion*, on the other hand, is a mutation of the *relative* or *vulgar place* of the moving body, and has its celerity estimated by the quantity of *relative space* run through,"

Now it is obvious, that this distinction conveys no ideas with a farther explanation of the terms by which it is expressed: but that explanation is impossible to be given. Thus, before we can understand what *absolute motion* is, we must understand what is meant by *absolute place*. But absolute place is a contradiction? for all *place* is *relative* and consists in the positions of different bodies with regard to one another. Were a globe in the regions of empty space to be put in motion by Almighty Power, and all the rest of the corporeal worlds to be soon afterwards annihilated, the motion would undoubtedly continue unchanged; and yet, according to this distinction, it would be at first *relative* and afterwards *absolute*. That the beginning of such a motion would be *perceptible*, and the remainder of it *imperceptible*, is readily granted; but on this account to consider it as of two kinds, is as absurd as to suppose the motion of the minute-hand of a clock to be affected by our looking at it.

5 The opinions of the Cartesians and of Newton respecting the source of motion.

Leaving therefore these unintelligible distinctions, we now come to consider a question still of a very abstruse nature, but much agitated among philosophers, viz. What is the original source of motion in the creation? Is it natural to matter? or are we to ascribe it to the immediate and continual agency of some *immaterial* being? The former has been strenuously argued by the Cartesians, and the latter by the Newtonians. The arguments of the former, founded upon the chimerical hypothesis of vortices and the original construction of matter, were evidently inconclusive; and the hypothesis of Sir Isaac Newton, who asserted that it was naturally *incapable* of motion, appeared more probable. To account for the quantity of motion in the universe, therefore, it became necessary to have recourse either to the Deity, or to some suborbinate spiritual agent; and this became the more necessary, as the doctrine of an absolute vacuum in the celestial spaces, that is, throughout the incomparably greatest part of the creation, was one of the fundamental maxims of the system. As it was absolutely denied that matter existed in these spaces, and it was plain that the celestial bodies affected one another at immense distances, the powers of attraction and repulsion were naturally called in as the sources of motion by their impulses upon inert and sluggish matter. These being admitted, a speculation ensued concerning their nature. *Spiritual*, it was confessed, they were; but whether they were to be accounted the immediate action of the divine Spirit himself, or that of some subordinate and inferior spirit, was a matter of no little dispute. Sir Isaac Newton towards the latter part of his life, began to relax somewhat of the rigidity of his former doctrine; and allowed that a very subtile medium, which he called *æther*, might be the cause of attraction and repulsion, and thus of the whole phenomena of nature. Since his time the multitude of discoveries in electricity, the similarity of that fluid to fire and light, with the vast influence it has on every part of the creation with which we are acquainted, have rendered it very probable that the æther mentioned by Sir Isaac is no other than the element of fire, "the most subtile † and elastic of all bodies, which seems to pervade and expand itself throughout the whole universe. Electrical experiments show that this mighty agent is every where present, ready to break forth into action if not restrained and governed with the greatest wisdom. Being always restless and in motion, it actuates and enlivens the whole visible mass; is equally fitted to produce and to destroy; distinguishes the various stages of nature, and keeps up the perpetual round of generations and corruptions, pregnant with forms which it

6 A subtle æther the probable cause of attraction and repulsion.

† Siris, n° 153, &c.

it conftantly fends forth and reforbs. So quick in its motions, fo fubtile and penetrating in its nature, fo extenfive in its effects, it feemeth no other than the vegetative foul or vital fpirit of the world.

7 The opinions of the ancients on this fubject.

"The animal fpirit in man is the inftrument both of fenfe and motion. To fuppofe fenfe in the corporeal world would be grofs and unwarranted; but locomotive faculties are evident in all its parts. The Pythagoreans, Platonifts, and Stoics, held the world to be an animal; though fome of them have chofen to confider it as a vegetable. However, the phenomena do plainly fhow, that there is a fpirit that moves, and a mind or providence that prefides. This providence, Plutarch faith, was thought to be in regard to the world what the foul is in regard to man. The order and courfe of things, and the experiments we daily make, fhow that there is a mind which governs and actuates this mundane fyftem as the proper and real agent and caufe; and that the inferior inftrumental caufe is pure æther, fire, or the fubftance of light, which is applied and determined by an infinite mind in the macrocofm or univerfe, with unlimited power, and according to ftated rules, as it is in the microcofm with limited power and fkill by the human mind. We have no proof either from experiment or reafon of any other agent or efficient caufe than the mind or fpirit. When, therefore, we fpeak of corporeal agents, or corporeal caufes, this is to be underftood in a different, fubordinate, and improper fenfe; and fuch an agent we know light or elementary fire to be."

8 Experiments proving that a fubtle æther may be the immediate caufe of the planetary motions, &c.

That this elementary fire, abforbed and fixed in all bodies, *may* be the caufe of the univerfal principle of gravity, is made fufficiently evident by numberlefs experiments. Homberg having calcined in the focus of a burning-glafs fome regulus of antimony, found that it had gained one tenth in weight, though the regulus, during the whole time of the operation, fent up a thick fmoke, and thereby loft a confiderable part of its own fubftance. It is in vain to alledge that any heterogeneous matter floating in the air, or that the air itfelf, may have been hurried into the mafs by the action of the fire. And that by this additional matter the weight was increafed: for it is known experimentally, that if a quantity of metal be even hermetically fecured within a veffel of glafs to keep of the air and all foreign matter, and the veffel be placed for fome time in a ftrong fire, it will exhibit the fame effect. "I have feen the operation performed (fays Mr Jones†) on two ounces of pewter-filings, hermetically fealed up in a Florence flafk, which in two hours gained 55 grains, that is nearly one 17th. Had it remained longer in the fire, it might propably have gained fomething more; as, in one of Mr Boyle's experiments, fteel-filings were found to have gained a fourth.

† Effay on the Firft Principles of Natural Philofophy.

"Of accounting for thefe effects there are but two poffible ways: 1. If the quantity of matter be the fame, or, in the cafe of calcination, be fomewhat lefs, after being expofed to the action of the fire, while the gravity of the whole is become greater; then does it follow that gravity is not according to the quantity of matter, and of courfe is not one of its properties. 2. If there be an increafe of the mafs, it can be imputed to nothing but the matter of light or fire entangled in its paffage through the fubftance, and fo fixed in its pores, or combined with its folid parts, as to gravitate together with it. Yet it is certain, from the phenomenon of light darting from the fun, that this elementary fire does not gravitate till it is fixed in metal, or fome other folid fubftance.—Here then we have a fluid which gravitates, if it gravitate at all, in fome cafes and not in others. So that which way foever the experiment be interpreted, we are forced to conclude that elementary or folar fire may be the caufe of the law of gravitation."

That it is likewife in many cafes the caufe of repulfion, is known to every one who has feen it fufe metals, and convert water and mercury into elaftic vapour. But there is a fact recorded by Mr Jones, which feems to evince that the fame fluid, which as it iffues from the fun exhibits itfelf in the form of light and heat, is in other circumftances converted into a very fine air, or cold æther, which rufhes very forcibly towards the body of that luminary. "As a fequel to what has been obferved (fays he) concerning the impregnation of folid fubftances with the particles of fire, give me leave to fubjoin an experiment of M. de Stair. He tells us, that upon heating red lead in a glafs whence the air was exhaufted by the rays of the fun collected in a burning-glafs, the veffel in which the faid red lead was contained burft in pieces with a great noife. Now, as all explofions in general muft be afcribed either to an admiffion of the air into a rarefied fpace, or to what is called the *generation* of it; and as air was not admitted upon this occafion, it muft have been generated from the calx within the veffel; and certainly was fo, becaufe Dr Hales has made it appear that this fubftance, like crude tartar and many others, will yield a confiderable quantity of *air* in diftillation. What went into the metal therefore as *fire*, came out of it again as *air;* which in a manner forces upon us conclufions of ineftimable value in natural philofophy, and fuch as may carry us very far into the moft fublime part of it."

One of the conclufions which the ingenious author thinks thus forced upon us, is, that the motion of the planets round the fun, as well as round their own axis, is to be attributed to the continual agency of this fluid, under its two forms of elementary fire and pure air. As fire and light, we know that it rufhes with inconceivable rapidity from the body of the fun, and penetrates every corporeal fubftance, exerting itfelf fometimes with fuch a force as nothing with which we are acquinted is able to refift. If it be indeed a fact, that this elementary fire, or principle of light and heat, afterwards cools, and becomes pure air, there cannot be a doubt, but that under fuch a form it will return with great force, though furely in a fomewhat different direction, towards the fun, forming a vortex, in which the planets are included, and by which they muft of courfe be carried round the centre. Mr Jones does not fuppofe that the air into which the principle of light and heat is converted, is of fo grofs a nature as our atmofphere. He rather confiders it as cool æther, juft as he reprefents light to be æther heated: but he maintains, that this æther, in its aerial form though not fit for human refpiration, is a better *pabulum* of fire than the air which we breathe.

This theory is exceedingly plaufible; and the au-

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thor supports it by many experiments. He has not, indeed, convinced us that the solar light is converted or convertible into pure air; but he has, by just reasoning from undoubted facts, proved that the whole expanse of heaven, as far as comets wander, is filled not only with light, which is indeed obvious to the senses, but also with a fluid, which, whatever it may be called, supplies the place of air in feeding the fire of these ignited bodies.

9
The existence of such an æther, however, does not completely solve the phenomena.

That the motion of the heavenly bodies should result from the perpetual agency of such a medium, appears to us a much more rational hypothesis, than that which makes them act upon each other at immense distances through empty space. But the hypothesis is by no means so complete a solution of the phænomena as some of its fond admirers pretend to think it. This fluid, whether called æther, heat, light, or air, is still material; and the question returns upon him who imagines that it is sufficient to account for gravitation, repulsion, magnetism, and cohesion, &c. "What moves the fluid itself, or makes the parts of which it is composed cohere together?" However widely it may be extended, it is incapable of positive infinity; and therefore *may be* divided into parts separated from each other; so that it must be held together by a foreign force, as well as a ball of lead, or a piece of wax. As matter is not essentially active, the motion of this æther, under both its forms, must likewise be considered as an effect, for which we do not think that any propelling power, in the body of the sun can be admitted as a sufficient cause. For how comes the sun to possess that power, and what makes the fluid return to the sun? We have no notion of power, in the proper sense of the word, but as intelligence and volition; and by the pious and excellent athor of the *Essay on the First principles of Natural Philosophy*, we are certain that the sun was never supposed to be intelligent.

10
It is therefore by some supposed to be animated.
‡ Siris, n° 277.

Bishop Berkeley, who admits of light or æther as the instrumental cause of all corporeal motion, gets rid of this difficulty, by supposing, with the ancients, that this powerful agent is animated. "According to the Pythagoreans and Platonics (says his Lordship ‡), there is a life infused throughout all things; the πυρ νοερον, πυρ τεχνικον, an intellectual and artificial fire, an inward principle, animal spirit, or natural life, producing and forming within, as art doth without; regulating, moderating, and reconciling the various motions, qualities, and parts of this mundane system. By virtue of this life, the great masses are held together in their ordinary courses, as well as the minutest particles governed in their natural motions, according to the several laws of attraction, gravity, electricity, magnetism, and the rest. It is this gives instincts, teaches the spider her web, and the bee her honey. This it is that directs the roots of plants to draw forth juices from the earth, and the leaves and cortical vessels to separate and attract such particles of air and elementary fire as suit their respective natures."

This life or animal spirit seems to be the same thing which Cudworth calls plastic nature, and which has been considered elsewhere. (See METAPHYSICS, n° 200 and *PLASTIC Nature.*) We shall therefore dismiss it at present, with just admitting the truth of the Bishop's position, "that if nature be supposed the life of the world, animated by one soul, compacted into one frame, and directed or governed in all its parts by one supreme and distinct intelligence, this system cannot be accused of atheism, though perhaps it may of mistake or impropriety."

11
A new theory of motion.

A theory of motion somewhat similar to that of Berkeley, though in several respects different from it, was not many years ago stated with great clearness, and supported with much ingenuity, in *An Essay on the Powers and Mechanism of Nature*, intended to improve, and more firmly establish, the grand superstructure of the Newtonian system. Mr Young, the author of the essay, admits, with most other philosophers of the present age, that body is composed of atoms which are impenetrable to each other, and may be denominated solid. These atoms, however, he does not consider as primary and simple elements, incapable of resolution into principles; but thinks that they are formed by certain motions of the parts of a substance immaterial and essentially active.

12
By supposing that a substance essentially active pervades the universe.

As this notion is uncommon, and the offspring of a vigorous mind, we shall consider it more attentively under the article *PLASTIC Nature.* It is mentioned at present as a necessary introduction to the author's theory of motion, of which he attributes both the origin and the continuance to the agency of this elementary substance pervading the most solid atoms of the densest bodies. Of every body and every atom he holds the constituent principles to be essentially active; but those principles act in such a manner as to counterbalance each other; so that the atom or body considered as a whole is inert, unless in so far as it resists the compression or separation of its parts. No body or atom can of itself begin to move, or continue in motion for a single instant: but being pervious to the active substance, and coalescing with it, that substance, when it enters any body, carries it along with it, till, meeting some other body in the way, either the whole of the active substance lodged in the former body passes into the obstacle, in which case the impelling body instantly ceases to move; or else part of that substance passes into the obstacle, and part remains in the impelling body; and in this case both bodies are moved with a velocity in proportion to the quantity of matter which each contains, combined with the quantity of active substance by which they are respectively penetrated.

13
Proofs of the existence of such a substance.

In order to pave the way for his proof of the existence of one uniform active substance, he observes, that "*change* being an essentially constituent part of motion, and change implying action, it follows that *all motion implies action, and depends on an active cause.* Every motion (he continues) has a beginning, a middle, and an end. The beginning is a change from rest to motion; the middle is a continuance in motion; the end is a change from motion to rest." He then proceeds to show, that the beginning of motion is by an action begun; the continuance of motion by an action continued; and the end of motion by a cessation of action.

"The first of these positions is admitted by every body. That the *continuance* of motion is by an action *continued*, will be proved, if it shall be shown that the continuance of a motion is nothing different from its beginning, in regard to any point of time assumed in the continued motion. Now the beginning of motion (he says) consists in the beginning of change of place,

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place. But if any given portions of time and of ſpace are aſſumed, a body beginning to move in the commencement of that time, and in the firſt portion of the ſpace aſſumed, then and there begins that particular motion: and whether before the body began to move in that ſpace it was moving in other ſpaces and times, has no relation to the motion in queſtion; for this being in a ſpace and time altogether diſtinct, is a diſtinct motion from any which might have preceded it immediately, as much as from a motion which preceded it a thouſand years before. It is therefore a new motion begun; and ſo it may be ſaid of every aſſumable point in the continued motion. The term *continued* ſerves only to connect any two diſtinct motions, the end of one with the beginning of the other; but does not deſtroy their diſtinctneſs."

He then proceeds to combat, which he does very ſucceſsfully, the arguments by which the more rigid Newtonians endeavour to prove that a body in motion will continue to be moved by its own *inertia*, till ſtopt by ſome oppoſite force. Having done this, he eſtabliſhes the contrary concluſion by the following ſyllogiſms:

"I. Whatever requires an active force to ſtop its motion, is diſpoſed to move.
Every body in motion requires an active force to ſtop its motion:
Therefore every body in motion is diſpoſed to move.
"II. Whatever is diſpoſed to motion is poſſeſſed of action.
But a body in motion is diſpoſed to continue in motion.
Therefore a body in motion is poſſeſſed of action.

Thus it appears, that the middle part of any motion is action equally with the beginning.

"The laſt part of motion is its *termination*. It is admitted that all motion is terminated by an action contrary to the direction of the motion. It is admitted, too, that the moving body *acts* at the time its motion is deſtroyed. Thus the *beginning* and the *end* of any uniform motion are confeſſed to be actions; but all the intermediate *continuation* which connects the beginning with the end is denied to be action. What can be more unaccountable than this denial? Is it not more conſonant to reaſon and analogy, to aſcribe to the whole continued motion one uninterrupted action? Such a concluſion true philoſophy, we think, requires us to make.

"To move or act, is an attribute which cannot be conceived to exiſt without a ſubſtance. The *action of a body in motion* is indeed the attribute of the body, and the body relatively to its own motion is truly a ſubſtance, having the attribute or quality of motion. But the body being a name ſignifying a combination of certain ideas, which ideas are found to ariſe from action (ſee *Plastic Nature*), that action which is productive of thoſe ideas whoſe combination we denominate body, is of the nature of an attribute. In other terms, body is to be conſidered as an attribute ſo long as it is conſidered as conſtituted of action.—To this attribute we muſt neceſſarily aſſign its ſubſtance. The actions which conſtitute body muſt be actions of ſomething, or there muſt be ſomething which acts. What then is this ACTIVE SOMETHING from whoſe agency we get the idea of body, or whoſe actions conſtitute body? Is it not ſufficient that it is ſomething active? A name might be ſurely given it, but a name would not render the idea more clear. Its deſcription may be found in every ſenſation; it is colour to the eye, flavour to the palate, odour to the noſe, ſound to the ear, and feeling to the touch; for all our ſenſations are but ſo many ways in which this ACTIVE SOMETHING is manifeſted to us. A ſubſtratum of ſolidity philoſophers have imagined to exiſt, and have in vain ſought to find. Our ACTIVE SUBSTANCE is the ſubſtratum ſo long ſought for, and with ſo little ſucceſs. We give it a quality by which it may be perceived; it ACTS. One modification of *action* produces MATTER, another generates MOTION. Theſe modifications of action are modes of the active ſubſtance, whoſe preſence is action: matter and motion conſtitute the whole of nature. THERE IS THEREFORE THROUGHOUT NATURE AN ACTIVE SUBSTANCE, THE CONSTITUENT ESSENCE OF MATTER, AND IMMEDIATE NATURAL AGENT IN ALL EFFECTS."

14 Which is unintelligent.

By an argument which we do not think very concluſive, our author determines this active ſubſtance to be unintelligent. "In our ſenſations individually, not diſcovering (ſays he) the traces, not ſeeing the characters of intelligence, but finding only action preſent and neceſſary, our inferences go no farther than our obſervations warrant us to do; and we conclude in all theſe things an action only, and that action unintelligent." Having given our opinion of real agency elſewhere (ſee METAPHYSICS, n° 118.), we ſhall not here ſtop to examine this reaſoning.—We may, however, aſk, Whether all our ſenſations individually be not excited for a *certain end?* If they be, according to our author's mode of arguing in another place, the exciting agent ſhould be an intelligent being. By this we are far from meaning to deny the reality of a ſecondary or inſtrumental cauſe of ſenſation which is deſtitute of intelligence. We are ſtrongly inclined to think that there is ſuch a cauſe, though our perſuaſion reſults not from this argument of our author's. In our opinion, he reaſons better when he ſays, "that a ſubordinate agent conſtructed as the matter of creation, inveſted with perpetual laws, and producing agreeably to thoſe laws all the forms of being, through the varieties of which inferior intelligences can, by progreſſive ſteps, arrive ultimately at the ſupreme contriver, is more agreeable to our ideas of dignity, and tends to impreſs us with more exalted ſentiments, than viewing the Deity directly in all the individual impreſſions we receive, divided in the infinity of particular events, and unawful, by his continual preſence in operations to our view inſignificant and mean."

15 And neither matter nor mind.

This active ſubſtance, or ſecondary cauſe, our author concludes to be neither matter nor mind. "Matter (ſays he) is a being, as a whole quieſcent and inactive, but conſtituted of active parts, which reſiſt ſeparation, or cohere, giving what is uſually denominated ſolidity to the maſs. Mind is a ſubſtance which thinks. A being which ſhould anſwer to neither of theſe definitions, would be neither matter nor mind; but an *immaterial*, and, if I may ſo ſay, an *immental* ſubſtance." Such is the active ſubſtance of Mr Young, which, Motion. which, considered as the cause of motion, seems not to differ greatly from the *plastic nature, hylarchical principle*, or *vis genetrix*, of others. The manner in which it operates is indeed much more minutely detailed by our author than by any other philosopher, ancient or modern, with whose writings we have any acquaintance.

"Every thing (he says) must be in its own nature either disposed to rest or motion; consequently the ACTIVE SUBSTANCE must be considered as a being naturally either quiescent or motive. But it cannot be naturally quiescent; for then it could not be active, because activity, which is a tendency to motion, cannot originate in a tendency to rest. Therefore the ACTIVE SUBSTANCE is by nature motive, that is, tending to motion. The ACTIVE SUBSTANCE is not solid, and does not resist penetration. It is therefore incapable of impelling or of sustaining impulse Whence it follows, that as it tends to move, and is incapable of having its motion impeded by impulse, it must actually and continually move: in other words, MOTION IS ESSENTIAL TO THE ACTIVE SUBSTANCE.

16 The manner in which it is supposed to operate,

"In order that this substance may *act*, some other thing upon which it may produce a change is necessary; for whatever suffers an action, receives some change. The active substance, in acting on some other thing, must impart and unite itself thereto; for its *action* is communicating its *activity*. But it cannot communicate its activity without imparting its substance; because it is the substance alone which possesses activity, and the quality cannot be separated from the substance. THEREFORE THE ACTIVE SUBSTANCE ACTS BY UNITING ITSELF WITH THE SUBSTANCE ON WHICH IT ACTS. The union of this substance with bodies, is not to be conceived of as a junction of small parts intimately blended together, and attached at their surfaces; but as an entire diffusion and incorporation of one substance with another in perfect coalescence. As bodies are not naturally active, whenever they become so, as they always do in motion, it must be by the accession of some part of the active substance. The active substance being imparted to a body, penetrates the most solid or resisting parts, and does not reside in the pores without, and at the surfaces of the solid parts. For the activity is imparted to the body itself; and not to its pores, which are no parts of the body: therefore, if the active substance remained within the pores, the cause would not be present with its effect; but the cause would be in one place and the effect in another, which is impossible.

Bodies by their impulse on others lose their activity in proportion to the impulse. This is matter of observation. Bodies which suffer impulse acquire activity in proportion to the impulse. This also is matter of observation. In impulse, therefore, the active substance passes out of the impelling body into the body impelled. For since bodies in motion are active, and activity consists in the presence of the active substance, and by impulse bodies lose their activity, therefore they lose their active substance, and the loss is proportional to the impulse. Bodies impelled acquire activity; therefore acquire active substance, and the acquisition is proportioned to the impulse. But the active substance lost by the impelling body ought to be concluded to be that found in the other; because there is no other receptacle than the impelled body to which the substance parted from can be traced, nor any other source than the active body whence that which is found can be derived. Therefore, in impulse, the active substance ought to be concluded to pass from the impelling body to the body impelled. The flowing of such a substance is a sufficient cause of the communication of activity, and no other rational cause can be assigned.

"The continued motion of a body depends not upon its *inertia*, but upon the continuance of the active substance within the body. The motion of a body is produced by the motion of the active substance in union with the body. It being evident, that since the active substance itself does always move, whatever it is united to will be moved along with it, if no obstacle prevent. In mere motion, the body moved is the patient, and the active substance the agent. In impulse, the body in motion may be considered as an agent, as it is made active by its active substance.—While the active substance is flowing out of the active body into the obstacle or impelled body, the active body will press or impel the obstacle For while the active substance is yet within the body, although flowing through it, it does not cease to impart to the body its own nature, nor can the body cease to be active, because not yet deprived of the active substance. Therefore, during its passing out of the body, such portion of the active substance as is yet within, is urging and disposing the body to move, in like manner as if the active substance were continuing in the body; and the body being thus urged to move, but impeded from moving, presses or impels the obstacle.

17 produce impulse,

"We see here (says our author) an obvious explanation of impulse; it consists in the flowing of the motive substance from a source into a receptacle:" and he thinks, that although the existence of such a substance had not been established on any previous grounds, the communication of motion by impulse does alone afford a sufficient proof of its reality.

He employs the agency of the same substance to account for many other apparent activities in bodies, such as those of *fire*, *electricity*, *attraction*, *repulsion*, *elasticity*, &c. All the apparent origins of corporeal activity, serve (he says) to impart the active substance to bodies; "and where activity is without any *manifest* origin, the active substance is derived from an invisible source."

Our limits will not permit us to attend him in his solution of all the apparent activities in bodies; but the orbicular motions of the planets have been accounted for in so many different ways by philosophers ancient and modern, and each account has been so little satisfactory to him who can think, and wishes to trace effects from adequate causes, that we consider it as our duty to furnish our readers with the account of this phenomenon which is given by Mr Young.

18 and cause the motion of the heavenly bodies.

The question which has been so long agitated, "Whence is the origin of motion?" our author considers as implying an absurdity. "It supposes (says he) that rest was the primitive state of matter, and that motion was produced by a subsequent act. But this supposition must ever be rejected, as it is giving precedency to the inferior, and inverting the order of nature." The substance which he holds to be the basis bafis of matter is effentially active; and its action is motion. This motion, however, in the original element, was *power* without direction, agency without order, activity to no end. To this power it was neceffary that a LAW fhould be fuperadded; that its agency fhould be guided to fome regular purpofe, and its motion confpire to the production of fome uniform effects." Our author fhows, or endeavours to fhow, by a procefs of reafoning which fhall be examined elfewhere, that the primary atoms of matter are produced by the circular motion of the parts of this fubftance round a centre; and that a fimilar motion of a number of thefe atoms round another centre common to them all, produces what in common language is called a *folid body*; a cannon ball, for inftance, the terreftrial globe, and the body of the fun, &c. In a word he labours to prove, and with no fmall fuccefs, that a principle of union is implied in the revolving or circulating movements of the active fubftance.

"But we may alfo affume (he fays) *à priori*, that a principle of union is a general law of nature; becaufe we fee in fact all the component parts of the univerfe are united fyftems, which fucceffively combine into larger unions, and ultimately form *one* whole." Let us then fuppofe the fun with all his planets, primary and fecondary, to be already formed for the purpofe of making one fyftem, and the orbits of all of them, as well as thefe great bodies themfelves, to be prevaded by the active fubftance, which neceffarily exifts in a ftate of motion, and is the caufe of the motion of every thing corporeal. "If to this motion a principle of union be added, the effect of fuch a principle would be a determination of all the parts of the active fubftance, and of courfe all the bodies to which it is united, towards a common centre, which would be at reft, and void of a tendency in any direction. But this determination of all the parts of the fyftem towards a common centre, tends to the deftruction both of the motion of the active fubftance and of the fyftem; for fhould all the parts continually approximate from a circumference towards a centre, the fun and planets would at laft meet, and form one folid and quiefcent mafs. But to preferve exiftence, and confequently motion, is the firft law of the active fubftance as of all being; and it cannot be doubted, that to preferve diftinct the feveral parts of the folar fyftem, is the firft law given to the fubftance actuating that fyftem. The union of the fyftem is a fubfequent law.

"When the *direct* tendency of any inferior law is obviated by a higher law, the inferior law will operate *indirectly* in the manner the neareft to its direct tendency that the fuperior law will permit. If a body in motion be obliquely obftructed, it will move on in a direction oblique to its firft motion. Now the law of union, which pervades the folar fyftem, being continually obftructed by the law of felf-prefervation, the motion of the active fubftance and of the bodies to which it is united can be no other than a revolving motion *about* the common centre of approach, *towards* which all the parts have a determination. But when this revolution has actually taken place, it gives birth to a new tendency, which fuperfedes the operation of the law of felf-prefervation. It has been fhown, that the motion effential to the active fubftance, required to be governed by fome law to give being to an orderly ftate of things. Now, there are motions fimple and motions complex; the more fimple is in all things firft in order, and out of the more fimple the more complex arifes in order pofterior. The moft fimple motion is rectilineal; therefore a rectilineal motion is to be confidered as that which is the original and natural ftate of things and confequently that to which *all things tend*. It will follow from hence, that when any portion of active fubftance in which the *law of union* operates, has in the manner above explained been compelled to affume a revolving motion, that is, a motion in fome curve; a tendency to a rectilineal motion will continually exift in every part of the revolving portion, and in every point of the curve which it defcribes during its revolution. And this rectilineal tendency will be a tendency to recede from the centre in every point of the revolving orbit, and to proceed in a tangent to the orbit of each point. Thefe two tendencies, if not originally equal, muft neceffarily in all cafes arrive at an equality. For the tendency towards the centre, called the *centripetal* tendency, that is the *law of union*, operating firft, if we fuppofe the motion approaches the centre, the tendency to recede from it called the *centrifugal* tendency, will have its proportion to the centripetal continually increafed as the orbit of revolution grows lefs, fo as ultimately to equal the centripetal tendency, and reftrain the motion from its central courfe, at which point it will no longer feek the centre but revolve round it."

As our author holds that every atom of matter is formed by the motion of parts of the active fubftance, and every body formed by the motion of atoms; fo he maintains, not only that the fun, moon, earth, planets and ftars, are penetrated by the fame fubftance, but that each is the centre of a vortex of that fubftance and that of thefe vortices fome are included within others. "The fubtile revolving fluid, the centre of whofe vortex the earth occupies, not only furrounds but prevades the earth, and other vortices their earths, to their centres; and the earth and planets are by its revolutions carried around on their own axes. The earth is an inactive mafs, and all its component maffes are feverally as well as collectively inactive; but the earth and all its parts have various collective and feparate movements, imparted from the fluid which furrounds, pervades, and conftitutes it. Being immerfed together with its proper furrounding fphere or vortex, in the larger fphere or vortex of the fun, it is carried thereby in a larger orbit about the fun, at the fame time that by the revolution of its proper fphere it rotates on its own axis."

19 Objections to this theory.

Such is the moft complete view which our limits will permit us to give of Mr Young's theory of motion. To the philofopher who confiders experiment as the only teft of truth, and who in all his inquiries employs his hands more than his head, we are fully aware that it will appear in no better light than as "the bafelefs fabric of a vifion." Even to the intellectual philofopher who is not frightened at the word *metaphyfics*, we are afraid than fuch an active fubftance as the author contends, for, will appear as inadequate to the production of the phenomena of gravitation and repulfion as the material æther of Mr Jones and his followers. A being void of intelligence, whether it be material or immaterial, quiefcent or motive, cannot

be

be the ſubject of law, in the proper ſenſe of the word. The laws of which Mr Young ſpeaks as neceſſary to regulate the motions of the active ſubſtance, muſt be mere *forces*, applied by ſome extrinſic and ſuperior power. And ſince "motion, as it is *eſſential* to the active ſubſtance, is power without direction, agency without order, activity to no end; ſince it is of ſuch a nature, that from its unguided agitations there could reſult neither connection, order, nor harmony;" it follows that thoſe extrinſic forces muſt be perpetually applied, becauſe what is *eſſential* to any ſubſtance can never be deſtroyed or changed ſo long as the ſubſtance itſelf remains.

Forces producing order out of confuſion, can be applied only by a being poſſeſſed of intelligence; and if the immediate and perpetual agency of an intelligent being be neceſſary to regulate the motions of the active ſubſtance, that ſubſtance itſelf may be thought ſuperfluous, and its very exiſtence be denied. *Entia non ſunt multiplicanda abſque neceſſitate*, is a rule of philoſophiſing which every man of ſcience acknowledges to be juſt. And it will hardly be denied, that the immediate and perpetual agency of an intelligent being upon Mr Jones's ætherial fluid, or even upon the matter of ſolid bodies themſelves, would be capable of producing every kind of motion without the inſtrumentality of a ſubſtance which is neither mind nor matter.

Such we conceive, are the objections which our metaphyſical readers may make to this theory. Part of their force, however, will perhaps be removed by the ingenious manner in which our author analyſes matter into an immaterial principle. But ſo much of it remains, that the writer of this article is inclined to believe that no mechanical account can be given of the motions of the heavenly bodies, the growth of plants, and various other phenomena which are uſually ſolved by attraction and repulſion. In the preſent age, philoſophers in general are ſtrangely averſe from admittting on any occaſion the agency of mind; yet as every effect muſt have a cauſe, it is ſurely not irrational to attribute ſuch effects as mechaniſm cannot produce to the operation either of intelligence or inſtinct. To ſuppoſe the Deity the immediate agent in the great motions of the univerſe, has been deemed impious; and it muſt be confeſſed that very impious concluſions have been deduced from that principle. But there is ſurely no impiety in ſuppoſing, with the excellent biſhop of Cloyne, that the fluid which is known to pervade the ſolar ſyſtem, and to operate with reſiſtleſs force, may be animated by a powerful mind, which acts inſtinctively for ends of which itſelf knows nothing. For the exiſtence of ſuch a mind, no other evidence, indeed, can be brought than what is afforded by a very ancient and very general tradition, and by the impoſſibility of accounting for the phenomena upon principles of mere mechaniſm. Perhaps ſome of our more pious readers may be inclined to think that the Supreme Being has committed the immediate government of the various planetary ſyſtems to powerful *intelligences*, or ANGELS, who as his miniſters, direct their motions with wiſdom and foreſight. Such an opinion is certainly not abſurd in itſelf; and it ſeems to be countenaced by an ancient writer who, though not known by the name of a philoſopher, knew as much of the matter as any founder of the moſt celebrated ſchool.

20 Other theories more ancient and rational.

*Pſal. 104.

To object to either of theſe hypotheſes, as has been ſometimes done, that it repreſents the government of the world as a perpetual miracle, betrays the groſſeſt ignorance; for we might as well call the movements of the bodies of men and brutes, which are certainly produced by minds, miraculous. We do not affirm that either hypotheſis is certainly true; but they are both as probable and as ſatisfactory as the hypotheſis which attributes agency to attraction and repulſion, to a ſubtile æther, or to a ſubſtance which is neither a mind nor matter. Were the immediate agency of intellect to be admitted there would be no room for many of thoſe diſputes which have been agitated among philoſophers, about the increaſe or diminution of motions in the univerſe; becauſe an intelligent agent, which could begin motion as well as carry it on, might increaſe or diminiſh it as he ſhould judge proper. If inſtinctive agency, or ſomething ſimilar to it, be adopted, there is the ſame room for inveſtigation as upon the principles of mechaniſm; becauſe inſtinct works blindly according to ſteady laws impoſed by a ſuperior mind, which may be diſcovered by obſervation of their effect. As we conſider this as by much the moſt probable hypotheſis of the two, we find ourſelves involved in the following queſtion: "If a certain quantity of motion was originally communicated to the matter of the univerſe, how comes it to paſs that the original quantity ſtill remains: Conſidering the many oppoſite and contradictory motions which ſince the creation have taken place in the univerſe, and which have undoubtedly deſtroyed a great part of the original quantity, by what means has that quantity been reſtored?

21 The queſtion Whether the original quantity of motion in the world remains unimpaired? anſwered by

If this queſtion can be ſolved by natural means, it muſt be upon the principles of Newton; for "in every caſe § where quantities and relations of quantities are required, it is the province of mathematics to ſupply the information ſought," and all philoſphers agree that Sir Iſaac's doctrine of the compoſition and reſolution of motion, though in what reſpects the heavenly bodies it may have no phyſical reality, is ſo mathematically juſt, as to be the only principle from which the quantity of motion, or the force of powers, can in any caſe be computed. If we chooſe to anſwer the queſtion, by ſaying that the motion left is reſtored by the interpoſition of the Deity, then we might as well have had recourſe to him at firſt, and ſay that he alone is the true principle of motion throughout the creation.

§ Young's Eſſay on the Powers and Mechaniſm, &c.

Before, we are reduced to this delemma, however, it is neceſſary, in the firſt place, to inquire whether there is or can be any real diminution of the quantity of motion throughout the univerſe? In this queſtion the Carteſians take the negative ſide; and maintain that the Creator at the beginning impreſſed a certain quantity of motion on bodies, and that under ſuch laws as that no part of it ſhould be loſt, but the ſame portion of motion ſhould be conſtantly preſerved in matter: and hence they conclude, that if any moving body ſtrike on any other body, the former loſes no more of its motion than it communicates to the latter. Sir Iſaac Newton takes the contrary ſide, and argues in the following manner: "From the various compoſitions of two motions, it is manifeſt there is not always

22 The Carteſians, and

23 By Newton.

Motion.

ways the ſame quantity of motion in the world; for if two balls, joined together by a ſlender wire, revolve with an uniform motion about their common centre of gravity, and at the ſame time that centre be carried uniformly in a right line drawn in the plane of their circular motion, the ſum of the motions of the two balls, as often as they are in a right line, drawn from their common centre of gravity, will be greater than the ſum of their motions when they are in a line perpendicular to that other. Whence it appears, that motion may be both generated and loſt. But, by reaſon of the tenacity of fluid bodies, and the friction of their parts, with the weakneſs of the elaſtic power in ſolid bodies, nature ſeems to incline much rather to the deſtruction than the production of motion; and in reality, motion becomes continually leſs and leſs.—For bodies which are either ſo perfectly hard or ſo ſoft as to have no elaſtic power, will not rebound from each other; their impenetrability will only ſtop their motion. And if two ſuch bodies equal to one another be carried with equal but oppoſite motions, ſo as to meet in a void ſpace, by the laws of motion they muſt ſtop in the very place of concourſe, loſe all their motion, and be at reſt for ever, unleſs they have an elaſtic power to give them a new motion. If they have elaſticity enough to make them rebound with one-fourth, one-half, or three-fourths, of the force they meet with, they will loſe three-fourths, one-half, or one-fourth, of their motion. And this is confirmed by experiments: for if two equal pendulums be let fall from equal heights, ſo as to ſtrike full upon each other; if thoſe pendulums be of lead or ſoft clay, they will loſe all, or almoſt all, their motion; and if they be of any elaſtic matter, they will only retain ſo much motion as they receive from their elaſtic power."

Motion, therefore, being thus, in the opinion of our celebrated author, *loſt*, or, *abſolutely deſtroyed*, it is neceſſary to find ſome cauſe by which it may be renewed. Such renovation Sir Iſaac attributes to *active* principles; for inſtance, "the cauſe of gravity, whereby the planets and comets preſerve their motions in their orbits, and all bodies acquire a great degree of motion in falling; and the cauſe of fermentation, whereby the heart and blood of animals preſerve a perpetual warmth and motion, the inner parts of the earth are kept perpetually warmed: many bodies burn and ſhine, and the ſun himſelf burns and ſhines, and with his light warms and cheers all things."

Elaſticity is another cauſe of the renovation of motion mentioned by Sir Iſaac. "We find but little motion in the world (ſays he), except what plainly flows either from theſe active principles, or from the command of the willer.

24 No power of motion ever loſt or deſtroyed.

With regard to the *deſtruction* or poſitive *loſs* of motion, however, we muſt obſerve, that notwithſtanding the authority of Sir Iſaac Newton, it is altogether impoſſible that any ſuch thing can happen. All moving bodies which come under the cognizance of our ſenſes are merely paſſive, and acted upon by ſomething which we call *powers*, or *fluids*, and which are to us totally inviſible. Motion, thererefore, cannot be loſt without a deſtruction or diminution of one of theſe *powers*, which we have no reaſon to think can ever happen. When two pendulums ruſh againſt each other, the motion is the mere effect of the action of gravity; and that action, which in this caſe is the *power*, continues to be the very ſame whether the pendulum moves or moves not. Could motion therefore, be exhauſted in this caſe, we muſt ſuppoſe, that by ſeparating two pendulums to the ſame diſtance from each other, and then letting them come together for a great number of times, they would at laſt meet with leſs force than before. But there is certainly not the leaſt foundation for this ſuppoſition; and no rational perſon will take it into his head, that ſuppoſing the whole human race had employed themſelves in nothing elſe from the creation to the preſent day, but ſeparating pendulums and letting them ſtop each other's motion, they would now come together with leſs force than they did at firſt. *Power*, therefore which is the cauſe of motion, is abſolutely indeſtructible. Powers may indeed counteract one another, or they may be made to counteract themſelves; but the moment that the obſtacle is removed, they ſhow themſelves in their priſtine vigour, without the leaſt ſymptom of abatement or decay.

25 Proved by Sir Iſaac Newton's doctrine of the compoſition and reſolution of motion. Plate CCCXIV.

Under the article MECHANICS, it has been ſhown, that when motion is compounded of two powers acting obliquely upon one another, more motion is loſt than the two powers taken together could ſpare. Thus, if the two powers AB and AC move a body through the diagonal of the ſquare AD; ſuppoſing each of theſe powers to be = 5, the diagonal through which they paſs will be 7 (A); but from an inſpection of the figure, it is manifeſt, that by the ſeparation of the two powers, a quantity of motion BC, equal to the length of the other diagonal, is loſt; for in as far as the two act oppoſite to each other, they muſt deſtroy motion. The quantity of motion produced therefore being 7, and the quantity loſt the ſame, the whole quantity originally exiſting in the two powers AB and BC ought to have been 14, when it is only 10. To make up for the deficiency therefore, we muſt ſearch for the origin of the two powers AB and BC, and this we ſhall find in the lines A*a*, A*c*, and A*d*; each of which is $3\frac{1}{2}$, altogether making 14; whence deducting 7 the motion loſt, we have 7 remaining for the motion produced. Let us now find out the origins of theſe powers, and we ſhall find thoſe of A*a* in the lines A*e* and A*f*; the origins of A*c* in A*f* and A*g*. The ſources of A*d* we find in the lines A*g* and A*h*. Thus we have now eight ſources of the four powers which generated the two firſt ones; and thus we find that the power AD = 7. requires two of 5 each = 10 for its generation; theſe two require four of $3\frac{1}{2}$ each for their production; and theſe again require eight of 2. 45 each for their production. Hence, in order to generate the two original powers AB and AC, we ſee that there is required at a very few ſteps no leſs than 20; and in like manner, to generate theſe eight powers, we muſt have recourſe to 16 others; ſo that the ultimate ſource of motion increaſes beyond all calculation.

Whether, therefore, we reckon the ultimate ſource of motion to be ſpiritual or material, it is plain that it muſt be to our conceptions *infinite*; neither will the phe-

(A) It will be ſomething more than 7; but the fractional part is omitted, as being of no importance in the illuſtration of the fact before us.

phenomena of nature allow us to give any other explanation than we have done: for no power whatever can lose more than its own quantity; and it seems absurd to think that the Deity would create the world in such a manner that it would ultimately become immoveable, and then have recourse to unknown principles to remedy the supposed defect. On the principle we have just now laid down, however, the matter becomes exceedingly plain and obvious. The creator at first formed two opposite powers, the action of which is varied according to the circumstances of the bodies upon which they act; and these circumstances are again varied by the action of the powers themselves in innumerable ways upon one another, and the approach of one body to another, or their receding to a greater distance. Where these powers happen to oppose each other directly, the body on which they act is at rest; when they act obliquely, it moves in the diagonal; or if the force acting upon one side is by any means lessened, the body, certainly must move towards that side, as is evident from the case of the atmosphere, the pressure of which, when removed from one side of a body, will make it move very violently towards that side; and if we could continually keep off the pressure in this manner, the motion would assuredly be *perpetual*. We must not imagine that motion is *destroyed* because it is *counteracted*; for it is impossible to destroy motion by any means but by removing the cause; counteracting the effect is only a temporary obstacle, and must cease whenever the obstacle is removed. Nature, therefore, having in itself an *infinite* quantity of motion, produces greater or lesser motions, according to the various actions of the moving powers upon different bodies or upon one another, without a possibility of the general stock being either augmented or diminished, unless one of the moving powers was to be withdrawn by the Creator; in which case, the other would destroy the whole system in an instant.

26 The nature of the moving powers unknown.

As to the nature of these great original powers, we must confess ourselves totally ignorant; nor do we perceive any data from which the nature of them can be investigated. The elements of light, air, &c. are the agents; but in what mannner they act, or in what manner they received their action, can be known only to the Creator.

Perpetual Motion, in mechanics, a motion which is supplied and renewed from itself, without the intervention of any external cause; or it is an uninterupted communication of the same degree of motion from one part of matter to another, in a circle or other curve returning into itself, so that the same momentum still returns undiminished upon the first mover.

The celebrated problem of a perpetual motion consists in the inventing a machine, which has the principle of its motion within itself. M. de la Hire has demonstrated the impossibility of any such machine, and finds that it amounts to this; *viz.* to find a body which is both heavier and lighter at the same, or to find a body which is heavier than itself.

To find a perpetual motion or to construct an engine, &c. which shall have such a motion, is a famous problem that has employed the mathematicians of 2000 years; though none perhaps have prosecuted it with attention and earnestness equal to those of the present age.

Infinite are the schemes, designs, plans, engines, wheels, &c. to which this longed-for perpetual motion has given birth; it were as endless as impertinent to give a detail of them all.

In effect, there seems but little in nature to countenance all this assiduity and expectation; among all the laws of matter and motion, we know of none yet which seems to furnish any principle or foundation for such an effect.

Animal Motion, that which is performed by animals at the command of the mind or will.

Though all the motions of animals, whether voluntary or involuntary, are performed by means of the muscles and nerves, yet neither these nor the subtile fluid which resides in them are to be accounted the ultimate sources of animal motion. They depend entirely upon the mind for those motions which are properly to be accounted *animal*. All the involuntary motions, such as those of the blood, the heart, muscles, organs subservient to respiration and digestion, &c. are to be classed with those of vegetables; for though no vegetable have them in such perfection as animals, there are yet traces of them to be found evidently among vegetables, and that so remarkably, that some have imagined the animal and vegetable kingdoms to approach each other so nearly that they could scarce be distinguished by a philosophic eye. See Muscle.

Though the motions of animals, however, depend on the action of the mind or of the will, external objects seem originally to have the command of the mind itself; for unless an animal perceive something, it will not be inclined to act. By means of the ideas once received, indeed, and retained in the memory, it acquires a self-moving power, independent of any object present at the time, which is not the case with vegetables; for however they may act from a present impulse, their motions never appear to be derived from any source which may not be accounted strictly mechanical.

According to some, motion is the cause of sensation itself; and indeed it seems very probable that the motions of that subtile fluid, called *light* or *electricity*, in our bodies always acompany our sensation; but whether these be the *cause*, or only the *medium*, of sense, cannot be discovered.

Though all animals are endowed with a power of voluntary motion, yet there is a very great variety in the degrees of that power; to determine which no certain rules can be assigned; neither can we, from the situation and manner of life of animals, derive any probable reason why the motion of one should differ so very much from that of another. This difference does not arise from their size, their ferocity, their timidity, nor any other property that we can imagine. The elephant though the strongest land animal, is by no means the slowest in its motions; the horse is much swifter than the bull, though there is not much difference in their size; a grey-hound much swifter than a cat, though the former be much larger, and though both live in the same manner, *viz.* by hunting. Among insects the same unaccountable diversity is observable. The louse and flea are both vermin, are both nearly of the same size, and both feed on the bodies of animals; yet there is no comparison between the swiftness of their motions: while the bug which is much larger than either, seems to to have a kind of medium ſwiftneſs between both.—This very remarkable circumſtance ſeems not even to depend on the range which animals are obliged to take in order to procure food for themſelves: the motion of a ſnail is ſlower than that of an earth-worm; while that of many caterpillars is much quicker than either; though we can ſcarce determine which of the three has the greateſt or the leaſt extenſive range for its food.

Of all animals the ſhell-fiſh move the ſloweſt, inſomuch that ſome have ſuppoſed them to be entirely deſtitute of loco-motive powers; and muſcles particularly are denied to have any faculty of this kind. Every one knows that theſe animals can open and ſhut their ſhells at pleaſure; and it cannot eſcape obſervation, that in every muſcle there is a fleſhy protuberance of a much redder colour than the reſt. This has been thought to be a tongue or proboſcis, by which the animal takes in its food; but is in reality the inſtrument of its motion from place to place. This protuberance is divided into two lobes, which perform the office of feet. When the river muſcle is inclined to remove from its ſtation, it opens its ſhell, thruſts out this protuberance, and digs a furrow in the ſand; and into this furrow, by the action of the ſame protuberance, the ſhell is made to fall in a vertical poſition. It is recovered out of this into the former horizontal one, by puſhing back the ſand with the ſame tentacula, lengthens the furrow, and thus the animal continues its journey by a continual turning topſy-turvy.—Marine muſcles perform their motions in the ſame manner, and by ſimilar inſtruments. In general they are firmly attached to rocks or ſmall ſtones by threads about two inches long, which are ſpun from a glutinous ſubſtance in the protuberances already mentioned; theſe are called, in Scotland, the *beards* of muſcles, and are thought to be the cauſe of the fatal diſorders which ſometimes attend the eating of muſcles. See Mytulus.

Other animals which dwell in bivalved ſhells, perform their motions by a kind of leg or foot; which, however, they can alter into almoſt any figure they pleaſe. By means of this leg they can not only ſink into the mud, or riſe out of it at pleaſure, but can even leap from the place where they are; and this can be done by the limpit, which people are apt to imagine one of the moſt ſluggiſh animals in nature.—When this creature is about to make a ſpring, it ſets its ſhell on edge, as if to to diminiſh friction; then, ſtretching out the leg as far as poſſible, it makes it embrace a portion of the ſhell, and by a ſudden movement, ſimilar to that of a ſpring let looſe, it ſtrikes the earth with its leg, and actually leaps to a conſiderable diſtance.

The ſpout, or razor-fiſh, is ſaid to be incapable of moving forward horizontally on the ſurface; but it digs a hole ſometimes two feet deep in the ſand, in which it can aſcend or deſcend at pleaſure. The leg, by which it performs all its movements, is fleſhy, cylindrical, and pretty long; and the animal can at pleaſure make it aſſume the form of a ball. When lying on the ſurface of the ſand, and about to ſink into it, the leg is extended from the inferior end of the ſhell, and makes the extremity of it take on the form of a ſhovel, ſharp on each ſide, and terminating in a point. With this inſtrument the animal makes a hole in the ſand; after which it advances the leg ſtill farther into it, makes it aſſume the form of a hook, and with this, as a fulcrum, it obliges the ſhell to deſcend into the hole. This operation is continued until the whole ſhell be covered; and when the animal wiſhes to regain the ſurface, it makes the extremity of the leg to aſſume the form of a ball, and makes an effort to extend it. The ball, however, prevents any farther deſcent, and the re-action of the muſcular effort raiſes up the whole ſhell, which operation is continued until it reaches the ſurface; and it is ſurpriſing with what facility theſe motions are accompliſhed by an animal ſeemingly ſo little qualified to move at all. Another particularity in this fiſh is, that though it lives among ſalt water, it abhors ſalt ſo much that when a little is thrown into its hole it inſtantly leaves it. But it is ſtill more remarkable, that if you once take hold of the ſpout fiſh, and then allow it to retire into its hole, it cannot then be driven out by ſalt; though unleſs it be taken hold of by the hand, the application of ſalt will make it come to the ſurface as often as you pleaſe. See Solen.

All other ſhell-fiſh, even thoſe apparently the moſt ſluggiſh and deſtitute of any apparatus for motion, are found to be furniſhed with ſuch inſtruments as enable them to perform all thoſe movements for which they have any occaſion. Thus the ſcallop, a well-known animal inhabiting a bivalved ſhell, can both ſwim upon the ſurface of water and move upon land. When it happens to be deſerted by the tide, it opens its ſhell to the full extent, and ſhutting it again with a ſudden jerk, the reaction of the ground gives ſuch an impulſe to the whole, that it ſometimes ſprings five or ſix inches from the ground; and by a continued repetition of this action, it gradually tumbles forward until it regains the water. Its method of ſailing is ſtill more curious. Having attained the ſurface of the water by means unknown to us, it opens the ſhell, and puts one half above water, the other with the body of the animal in it, remaining below. Great numbers of them are thus frequently ſeen ſailing in company with their ſhells ſticking up above water when the weather is fine, and the wind acting upon them as ſails; but on the leaſt alarm they inſtantly ſhut their ſhells, and all ſink to the bottom together. See Pecten.

The oyſter has generally been ſuppoſed one of the moſt ſluggiſh animals in nature, and totally incapable of voluntary motion; but from the reſearches of the Abbé Dicquemarre, this opinion ſeems to be erroneous. The oyſter, like many other bivalved ſhell-fiſh, has a power of ſquirting water out from its body; and this property may eaſily be obſerved by putting ſome of them into a plate with as much ſea-water as will cover them. The water is ejected with ſo much force, as not only to repel the approach of ordinary enemies, but to move the whole animal backwards or ſideways, in a direction contrary to that in which the water was ejected. It has been alſo ſuppoſed, that oyſters are deſtitute of ſenſation; but M. Dicquemarre has ſhown, that they not only poſſeſs ſenſation, but that they are capable of deriving knowledge from experience. When removed from ſuch places as are entirely covered with the ſea, when deſtitute of experience, they open their ſhells and die in a few days; but if they happen to eſcape this danger, and the water covers them again, they will not open their ſhells again,

again, but keep them shut, as if warned by experience to avoid a danger similar to what they formerly underwent. See OSTREA.

The motions of the sea-urchin are perhaps more curious and complicated than those of any other animal. It inhabits a beautiful multivalved shell, divided into triangular compartments, and covered with great numbers of prickles; from which last circumstance it receives the name of *sea-urchin* or *sea hedge-hog*. The triangles are separated from one another by regular belts, and perforated by a great number of holes, from every one of which issues a fleshy horn similar to that of a snail, and capable of moving in a similar manner. The principal use of these horns seems to be to fix the animal to rocks or stones, though it likewise makes use of them in its progressive motion. By means of these horns and prickles, it is enabled to walk either on its back or its belly; but it most commonly makes use of those which are near the mouth. Occasionally it has a progressive motion by turning round like a wheel. Thus, says Mr Smellie ‡, the sea-urchin furnishes an example of an animal employing many thousand limbs in its various movements. The reader may try to conceive the number of muscles, fibres, and other apparatus which are requisite to the progressive motion of this little animal.

‡ Phil. of Nat. Hist.

Those animals called *sea-nettles* or *medusæ*, though extremely slow in their motions, are nevertheless evidently capable of moving at pleasure from place to place. The variety of their figure is such, that it is difficult to assign them any determinate figure whatever. In general, however, they resemble a truncated cone, the base of which is applied to the rock to which they adhere. Their colours are various, whitish, brown, red, or greenish: the mouth is very large; and when opened appears surrounded with filaments resembling the horns of snails, which being disposed in three rows around it, give the animal the appearance of a flower*; and through every one of these the animal has the power of squirting the sea-water. The structure of these animals is extremely singular; they consisting all of one organ, *viz.* a stomach. When searching for food, they extend their filaments, and quickly entangle any small animals that come within their reach. The prey is instantly followed, and the mouth shut close upon it like a purse; in which state it remains for many days before the nutritive parts are extracted. The animal, though scarcely an inch or an inch and a half in diameter, is nevertheless so dilatable, that it can swallow large whelks and muscles, the shells of which are thrown out by the mouth after the nutritive parts have been exhausted. Sometimes the shell is too large to be voided this way; in which case the body of the animal splits, and the shell is voided through the opening, which in a short time heals up again. The progressive motion of this creature is so slow, that it resembles that of the hour-hand of a clock, and is performed by means of innumerable muscles placed on the outside of the body. All these are tubular, and filled with a fluid, which makes them project like prickles. On occasion it can likewise loosen the base of the cone from the rock, and inverting its body move by means of the filaments already mentioned, which surround the mouth; but even the motion performed in this manner is almost as slow as the other.

* See Actinia.

Some animals are capable of moving backwards, apparently with the same facility that they do forwards, and that by means of the same instruments which move them forward. The common house-fly exhibits an instance of this, and frequently employs this retrograde motion in its ordinary courses; though we cannot know the reason of its employing such an extraordinary method. Another remarkable instance is given by Mr Smellie in the *mason-bee*. This is one of the solitary species, and has its name from the mode of constructing its nest with mud or mortar. Externally this nest has no regular appearance, but at first sight is taken for a quantity of dirt adhering to the wall; though the internal part be furnished with cells in the same regular manner with the nests of other insects of the bee-kind. When this bee leaves its nest, another frequently takes possession of it; in which case a battle never fails to ensue on the return of the real proprietor. The dispute is decided in the air; and each party endeavours to get above the other, as birds of prey are wont to do in order to give a downward blow. The undermost one, to avoid the stroke, instead of flying forward or laterally, always flies backward. The encounter is so violent, that when they strike, both parties fall to the ground.

Vegetable MOTION. Though vegetables have not the power of moving from one place to another like animals, they are nevertheless capable of moving their different parts in such a manner as would lead us to suspect that they are actuated by a sort of instinct. Hence many have been induced to suppose, that the animal and vegetable kingdoms are in a manner indistinguishable from one another; and that the highest degree of vegetable life can hardly be known from the lowest degree of animal life. The essential and insuperable distinction, however, between the two, is the faculty of sensation, and locomotion in consequence of it. Were it not, indeed, for the manifestation of sense by moving from one place to another, we should not be able to tell whether vegetables were possessed of sensation or not; but whatever motions they may be possessed of, it is certain that no vegetable has the faculty of moving from one place to another. Some have endeavoured to distinguish the two kingdoms by the digestion of food; alleging that plants have no proper organs, such as a stomach, &c. for taking in and digesting their aliment. But to this it has been replied, that the whole body of a vegetable is a stomach, and absorbs its food at every pore. This, however, seems not to be a sufficient answer. All animals take in their food at intervals, and there is not a single instance of one which eats perpetually. The food is also taken into the body of the animal, and application of the parts made by means of the *internal* organization of the viscus; but in vegetables, their whole bodies are immersed in their food, and absorb it by the surface, as animal bodies will sometimes absorb liquids when put into them. The roots of a tree indeed will change their direction when they meet with a stone, and will turn from barren into fertile ground; but this is evidently mere mechanism, without any proof of will or sensation; for the nourishment of the root comes not from the stone, but from the earth around it: and the increase in size is not owing to any expansion of the matter which the root already contains,

contains, but to the acquisition of new matter: whence the increase of size must always take place in the direction from whence the nourishment proceeds. On this principle also we may explain the reason why the roots of a tree, after having arrived at the edge of a ditch instead of shooting out into the air, will creep down the one side, along the bottom, and up the other.

In their other movements the vegetables discover nothing like sensation or design. They will, indeed, uniformly bend towards light, or towards water; but in the one case we must attribute the phenomena to the action of the elements of light and air upon them; and in the latter the property seems to be the same with what in other cases we call attraction. Thus, if a root be uncovered, and a wet spunge placed near it in a direction different from that in which the root was proceeding, it will soon alter its position, and turn towards the sponge: and thus we may vary the direction of the root as often as we please. The efforts of a plant to turn from darkness or shade into sunshine are very remarkable; as, in order to accomplish this, not only the leaves will be inclined, but even the stems and branches twisted. When a wet spunge is held under the leaves of a tree, they bend down in order to touch it. If a vessel of water be put within six inches of a growing cucumber, in less than 24 hours the latter will alter its direction; the branches will bend towards the water, and never alter their course until they come in contact with it. The most remarkable instance of this kind of motion, however, is, that when a pole is brought near a vine, the latter will turn towards it, and never cease extending its branches till it lays hold of the support.

The motions of the sensitive plant, and others of the same kind, have been considered as very wonderful; but it is doubtful if any of them be really more so than that of the vine just mentioned. None of these show any kind of propensity to move without an actual touch. A very slight one, indeed, makes the sensitive plant contract, and the whole branch, together with the leaves, bend down towards the earth.—This is so similar to some phenomena of electricity, that very few will hesitate at ascribing both to the same cause. Even the motions of the hedysarum gyrans, which at first sight seem so much more surprising than those of the sensitive plant, may be explained upon the same principle. There is a specimen of this plant in the botanic garden of Edinburgh. It is a native of the East Indies, and its motions are occasioned by the sun-beams. The leaves are the only moveable parts. They are supported by long foot-stalks; and when the sun shines upon them they move briskly in every direction. Their most usual motion is upward and downward; but not unfrequently they turn almost quite round, and then the foot-stalks are evidently twisted. These motions continue only while the light and heat of the sun continues, ceasing when at night, or when the weather becomes cloudy and cold. The American plant called *Dionœa muscipula, or Venus's fly trap*, is another example of very wonderful mechanism in vegetables, though even this does not argue any degree of sensation in this plant more than in others. The leaves of the dionæa are jointed, and furnished with two rows of prickles. A number of small glands upon the surface secrete a sweet juice, which entices flies to come and settle upon it; but the moment these insects touch the fatal spot, the leaves fold up, and squeeze them to death between the prickles. The leaves fold up in the same manner when the plant is touched with a straw or pin.

The folding up of the leaves of certain plants in the absence of the sun's light, called their *sleep*, affords another very curious instance of vegetable motion.—Almost all vegetables, indeed, undergo such a remarkable change in the night, that it is difficult to know exactly how many kinds do really sleep. They fold up their leaves in many different ways; but all agree in disposing of them in such a manner as to afford the best protection to the young stems, flower buds, or fruit. The leaves of the tamarind-tree contract round the young fruit, in order to protect it from nocturnal cold; and those of senna, glycina, and many other papilionaceous plants, dispose of their leaves in the same manner. The leaves of the chickweed, asclepias, atriplex, &c. are disposed in opposite pairs. In the night-time they rise perpendicularly, and join so close at the top that the flowers are concealed by them. In like manner do the leaves protect the flowers of the sida, or althæ theophrasti, the aycnia, and œnothira, the solanum, and the Egyptian vetch. All these are erected during the night; but those of the white lupine, in time of sleep, hang down.

The flowers of plants also have motions peculiar to themselves. Many of them during the night are inclosed in their calyxes. Some, particularly those of the German spurge, geranium striatum, and common Whitlow grass, when asleep bend towards the earth; by which means the noxious effects of rain or dew are prevented. All these motions have been commonly ascribed to the sun's rays; and Mr Smellie informs us, that in some of the examples above mentioned the effects were evidently to be ascribed to heat; but plants kept in an hot-house, where the temperature of the day and night are alike, contract their leaves, and sleep in the same manner as if they were exposed to the open air; "whence it appears (says he), that the sleep of plants is owing rather to a peculiar law, than to a quicker or slower motion of the juices." He suspects, therefore, that as the sleep of plants is not owing to the mere absence of heat, it may be occasioned by the want of light; and to ascertain this he proposes an experiment of throwing upon them a strong artificial light. "If, notwithstanding this light (says he), the plants are not roused, but continue to sleep as usual, then it may be presumed that their organs, like those of animals, are not only irritable, but require the reparation of some invigorating influence which they have lost while awake, by the agitations of the air and of the sun's rays, by the act of growing, or by some other latent cause." On this, however, we must remark, that the throwing of artificial light upon plants cannot be attended with the same consequences as that of the light of the sun, unless the former were as strong as the latter, which is impossible; and even granting that we could procure an artificial light as strong as that of the sun, a difference might be occasioned by the different directions of the rays, those of the sun being very nearly parallel, while the rays of all artificial light diverge very greatly. If, therefore, Motion. we are to make an experiment of this kind, the rays should be rendered parallel by means of a burning mirror. Here again we would be involved in a difficulty: for the rays of the sun proceed all in one direction; but as of necessity we must employ different mirrors in our experiment, the light must fall upon the plant in different directions, so that we could not reasonably expect the same result as when the plants are directly exposed to the rays of the sun.

The motion of plants, not being deducible from sensation, as in animals, must be ascribed to that property called *irritability:* and this property is possessed *insensibly* by the parts of animals in a greater degree than even by the most irritable vegetable. The muscular fibres will contract on the application of any stimulating substance, even after they are detached from the body to which they belonged. The heart of a frog will continue to beat when pricked with a pin for several hours after it is taken out of the body. The heart of a viper, or of a turtle, beats distinctly from 20 to 30 hours after the death of these animals. When the intestines of a dog, or any other quadruped, are suddenly cut into different portions, all of them crawl about like worms, and contract upon the slightest touch. The heart, intestines, and diaphragm, are the most irritable parts of animal bodies; and to discover whether this quality resides in all plants, experiments should be made chiefly on leaves, flowers, buds, and the tender fibres of the roots,

The motions of plants are universally ascribed by our author to *irritability,* to which also we have ascribed them under the article Animal. The term, however, requires an explanation; and to give this in an intelligible manner requires some attention. The most obvious comparison is that of an electrified thread; which, on the approach of any unelectrified substance, shows a variety of motions, equally surprising with those of the parts of plants or the muscular fibres cut out of the body. Could we suppose that the electricity of a thread might be preserved after it was cut off from the electrifying substance, it would show as much irritability as even the muscular fibres, or portions of the intestines of animals. We know, from the, history of the torpedo, electrical eel, &c. that there are animals in which the electric fluid acts in such a manner as to produce a much more powerful effect than that of giving motion to the leaves of plants. The readiness, therefore, with which this fluid is thrown into agitations when any substance in which it acts is touched, is without doubt the irritability in question; but we have from thence no more reason to ascribe sensation to these irritable bodies, than to an electrified bottle when it discharges itself, or makes a cork-ball play around it.

In a paper read before the Academy of Sciences at Paris, by M. Broussonet, the author inclines to confound irritability and sensibility together. "The different parts of plants (says he) enjoy the faculty of motion; but the motions of a vegetable are very different in their nature from those of an animal: the most sensible, those that are produced with most rapidity in plants, are always influenced by some stimulating cause. Irritability, which is nothing but *sensibility* made manifest by motion, is a general law to which nature has subjected all living beings; and it is this that continually watches over their preservation. Being more powerful in animals than in plants, it may be often confounded in these last with phenomena that depend on a quite different cause. In the vegetable it is only the organ which is exposed to the action of the stimulating power that moves. Irritation in particular places never produces that prompt combination of sensations which we observe in animals; in consequence of which certain parts are put in motion without being directly affected, and which otherwise might have been passive.

"The more perfect the organization in the different parts of animals is, the more apparent are the signs of irritability. The parts that come nearest to those of vegetables, and in which of consequence the organization is most imperfect, are the least irritable. The same law holds with regard to plants; but the result is opposite: the signs of irritability are most sensible in proportion to the analogy of the parts with those of animals; and they are imperceptible in those that are dissimilar. This assertion is proved by what we observe in the organs destined in vegetables to perpetuate the species. Those parts alone seem sensible to stimuli; the bark, leaves, stalks, and roots showing no signs of irritability.

"The vital motions in plants are slow, and entirely determined by circumstances, which are always repeated and equally diffused over all the parts. In animals, on the contrary, almost all the vital motions are very sensible; such are the pulsations of the heart and arteries, the dilation of the thorax, &c.: these being absolutely necessary to the preservation of the individual, are always reproduced in a similar manner in those of the same species. and in the same direction; and this takes place in like manner in plants. The twining plants, for instance such as the hop, follow constantly, as they twist themselves round a pole, the direction of the south towards the west. If vegetables are obstructed in exercising these motions, they soon perish; if, for example, we untwist a twining plant which had taken its direction round a branch from the right to the left, and place it in a contrary direction, it withers in a short time; especially if it has not vigour enough to regain its natural situation. We bring death in the same manner on an animal, if we interrupt any of its vital motions. The law by which plants are forced to move in a particular manner is very powerful. When two twining plants, one of which is weaker than the other, for example two plants of woodbine, happen to encounter, they twist round each other, the one directing itself to the right and the other to the left: this last is always the weakest; it is forced to take a direction contrary to that which it would have done if it had not met with the other; but if by any accident, these two twigs of woodbine should come afterwards to be separated, they both resume their natural direction, that is from right to left.

"The motions essentially vital, which have in plants the greatest affinity with those of animals, are the course of the sap, the passage of the air in the, trachea, the different positions which the flowers of certain plants take at certain hours of the day &c. But if we attend to the manner in which all these motions in plants are performed, we will find that they present a greater number

number of modifications than the analogous motions that take place in animals. The temperature of the atmosphere, its agitation, light, &c. have great influence on the motion of plants, by accelerating or retarding the course of their fluids; and, as they cannot change their place, these variations produce in them changes more obvious and more uniform than in animals."

Our author now proceeds to inform us, that some of the motions of plants are occasioned by the rarity of the juices in plants, and others by their abundance. Of the former kind are those by which the capsules of some plants suddenly burst with a spring, and throw their seeds to some distance, Of the other kind are the action of the stamina in the *parietaria*, the inflection of the peduncles of flowers, and of the pistilla. "These motions (says he) which are particularly observed in the organs destined to the reproduction of the individual, not appearing except in circumstances that render them absolutely necessary, seem in some measure to be the effect of a particular combination: they are, however, merely mechanical; for they are always produced in the same way and in the same circumstances. Thus the rose of Jericho, and the dry fruit of several species of *mesembryanthemum*, do not open but when their vessels are full of water.

"The sudden disengagement of fluids produces a kind of motion. To this cause we must attribute a great number of phenomena observable in the leaves of several plants, and which do not depend on irritability. The small glands in each leaf of the *dionæa* are no sooner punctured by an insect than it instantly folds up and seizes the animal: the puncture seems to operate a disengagement of the fluid which kept the leaf expanded by filling its vessels. This explanation is the more probable, that in the early state of the vegetation of this plant, when the small glands are hardly evolved, and when probably the juices do not run in sufficient abundance, the leaves are folded up exactly as they appear when punctured by an insect at a more advanced period. We observe a phenomenon similar to this in both species of the *drosera* (sundew). The mechanism here is very easily observable: the leaves are at first folded up: the juices are not yet propelled into the fine hairs with which they are covered; but after they are expanded, the presence of the fluid is manifest by a drop seen at the extremity of each hair: it is by absorbing this fluid that an insect empties the vessels of the leaf, which then folds up, and resumes its first state: the promptitude of the action is proportioned to the number of hairs touched by the insect. This motion in some degree resembles that which takes place in the limb of an animal kept, in a state of flexion by a tumour in the joint; when the matter which obstructed the motion is discharged, the limb instantly resumes its former position. The phenomena that depend on the abundance of fluids are particularly evident in plants which grow in wet soils; the *drosera* and *dionæa* are of this kind; and it is known by the experiments of Mess. Du Fay and Du Hamel, that sensitive plants are particularly sensible when the sun is obscured by clouds and the air warm and moist. The influence of external causes sometimes so modifies the vital motion in plants, that we would be tempted to ascribe them to volition, like those that depend entirely on that faculty in animals. If we set a pole in the ground near a twining plant, it always lays hold of the pole for support. in whatever place we put it. The same thing occurs in the tendrils of the vine; which always attach themselves to the support presented them on whatever side it may be placed, provided they can reach it: but these motions are entirely vital: the twining plants and the tendrils direct themselves to every quarter, and consequently cannot fail of meeting with the bodies within their reach. These motions are performed as long as the parts continue to grow; but when they cease to elongate, if they have not been able to reach any body on which they can fix, they bend back upon themselves. This and other observations show how far the vital motions in plants may be modified by external causes, and how essentially they differ from those that are the effect of volition in animals.

"Some plants appear endowed with no sort of motion: some have leaves that can move in different directions; their motions are generally modified by different causes; but none appear so eminently possessed of this quality as the *hedysarumgyrans* of Linnæus.—No part of this plant shows any signs of irritability upon application of stimuli: and the motion of its foliola ceases when the leafets are agitated by the wind.—When the sun is warm, the little leaves of the hedysarum are also immoveable; but when the weather is warm and moist, or when it rains, they move very freely. This motion seems indispensably necessary to the plant; for it begins as soon as the first leaves unfold, and continues even during the night; but in time it grows weaker. In our stoves it is most considerable during the first year; in the second it is not very sensible: in its native place all the leaves have a motion never observed here. The moving leafets are most agitated while the plants are in full flower, and the process of fructification goes on. The oscillatory motion is so natural to it, that it not only remains for three or four days in the leafets of a branch that has been cut off and put in water, but is even continued though the branch be exposed to the air. The leaves seem to perform the office of the heart in vegetables. When a plant is stripped of its leaves, the progress of vegetation is arrested; and such vegetables resemble those animals which have a periodical sleep, induced by a diminution of the action of the heart. Many plants hardly show any signs of motion; many seem also wholly cataleptic; which is rarely if ever found in animals. The footstalks of the flowers of dracocephalum, a Virginian plant, preserve themselves in whatever position they are placed.

Muscular Motion. See Muscle.

MOTIVE, is sometimes applied to that faculty of the human mind, by which we pursue good and avoid evil. Thus Hobbes distinguishes the faculties of the mind into two sorts, the cognitive and motive.

MOTTE (Anthony Houdart de la), an ingenious Frenchman, greatly distinguished by his writings in prose and verse, and by his literary contests with many eminent persons, was born at Paris in 1672. He wrote with very different success, no man having been more praised or more criticised than he was: his literary paradoxes, Motoualis. doxes, his singular systems, in all branches of polite learning, and above all his judgment upon the ancients, which, like those of Perrault, were thought disrespectful and detracting, raised him up formidable adversaries. Racine Boileau. Rousseau, and Madam Dacier, were among the number of those who made it their business to avenge antiquity on a man who, with more wit than genius or learning, assumed a kind of dictatorial authority in the province of belles letters. He became blind in the latter years of his life, and died in 1731. He wrote a great deal in epic poetry tragedy, comedy, lyric, pastoral, and fables; besides a vast variety of discourses, critical and academical, in prose. A complete edition of all his works was published in 11 vols 8vo, in 1754; though, as has been said of our Swift, his reputation had been better consulted by reducing them to three or four.

MOTOUALIS, a small nation of Syria, inhabiting to the east of the country of the Druses, in the valley which separates their mountains from those of Damascus; of which the following account is given by Mr Volney in his Travels, vol. ii. p. 48.

The characteristic distinction between them and the other inhabitants of Syria (says our author) is, that they, like the Persians, are of the sect of Ali, while all the Turks follow that of Omar, or Moaouia. This distinction, occasioned by the schism which in the 36th year of the Hejira arose among the Arabs, respecting the successors of Mahomet, is the cause of an irreconcileable hatred between the two parties. The sectaries of Omar, who consider themselves as the only orthodox, assume the title of *Sonnites* which has that signification, and term their adversaries *Shiites*, that is "sectaries of Ali," The word *Motoualis* has the same meaning in the dialect of Syria. The followers of Ali, dissatisfied with this name, substitute that of *Adlia*, which means "assertors of justice," literally "Justiciarians;" a denomination which they have assumed in consequence of a doctrinal point they advance in opposition to the Sonnite faith. A small Arabic treatise, entitled Theological Fragments concerning the Sects and Religions of the World, has the following passage:

"Those sectaries who pretend that God acts only on principles of justice, conformable to human reason, are called *Adlia* or *Justiciarians*. God cannot (say they) command an impracticable worship, nor ordain impossible actions, nor enjoin men to perform what is beyond their ability; but wherever he requires obedience, will bestow the power to obey. He removes the cause of evil, he allows us to reason, and imposes only what is easy, not what is difficult; he makes no man responsible for the actions of another, nor punishes him for that in which he has no part: he imputes not as a crime what himself has created in man; nor does he require him to avoid what destiny has decreed. This would be injustice and tyranny, of which God is incapable from the perfection of his being." To this doctrine, which diametrically opposes the system of the Sonnites, the Matoualis add certain ceremonies which increase their mutual aversion, They curse Omar and Moaouia as rebels and usurpers; and celebrate Ali and Hosain as saints and martyrs. They begin their ablutions at the elbow, instead of the end of the finger, as is customary with the Turks; they think themselves defiled by the touch of strangers; and, contrary to the general practice of the Easterns, neither eat nor drink out of a vessel which has been used by a person not of their sect, nor will they even sit with such at the same table.

Motoualis. These doctrines and customs, by separating the Motoualis from their neighbours have rendered them a distinct society. It is said they have long existed as a nation in this country, though their name has never been mentioned by any European writer before the present century; it is not even to be found in the maps of Donville: La Roque, who left their country not a hundred years ago, gives them the name of *Amediens*. Be this as it may, in latter times their wars, robberies, successes, and various changes of fortune, have rendered them of consequence in Syria. Till about the middle of this century, they only possessed Balbek their capital, and a few places in the valley, and Anti-Lebanon, which seems to have been their original country. At that period we find them under a like government with the Druzes, that is to say, under a number of Shaiks, with one principal chief of the family of Harfoush. After the year 1750 they established themselves among the heights of Bekaa, and got footing in Lebanon, where they obtained lands belonging to the Maronites, almost as far as Besharrai. They even incommoded them so much by their ravages, as to oblige the Emir Yousef to attack them with open force and expel them; but on the other side, they advanced along the river even to the neighbourhood or Sour, (Tyre). In this situation, Shaik Daher had the address, in 1760, to attach them to his party. The pachas of Saide and Damascus claimed tributes, which they have neglected paying, and complained of several robberies committed on their subjects by the Motoualis; they were desirous of chastising them; but this vengeance was neither certain nor easy. Daher interposed; and by becoming security for the tribute; and promising to prevent any depredations, acquired allies who were able, as it is said, to arm 10,000 horsemen, all resolute and formidable troops. Shortly after they took possession of Sour, and made this village the principal sea-port. In 1771 they were of great service of Ali Bey and Daher against the Ottomans. But Emir Yousef having in their absence armed the Druzes, and ravaged their country. He was besieging the castle of Djezin when the Motoualis, returning from Damascus, received intelligence of this invasion. At the relation of the barbarities committed by the Druzes, an advanced corps, of only 500 men, were so enraged, that they immediately rushed forward against the enemy, determined to perish in taking vengeance. But the surprise and confusion they occasioned, and the discord which reigned between the two factions of Mansour and Yousef so much favoured this desperate attack, that the whole army, consisting of 25,000 men, was completely overthrown.

In the following year, the affairs of Daher taking a favourable turn, the zeal of the Motoualis cooled towards him, and they finally abandoned him in the catastrophe in which he lost his life. But they have suffered for their imprudence under the administration of the pacha who succeeded him. Since the year 1777, Djezzar, master of Acre and Saide has incessantly ſently laboured to deſtroy them. His perſecution forced them in 1784 to a reconciliation with the Druſes, and to enter into an alliance with the Emir Youſef. Though reduced to leſs than 700 armed men, they did more in that campaign than 15,000 or 20,000. Druzes and Maronites aſſembled at Dair-el-Kamar. They alone took the ſtrong fortreſs of Mar-Djebaa, and put to the ſword 50 or 60 Epirots who defended it. But the miſunderſtanding which prevailed among the chiefs of the Druzes having rendered abortive all their operations, the pacha has obtained poſſeſſion of the whole valley, and the city of Balbek itſelf. At this period not more than 500 families of the Motoualis remained, who took refuge in Anti-Lebanon, and the Lebanon of the Maronites; and, driven as they now are from their native ſoil, it is probable they will be totally annihilated, and even their very name become extinct.

MOTTEUX (Peter), a French gentleman, born and educated at Rouen in Normandy. Coming over to England on account of the perſecution of the Proteſtants, he became a conſiderable trader in London, kept an Eaſt-India warehouſe in Leadenhall-ſtreet, and had a genteel place in the general poſt-office, relating to foreign letters, being maſter of ſeveral languages. He was a man of wit and humour; and acquired ſo perfect a maſtery of the Engliſh language, that he not only was qualified to oblige the world with a very good tranſlation of Don Quixote, but alſo wrote ſeveral ſongs, prologues, epilogues, &c. and what was ſtill more extraordinary, became a very eminent dramatic writer in a language to which he was not a native. He was at laſt, in the year 1718, found dead in a diſorderly houſe, on his birth day, when he completed his 58th year.

MOTTO, in armoury, a ſhort ſentence or phraſe, carried in a ſcroll, generally under, but ſometimes over, the arms; ſometimes alluding to the bearing, ſometimes to the name of the bearer, and ſometimes containing whatever pleaſes the fancy of the deviſer.

MOUCHO MORE. See AGARICUS.

MOVEABLE, in general, denotes any thing capable of being moved.

Moveable-Feaſts, are ſuch as are not always held on the ſame day of the year or month; though they be on the ſame day of the week. See FEASTS.

Thus, Eaſter is a moveable feaſt, being always held on the Sunday which falls upon or next after the firſt full moon following the 21ſt of March.

All the other moveable feaſts follow Eaſter, *i. e.* they keep their diſtance from it; ſo that they are fixed with reſpect thereto.

Such are Septuageſima, Sexageſima, Aſh-Wedneſday, Aſcenſion-day, Pentecoſt, Trinity-Sunday, &c. which ſee under their proper articles, SEPTUAGESIMA, &c.

Moveable-Subject, in law, any thing that moves itſelf, or can be moved; in contradiſtinction to immoveable or heritable ſubjects, as lands, houſes, &c.

MOVEMENT, MOTION, a term frequently uſed in the ſame ſenſe with automaton.

The moſt uſual movements for keeping time are watches and clocks: the firſt are ſuch as ſhow the parts of time, and are portable in the pocket; the ſecond, ſuch as publiſh it by ſounds, and are fixed as furniture. See HOROLOGY.

MOVEMENT, in its popular uſe among us, ſignifies all the inner work of a watch, clock, or other engine, which move, and by that motion carry on the deſign of the inſtrument.

The movement of a clock or watch is the inſide, or that part which meaſures the time, ſtrikes, &c. excluſive of the frame, caſe, dial-plate, &c.

The parts common to both of theſe movements are, the main-ſpring, with its appurtenances; lying in the ſpring-box, and in the middle thereof lapping about the ſpring-arbor, to which one end of it is faſtened. A-top of the ſpring arbor is the endleſs-ſcrew and its wheel; but in ſpring-clocks, this is a ratchet-wheel with its click, that ſtops it. That which the main-ſpring draws, and round which the chain or ſtring is wrapped, is called the *fuſy*; this is ordinarily taper; in large works, going with weights, it is cylindrical, and called the *barrel*. The ſmall teeth at the bottom of the fuſy or barrel, which ſtop it in winding up, is called the *ratchet*; and that which ſtops it when wound up, and is for that end driven up by the ſpring, the *garde-gut*. The wheels are various: the parts of a wheel are, the hoop or rim; the teeth, the croſs, and the collet or piece of braſs ſoldered on the arbor or ſpindle whereon the wheel is rivetted. The little wheels playing in the teeth of the larger are called *pinions*; and their teeth, which are 4, 5, 6, 8, &c. are called *leves*; the ends of the ſpindle are called *pivots*; and the guttered wheel, with iron ſpikes at bottom, wherein the line of ordinary clocks runs, the *pulley*. We need not ſay any thing of the hand, ſcrews, wedges, ſtops, &c. See WHEEL, FUSY, &c.

Perpetual MOVEMENT. Many have attempted to find a perpetual movement, but without ſucceſs; and there is reaſon to think, from the principles of mechanics, that ſuch a movement is impoſſible: for though, in many caſes of bodies acting upon one another, there is a gain of abſolute motion, yet the gain is always equal in oppoſite directions; ſo that the quantity of direct motion is never increaſed.

To make a perpetual movement, it appears neceſſary that a certain ſyſtem of bodies, of a determined number and quantity, ſhould move in a certain ſpace for ever, and in a certain way and manner; and for this there muſt be a ſeries of actions returning in a circle, otherwiſe the movement will not be perpetual; ſo that any action by which the abſolute quantity of force is increaſed, of which there are ſeveral ſorts, muſt have its correſponding counter-action, by which the gain is deſtroyed, and the quantity of force reſtored to its firſt ſtate.

Thus by theſe actions there will never be any gain of direct force to overcome the friction and reſiſtance of the medium; ſo that every motion being diminiſhed by theſe reſiſtances, they muſt at length languiſh and ceaſe.

MOUFET (Thomas), a celebrated Engliſh phyſician, was born at London, and practiſed medicine with great reputation. Towards the latter end of his life he retired to the country, and died about the year 1600. This phyſician is known by a work which was begun by Edward Wotton, and printed at London in

1634, folio, with the title of *Theatrum Insectorum*. A translation of it into English was published at London in 1658, folio. Martin Lister gives a very unfavourable opinion of this book: "As Moufet (says he) made use of Wotton, Gesner, &c. an excellent work might have been expected from him; and yet his *Theatrum* is full of confusion, and he has made a very bad use of the materials with which these authors have furnished him. He is ignorant of the subject of which he treats and his manner of expression is altogether barbarous. Besides this, he is extremely arrogant, to say no worse; for though he has copied Aldrovandus in innumerable places, he never once mentions his name." But Ray thinks that Lister, by expressing himself in this manner, has not done justice to Moufet; and he maintains that the latter has rendered an essential service to the republic of letters.

MOUG-DEN, or CHEN-YANG; a city of Chinese Tartary, and capital of the country of the Mantchews or eastern Tartars. These people have been at great pains to ornament it with several public edifices, and to provide it with magazines of arms and storehouses. They consider it as the principal place of their nation; and since China has been under their dominion, they have established the same tribunals here as at Peking, excepting that called *Lii-pou;* these tribunals are composed of Tartars only; their determination is final; and in all their acts they use the Tartar characters and language. The city is built on an eminence: a number of rivers add much to the fertility of the surrounding country. It may be considered as a double city, of which one is inclosed within the other: the interior contains the emperor's palace, hotels of the principal mandarins, sovereign courts, and the different tribunals; the exterior is inhabited by the common people, tradesmen, and all those who by their employments or professions are not obliged to lodge in the interior. The latter is almost a league in circumference; and the walls which enclose both are more than three leagues round: these walls were entirely rebuilt in 1631, and repaired several times under the reign of Kang-hi.—Near the gates are two magnificent tombs of the first emperors of the reigning family, built in the Chinese manner, and surrounded by a thick wall furnished with battlements; the care of them is entrusted to several Mantchew mandarins, who at stated times are obliged to perform certain usual ceremonies; a duty which they acquit themselves of with the same marks of respect and veneration as if their masters were still living.

MOVING PLANTS. See HEDYSARUM, TREMELLA, and MIMOSA.

MOULD, or MOLD, in the mechanic arts, &c. a cavity artfully cut, with design to give its form or impression to some softer matter applied therein. Moulds are implements of great use in sculpture, foundery, &c. The workmen employed in melting the mineral or metallic glebe dug out of mines, have each their several moulds to receive the melted metal as it comes out of the furnace; but these are different according to the diversity of metals and works. In gold mines, they have moulds for ingots; in silver mines, for bars; in copper and lead mines, for pigs or salmons; in tin mines, for pigs and ingots; and in iron mines, for sows, chimney-backs, anvils, caldrons, pots, and other large utensils and merchandizes of iron; which are here cast, as it were, at first hand.

MOULDS of founders of large works, as statues, bells, guns, and other brazen works, are of wax, supported within-side by what we call a core, and covered without-side with a cap or case. It is in the space which the wax took up, which is afterwards melted away to leave it free, that the liquid metal runs, and the work is formed; being carried thither through a great number of little canals, which cover the whole mould. See FOUNDERY.

MOULDS of moneyers are frames full of sand, wherein the plates of metal are cast that are to serve for the striking of species of gold and silver. See COINING.

A sort of concave moulds made of clay, having within them the figures and inscriptions of ancient Roman coins, are found in many parts of England, and supposed to have been used for the casting of money. Mr Baker having been favoured with a sight of some of these moulds found in Shropshire, bearing the same types and inscriptions with some of the Roman coins, gave an account of them to the Royal Society. They were found in digging of sand, at a place called Ryton in Shropshire, about a mile from the great Watling-street road. They are all of the size of the Roman denarius, and of little more than the thickness of our halfpenny. They are made of a smooth pot or brick clay, which seems to have been first well cleansed from dirt and sand, and well beat or kneaded, to render it fit for taking a fair impression. There were a great many of them found together, and there are of them not unfrequently found in Yorkshire; but they do not seem to have been met with in any other kingdom, except that some have been said to be once found at Lyons. They have been sometimes found in great numbers joined together side by side, on one flat piece of clay, as if intended for the casting of a great number of coins at once; and both these, and all the others that have been found, seem to have been of the emperor Severus. They are sometimes found impressed on both sides, and some have the head of Severus on one side and some well known reverse of his on the other. They seem plainly to have been intended for the coinage of money, though it is not easy to say in what manner they can have been employed to that purpose, especially those which have impressions on both sides, unless it may be supposed that they coined two pieces at the same time by the help of three moulds, of which this was to be the middle one. If by disposing these into some sort of iron frame or case, as our letter-founders do the brass moulds for casting their types, the melted metal could be easily poured into them, it would certainly be a very easy method of coining, as such moulds require little time or expence to make, and therefore might be supplied with new ones as often as they happen to break.

These moulds seem to have been burnt or baked sufficiently to make them hard; but not so as to render them porous like our bricks, whereby they would have lost their smooth and even surface, which in these is plainly so close, that whatever metal should be formed in them would have no appearance like the sand-holes by which counterfeit coins and medals are usually detected.

Moulds of founders of small works are like the frames of coiners; it is in these frames, which are likewise filled with sand, that their several works are fashioned; into which, when the two frames, whereof the mould is composed, are rejoined, the melted brass is run.

Moulds of letter-founders, are partly of steel and partly wood. The wood, properly speaking, serves only to cover the real mould which is within, and to prevent the workman, who holds it in his hand, from being incommoded by the heat of the melted metal. Only one letter or type can be formed at once in each mould. See Letter-Foundery.

Moulds, in the manufacture of paper, are little frames composed of several brass or iron wires, fastened together by another wire still finer. Each mould is of the bigness of the sheet of paper to be made, and has a rim or ledge of wood to which the wires are fastened. These moulds are more usually called frames or forms. See *Paper-Making*.

Moulds, with furnace and crucible makers, are made of wood, of the same form with the crucibles; that is, in form of a truncated cone: they have handles of wood to hold and turn them with, when, being covered with the earth, the workman has a mind to round or flatten his vessel.

Moulds for leaden bullets are little iron pincers, each of whose branches terminates in a hemispherical concave, which when shut form an entire sphere. In the lips or sides where the branches meet, is a little jet or hole, through which the melted lead is conveyed.

Laboratory Moulds, are made of wood, for filling and driving all sorts of rockets and cartridges, &c.

Glaziers Moulds. The glaziers have two kinds of moulds, both serving to cast their lead: in the one they cast the lead into long rods or canes fit to be drawn through the vice, and the grooves formed therein; this, they sometimes call ingot-mould. In the other, they mould those little pieces of lead a line thick and two lines broad, fastened to the iron bars. These may be also cast in the vice.

Goldsmiths Moulds. The goldsmiths use the bones of the cuttle-fish to make moulds for their small works; which they do by pressing the pattern between two bones, and leaving a jet or hole to convey the silver through, after the pattern has been taken out.

Mould, among masons, is a piece of hard wood or iron, hollowed within side, answerable to the contours of the mouldings or cornices, &c. to be formed. This is otherwise called *caliber*.

Moulds, among plumbers, are the tables whereon they cast their sheets of lead. These they sometimes call simply *tables*. Besides which they have other real moulds, wherewith they cast pipes without soldering. See each described under Plumbery.

Moulds, among the glass-grinders, are wooden frames, whereon they make the tubes wherewith they fit their perspectives, telescopes, and other optic machines. These moulds are cylinders, of a length and diameter according to the use they are to be applied to, but always thicker at one end than the other, to facilitate the sliding. The tubes made on these moulds are of two kinds; the one simply of pasteboard and paper; the other of thin leaves of wood joined to the pasteboard. To make these tubes to draw out, only the last or innermost is formed on the mould; each tube made afterwards serving as a mould to that which is to go over it, but without taking out the mould from the first. See Grinding.

Moulds used in basket-making are very simple, consisting ordinarily of a willow or osier turned or bent into an oval circle, square, or other figure, according to the baskets, panniers, hampers, and other utensils intended. On these moulds they make, or more properly measure, all their work; and accordingly they have them of all sizes, shapes, &c.

Mould, in ship-building, a thin flexible piece of timber, used by shipwrights as a pattern whereby to form the different curves of the timbers, and other compassing pieces in a ship's frame. There are two sorts of these, viz. the bend-mould and hollow-mould; the former of these determines the convexity of the timbers, and the latter their concavity on the outside, where they approach the heel, particularly towards the extremities of the vessel. The figure given to the timbers by this pattern is called their *bevelling*.

Moulds, among tallow-chandlers, are of two kinds: the first for the common dipped candles, being the vessel wherein the melted tallow is disposed, and the wick dipped. This is of wood, of a triangular form, and supported on one of its angles; so that it has an opening of near a foot a-top: the other, used in the fabric of mould candles, is of brass, pewter, or tin.—Here each candle has its several mould. See Candle.

Moulds, among gold-beaters, a certain number of leaves of vellum or pieces of guts cut square, of a certain size, and laid over one another, between which they put the leaves of gold and silver which they beat on the marble with the hammer. See Gold-leaf.

They have four kinds of moulds; two whereof are of vellum and two of gut: the smallest of those of vellum consists of 40 or 50 leaves; the largest contains 100: for the others, each contain 500 leaves The moulds have all their several cases, consisting of two pieces of parchment, serving to keep the leaves of the mould in their place, and prevent their being disordered in beating.

Mould, in agriculture, a general name for the soft earthy substance with which the dry land is generally covered, and in which all kinds of vegetables take root and grow. It is, however, far from being an homogeneous substance; being compounded of decayed animal and vegetable matters, calcareous, argillaceous, and siliceous earths, all mixed together in various proportions, and with the different degrees of moisture, constituting all the varieties of soil throughout the world. All kinds of mould contain some inflammable substance, which remains in them from the decayed animals and vegetables; and they are more or less black in proportion to the quantity of phlogiston they contain. The black mould yields by distillation a volatile alkali and oil.

MOULDINESS, a term applied to bodies which corrupt in the air, from some hidden principle of humidity therein; and whose corruption shows itself by a certain white down or lanugo on their surface, which viewed through a microscope appears like a kind of meadow, out of which arise herbs and flowers, some only in the bud, others full-blown, and others decayed; each having its root, stalk, and other parts. See Mucor.

MOULDING, any thing caſt in in a mould, or that ſeems to have been ſo, though in reality it were cut with a chiſel or the axe.

Mouldings in architecture, projectures beyond the naked wall, column, wainſcot, &c. the aſſemblage of which forms corniches, door-caſes, and other decorations of Architecture. See that article.

MOULIN (Charles du), a celebrated civilian, and one of the moſt learned men of the 16th century, was born of a conſiderable family at Paris in 1500, and acquired great reputation by his ſkill in the law. He publiſhed many works, which have been collected together, and printed in five volumes folio; and are juſtly conſidered as the moſt excellent works that France has produced on the ſubject of civil law. He died at Paris in 1566.

Moulin (Peter du), a Proteſtant divine, believed to be of the ſame family with the former, was born in 1568. He taught philoſophy at Leyden; and afterwards became chaplain to the princeſs of Navarre. At the king of England's deſire he came to England in 1615, and prepared a plan for the union of the Proteſtant churches. The univerſity of Leyden offered him a profeſſorſhip of divinity in 1619: but he refuſed it, and preſided at the ſynod held by the Calviniſts at Alais in 1620. Some time after, being informed by Mr Drelincourt that the French king reſolved to have him thrown into priſon, he retired to Sedan, where the duke de Bouillon made him profeſſor of divinity, and miniſter in ordinary. He was employed by the Calviniſts in the moſt important affairs; and died at Sedan in 1658. His principal works are, 1. The anatomy of Arminianiſm. 2. A treatiſe on repentance, and the keys of the church. 3. The capuchine, or the hiſtory of thoſe monks. 4. The buckler of faith, or a defence of the reformed churches. 5. The judge of controverſies and traditions. 6. The anatomy of the maſs. 7. The novelty of Popery.

Peter du Moulin, his eldeſt ſon was chaplain to Charles II. of England, and prebendary of Canterbury, where he died in 1684, aged 84. He wrote, 1. The peace of the ſoul, in French. 2. *Clamor regii ſanguinis;* which Milton, by miſtake, attributed to Alexander Morus. 3. A defence of the Proteſtant religion, in Engliſh.

MOULINET, is uſed in mechanics, to ſignify a roller, which, being croſſed with two levers, is uſually applied to cranes, capſtans, and other ſorts of engines of the like nature, to draw ropes, and heave up ſtones, &c.

Moulinet is alſo a kind of turnſtile, or wooden croſs, which turns horizontally upon a ſtake fixed in the ground; uſually placed in paſſages to keep out horſes, and to oblige paſſengers to go and come one by one. The moulinets are often ſet near the outworks of fortified places at the ſides of the barriers, through which people paſs on foot.

MOULINS, a town of France, and capital of Bourbonnois. The houſes of the Chartreux, and that of the Viſitation, are magnificent. It carries on a conſiderable trade in cutlery ware, and is ſeated on the river Allier, in a pleaſant fertile plain, almoſt in the middle of France, 30 miles ſouth of Nevers, and 55 north of Clermont. E. Long. 3. 25. N. Lat. 46. 34.

MOULTON (North), a town of Devonſhire on the river Moul, and the north ſide of South Moulton, of whoſe hundred it is a member, and anciently gave name to it, as the latter does now. It has two fairs, on Tueſday after May 11, and on Nov. 12.

Moulton (South) on the ſame ſtream, 182 miles from London. This, as well as the former, was anciently a royal demeſne. This corporation, which once ſent members to parliament in the reign of Edward I. conſiſts of a mayor, 18 capital burgeſſes, a recorder, town-clerk, and 2 ſerjeants at mace. Here is a market on Saturdays; and fairs are held the firſt Tueſday after May 11, and Nov. 12. Their chief manufactures are ſerges, ſhalloons, and felts; and great quantities of wool brought from the country are bought up here every Saturday. In the year 1684, a merchant of London, a native of this town, built and endowed a free-ſchool here; beſides which, here is a charity-ſchool.

MOULTING, or Molting, the falling off or change of hair, feathers, ſkins, horns, or other parts of animals, happening in ſome annually, in others only at certain ſtages of their life.

The generality of animals moult in the ſpring. The moulting of a hawk is called *mewing*. The moulting of a deer is the quitting of his horns in February or March. The moulting of a ſerpent is the putting off his ſkin. See Exuviæ.

MOUND, a term uſed for a bank or rampart, or other fence, particularly that of earth.

Mound, in heraldry, a ball or globe with a croſs upon it, ſuch as the Britiſh kings are uſually drawn with, holding it in their left hand, as they do the ſceptre in the right.

MOUNT, an elevation of earth, called alſo *mountain*. See Mountain.

Mount Edgecumbe, a prodigious high peak, at the entrance of Cook's ſtrait, in New Zealand, on the weſt ſide. Its height is ſuppoſed not to be much inrior to that of the peak of Teneriffe.

Mount-Sorrel, a town in Leiceſterſhire, ſo named from a high mount or ſolid rock adjoining to the town, of a duſky red or ſorrel-coloured ſtone, extremely hard. Of rough ſtones hewn out of this rock the town is built. It has a market on Mondays. It was noted formerly for its caſtle, and is ſeated on the river Stour, over which there is a bridge. It is 20 miles ſouth-eaſt by ſouth of Derby, and 105 north-weſt by north of London. W. Long. 1. 9. N. Lat. 52. 45.

Mounts of Piety, certain funds or eſtabliſhments in Italy, where money is lent out on ſome ſmall ſecurity. There were alſo mounts of Piety in England, raiſed by contribution for the benefit of people ruined by the extortions of the Jews.

MOUNTAIN (*Mons*), a conſiderable eminence of land, elevated above every thing adjoining to it, and commanding all the ſurrounding places: It is commonly full of inequalities, cavities more or leſs expoſed, and ſtrata half laid open.

This name is likewiſe given to a chain of mountains; as when we ſpeak of Mount Atlas in Africa; Mount Caucaſus, which begins above Colchis and ends at the Caſpian ſea; the Pyrenean mountains, which ſeparate France from Italy; and the Appenine mountains, which run through the whole of Italy.

Thoſe who have ſurveyed the earth in general, and ſtudied

 ſtudied nature on a grand ſcale, have conſtantly been ſtruck with admiration and aſtoniſhment at the ſight of ſuch majeſtic eminences, which extending in different ways, ſeem to rule over the reſt of the globe, and which preſent to the beholder a ſpectacle equally magnificent and intereſting. In them it has been ſuppoſed we muſt ſearch for a ſolution of the important problem regarding the creation of the world.

Naturaliſts reckon ſeveral kinds of mountains: we ſhall find that theſe elevations of the earth have not all the ſame origin, nor date their commencement from the ſame era.

1. Thoſe mountains which form a chain, and which are covered with ſnow, may be conſidered as *primitive* or antediluvian. They are like majeſtic bulwarks ſcattered on the ſurface of the globe, and greatly exceed the other mountains in height. In general, their elevation is very ſudden, and their aſcent very ſteep and difficult. Their ſhape is that of a pyramid crowned with ſharp and prominent rocks, on which no verdure is to be ſeen, but which are dry, naked, and as it were ſtripped of their ſoil, which has been waſhed away by the rains, and which preſent an awful and horrible aſpect, ſufficient to impreſs the coldeſt imagination with terror. Theſe primitive mountains, which aſtoniſh the eye, and where wind only reigns, are condemned by nature to perpetual ſterility. At the foot of them we frequently find paths leſs ſteep and winding than when we aſcend to a greater height. They every where preſent thundering caſcades, frightful precipices, and deep valleys. The depreſſions and excavations correſpond with the quantity of water, the motion of which is accelerated in its fall, and which ſometimes produces a total ſinking or an inclination of the mountain. The wrecks to be found at the foot of moſt peaks, ſhow how much they have ſuffered from the hand of time. Nothing meets the eye but enormous rocks, heaped in confuſion on one another, which prevent the approach of the human race. On the ſummits of theſe mountains or high eminences, which are only a ſeries of peaks frequently detached from one another, the prominent rocks are covered with eternal ſnow and ice, and ſurrounded with floating clouds which are diſperſed into dew. In a word, the rugged cliffs oppoſe an inacceſſible rampart to the intrepidity of man; and nature exhibits a picture of diſorder and decay (A). No ſhells or other organized marine bodies are to be found in the internal part of theſe primitive mountains; and though ſearch has been made, by digging, on the tops of the Alps and the Pyrenees, no ſubſtances of this nature have yet been diſcovered except on the ſides near the baſe. Nothing is to be met with but continued rocks, caverns dug by the hand of nature, and abounding in cryſtallizations of great beauty, with various minerals. The ſtone of which they conſiſt is an immenſe maſs of quartz, ſomewhat varied, which penetrates into the bowels of the earth in a direction almoſt perpendicular to the horizon. We find no calcareous ſpar but in the fiſſures or rents which have ſome extent and an evident direction; and at great depths we find new parts as it were, or in other words, the primitive ſtate of things. All primitive mountains furniſh proofs of theſe aſſertions. Of this kind in Europe are the Pyrenees, the Alps, the Apennines, the mountains of Tirol, the mountain of the giants in Sileſia, the Carpathian mountains, the mountains of Saxony, thoſe of Norway, &c. In Aſia we find the Riphean mountains, Mount Caucaſus, Mount Taurus, and Mount Libanus; in Africa, the mountains of the moon; and in America the Apalachian mountains, and the Andes or Cordilleras. Many of the latter have been the ſeats of volcanoes.

2. Another kind of mountains are thoſe which are either detached, or ſurrounded with groups of little hills, the ſoil of which is heaped up in diſorder, and the cruſt gravelly and confuſedly arranged together. Theſe are truncated or have a wide mouth in the ſhape of a funnel towards the ſummit, and which are compoſed of, or ſurrounded with, heaps of calcined and half vitrified bodies, lava, &c. This claſs of mountains appear to have been formed by different ſtrata raiſed up and diſcharged into the air, upon occaſion of the eruption of ſome ſubterraneous fire. The iſles of Santorin, Monte-Nuovo, Mount Etna, Adam's Peak in the iſland of Ceylon, the peak of Teneriffe in the Canary Iſlands, and many others, have been formed in this manner. When very high mountains of this kind are covered with ſea-ſhells, we may conſider their ſummits as having once conſtituted a part of the bottom of the ocean. A number of theſe mountains have been formed in the memory of man, and preſent nothing to the view but diſordered ruins; confuſed maſſes, parts heaped together in the greateſt irregularity, and productions formed by eruptions or by the falling in of the earth. When a mountain of this

(A) It is obſerved, ſays the Abbé Palaſſou, that at the foot of the Pyrenean mountains, the ſoil of ſeveral countries conſiſts wholly of the mud and rubbiſh depoſited by the rivers which deſcend from them. According to Herodotus, a great part of Egypt was in like manner formed by the different ſubſtances brought thither by the Nile: Ariſtotle calls it the work of the Nile; and on this account the Ethiopians boaſted that Egypt was indebted to them for its origin. The inhabitants of the Pyrenees might ſay the ſame thing of almoſt the whole tract of country ſituated along the northern chain from the ocean to the Mediterranean, forming that kind of iſthmus which ſeparates the two ſeas. The ſurface of our globe is thus in a ſtate of perpetual change; the plains are elevated, the mountains are levelled, and water is the principal agent employed by nature in theſe great revolutions. Time alone is wanting to verify the ſaying of Louis XIV. to his grandſon: Poſterity will one day be able to ſay, "The Pyrenees are no more." The period, however, muſt neceſſarily be very diſtant. M. Genſanne, from obſervations which he thinks well-founded, concludes, that the mountains are lowered about ten inches every century. Suppoſing them therefore to be 1500 toiſes above the level of the ſea, and always ſuſceptible of being lowered in the ſame degree, a million of years would elapſe before their total deſtruction.

Mountain. this kind is connected with the land, and advances farther into the sea than the adjoining country, it is then termed a *Cape*, *Head*, or *Promontory*; such as the Cape of Good Hope at the southern extremity of Africa. Mountains of the second rank are commonly more easy of access. Dr Haller observes, that the angle formed between their base and their declivity is larger; that they have fewer springs; and that their plants are different from those of the Alps. The peasants in Swisserland, he tells us, are acquainted with the difference betwixt these two kinds of mountains.

3. Those mountains, whether arranged in a group or not, the earth or stone of which is disposed in strata more or less regular, and consisting of one or more colours and substances, are produced by the substances deposited slowly and gradually by the waters, or by soil gained at the time of great floods. We daily see little hills formed in this manner, which are always of a small height compared with those of the first order, and round in the top, or covered with soil frequently forming a pretty flat and extensive surface. We there find likewise sand and heaps of round pebbles like such as have been worn by the waters. The internal part of these mountains consists of a heap of strata almost horizontal, and containing a prodigious quantity of shells, marine bodies, and fish-bones. Although these mountains formed by strata sometimes degenerate into little hills, and even become almost flat, they always consist of an immense collection of fossils of different kinds, in great preservation, and which are pretty easily detached from their earthy bed, whether harder or softer. These fossils, consisting of marine shells intermixed and confounded with heaps of organised bodies of another species, present a picture of astonishing disorder, and give indubitable indications that some extraordinary and violent current has confounded and accumulated in the greatest disorder and precipitation foreign substances and shells of various kinds. These, removed from their natural and original place, by their union form an elevation and a mountain, which are in fact nothing but a composition of the wrecks of bodies formerly organised. All these phenomena seem to prove, that most of these mountains chiefly owe their origin to the sea, which once covered some parts of our continent, now left dry by its retreat. (According to the principles of this system, Anaxarchus explained the formation of the mountains of Lampsacus). In these mountains we likewise find wood, prints of plants, strata of clay, marl, and chalk, different beds of stone succeeding one another, such as slate, marble which is often full of sea shells, lime-stone which appears to be wholly formed from the wreck of shells, plaster-stone, entire strata of ochre, and beds of bitumen, mineral salt, and alum.

The strata of mountains which are lower and of a recent date, or formed by recent accidents, sometimes appear to rest upon, or to take their rise, from the sides of primitive mountains which they surround, and of which they in some measure form the first steps in the ascent; and they end by being insensibly lost in the plains. With respect to the irregularity of some strata in recent mountains, it is owing to violent and sudden inundations, to torrents, and to local revolutions which have produced angles, leaps, and sinkings down of the strata. It is generally observed, however, that the strata in mountains are exactly parallel to each other throughout all their different windings. M. Desmarest remarks, that in two mountains which by their brows form the hollow of a valley, we find strata of earth or stone of the same kind, and disposed and arranged in the same manner. We have already shown, under the article EARTH, why the strata of recent mountains are not every where the same in number and thickness. Some strata are only a quarter of an inch thick, others are more than ten feet: in some places we find 30 or 40 beds succeeding each other, in others only three or four. In recent mountains composed of strata, M. Lehmann observes, the lowest stratum is always pit-coal; and this rests on a coarse and ferruginous gravel or sand. Above the pit-coal we find strata of slate, schistus, &c. and the upper part of the strata is constantly occupied by limestone and salt-springs. It is easy to perceive the utility of these observations, when we intend to work for these minerals; and by attending to the distinction which has been made of the different mountains of the same kind, we may know the nature of those substances which upon search we may expect to find in them. The specimens which appear without, indicate what substances are concealed within.

In general, it has been observed, that when two or more mountains run parallel to each other, the salient angles correspond with the receding ones; and these angles are sharper and more striking in deep and narrow valleys. Dr Haller observes, that there are many places in the Alps and in mountains, where two chains are prolonged contrary to the axis of the valley, and join so as only to leave as much space as is necessary for the discharge of the water. In other places the mountain is continued, for instance, to the north, and discontinued to the south, where it opens into a valley. In others, the two chains retire and form a bend on each side, the concavity of which fronts the axis; hence arise valleys almost round and completely united.

It is likewise worthy of observation, that primitive mountains which form vast chains are commonly connected together; that they succeed one another for a space of several hundred leagues; and cover with their principal branches, and their various collateral ramifications, the surface of continents. Father Kircher and many others have observed, that the principal chain generally runs from south to north, and from east to west. The Cordilleras in the New world, Dr Haller observes, extend from north to south; the Pyrenees have nearly the same direction; the Alps run from east to west; and there must be a chain of this kind in Africa, for the great rivers in that quarter of the world run to the east on the one side and to the west on the other. The chain of Thibet appears to be parallel to the Alps; and, from the great length of the road through the snows, it may be inferred that the mountains of Thibet have a very great elevation. Those mountains which, strictly speaking, are the principal roots, and the capital point of elevation and division, present very considerable masses, both with regard to their height and their size or extent: they commonly occupy and traverse the centre of continents.

Those

Mountain. Those which have a smaller elevation arise from these principal chains; they gradually diminish in proportion to their distance from their root, and at length wholly disappear either on the sea-coast or in the plains. Others are continued along the shore of the sea; their chain is interrupted only to make room for the waters of the ocean, under the bed of which the base of these mountains extends; and it again occurs in islands, which perpetuate their continuation till the whole chain re-appears The highest mountains and the greatest number of islands are generally found between or near the tropics, and in the middle of the temperate zones; while the lowest are adjacent to the poles; though this does not always hold good without exception. M. Buache, a member of the Academy of Sciences at Paris, has laid down a system of physical geography concerning the structure of the terraqueous globe, considered with respect to the great chains of mountains which cross the continents and seas from pole to pole, and from east to west. According to this system, there is an uninterrupted series of mountains and high grounds which divide the earth into four declivites, from which the rivers descend. These chains of mountains are continued from one continent to another under the ocean; and the islands which are observed in it, are as it were the summits of the mountains. M. Buache's work is entitled *Tables et Cartes de la Geographie physique*. But that this system, with regard to the islands, must be erroneous, will appear evident from our article Earth.

In the *Journal de Physique* for May 1779, we are informed, that Dr Pallas, who has travelled through Siberia, and almost all the Russian empire in the north of Asia, thinks he has discovered the insufficiency of the principal systems hitherto proposed to account for the formation of mountains. This accurate observer has prosecuted the study of mountains by traversing immense regions, and visiting as it were the secret work shops of nature in almost the fourth part of our hemisphere. He has not trusted to the vague reports of others, but from observations which he himself had occasion to make for the space of ten years; he has, in a work entitled *Observations on Mountains*, explained both the direction of the northern chains, and the particular composition of each. He is thence led to make an ingenious conjecture concerning the formation of the principal groups of mountains, and concerning the irregular distribution and the figure of the whole continent. Under the article Earth an account is given of the different systems which have been formed concerning the formation and configuration of our globe. To establish a general system, it would perhaps be necessary to have travelled over the whole earth; and to have studied all the chains of mountains, their direction, and particular composition, for a long series of years. Thus very little attention is required to perceive, in the different systems mentioned under the article Earth, the influence of climate and local situation. Burnet, Whiston, and Woodward, who were acquainted only with England, where very few great chains of mountains are to be seen, where they are almost all insulated or detached, and where the soil of extensive plains is formed by horizontal and pretty regular strata, naturally thought that these general and concentric strata were to be found all around the globe; and considered mountains as nothing but the wrecks of these strata, either raised or swallowed up by the violence of the waters. Scheuchzer, who studied among the steep mountains of Switzerland, amid rocks of granite, petrosilex, jasper and hard stones, and who found nothing on the most elevated plains of the Alps but strata of similar substances, had recourse to the power of the Almighty, who broke in pieces these strata, and elevated their splinters into the form of mountains. Ray, Morro, and Stenon, who saw nothing all around them but burning mountains and traces of volcanic productions—deceived by the constitution of the hills of Italy, which are almost all formed of lava, pozzolana, and basaltic substances, and by the origin of the Monte Nuovo, which rose up almost before their eyes, have considered great mountains as formed by a cause which undoubtedly has a secondary, but to which they have ascribed a primary and principal, influence. M. de Buffon, who delineated nature at the foot of the utmost extremity of the French Alps, and who perceived them gradually attain a greater elevation as they advanced towards the southern parts of France and towards Savoy, concluded from his theory, and in support of the same theory, that the highest mountains were near the equator; that they became lower towards the poles; and that, being produced by the flux and reflux of the sea, they were formed of the substances which it deposited.

We shall now lay before our readers the geographical description of the directions of the principal mountains, and of that kind of connection which subsists betwixt them. This description differs from that of M Buache, and may be read with a map of the world before us.

M. Buache places the most elevated points of the great chain of mountains under the equatorial line: but according to the author whom we follow in this place, the fullest and most continuous lands, and perhaps likewise the most elevated, are to be found at a distance from the equator, and towards the temperate zones. If, in fact, we survey the globe's surface, we will not be able to perceive that chain of mountains, which running from east to west, and dividing the earth into two portions, ought again to meet. On the contrary, extensive plains seem to accompany the line through almost its whole extent. In Africa, the deserts of Nigritia and those of Upper Ethiopia, are on the one side of the line; and on the other are the sandy plains of Nicoco, Caffraria, Monoemugi, and Zanguebar. From the eastern shores of Africa to the Sunda islands, is a space of 1500 leagues of sea with almost no islands, except the Laccadive and Maldive islands; most part of which have little elevation, and which run from north to south. From the Molucca islands and New Guinea, to the western borders of America, the sea occupies a space of 3000 leages. Though Chimboraco and Pichincha in America, the two highest mountains which have been measured, are near and even under the line, yet from this no conclusion can be drawn; because on one side these mountains run in a direction not parallel to the equator; the Andes or Cordilleras attain a greater elevation as they remove from the equator towards the poles; and a vast plain is found exactly under the line, between the Oronooko and the river of the Amazons. Besides, the latter river,

which

which takes its rise in the province of Lima about the 11th degree of south latitude, after crossing the whole of South America from west to east, falls into the ocean exactly under the equator. This shows that there is a descent for the space of 12 degrees or 300 leagues. From the mouth of the river of the Amazons, to the western shores of Africa, the sea forms another plain of more than 50 degrees.

From the few certain facts and accurate observations which we have received from well informed travellers, we might almost affirm that the most elevated land on our globe is situated without the tropics in the northern and southern hemispheres. By examining the course of the great rivers, we in fact find that they are in general discharged into three great reservoirs, the one under the line, and the other two towards the poles. This, however, we do not mean to lay down as a thing universally true, for it is allowed, that, besides the two elevated belts, the whole surface of the earth is covered with innumerable mountains, either detached from one another or in a continued chain. In America, the Oronooko and the river of the Amazons run towards the line, while the river St Lawrence run towards the 50th degree of north latitude, and the river de la Plata towards the 40th degree of south latitude. We are still too little acquainted with Africa, which is almost all contained within the tropics, to form any accurate conclusions concerning this subject. Europe and Asia, which form only one great mass, appear to be divided by a more elevated belt, which extends from the most westerly shores of France to the most easterly of China, and to the island of Sagalen or Anga-hata, following pretty nearly the 50th degree of north latitude. In the new continent, therefore, we may consider that chain where the Mississippi, the river St Lawrence, the Ohio, and the river de los Estrechos, take their rise, as the most elevated situation in North America; whence the Mississippi flows towards the equator, the river St Lawrence towards the north-east, and the rest towards the north-west. In the old continent, the belt formerly mentioned, and to which we may assign about 10 degrees in breadth, may be reckoned from the 45th to the 55th degree of north latitude; for in Europe the Tagus, the Danube, the Dnieper, the Don, and the Volga, and in Asia the Indus, the Ganges, the Meran, the Mecon, the Hoang-ho, and the Yantg-tse-Kiang, descending as it were from this elevation, fall into the great reservoir between the tropics; whilst towards the north the Rhine, the Elbe, the Oder, the Vistula, the Obi, the Jenisei, the Lena, the Indigirka, and the Kowyma, are discharged into the northern reservoir.

Judging from these mountains the height of which has been calculated, and from the immense chains with which we are acquainted, we may infer that the highest mountains are to be found in this elevated belt. The Alps of Swisserland and Savoy extend through the 45th, the 46th, and the 47th degrees. Among them we find St Gothard, Furca, Bruning, Russ, Whiggis, Scheidek, Gunggels, Galanda, and lastly that branch of the Swiss Alps which reaches Tirol by the name of Arlenberg and Arula. In Savoy, we meet with Mount Blanc, the Peak of Argentiere, Cornero, Great and little St Bernard, Great and Little Cenis, Coupeline, Servin, and that branch of the Savoyard Alps which proceeds towards Italy through the duchy of Aost and Montserrat. In this vast heap of elevated peaks, Mont Blanc and St Gothard are particularly distinguished. The Alps, leaving Swisserland and Savoy, and passing through Tirol and Carniola, traverse Saltzbourg, Stiria, and Austria, and extend their branches through Moravia and Bohemia, as far as Poland and Prussia. Between the 47th and 48th degrees, we meet with Grimming the highest mountain of Stiria, and Priel which is the highest in Austria. Between the 46th and 47th degrees, the der Bacher and the der Reinschnicken, form two remarkable chains. The upper one, which traverses the counties of Trencsin, Arrava, Scepus, and the Kreyna, separates Upper Hungary from Silesia, Little Poland, and Red Russia; the inferior one traverses Upper Croatia, Bosnia, Servia, and Transylvania, separates Upper Hungary from Turkey in Europe, and meets the upper chain behind Moldavia, on the confines of Little Tartary. In these mountains are situated the rich mines of Schemnitz.

To form a general idea of the great height of this Alpine belt, it is necessary only to remark, that the greatest depth of the wells at Schemnitz is 200 toises; and yet it appears from the barometrical calculations of the learned M. Noda, that the greatest depth of these mines is 286 toises higher than the city of Vienna. The granito-argillous mountains of Schemnitz, and of the whole of this metallic district, are inferior, however, to the Carpathian mountains. Mount Krivany in the county of Arrava, and the Carpathian mountains between Red Russia and the Kreyna, appear by their great elevation to rule over the whole of the upper Alpine chain. In the inferior chain we likewise meet with mountains of an extraordinary height; among others, Mount Mediednik, which gives its name to a chain extending far into Bosnia; and Mount Hemus, celebrated even among the ancients. In short, this extensive chain reaches into Asia, and is there confounded with another chain no less famous, which, following exactly the 50th degree of latitude, runs through the whole of Asia. This chain of mountains is described by Dr Pallas in the work abovementioned; and we shall now trace its course in company with this intelligent observer.

This author places the head of the mountains of Oural, between the sources of the Taik and the Bielaïa, about the 53d degree of latitude, and the 47th of longitude. Here the European Alps, after having travelled Europe, and sent of various branches which we shall afterwards examine, lose their name, which is changed into that of the Ouralic or Uralian mountains, and begin their course in Asia. This lofty chain, which separates Great Bulgaria from the desarts of Ischimska, proceeds through the country of the Eleuths, follows the course of the river Irtis, approaches the lake Teleskaia, and afterwards forms a part of the same system of mountains with the Altaic chain. There they give rise to the Oby, the Irtis, and the Jenisei, which begin their course about the 50th degree of north latitude, and fall into the Frozen Ocean.

The Altaic chain, after having embraced and united all the rivers which supply the Jenisei, is continued

Mountain. under the name of *Saianes*, without the fmalleft interruption, as far as the Baikal lake. The extenfion of this chain to the fouth forms that immenfe and elevated plain which is loft in Chinefe Tartary, which may be compared with the only plain in Quito, and which is called *Goli* or *Chamo*. The Altai afterwards interpofing between the fource of the Tchikoi and of the rivers which fupply the Amur or Sagaleen, rifes towards the Lena, approaches the city Jakuck beyond the 60th degree of latitude, runs from that to the fea of Kamtfchatka, turns round the Ochockoi and Penfink gulphs, joins the great marine chain of the Kurile ifles near Japan, and forms the fteep fhores of Kamtfchatka, between the 55th and 60th degrees of latitude. Such is the direct courfe of the high mountains conftituting the belt which, we imagine, is to be found in the northern hemifphere, and which, after becoming lower, paffing under the fea, and forming by means of their elevated peaks that archipelago of iflands which derives its name from the unfortunate Bhering, again rife and enter North America, on the weftern fide, about the Straits of Anian. After running in the fame parallel, and giving rife to the Ohio, the Riviere-Longue, the river St Lawrence, and the Miffiffippi, they are loft in Canada. From the eaftern fhores of America to the weftern fhores of Europe, we find a vaft interruption. Perhaps the chain was at firft continued completely round the globe; but extraordinary revolutions, by feparating the old and new continents, may have occafioned this divifion, and left nothing but the Azores and fome detached points as a monument of what formerly exifted, till we come to the Britifh ifles.

Before we proceed to inquire whether a belt of a fimilar elevation exifts in the fouthern hemifphere, we may remark thofe branches and ramifications which the great northern Alpine belt fends forth both towards the equator and the antarctic pole. Thefe new chains, which gradually become lower as they approach the boundary towards which they tend, appear a fufficient proof that the equator is not the moft elevated part of the earth.

The European Alps produce three principal chains, which run towards the equator, and fome fmaller ones running towards the pole. The firft fouthern chain is fent out through Dauphiné; traverfes Vivarais, Lyonnois, Auvergne, Cevennes, and Languedoc; and, after joining the Pyrenees, enters Spain. There it divides into two or three ramifications, one of which runs through Navarre, Bifcay, Arragon, Caftile, Marche, and Sierra Morena and extends into Portugal. The other, after traverfing Andalufia and the kingdom of Grenada, and there forming a number of fierras, again makes its appearance, beyond the Straits of Gibraltar, in Africa, and coafts along its northern fhores under the name of *Mount Atlas*.—The fecond principal chain of the Alps paffes out through Savoy and Piedmont; fpreads its roughneffes over the ftates of Genoa and Parma; forms the belt of the Apennines; and after frequently changing its name, and dividing Italy into two parts, terminates in the kingdom of Naples and in Sicily, producing volcanoes in every part of its courfe. The third chain is fent off from Hungary, and fcatters innumerable mountains over all Turkey in Europe, as far as the Morea and the Archipelago at the bottom of the Mediterranean fea. The northern branches, though fmaller at firft, are no lefs clearly defined; and fome of them even extend their ramifications as far as the Frozen Ocean. An Alpine branch, iffuing from Savoy thro' the country of Gex, proceeds through Franche-Comte, Suntgaw, Alface, the Palatinate, and Veterabia.—Another iffues from the territory of Saltzbourg, paffes along Bohemia, enters Poland, fends off a ramification into Pruffia towards the deferts of Waldow, and after having paffed through Ruffia is loft in the government of Archangel.

The Afiatic Alps fend forth in like manner feveral branches both to the fouth and north. The Ouralic mountains, between the fources of the Bielaia and the Jaik, produce three principal branches; the firft of which, including the Cafpian Sea in one of its divifions, enters Circaffia through the government of Aftracan, paffes through Georgia under the name of *Caucafus*, fends a vaft number of ramifications to the weft into Afiatic Turkey, and there produces the mountains Tfchilder, Ararat, Taurus, Argée, and many others in the three Arabias; while the other divifion, paffing between the Cafpian Sea and the lake Aral, penetrates through Chorafan into Perfia. The fecond branch, taking a more eafterly direction, leaves the country of the Eleuths; reaches Little Bucharia; and forms the ramparts of Gog and Magog, and the celebrated mountains formerly known by the name of *Caf*, which M. Bailly has made the feat of the war between the Dives and the Peris*. It traverfes the kingdoms of Cafgar and Turkeftan, enters through that of Lahor into the Mogul territory, and, after giving rife to the elevated defert of Chamo forms the weftern peninfula of India. While thefe two branches run towards the fouth, the third branch of the Ouralic chain rife towards the north, following almoft the 79th degree of longitude, and forms a natural boundary between Europe and Afia; without, however, bounding the immenfe empire of Ruffia. This chain, after coming oppofite to Nova Zembla, divides into two confiderable branches. The one, running to the north-eaft, paffes along the Arctic fhores; the other, proceeding towards the north-weft, meets the northern European chain, traverfes Scandinavia in the fhape of a horfe-fhoe, covers the low-lands of Finland with rocks; and, as is obferved by Dr Pallas, appears to be continued from the North Cape of Norway through the marine chain of Spitzbergen, fcattering iflands and fhelves perhaps throughout the northern ocean, that, paffing through the pole, it may join the northern and eaftern points of Afia and North America.

* Letters fur les Atlantides, let. 16.

The Ouralic, which in the country of the Mongols becomes the Altaic chain, proceeds towards the equator. After forming the mountains and caverns wherein, as we are told, the afhes of the Mongol emperors of the race of Ghengis-Kan are depofited, together with the vaft plain of Chamo, confifting of arid fand, and the frightful rocks and precipices of Thibet, which form the myfterious and defert retreats of the Grand Lama, it croffes the rivers Ava and Menan; contains in its fubdivifions the kingdoms of Ava, Pegu, Laos, Tonquin, Cochinchina, and Siam; fupports the peninfula of Malacca; and overfpreads the Indian ocean with the ifles of Sonda, the Moluccas, and the Philippines, From the borders of the Baikal lake and of the province of Selinginfkoy, Mountain. ginskoy, a branch is detached, which spreads over Chinese Tartary and China, is continued into Corea, and gives rise to the islands of Japan.

The great chain having extended to the north, near the city of Jakuck, upon the banks of the Lena, sends off one of its branches to the north-west, which passing between the two Tungusta, is lost in marshy grounds lying in the northern parts of the province of Jennisseiskoy. The same chain, after it has reached the eastern part of Asia, is lost in the icy regions of the north about Nos-Tschalatskoy or the icy Promontory, and Cap Czuczenskoy.

It will be more difficult, perhaps, to trace the elevated belt in the southern hemisphere beyond the tropic of Capricorn, than it has been to distinguish that towards the north. An immense extent of ocean seems to occupy the whole Antarctic part of the globe. The greatest south latitude of the old continent is not more than 34 degrees, and South America scarcely extends to the 55th degree. In vain has the enterprising Cook attempted to discover regions towards the pole: his progress was constantly interrupted by tremendous mountains and fields of ice. Beyond the 50th degree no land and no habitation is to be found. The islands of New Zealand are the farthest land in these desert seas; and yet the south cape of Taral-Poenamoo extends only to the 48th degree: We do not mention Sandwich-land, which is situated in the 58th degree, because it is too small and too low. It must be recollected, however, that according to the declarations of travellers, the Cordilleras become higher as they advance southward to the Straits of Magellan; and that the Terra del Fuego, which lies in the latitude of 55, is nothing but a mass of rocks of prodigious elevation. America, however, exhibits to our view elevated points, whence chains of mountains are distributed in different directions over the whole surface of the new continent. There must likewise be great reservoirs, where the most remarkable rivers take their rise, and from which they necessarily descend towards their mouth. In the southern hemisphere, this elevated belt is nearer the equator; and though it does not extend to the 50th degree, it is evidently to be met with and may be accurately traced between the 20th and 30th degrees. The high mountains of Tucuman and of Paraguay, which intersect South America about the 25th degree of latitude, may be considered as the American Alps. If we look into the map of the world, we will be able to distinguish an elevated belt all along this parallel. In Africa, Monomotapa and Caffraria are covered with very high mountains, from which pretty large rivers descend. In the Pacific Ocean, we find New Holland, New Caledonia, the New Hebrides, and the Friendly and the Society islands, under the same parallel. We may, therefore, with sufficient propriety, distinguish this parallel by the name of the *Southern Alps*, as we have already distinguished the elevated belt of the 50th degree of north latitude by that of the *Northern Alps*. In America, the Rio de la Plata, which after a course of 500 leagues falls into the ocean at the 35th degree of south latitude; the Pavana, which rises from the mountains of the Arapes, and falls into the Plata at Corriente; the great number of rivers which flow into that of the Amazons, such as the Paraba, which receives in its course the tribute of more than 30 other rivers; the Madera, the Cuchirara, the Ucayal, &c. &c. all descend from these southern Alps. From these Alps likewise three considerable branches of mountains are detached, which go by the common name of *Andes* or *Cordilleras*.—The first branch, which extends towards the south, and passes out from Paraguay through Tucuman, separates Chili from these provinces and from Chimito, and is continued through the Terra Magellanica as far as Terra del Fuego. The second branch, directing its course towards the equator, traverses Peru, in vain endeavouring to conceal treasures which the avarice of men has taught them to discover in its bowels; bounds the Spanish Missions; enters Terra Firma thro' Popayan; and unites South and North America by the isthmus of Panama. The third division, issuing from Paraguay through Guayra and the territory of Saint-Vincent, traverses Brazil, distributes ramifications into Portuguese, French, and Dutch Guiana, crosses the Oronooko, forms the mountains of Venezuela, and near Carthagena meets the second branch coming from Popayan.

We have already supposed, that the elevated belt of North America was situated about the 45th degree of north latitude; and there we imagined we recognized the continuation of the northern Alps of the old continent. This chain likewise sends forth considerable branches on both sides. One of them is detached across the sources of the Mississippi, the Belle-Riviere, and the Missouri, and at the entrance of New Mexico divides, in order to form California to the west, and the Apalachian mountains to the east.—Thence proceeding through New Biscay, the audience of Guadalaxara, Old Mexico, and Guatimala, it meets at Panama the southern branch, which is part of the Alps of Paraguay. The second branch, following the course of the Mississippi, separates Louisiana from Virginia; serves as a bulwark to the United States of America; forms the Apalachian mountains in Carolina; and at last, traversing East Florida, incloses the Gulph of Mexico with the Great and Little Antilles. In the north, we can trace the branches of the elevated belt; on one side observe them proceeding towards Canada, directing their course through Labrador to Hudson's Straits, and at length confounded with the rocks of Greenland, which are covered with eternal snow and ice. On the other side, we see them rising through the country of the Assinipoels and the Kristinos, as far as Michinipis and the northern Archipelago.

We have thus traced the directions of the great chains of mountains. There are certain projecting and pretty sensible points on the Globe, which appear to supply every region with great rivers and high mountains. The Alps of Switzerland and Savoy in Europe, the union of the Ouralic mountains in Asia, (B) the Andes of Tucuman and Paraguay in South America, and the high countries, whence the Missisippi,

(B) These M. Bailly considers as the most elevated part of the globe. *Lettres sur les Atlantides*, p. 236.

Mountain. ssippi, the river Saint Lawrence, and the Belle Riviere descend, may be considered as some of these; though M. Buache places them much nearer the equator, and even under the line. But his object was to form a system to support his own, and to confirm another; ours is merely to state what we have observed, and what indeed must occur to every one who surveys the surface of the globe as it is delineated by our best geographers.

So many observations fully show that the primitive mountains may be considered as the foundation of our globe. By their shape, elevation, direction, and continuity, they give rise to the greatest part of winds, or produce that variety which prevails among them. Primitive mountains, as we have already said, are distinguished likewise by their internal structure, by the nature of the stones of which they are composed, and by the minerals which they contain. The highest mountains are, properly speaking, nothing but peaks or cones consisting of solid rock. This pyramidal form has been supposed to be at first owing to a kind of crystallization; and the late M. Rouelle was of opinion, that the substances of which our globe is composed originally swam in a fluid. The similar parts of which the great mountains consist, according to this philosopher, approached one another and formed a crystallization, sometimes in a group, and at other times detached at the bottom of the waters. Upon this supposition, we might analyse different portions or blocks of rock taken from primitive mountains; and by making them crystallise, we would then have in miniature a part of the same economy or connection of mountains, a figurative portion, in short, of the skeleton of the earth.—We may farther presume, that those steep rocks which it now seems almost impossible to surmount even in imagination, are co-eval with the existence of the world.

Mountains with flat summits sometimes rest on the base of primitive mountains; and contain marble, fossils, and limestone. When mountains of the same kind possess a round and more regular shape, they consist of chalk and other calcareous and friable substances arranged in strata, Granite-argillous mountains, like those of Shemnitz, generally form metallic districts. Hills composed of brown free-stone every where present irregular points, indicating broken strata and heaps of rubbish.

Dr Pallas (in the systematic part of the Memoir above mentioned, concerning the substances of which the highest mountains are composed) lays it down as an axiom, that the highest mountains of the globe forming continued chains, are composed of that rock which is called *granite*, the base of which is always a quartz, with a greater or smaller mixture of felt-spar, mica, and small schoerls, scattered without order, and in irregular fragments of different sizes. This old rock, and the same arising from its decomposition, form the base of all continents. Granite is found below mountains composed of strata (this observation is not applicable to the courses of mountains formed by strata); it constitutes the large protuberances, and as it were the heart, of the greatest Alps in the known world: hence we may with the greatest probability infer, that this rock forms the principal ingredient in the internal composition of our globe. It is never found in regular strata, but in huge masses and in shapeless blocks; its origin is prior to that of all animated beings; it exhibits not the smallest traces of petrifaction, and seems not to have received the least impression from any organised substance. High eminences, whether in continued chains or in the form of steep peaks, are never covered with clayey or calcareous strata, deriving their origin from the sea; but appear to have been from their very first formation elevated above the level of the ocean. The sides of these great chains are for the most part covered with schistous belts, and surrounded with mountains of the second and third orders. This is proved by the Ouralic and Altaic chains, which have been traced by Dr Pallas. Such is the system proposed by this author. The high or primitive and ancient mountains, which have existed from the beginning of time, are granitous; the schistous mountains, to which he gives the name of *secondary*, have arisen from the sides of the primitive by the decomposition of the granite; and those which he calls *tertiary* mountains, or mountains of the third order, are nothing but substances deposited by the sea, and raised up by volcanoes, or swept away by a violent irruption, a powerful inundation, or an universal deluge. This hypothesis concerning the formation of mountains is borrowed from nature itself, and appears to be confirmed by many facts in natural history.

We shall now proceed to state the height of most of the primitive mountains; an object no less worthy of attention than their structure and variety.

According to M. Pontoppidan, the highest mountains in Norway are 3000 toises in height. According to M. Brovallius, the highest mountains in Sweden are 2333 toises. It is supposed, however, that both these calculations are erroneous.

From the Memoirs of the Academy of Sciences at Paris, it appears, that the mountains in France most elevated above the surface of the Mediteranean are the Puy-de-Dome, which is 817 toises, and the Mont d'Or, which is 1048 toises. These two mountains are in Auvergne, and are supposed to be extinguished volcanoes. Mount Cantal is 993 toises high: Mount Ventoux is 1036: the south peak of Canigou in the Pyrenees, according to M. de Rocheblave, is 1442; and according to M. de Plantade, 1453: and Saint Barthelemi is 1184.

M. Needham observes, that the highest Alps in Savoy are the convent of the great Saint Bernard, at the point of the rock to the south-west of that mountain, which is 1274 toises; Mount Sérené, which is 1283; and Mount Tourne, which is 1683. According to the measurement of the English observer, the peak or needle of Argentiere is 2094 toises high. M. Facio de Duiller and M. Duluc make the ridge of Mont Blanc 2213 toises; but according to the observation of M. Shuckburg, its elevation is 2447 toises one foot (by M. de Saussure's measurement 2426 toises) above the level of the Mediteranean.

The principal mountains of the Alps are among the most elevated in the world; and particularly Mont-Blanc, that enormous mass of granite, which is situated in the centre of the Alps, and the access to which is rendered so difficult by the sharp peaks, walls of ice, and everlasting snows wherewith it is covered, is the

 highest

higheſt mountain which has been meaſured either in Europe, Aſia, or Africa. The altitude of the Alps of Switzerland has been aſcertained by different philoſophers; We ſhall content ourſelves with mentioning the moſt remarkable of thoſe mountains covered with ſnow, which in Switzerland are called *Gletſchers* or *Glaciers*. St Gothard, according to Scheuchzer, is 1650 toiſes; and Lignon, near the lake of Como, north eaſt, is, according to Pini, 1486 toiſes in height. M. Paſumot, engineer to the king of the French, juſtly obſerves, that the heights aſſigned by Mikheli to the mountains of Switzerland appear rather to be ideal computaions than founded on obſervations. An opinion of them may be formed from the following: According to this author, Mount Pilate or Frankmont, in the diſtrict of Lucerne, is 1403 toiſes in height; Mount Cenis, 1445; Raukhſtok, 1760; the Nolle ridge of Titliſberg, 2001, Ghemi, 2421; Grimſelberg, in the canton of Berne, 2539; the Cornera, part of Loukmanier, 2654: Fourke, 2669; Schrekhorn, 2724; and St Gothard, at its moſt elevated point, 2750. Mikheli likewiſe reckons 20 other mountains, the height of which exceeds 2000 toiſes. The reader may conſult the *Table comparative des hauteurs des principales montagnes*, by M. Paſumot (*Journal de Phyſique*, September 1783.)

Throughout the globe we will not perhaps meet with higher mountains than thoſe of Peru, which go by the name of *Cordilleros de los Andos*. According to the obſervations of the academicians ſent to South America in 1735 by the Spaniſh aund French courts to meaſure a degree of the meridian and to aſcertain the true figure of the earth, the principal ſummits of theſe extraordinary mountains, which are ſituated near Quito, and which are conſtantly covered with ſnow though they lie under the equator, have the following geometrical elevations above the level of the ſea; Quito-Capilate, 1707 toiſes; El-Coraſon, 2470 (c); Cotacatche, 2570; Ek-Atlas, 2730; and Noyamble-orcu, under the line, 3030. All the other mountains have been or ſtill are, volcanoes. The following is an enumeration of them, together with their ſeveral heights: Pichincha 2430; Cargavi-raſo, 2450; Sinchonalagon or Sinchoulagoa, 2570; Sangai, 2680; Illinika 2717, Kotopaxi, 2950; Antiſana, 3020; Cagambeorcon, ſituated under the line, 3030; Cimboraſo or Chimboraco, 3220. The laſt mentioned mountain, which forms part of the Cordilleras in Peru, is one of the largeſt and probably the higheſt in the world. It is ſeen at ſea from the gulph of Guayaquil, which is more than 60 leagues diſtant.

Other very elevated mountains are Mount Sinai in Japan; Mount Caucaſus in Aſia; the ſouthern peak of the Pyrenees; the peak of Teneriffe in one of the Canary iſlands, which according to M. Bouguer is 2100 toiſes (according to later obſervations, made by M. M. de Verdun, de Borda, and Pingre, French academicians, in 1754, the peak of Teyde, more commonly known by the name of the *peak of Teneriffe*, is only 1904 toiſes perpendicular height above the level of the ſea) Mount Gibel or Etna in Sicily is 1672 toiſes; St George's peak in the Azores; Adam's peak in Ceylon; the mountains of the Moon; Mounts Athos, Olympus, Taurus, and Emaus: Mount Cenis in the Alps on the road from France to Italy, is 1460 toiſes; the Great and Little Atlas, and many others, on the top of which we feel, even in the middle of ſummer, a more piercing cold than that of the ſevereſt froſts of our climates. After this, it cannot appear wonderful that the vapours which reach ſo great heights are there congealed; and that the ſummits of theſe mountains, even in the warmeſt climates, are conſtantly covered with ſnow, while the inhabitants of the plain enjoy a temperate atmoſphere, or are ſubject to extreme heat. The height of thoſe mountains, added to their being placed on the moſt elevated parts of the globe, is the chief cauſe of the phenomena peculiar to them. In that part of Aſia which is ſeparated by the chain of mountains called the *Ghauts*, there are two very different ſeaſons at one and the ſame time. While it is winter on the Malabar coaſt, for inſtance, the Coromandel coaſt, which has the ſame degree of elevation, and in ſome places is only 20 leagues diſtant, enjoys an agreeable ſpring or the temperature of autumn. The traveller in the Alps generally experiences, even in ſummer, the four ſeaſons of the year. In the Andes we meet with a change of temperature no leſs curious; for as we deſcend from their ſummit to their baſe, we experience all the varieties of heat and cold which are felt in every climate of the earth, at whatever ſeaſon (D). There are many other mountainous countries in which we paſs at once from a ſerene ſky to dreadful

(c) This is the greateſt height to which any perſon is known to have aſcended in America; the greateſt elevation which has been reached in the Alps is the top of Mont-Blanc, which is 2426 toiſes, and which Dr Paccard aſcended on the 8th of Auguſt 1786. M. de Sauſſure arrived there likewiſe on the 3d of Auguſt 1787, accompanied by 17 perſons.

(D) The more we are elevated above the ſurface of the earth, it becomes the colder; and accordingly the tops of the higheſt mountains are always covered with ſnow. At the height of about 2300 toiſes above the level of the ſea, no plant whatever is found to grow: and it appears from the obſervations of MM. de la Condamine, Bouguer, Godin, Dom George Juan, and Dom Antonio de Ulloa, the academicians ſent to Quito in 1735, that at the height of 2434 the ſnow is perpetual, and never melts at any time of the year even under the equator. The congelation begins and continues in all the mountains of the Cordilleras at the ſame height above the level of the ſea, which is determined by an equal elevation of the mercury in the barometer. But from experiments which have been made, Sir Iſaac Newton concludes, that the denſity of the atmoſphere at any height is as the weight of the incumbent air, that is, as the height of the mercury in the barometer; and conſequently the denſity of the air is the ſame in the whole region of the atmoſphere, where the congelation is continual, and where that perpetual cold commences which is felt on all mountains. Above this conſtant height the denſity of the air continues to diminiſh, and the cold becomes greater and greater till we dreadful ftorms and tempefts. It cannot therefore be doubted, that mountains have a great influence on the temperature of the countries to which they belong, by ftopping the courfe of certain winds, by forming barriers to the clouds, by reflecting the fun's rays, and by ferving as elevated conductors to the electricity of the atmofphere. It was formerly faid by travellers, that on the peak of Teneriffe they found that brandy loft its ftrength; that fpirit of wine became almoft infipid; that pepper, ginger, and falt, had little or no tafte when applied to the tongue; but, it was alleged, that Canary wines ftill retained their ftate on that mountain. Thefe ftories appeared too marvellous not to require new experiments; and M M. de Lamanon and Mongez, who vifited this peak in 1785, tell us, that the flavour and tafte of liquors appeared to have fuftained no lofs at that height: (See the experiments made on the Pic du Midi in the Pyrenees by M. Darcet, in the *Journal de Phyfique* for November 1776; and a journey to the peak of Teneriffe, in the fame *Journal* for Auguft 1785.) At the foot, and fometimes at the middle, of thofe lofty mountains, the tops of which are always covered with fnow, we frequently find fprings which begin to run in May and dry up in September. When the fun approaches near enough to the tropic to warm the fummits of thefe mountains, the fnow with which they are covered melts, filtrates through their interior part, and iffues forth at their bafe. The only trees which grow on mountains of this kind are firs, pines, and other refinous trees; and the grafs becomes fhorter towards their fummit.

Mountains were not formed to be an ufelefs load upon the earth, but evidently anfwer very important purpofes; and we cannot enough admire their form and that kind of harmony which is difcernible in their arrangement. Some of them, vomiting out fire or fmoke, lava, and fulphur, indicate that they in fome meafure anfwer the purpofe of a chimney to fomething within the earth, which, if confined, would burft it in pieces: (See VOLCANO.) Of this kind are Mount Hecla in Iceland, Mount Etna in Sicily, Mount Vefuvius in the kingdom of Naples, Pichincha and Kotopaxi in America, &c. Others, the fummits of which reach into the clouds, attract and abforb the vapours of the fea, &c. which float in the air. It is obferved by M. l'Abbé Palaffon, that ftorms are moft frequent at the foot of thofe high mountains which form extenfive chains. Their enormous maffes, which feem to fupport the heavens on their fhoulders, arreft and fix the different meteors as they are formed. The clouds, in like manner, driven by the winds from different points of the horizon, there meet with impenetrable barriers, are there accumulated in great quantity, and remain fufpended on thefe bulwarks of the globe's furface, till the agitation of the atmofphere fucceeding the calm, produces ftorms, which are fo much the more terrible that they cannot expand and be difperfed but with great difficulty. They are commonly repelled from the mountains; and are then obferved to fpread over whole countries, to diffolve with peals of thunder, and to fall down in deftructive hail-fhowers fatal to the harveft and to the whole produce of the fields. This fcourge is peculiarly dreadful during the feafons of fpring and fummer, when a fufficient quantity of fnow remains on the mountains to cool the atmofphere.

Some chains of mountains have openings; in others they are wanting: of the former kind are the ftraits of Thermopylæ, the Cafpian ftraits, the pafs of the Cordilleras, &c.

Thofe fpaces which feparate the tops of mountains are fo many bafons deftined for the reception of the condenfed mifts, and of the clouds precipitated into rain. The bowels of mountains appear to be great and inexhauftible refervoirs, and to contain fubterraneous canals and lateral openings formed by the hand of nature, that the feveral fpecies of animals may be fupplied with drink, that the earth may be fertilifed, and that nourifhment may be afforded for the growth of vegetables. The ftreams and rivers defcend from the ridges of mountains, the declivities of which form fo many inclined plains: Thus we find the Alps give rife to the Rhine, the Danube, the Rhone, and the Po. With regard to the wonderful ftructure, by means of which fo many advantages are obtained, fee the articles EARTH, SPRINGS, &c.

Mountains of the firft order form vaft folitudes and horrid deferts, where the habitations of men are not to be feen, and their footfteps are feldom to be traced. By their grandeur, their elevation, the variety of their pofitions, the fublime and awful exhibition of wonders which they contain, they elevate the mind and fire the imagination of the obferver. But thefe majeftic eminences have other advantages which deferve our attention. They form the common retreat of a multitude of wild beafts, which are fubfervient to our ufe: there the bear, the lynx, the ermine, the martin, the fox, and many other animals, the fkins of which we employ for furs, take up their abode; and thither the eagle and the vulture refort in fafety. Mountains likewife afford nourifhment to rein-deer, buffaloes, fallow-deer, roe-deer, and chamois; and they are vifited by birds of paffage which, under the guidance of inftinct, follow the fhorteft road to the place of their deftination. They produce medicinal plants, which almoft never grow elfewhere. In Swifferland they are alfo covered with deep forefts, which, by the great height of the trees, announce their antiquity. They afford both timber and fuel, and fupply the inhabitants with abundance of excellent pafture for their beftial during the whole fummer. The moft precious ftones, both for brilliancy and hardnefs, acquire their forms and colours in the fiffures of the rocks: the internal rents of mountains are filled and in a manner cemented by different metallic fubftances; while the grottos are furnifhed with numerous congelations, fhining

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we reach the fummits of the mountains, which prefent to our view all the horrors of winter as they are felt in the polar regions. But below this height, as the denfity of the air becomes greater in confequence of being conftantly preffed upon by a great fuperincumbent weight, the fun's heat increafes, fo that thofe who inhabit the plains at the foot of the mountain are expofed to all the inconveniences of the torrid zone.

Mountain.

shining crystals, and substances of an extraordinary nature and figure. In short, every thing concurs to show, that the existence of mountains is absolutely necessary; and that in order to acquire a proper knowledge of them, they must be considered in many different points of view. Their position, their direction, their elevation, the extent of their base, their figure, their various external windings, their internal structure; in a word, every thing relating to the theory of the globe, and to the different temperatures of the atmosphere, must engage the observer's attention; and by studying and carefully examining the general constitution of mountains, the particular facts which they present to our view, their influence, their action on the atmosphere, the different substances of which they are composed, together with the arrangement and mixture of these substances, we may at length discover the true mechanism of the earth. The reader may consult the *Essais Sur l'etude des Montagnes; Journel de M. l'Abbé Rozier*, November 1773.

The difficulty and danger of ascending to the tops of mountains proceeds not from the thinness of the air, as has been commonly reported; but the reason is, that they rise with such a rugged and precipitate ascent, that they are utterly inaccessible. In some places they appear like a great wall of 600 or 700 feet high; in others, there stick out enormous rocks, that hang upon the brow of the steep, and every moment threaten destruction to the traveller below.

In this manner almost all the tops of the highest mountains are bare and pointed: and this naturally proceeds from their being so continually assaulted by thunders and tempests. All the earthy substances with which they might have been once covered, have for ages been washed away from their summits; and nothing is left remaining but immense rocks, which no tempest has hitherto been able to destroy.

Nevertheless, time is every day and every hour making depredations; and huge fragments are seen tumbling down the precipice, either loosened from the summit by the frost or rains, or struck down by lightning. Nothing can exhibit a more terrible picture than one of these enormous rocks, commonly larger than an house, falling from its height with a noise louder than thunder, and rolling down the side of the mountain. Dr Plot tells us of one in particular, which being loosened from its bed, tumbled down the precipice, and was partly shattered into a thousand pieces. Notwithstanding, one of the largest fragments of the same, still preserving its motion, travelled over the plain below, crossed a rivulet in the midst, and at last stopped on the other side of the bank! These fragments, as was said, are often struck off by lightning and sometimes undermined by rains; but the most usual manner in which they are disunited from the mountain is by frost: the rains insinuating between the interstices of the mountain, continue there until there comes a frost; and then, when converted into ice, the water swells with an irresistible force, and produces the same effect as gun-powder, splitting the most solid rocks, and thus shattering the summits of the mountain.

But not rocks alone, but whole mountains, are, by various causes, disunited from each other. We see, in many parts of the Alps, amazing clefts, the sides of which so exactly correspond with the opposite, that no doubt can be entertained of their having been once joined together. At Cajeta in Italy, a mountain was split in this manner by an earthquake; and there is a passage opened through it, that appears as if elaborately done by the industry of man. In the Andes these breaches are frequently seen. That at Thermopylæ in Greece has been long famous. The mountain of the Troglodytes in Arabia has thus a passage through it; and that in Savoy, which nature began and which Victor Amadeus completed, is an instance of the same kind.

We have accounts of some of these disruptions immediately after their happening. "In the month of June, in the year 1714, a part of the mountain of Diableret, in the district of Valais in France, suddenly fell down, between two and three o'clock in the afternoon, the weather being very calm and serene. It was of a conical figure, and destroyed 55 cottages in the fall. Fifteen persons, together with about 100 beasts, were also crushed beneath its ruins, which covered an extent of a good league square. The dust it occasioned instantly covered all the neighbourhood in darkness. The heaps of rubbish were more than 300 feet high. They stopped the current of a river that ran along the plain, which now is formed into several new and deep lakes. There appeared, through the whole of this rubbish, none of those substances that seemed to indicate that this disruption had been made by means of subterraneous fires. Most probably, the base of this rocky mountain was rotted and decayed; and thus fell, without any extraneous violence." In the same manner, in the year 1618, the town of Pleurs in France was buried beneath a rocky mountain, at the foot of which it was situated.

These accidents, and many more that might be enumerated of the same kind, have been produced by various causes: by earthquakes, as in the mountain at Cajeta; or by being decayed at the bottom, as at Diableret. But the most general way is, by the foundation of one part of the mountain being hollowed by waters, and, thus wanting a support, breaking from the other. Thus it generally has been found in the great chasms in the Alps, and thus it almost always is known in those disruptions of hills which are known by the name of *land slips*. These are nothing more than the sliding down of an higher piece of ground, disrooted from its situation by subterraneous inundations, and settling itself upon the plain below.

There is not an appearance in all nature that so much astonished our ancestors as these land-slips. In fact, to behold a large upland, with its houses, its corn, and cattle, at once loosened from its place, and floating as it were upon the subjacent water; to behold it quitting its ancient situation, and travelling forward like a ship, in quest of new adventures; this is certainly one of the most extraordinary appearances that can be imagined; and, to a people ignorant of the powers of nature, might well be considered as a prodigy. Accordingly, we find all our old historians mentioning it as an omen of approaching calamities. In this more enlightened age, however, its cause is very well known; and, instead of exciting ominous apprehensions in the populace, it only gives rise to

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Mountain. some very ridiculous law-suits among them, about whose the property shall be; whether the land which has thus slipt, shall belong to the original possessor or to him upon whose grounds it has encroached and settled. What has been the determination of the judges is not so well known; but the circumstances of the slips themselves have been minutely enough and exactly described.

In the lands of Slatberg in the kingdom of Ireland, there stood a declivity gradually ascending for near half a mile. In the year 1713, and on the 10th of March, the inhabitants perceived a crack on its side, somewhat like a furrow made with a plough, which they imputed to the effects of lightning, as there had been thunder the night before. However, on the evening of the same day, they were surprised to hear an hideous confused noise issuing all round from the side of the hill; and their curiosity being raised, they resorted to the place. There, to their amazement, they found the earth, for near five acres all in gentle motion, and sliding down the hill upon the subjacent plain. This motion continued the remaining part of the day and the whole night: nor did the noise cease during the whole time; proceeding probably from the attrition of the ground beneath. The day following, however, this strange journey down the hill ceased entirely; and above an acre of the meadow below was found covered with what before composed a part of the declivity.

However, these slips, when a whole mountain's side seems to descend, happen but very rarely. There are some of another kind, however, much more common; and, as they are always sudden, much more dangerous. These are snow-slips, well known, and greatly dreaded by travellers. It often happens, that when snow has long been accumulated on the tops and on the sides of mountains, it is borne down the precipice either by means of tempest or its own melting. At first, when loosened, the volume in motion is but small: but it gathers as it continues to roll; and by the time it has reached the habitable parts of the mountain, it is generally grown of enormous bulk. Wherever it rolls, it levels all things in its way, or buries them in unavoidable destruction. Instead of rolling, it sometimes is found to slide along from the top; yet even thus it is generally as fatal as before. Nevertheless, we have had an instance a few years ago, of a small family in Germany that lived for above a fortnight beneath one of these snow-slips. Although they were buried during that whole time in utter darkness, and under a bed of some hundred feet deep, yet they were luckily taken out alive, the weight of the snow being supported by a beam that kept up the roof, and nourishment supplied them by the milk of a she-goat that was buried under the same ruin.

Attraction of Mountains. This is a late discovery, and a very considerable confirmation of Sir Isaac Newton's theory of universal gravity. According to the Newtonian system, an attractive power is not only exerted between those large masses of matter which constitute the sun and planets, but likewise between all comparatively smaller bodies, and even between the smallest particles of which they are composed. Agreeably to this hypothesis, a heavy body, which ought to gravitate or tend toward the centre of the earth, in a direction perpendicular to its surface, supposing the said surface to be perfectly even and spherical, ought likewise, though in a less degree, to be attracted and tend towards a mountain placed on the earth's surface; so that a plumb-line, for instance, of a quadrant hanging in the neighbourhood of such a mountain, ought to be drawn from a perpendicular situation, in consequence of the attractive power of the quantity of matter of which it is composed acting in a direction different from that exerted by the whole mass of matter in the earth, and with a proportionably inferior degree of force.

Though Sir Isaac Newton had long ago hinted at an experiment of this kind, and had remarked, that "a mountain of an hemispherical figure, three miles high and six broad, would not, by its attraction, draw the plumb-line two minutes out of the perpendicular (E): yet no attempt to ascertain this matter by actual experiment was made till about the year 1738; when the French academicians, particularly Messrs Bouger and Condamine, who were sent to Peru to measure a degree under the equator, attempted to discover the attractive power of Chimboraço, a mountain in the province of Quito. According to their observations, which were however made under circumstances by no means favourable to an accurate solution of so nice and difficult a problem, the mountain Chimboraço, exerted an attraction equal to eight seconds. Though this experiment was not perhaps sufficient to prove satisfactorily even the reality of an attraction, much less the precise quantity of it; yet it does not appear that any steps had been since taken to repeat it.

Through the munificence of his Britannic majesty, the royal society were enabled to undertake the execution of this delicate and important experiment: the astronomer-royal was chosen to conduct it. After various inquiries, the mountain Schehallien, situated nearly in the centre of Scotland, was pitched upon as the most proper for the purpose that could be found in Britain. The observations were made by taking the meridian zenith distances of different fixed stars, near the zenith, by means of a zenith sector of ten feet radius; first on the south, and afterwards on the north side of the hill, the greatest length of which extended in an east and west direction.

It is evident, that if the mass of matter in the hill exerted any sensible attraction, it would cause the plumb-line of the sector, through which an observer viewed a star in the meridian, to deviate from its perpendicular situation, and would attract it contrarywise at the two stations, thereby doubling the effect. On the south side the plummet would be drawn to the northward, by the attractive power of the hill placed to the northward of it: and on the north side a contrary and equal deflection of the plumb-line would take

(E) By a very easy calculation it is found that such a mountain would attract the plumb-line 1′ 18″ from the perpendicular.

take place, in consequence of the attraction of the hill, now to the southward of it. The apparent zenith distances of the stars would be affected contrarywise; those being increased at the one station which were diminished at the other: and the correspondent quantities of the deflection of the plumb-line would give the observer the sum of the contrary attractions of the hill, acting on the plummit at the two stations; the half of which will of course indicate the attractive power of the hill.

The various operations requisite for this experiment lasted about four months; and from them it appears, that the sum of the two contrary attractions of the mountain Schehallien, in the two temporary observations which were successively fixed half-way up the hill (where the effect of its attraction would be greatest), was equal to 11″. 6.—From a rough computation, founded on the known law of gravitation, and on an assumption that the density of the hill is equal to the mean density of the earth, it appears that the attraction of the hill should amount to about the double of this quantity. From thence it was inferred, that the density of the hill is only about half the mean density of the earth. It does not appear, however, that the mountain Schehallien has ever been a volcano, or is hollow; as it is extremely solid and dense, and seemingly composed of an entire rock.

The inference drawn from these experiments may be reduced to the following:

"1. It appears, that the mountain Schehallien exerts a sensible attraction; therefore, from the rules of philosophising, we are to conclude, that every mountain, and indeed every particle of the earth, is endued with the same property, in proportion to its quantity of matter.

"2. The law of the variation of this force, in the inverse ratio of the squares of the distances, as laid down by Sir Isaac Newton, is also confirmed by this experiment. For if the force of attraction of the hill had been only to that of the earth as the matter in the hill to that of the earth, and had not been greatly increased by the near approach to its centre, the attraction thereof must have been wholly insensible. But now, by only supposing the mean density of the earth to be double to that of the hill, which seems very probable from other considerations, the attraction of the hill will be reconciled to the general law of the variation of attraction in the inverse duplicate ratio of the distances, as deduced by Sir Isaac Newton from the comparison of the motion of the heavenly bodies with the force of gravity at the surface of the earth; and the analogy of nature will be preserved.

"3. We may now, therefore, be allowed to admit this law, and to acknowledge, that the mean density of the earth is at least double of that at the surface; and consequently that the density of the internal parts of the earth is much greater than near the surface. Hence also, the whole quantity of matter in the earth will be at least as great again as if it had been all composed of matter of the same density with that at the surface; or will be about four or five times as great as if it were all composed of water.—This conclusion, Mr Maskelyne adds, is totally contrary to the hypothesis of some naturalists, who 'suppose the earth to be only a great hollow shell of matter; supporting itself from the property of an arch, with an immense vacuity in the midst of it.' But, were that the case, the attraction of mountains, and even smaller inequalities in the earth's surface, would be very great, contrary to experiment, and would affect the measures of the degrees of the meridian much more than we find they do; and the variation of gravity, in different latitudes, in going from the equator to the poles, as found by pendulums, would not be near so regular as it has been found by experiment to be.

"4. As mountains are by these experiments found capable of producing sensible deflections of the plumb-lines of astronomical instruments; it becomes a matter of great importance, in the mensuration of degrees in the meridian, either to choose places where the irregular attractions of the elevated parts may be small; or where, by their situation, they may compensate or counteract the effects of each other."

For measuring the heights of mountains, see the article Barometer.

Burning Mountains. See Ætna, Hecla, Vesuvius, and Volcano.

Marble Mountains. Of these there are great numbers in Egypt, from which, though immense quantities have been carried off for the multitude of great works erected by the ancient Egygtians; yet, in the opinion of Mr Bruce who passed by them in his journey to Abyssinia, there is still such an abundant supply, that it would be sufficient to build Rome, Athens, Corinth, Syracuse, Memphis, Alexandria, and half a dozen more of such cities.

The first mountain of this kind mentioned by Mr Bruce is one opposite to Tersowey, consisting partly of green marble, partly of granite, with a red blush upon a grey ground, and square oblong spots. Here he saw a monstrous obelisk of marble, very nearly square, broken at the end, and nearly 30 feet long and 19 feet in the face. Throughout the plain there were scattered small pieces of jasper, with green, white, and red spots, called in Italy *diaspro sanguine;* and all the mountains upon that side seemed to consist of the same materials. Here also were quantities of small pieces of granite of various kinds, as well as porphyry, which had been carried down by a torrent, probably from the ancient quarries. These pieces were white mixed with black spots, and red with green veins and black spots. All the other mountains on the right hand were of red marble, but no great beauty; those on the opposite side being green marble, probably of the serpentine kind. This, he says, was one of the most extraordinary sights he ever saw. The former mountains were of a considerable height, without a tree, shrub, or blade of grass upon them; and this looked exactly as if it had been covered over with Havannah and Brazil snuff. Proceeding farther on, he entered another defile with mountains of green marble on every side. The highest he saw appeared to be composed of serpentine marble; having a large vein of green jasper spotted with red running through about one-third of its thickness. It was extremely hard; so that it did not yield to the blows of a hammer, though it was evident that it had formerly been quarried; and there were channels for bringing water, which terminated

nated in this quarry of jasper; "a proof (says Mr Bruce) that water was one of the means used in cutting those hard stones,"

On these mountains, our author observes, that "the porphyry shows itself by a fine purple sand without any gloss upon it, though the colour is very agreeable to the eye. It is mixed with the white sand and fixed marble of the plains. Green and unvariegated marble is also found in the same mountain with the porphyry. The marble is brittle for some inches where the two veins meet: but the porphyry is as hard as in other places. The granite appears like a dirty brown stone covered with sand; but this is only the change made upon it by the sun and weather; for on breaking it, the colour appears to be green with black spots, and a reddish cast on the surface. The reddish colour appears to be impaired by exposure to the atmosphere; but is recovered upon polishing it anew. It is in greater quantity than the porphyry, and nearer to the Red Sea. The granite is next to the prophyry, but never joined with it in the same mountain. Being covered with a reddish sand, it looks as if the whole mountain were covered with brick dust." There is likewise a kind of red marble with white veins, which our author has seen at Rome and likewise in Britain. The common green, called *serpentine*, looks as if it were covered with Brazil snuff. Along with this green he saw two samples of the beautiful kind called *Isabella;* one of them with the yellowish cast of Quaker-colour, the other of that bluish cast called *dove colour;* and these two seemed to divide the mountains with the serpentine. Here also he saw the vein of jasper; but had not time to determine whether it was the same with that called bloody-jasper or blood-stone or not.

The marble of greatest value, however, is that called *Verde Antico*, which is of a dark-green colour with white spots. It is found, like the jasper, in the mountains of the plain green serpentine, and is not discoverable by the dust or any particular colour upon it. "First (says Mr Bruce) there is a blue flaky stone exceedingly even and smooth in the grain, solid, and without sparks and colour. When broken it is something lighter than a slate, and more beautiful than most kinds of marble; it is like the lava of volcanoes when polished. After lifting this we come to the beds of verde antico; and here the quarrying is very obvious; for it has been uncovered in patches not above 20 feet square. Then, in another part the green stone has been removed and another pit wrought." In other places of the plain he saw pieces of African marble, but no rocks or mountains, of it. He supposes it to be found in the heart of some other coloured marble, and in strata like the jasper and verde antico; and, as he suspects, in the mountains of Isabella marble, especially of the yellowest sort. This vast store of marble is placed on a ridge, whence there is a descent to the east and west, so that it could be conveyed either to the Nile or the Red Sea. The level ground and hard fixed gravel are proper for the heaviest carriages; so that any weight whatever might easily be conveyed to the place of embarkation. In the more distant mountains also he observed the same care taken to facilitate the carriage: for the defiles between those mountains he supposes not to be natural but artificial openings: and he observed the roads from them to the Nile to be cut with a descent of about one foot in 50 at most, so that, all the way down, the carriages must have moved with as little draught as possible, at the same time that the vast friction would prevent any undue acceleration; to which also some other means must have contributed: But thus, he thinks, it may be explained how such immense blocks might have been removed as were employed in the ancient Egyptian works.

Mountains of marble and poryhyry are not peculiar to Egypt, for they are likewise to be met with in the north of Scotland; and in the Western Isles there are likewise such quantities of these materials to be met with, as, in the opinion of Mr Williams, would be sufficient to serve all Europe.

Written MOUNTAIN, *Mountain of Inscriptions*, or *Jibel-al-Mokatteb*, a supposed mountain, or chain of mountains, in the wilderness of Sinai; on which, for a great extent of space, the marble of which the mountain consists is inscribed with innumerable characters reaching from the ground sometimes to the height of 12 or 14 feet. These were mentioned by a Greek author in the third century, and some of them have been copied by Pococke and other late travellers; notwithstanding which, there is still a very great uncertainty even of the *existence* of such mountain or mountains. The vast number of these inscriptions, the desart place in which they are found, and the length of time requisite for executing the task, has induced a notion by no means unnatural, that they are the work of the Israelites during their forty years wandering in the wilderness. Others are of opinion that they contain nothing of any importance; but consist merely of the names of travellers and the dates of their journeys

M. Niebuhr, who visited this country about 30 years ago, made every attempt in his power, though without success, to obtain a sight of this celebrated mountain. On applying to some Greeks at Suez, they all declared that they knew nothing of the written mountain: they, however, directed him to an Arabian sheik, who had passed all his lifetime in travelling between Suez and Mount Sinai; but he knew no more of it than the former. Understanding, however, that a considerable reward would be given to any person who would conduct them thither, this Arab directed them to another; who pretended not only to know that mountain, but all others upon which there were any inscriptions throughout the desart. On inquiring particularly, however, our travellers found that he was not to be depended upon; so that they were obliged to have recourse to a fourth sheik, who by his conversation convinced them that he had seen mountains with inscriptions in unknown characters upon them. It does not appear, however that this person was very capable, more than the rest, of leading them to the place they so much wished for; though he conducted them to some rocks upon which there were inscriptions in unknown characters. They are most numerous in a narrow pass between two mountains named *Om-er-ridsjein*; and, says M. Niebuhr, "the pretended Jibel-al-Mokatteb may possibly be in its neighbourhood." Some of these inscriptions were copied by our author; but he does not look upon them to be of of any consequence. "They seem (says he) to have been executed at idle hours by travellers, who were satisfied with cutting the unpolished rock with any pointed instrument, adding to their names and the date of their journeys some rude figures, which bespeak the hand of a people but little skilled in the arts. When such inscriptions are executed with the design of transmitting to posterity the memory of such events as might afford instructive lessons, greater care is generally taken in the preparation of the stones, and the inscriptions are engraven with more regularity."

When M. Niebuhr arrived at last at the mountain to which the sheik had promised to conduct him, he did not find there any inscriptions; but on climbing up to the top, he found nothing there but an Egyptian cemetery, the stones of which were covered with hieroglyphics. The tomb stones are from five to seven feet in length, some standing on end and others lying flat; and "the more carefully they are examined (says he), the more certainly do they appear to be sepulchral stones, having epitaphs inscribed on them. In the middle of these stones is a building, of which only the walls now remain; and within it are likewise a great many of the sepulchral stones. At one end of the building seems to have been a small chamber, of which the roof still remains. It is supported upon square pillars; and these, as well as the walls of the chamber, are covered with hieroglyphic inscriptions. Thro' the whole building are various busts executed in the manner of the ancient Egyptians. The sepulchral stones and the busts are of hard and fine-grained sand-stone." M. Niebuhr is of opinion that this cemetery was not the work of the Egyptians themselves, but of some colony which came from Egypt, and had adopted the manners and customs of the people. He supposes that it might have been built by the Arabs who had conquered Egypt under the shepherd kings and adopted the Egyptian manners during their residence there. As it must have belonged to an opulent city, however, he owns that there is a great difficulty in accounting for the existence of such a city in the midst of a desart.

The translator of Volney's travels ascribes these inscriptions to the pilgrims which visit Mount Sinai. But to this, as well as to every other conjecture, there is this objection, that whether the inscriptions be well executed or not, whether they contain matters of importance or not, they ought to have been written in a language which *somebody* could understand; but from the copies that have been taken of them by Dr Pococke, and others, it does not appear that they could be explained either by him or any other person.

When Dr Clayton, bishop of Clogher, visited this part of the world about the year 1723, he expressed the greatest desire to have the matter concerning this written mountain or mountains ascertained, and even made an offer of L. 500 Sterling to any literary person who would undertake the journey and endeavour to decypher the inscriptions; but no such person has appeared, and the existence of the mountains is testified only by the superior of a convent at Cairo, who gave that mentioned in the beginning of this article. Untill that part of the world, therefore, become more accessible to travellers, there is but little hope that we can come to any certainty in the matter. M. Niebuhr plainly, from his own accounts, had not influence enough with the Arabs to show him almost any thing, as they refused to conduct him even to the summit of Mount Sinai.

White MOUNTAINS. See *New* HAMPSHIRE.

MOUNTAINS *of the Moon*, a chain of mountains in Africa, extending themselves between Abyssinia and Monomotapa, and receiving the above denomination from their great height.

MOUNTAINS *of the Lions*, also in Africa, divide Nigritia from Guinea, and extend as far as Ethiopia. They were styled by the ancients *the mountains of God*, on account of their being greatly subject to thunder and lightning.

MOUNTAIN *of Forty-days*; a mountain of Judea, situated in the plain of Jericho to the north of that city. According to the Abbe Mariti's description, the summit of it is covered neither with shrubs, turf, nor earth: it consists of a solid mass of white marble, the surface of which is become yellow by the injuries of the air. "The path by which you ascend to it (says our author) fills one with terror, as it rises with a winding course between two abysses, which the eye dares scarcely behold. This path is at first pretty broad, but it at length becomes so confined, that one can with difficulty place both feet upon it at the same time. When we had ascended a little higher, we found an Arab stretched out on the path, who made us pay a certain toll for our passage. Here the traveller requires courage. One of the parapets of the path being broke, we clung to the part which remained until we had reached a small grotto, situated very commodiously as it gave us an opportnnity of recovering our breath. When we had rested ourselves a little, we pursued our course, which became still more dangerous. Suspended almost from the rock, and having before our eyes all the horror of the precipice, we could advance only by dragging one foot after the other; so that had the smallest fragment given way under us, we should have been hurried to the bottom of this frightful abyss.

"Proceeding a little farther, we found a second grotto, the entrance of which was about nine feet in breadth. It would be of considerable size were not about two-thirds of it filled up by part of the roof, which had tumbled down. This grotto conducts to another, which we had the curiosity to enter, but we were almost stifled by the great number of bats which were fluttering up and down in it. Being desirous of retreating almost as soon as we had entered they flew in such numbers around us that they in a manner covered our whole bodies; but they luckily made a passage for themselves, and suffered us to breathe with freedom. By the glimmering light which reached this grotto, we perceived that the bottom of it was covered to the height of a hand-breadth with the excrements of these animals; and we remarked some niches in the sides of it, which gave us reason to conclude, that it had once served as a sepulchre to the ancient anchorets. This is the more probable, as the other grotto appears by the remains of an altar and of some Greek paintings to have been formerly a church. In the right corner there is a large cistern, the plaster of which retains its original solidity, though broken

broken in a few places. In the left corner there is a ſmall ſtair which conducts to a third grotto. This is much longer and broader than any of the former, and its walls are ornamented alſo with Greek paintings, which repreſent the twelve apoſtles in their natural ſize. Their figures, however, are ſo much changed, that one could ſcarcely diſtinguiſh who they are, were it not that their names are written in Greek characters upon the glory which ſurrounds their heads.—At the farther end of this grotto ſtands a ſquare altar a little damaged; above which is an oval painting of the Annunciation, in perfect preſervation. The chiſel has been employed to render theſe grottos regular and ſmooth; and it appears that they were inhabited by a certain number of hermits, who devoted themſelves to a life of contemplation. No writer has been able to tell us who the founder of this hermitage was.—Nicephorus and Euſebius who have deſcribed all the churches and religious places of Paleſtine and Judea; do not ſpeak of theſe chapels.

"This mountain is one of the higheſt in the province, and one of its moſt ſacred places. It takes its name from the rigorous faſt which Chriſt obſerved here after having triumphed over the vanities of the world and the power of hell. In remembrance of this miracle, a chapel was formerly conſtructed on the ſummit of the mountain. It may be ſeen from the plain, but we could not approach it, as the path was almoſt entirely deſtroyed. It, however, may be acceſſible on the other ſide of the mountain, which we did not viſit. A great many ſcattered grottos are ſeen here; in one of which, according to Quareſmius, were depoſited the bodies of ſeveral anchorets, which are ſtill entire. I have heard the ſame thing aſſerted in the country, but I could never meet with any perſon who had ſeen them. Here we enjoyed the moſt beautiful proſpect imaginable. This part of the Mountain of Forty Days overlooks the mountain of Arabia, the country of Gilead, the country of the Ammonites, the plains of Moab, the plain of Jericho, the river Jordan, and the whole extent of the Red Sea. It was here that the devil ſaid to the ſon of God, "All theſe kingdoms will I give thee, if thou wilt fall down and worſhip me."

MOURNING, a particular dreſs or habit worn to ſignify grief on ſome melancholy occaſion, particularly the death of friends or of great public characters.—The modes of mourning are various in various countries; as alſo are the colours that obtain for that end. In Europe, the ordinary colour for mourning is black; in China, it is white; in Turkey, blue or violet; in Egypt, yellow; in Ethiopia, brown. White obtained formerly in Caſtile on the death of their princes. Herrera obſerves, that the laſt time it was uſed was in 1498, at the death of prince John. Each people pretend to have their reaſons for the particular colour of their mourning: white is ſuppoſed to denote purity; yellow, that death is the end of human hopes. in regard that leaves when they fall, and flowers when they fade, become yellow; brown denotes the earth, whither the dead return; black, the privation of life, as being the privation of light: blue expreſſes the happineſs which it is hoped the deceaſed does enjoy: and purple or violet, ſorrow on the one ſide, and hope on the other, as being a mixture of black and blue.

MOURNING, among the ancients, was expreſſed various ways.

Amongſt the Jews, on the death of their relations or intimate friends, grief or mourning was ſignified by weeping, tearing their clothes, ſmiting their breaſts, or tearing them with their nails, pulling or cutting off their hair and beards, walking ſoftly, *i, e.* bare foot, lying upon the ground, faſting, or eating upon the ground. They kept themſelves cloſe ſhut up in their houſes, covered their faces, and abſtained from all work, even reading the law, and ſaying their uſual prayers. They neither dreſſed themſelves nor made their beds, nor ſhaved themſelves, nor cut their nails, nor went into the bath, nor ſaluted any body: ſo that ſulkineſs ſeems to have been an indication of ſorrow; and dirtineſs, of diſtreſs. The time of mourning among the Jews was generally ſeven days: tho' this was lengthened or ſhortened according to circumſtances; but 30 days were thought ſufficient upon the ſevereſt occaſions. The different periods of the time of mourning required different degrees of grief, and different tokens of it.

The Greeks, on then death of friends, ſhowed their ſorrow by ſecluding themſelves from all gaiety, entertainments, games, public ſolemnities, the enjoyment of wine, and the delights of muſic. They ſat in gloomy and ſolitary places, ſtripped themſelves of all external ornaments, put on a courſe black ſtuff by way of mourning, tore their hair, ſhaved their heads, rolled themſelves in the duſt and mire, ſprinkled aſhes on their heads, ſmote their breaſts with their palms, tore their faces, and frequently cried out with a lamentable voice and drawling tone, reiterating the interjection ε, ε, ε, ε; hence funeral lamentations were called Ελεγοι. If they appeared in public during the time of mourning, they had a veil thrown over their faces and heads. During the funeral proceſſion, certain perſons called εξαρχοι θρηνων marched before, and ſung melancholy ſtrains called ογοφυρμοι Ιαλεμοι, Αιλοι and Αιλινοι. Theſe vocal mourners ſung thrice during the proceſſion round the pile and round the grave. Flutes were alſo uſed to heighten the ſolemnity. At the funerals of ſoldiers, their fellow-ſoldiers who attended, as a teſtimony of their affliction, held their ſhields, their ſpears, and the reſt of their armour, inverted.

As to the tokens of private grief among the Romans, they were the ſame as thoſe already obſerved as cuſtomary amongſt the Greeks. Black or dark-brown were the colour of the mourning habits worn by the men; they were alſo common to the women. The mourning of the emperors at firſt was black. In the time of Auguſtus, the women wore white veils, and the reſt of their dreſs black. From the time of Domitian they wore nothing but white habits, without any ornaments of gold, jewels, or pearls. The men let their hair and beards grow, and wore no wreaths of flowers on their heads while the days of mourning continued. The longeſt time of mourning was ten months; this was Numa's eſtabliſhment, and took in his whole year. For a widow to marry during this time was infamous. Mourning was not uſed for children who died under three years of age. From this age to ten they mourned as many months as the child was years old. A remarkable victory or other happy event, occaſioned the ſhortening of the time of mourning:

ing: The birth of a child, or the attainment of any remarkable honour in the family, certain feasts in honour of the gods, or the consecration of a temple, had the same effect. After the battle of Cannæ, the commonwealth decreed that mourning should not be worn for more than 30 days, that the loss might be forgot as soon as possible. When public magistrates died, or persons of great note, also when any remarkable calamity happened, all public meetings were intermitted the schools of exercise, baths, shops, temples, and all places of concourse, were shut up, and the whole city put on a face of sorrow: the senators laid aside the *laticlave*, and the consuls sat in a lower seat than ordinary. This was the custom of Athens also, and was observed upon the death of Socrates not long after he had been sentenced to death by their judges.

Preficæ, or mourning women, (by the Greeks called θρηνων εξαρχοι), went about the streets: this was customary among the Jews as well as the Greeks and Romans, (Jerem. ix. 17.)

MOUSE, in zoology. See Mus.

Mouse-Ear, in botany. See Hierachium.

Mouse Tail. See Myoxus.

Dor-Mouse. See Myohua.

Shrew-Mouse. Ser Sorex.

MOUSELLE, the name of an East Indian tree, with white tubular flowers, which fall off every day in great plenty. They are of a sweet agreeable smell and the Gentoos are very fond of wearing them, stringing and hanging them about their necks and arms. The fruit is a pale red-cherry, of the shape and size of our white heart-cherry, but the foot-stalk is not quite so long. This fruit has a stone in it containing a bitter oily kernel. The Indians rub with this oil any part stung by a scorpion or bitten by a centipede, which it soon cures. The crows are very fond of the fruit.

MOUSEL, or Mosul, a large city of Turkey in Asia, and capital of a Beglerbegate, stands on the west banks of the Tigris, in the latitude, according to Mr Ives's observation, of 36° 30. It is surrounded with stone-walls, but has many of its streets lying waste. Tavernier speaks of it as a ruined place, with only two blind markets and a sorry castle; yet, he says, that it is much frequented by merchants, and that its basha commands 3000 men. There is a bridge of boats over the Tigris; and the city is a thoroughfare from Persia to Syria, which makes it a place of trade, and which is more augmented by a constant traffic from this place to Bagdad. The country on this side the river is sandy and barren: but over against it is exceedingly fruitful, and yields very good crops of corn and fruit in abundance. Mr Ives says it was the best built city he had seen in Turkey; but had nothing in it to attract the notice of an European. It was besieged for near six months by Nadir Shah without success. Breaches were frequently made in the walls, and assaults continued for three days successively; but the assailants were constantly repulsed, and the breaches made in the day-time repaired during the night. The besieged had unanimously resolved to die rather than to submit. The Turks declared, that should the place be forced to surrender, they were determined to put to death all their wives and daughters first, that they might not fall into the vile hands of the abhorred Persians. The place was therefore defended with uncommon bravery; even the women and children exerted themselves with the greatest alacrity. The Christians behaved in such a manner as to gain the esteem and admiration of the other inhabitants; and some of their churches being demolished, they were afterwards repaired at the expence of government.

In this city there are a great many mosques, the largest and most stately of which is ornamented on the top with green tiles. At the doors of these houses there are usually inscriptions in gilt letters, declaring the awfulness of the building, as being the house of God. One of them has a minaret which bends like those of Bagdad. Some of the most bigotted Turks say, that Mahomet saluted this minaret as he passed; on which it bent its head in reverence to the prophet, and ever after continued in that situation. The manufacture of this city is *mussolen* (muslin), which is made very strong and pretty fine. In the year 1757 this city and the country adjacent was visited by a dreadful famine, owing to the preceding hard winter, and innumerable multitudes of locusts, by which the fruits of the earth were destroyed. When Mr Ives was there in 1758, the country was comparatively depopulated. Almost all the brute creation had been destroyed for the subsistence of man. During the famine the people had eaten dogs, and every kind of animal which is held in abhorrence at any other time, not sparing even their own children; and the dead bodies lay in the streets for want of people to bury them. Their fruit-trees were also destroyed by the frost; so that when our author was there scarce any fruit could be had. The neighbouring mountains afford silver mines; and they would yield much quicksilver if the Turks had either the skill or inclination to work them to advantage. Lanza says, that some time ago an Englishman who travelled through these parts got two or three bottles of it, which he presented to the basha as a specimen of what might be done in that way: but no farther attempt was made. Here also are some lead mines, which supply as much of that metal as furnishes them with bullets and some necessary utensils.

MOU-TAN, or peony-shrub of China: also called *hoa-vang*, or "the king of flowers;" and *peleang-kin*, "an hundred ounces of gold," in allusion to the excessive prices given formerly by some of the virtuosi for certain species of this plant. The mou-tan seems to claim pre-eminence, not only on account of the splendor and number of its flowers, and of the sweet odour which they diffuse around, but also on account of the multitude of leaves which compose them, and of the beautiful golden spots with which they are interspersed. This plant, which is of a shrubby nature, shoots forth a number of branches, which form a top almost as large as those of the finest orange-trees that are planted in boxes. Some of the mou-tan have been seen eight or ten feet in height. The reason why few are raised at present to this size is, because their flowers are less beautiful, and their branches being too weak, cannot sustain their weight. The root of the mou-tan is long and fibrous, of a pale yellow colour, and covered with a greyish or reddish rind. Its leaves are deeply indented, and of a much darker green above than below. Its flowers, which are composed of numberless

berless petals, blow like a rose, and are supported by a calyx composed of four leaves. From the bottoms of the petals arise several stamina without any order which bear on their tops small antheræ, of a beautiful golden colour. The fruit bend downwards like those of common peony, burst when they become dry, and shed their seeds.

Grosier's Hist. of China.

There are three kinds of mou-tan common mou-tan, dwarf mou-tan, and the mou-tan tree. The last species seems at present to be lost; some of them were formerly seen which were 25 feet in height. Dwarf mou-tan is little esteemed: a few plants of this kind are only cultivated to preserve the species. Common mou-tan, which has always been highly prized by florists, is more generally dispersed. It is raised like an espalier in form of a fan, bush, or orange-tree. Some of them flower in spring, others in summer, and some in autumn. These different species must each be cultivated in a different manner.

The vernal and summer mou-tan are those that are cultivated in greatest number; those of autumn require too slavish an attention during the great heat of the dog-days. The mou-tan of each season are divided into single and double; the former are subdivided into those of 100 leaves and 1000 leaves; the second have a large calyx filled with stamina, that bear on their tops gold coloured antheræ. These are the only kind that produce seed. The flowers of both appear under the different forms of a bason, pomegranate, marigold, &c. Some of the mou-tan are red, others violet, purple, yellow, white, black, and blue; and these colours, varied by as many shades, produce a prodigious number of different kinds. We are assured, that the Chinese florists have the secret of changing the colour of their mou tan, and of giving them whatever tints they please; but they cannot effect this change but upon those plants which have never produced flowers.

A mou-tan, to please the eye of a Chinese florist, must have a rough crooked stalk, full of knots, and of a blackish green colour; its branches must cross one another, and be twisted in a thousand fantastical figures; the shoots that proceed from them must be of a delicate green shaded with red; the leaves must be large, of a beautiful green, very thick, and supported by reddish stalks; its flowers must blow at different times, in form of a tuft, be all of the same colour, and stand erect upon their stems; they must also be seven or eight inches in diameter, and exale a sweet and agreeable odour.

MOUTH, in anatomy, a part of the face, consisting of the lips, the gums, the insides of the cheeks, the palate, the salival glands, the os hyoides, the uvula, and the tonsils, which see under the article ANATOMY.

Mr Derham observes, that the mouth in the several species of animals is nicely adapted to the uses of such a part, and well sized and shaped for the formation of speech, the gathering and receiving of food, the catching of prey, &c. In some creatures it is wide and large, in others little and narrow; in some it is formed with a deep incisure into the head, for the better catching and holding of prey, and more easy communution of hard, large, and troublesome food; and in others with a shorter incisure, for the gathering and holding of herbaceous food. In birds it is neatly shaped for piercing the air: hard and horny, to supply the want of teeth; hooked, in the rapacious kind, to catch and hold their prey; long and slender in those that have their food to grope for in moorish places; and broad and long in those that search for it in the mud. Nor is the mouth less remarkable in insects; in some it is forcipated, to catch, hold, and tear the prey; in others aculeated, to pierce and wound animals, and suck their blood; in others, strongly rigid, with jaws and teeth, to gnaw and scrape out their food, carry burdens, perforate the earth, nay the hardest wood, and even stones themselves, for houses and nests for their young.

MOUVANS (Paul Richard), surnamed the *Brave*, a Protestant officer, was born at Castellane in Provence, of a respectable family, and made a considerable figure in the civil wars of France during the 16th century. His brother, who was likewise a Protestant, having been killed in a popular tumult excited by the Romish priests at Draguignan, he took up arms to avenge his death; and, having assembled 2000 men, committed great devastations in Provence. Being pursued by the Count de Tende at the head of 6000 men, and finding himself too weak to keep the field, he took post in a convent strongly fortified by nature, and there resolved to defend himself to the last extremity. That the war might be terminated amicably, the Count de Tende proposed an interview; to which Mouvans agreed, on condition that his brother's murderers should be punished, and that those who had taken up arms with him should not be molested. These terms being accepted, he dismissed his troops, reserving only a guard of 50 men for the security of his person. This precaution was not unnecessary; for the parliament of Aix had received orders from court to punish him capitally for being concerned in the conspiracy of Amboise. The baron de la Garde made an attempt to apprehend him, but he was worsted and repulsed with considerable loss. Mouvans at length resolved to retire to Geneva, where his life would not be in danger; and there he lived for some time in tranquillity, nobly rejecting the splendid offers made him by the duke of Guise if he would join the Catholic party. He returned to France at the recommencement of the troubles, in consequence of the massacre of Vassy in 1562, and continued to distinguish himself in the Protestant armies. His conduct at Sisterou, where he commanded together with Captain Senas when that city was besieged by the Count de Sommerive, is particularly deserving of admiration. After sustaining an assault of seven hours, in which the besiegers were repulsed with considerable loss, Mouvans, perceiving that he was too weak to wait a second, determined to abandon the city, and left it during the night with his troops and those of the inhabitants who chose to accompany him, by a pass which the enemy had neglected to guard. The number of the inhabitants amounted to 4000 of every age and sex, men, women, children, and mothers with their infants at their breast. This body, in which there was not 1000 men fit to bear arms, directed their course towards Grenoble. Musketeers were placed in the front and rear, while the defenceless and unarmed occupied the centre. To add to the difficulty of the march, they were frequently obliged to go out of the way, and to cross steep and

ruggged

rugged mountains, in order to avoid the ambuscades which the enemy had laid for them on the road. They stopped some days to refresh themselves in the valleys of Angrone and Pragelas, where they were cordially received and supplied with provisions by the Vaudois. After a march of 21 or 22 days, and being exposed to the greatest fatigue and famine, the wretched fugitives at length arrived at Grenoble. The baron des Adrets sent them under an escort to Lyons, where they remained till the treaty of pacification. In 1568 Mouvans was defeated at Mesignae in Perigord, and lost his life in the engagement. Upon this occasion he commanded, together with Peter Gourde, the advanced guard of the Protestant army. It is alleged, that in despair he dashed out his brains against a tree.

MOWEE, one of the Sandwich islands discovered by Captain Cook, is 162 miles in circumference. A low isthmus divides it into two circular peninsulas, of which the eastern is double the size of the western. The mountains in both rise to an exceeding great height, and may be seen at the distance of more than 30 leagues. The northern shores, like those of Owyhee, afford no soundings, and the country presents the same appearance of verdure and fertility. Near the west point of the smaller peninsula is a spacious bay, with a sandy beach shaded with cocoa-nut trees. The country behind has a most romantic appearance, the hills rising almost perpendicularly in a great variety of peaked forms; and their steep sides and deep chasms between them are covered with trees. The tops of these hills are entirely bare, and of a reddish brown colour. The number of inhabitants are computed at about 65,000. E. Long. 204. 4. N. Lat. 20. 50.

MOXA, or MUGWORT of China; is a soft lanuginous substance, prepared in Japan from the young leaves of a species of ARTEMISIA, by beating them together when thoroughly dried, and rubbing them betwixt the hands till only the fine fibres are left. The down on the leaves of mullein, cotton, hemp, &c. do as well as moxa.

In the Eastern countries it is used by burning it on the skin; a little cone of the moxa is laid upon the part, previously moistened, and set on fire at the top; it burns down with a temperate glowing heat, and produces a dark coloured spot, the exulceration of which is promoted by applying a little garlic; the ulcer is left to discharge, or is soon healed according to the intention in using the moxa. See ARTEMISIA.

MOYLE (Walter), a learned English writer in the 18th century, descended of a good family in Cornwall, where he was born in 1672. He was sent to Oxford, and thence removed to the temple; where he applied himself chiefly to the general and more noble parts of the law, such as led him to the knowledge of the constitution of the English government. In 1697 he had a share with Mr Trenchard in writing a pamphlet, intitled, "An Argument showing that a Standing Army is inconsistent with a Free Goverment, and absolutely destructive to the Constitution of the English Monarchy." He translated Xenophon's Discourse upon Improvin g the State of Athens. He was for some time member of parliament, in which he always acted an honourable part; applying himself to the improvement and regulation of trade, and the employment of the poor, which has so near a connection with trade. He afterwards retired to his seat at Bake in Cornwall, where he applied himself with vigour to his studies, and died in 1721. In 1726, his works were printed at London, in 2 vols 8vo.

MOYRA. See MOIRA.

MUCILAGE, in pharmacy, is in general any viscid or glutinous liquor.

MUCILAGE, also imports the liquor which principally serves to moisten the ligaments and cartilages of the articulations, and is supplied by the mucilaginous glands.

MUCOR, in botany: A genus of the order of fungi, belonging to the cryptogamia class of plants. The fungus has vesicular heads supported by foot-stalks.—There are 12 species; the most remarkable of which are, 1. The spærocephalus, or grey round-headed mucor, growing upon rotten wood, and sometimes upon decayed plants and mosses. The stalks of this are generally black, about a line in height; bearing each at the top a spherical ball about the size of a pin's head; its coat or rind is covered with a grey powder, and containing within a black or fuscous spongy down. The coat bursts with a ragged, irregular margin. 2. The lichenoides, or little, black, pin-headed mucor. This species grows in groups near to each other, in chasms of the barks of old trees, and upon old park-pales. The stalks are black, about two lines in height; bearing each a single head, sometimes a double or treble one, of the size of mustard or poppy seeds, of a roundish figure at first, but when burst often flattish or truncated, and of a black colour. The internal powdered down is black with a tinge of green. 3. The mucedo, or common grey mould, grows on bread, fruits, plants, and other substances in a putrid state. It grows in clusters: the stalks a quarter of an inch high, pellucid, hollow, and cylindrical; supporting each a single globular head, at first transparent, afterwards dark grey; which bursts with elastic force, and ejects small round seeds discoverable by the microscope. 4. The glaucus, or grey cluster-headed mould. is found on rotten apples, melons, and other fruits: as also upon decayed wood, and the stalks of wheat. These are of a pellucid grey colour; the stalks generally single, supporting a spherical ball, which, when magnified, appears to be compounded of numerous, fine, moniliform, necklace-like radii. 5. The crustaceus, or fingered mould, is frequent upon corrupted food of various kinds. It is of a white aqueous colour; the stalks single, each supporting at the top four or five necklace-like radii, diverging from the same point or centre. 6. The septicus, or yellow frothy mucor, is found on the leaves of plants, such as ivy and beech, &c. sometimes upon dry sticks, and frequently upon the tan or bark in hot-houses. It is of no certain size or figure, but of a fine yellow colour, and a substance resembling at first cream beat up into froth. In the space of 24 hours it acquires a thin filmy coat, becomes dry and full of a sooty powder, adhering to downy threads. The seeds under the microscope appear to be globular. Haller ranks it under a new genus, which he terms *fuligo;* the characters of which are, that the plants contained under it are soft, and like butter at first, but soon change into a black sooty powder.

MUCUS, a mucilaginous liquor secreted by certain glands,

glands, and serving to lubricate many of the internal cavities of the body. In its natural state it is generally limpid and colourless; but, from certain causes, will often assume a thick consistence and whitish colour like pus. As it is sometimes of very great importance in medicine to distinguish these two fluids from each other, this was lately proposed as the subject of a prize disputation by the Æsculapian Society of Edinburgh. The prize was gained by Mr Charles Darwin student of medicine from Litchfield. The conclusions drawn from his experiments were,

1. Pus and mucus are both soluble in the vitriolic acid, though in very different proportions, pus being by far least soluble.

2. The addition of water to either of these compounds decomposes it. The mucus thus separated either swims in the mixture or forms large flocculi in it; whereas the pus falls to the bottom, and forms, on agitation, an uniform turbid mixture.

3. Pus is diffusible through a diluted vitriolic acid, though mucus is not. The same also occurs with water, or with a solution of sea-salt.

4. Nitrous acid dissolves both pus and mucus. Water added to the solution of pus produces a precipitate, and the fluid above becomes clear and green, while water and the solution of mucus form a turbid dirty-coloured fluid.

5. Alkaline lixivium dissolves, though sometimes with difficulty, mucus, and generally pus.

6. Water precipitates pus from such a mixture, but does not mucus.

7. Where alkaline lixivium does not dissolve pus, it still distinguishes it from mucus, as it then prevents its diffusion through water.

8. Coagulable lymph is neither soluble in concentrated nor diluted vitriolic acid.

9. Water produces no change on a solution of serum in alkaline lixivium, until after long standing, and then only a very slight sediment appears.

10. Corrosive sublimate coagulates mucus, but does not pus.

From the above experiments it appears, that strong vitriolic acid and water, diluted vitriolic acid, and caustic alkaline lixivium and water, will serve to distinguish pus from mucus; that the vitriolic acid can separate it from coagulable lymph, and alkaline lixivium from serum.

Hence, when a person has any expectorated matter, the decomposition of which he wishes to ascertain, let him dissolve it in vitriolic acid, and in caustic alkaline lixivium; and let him add pure water to both solutions. If there be a fair precipitation in each, he may be assured that some pus is present. But if there be a precipitation in neither, it is a certain test that the mixture is entirely mucus. If the matter cannot be made to dissolve in alkaline lixivium by time and trituration, we have also reason to believe that it is pus.

MUCK, or RUNNING A MUCK, is a practice that has prevailed time immemorial in Batavia. To run a muck, in the original sense of the word, is to get intoxicated with opium, and then rush into the street with a drawn weapon, and kill any one that comes in the way, till the party is himself either killed or taken prisoner. If the officer takes one of these *amocks* or *mohawks* (as they have been called by an easy corruption) alive, he has a considerable reward; and the unhappy wretches are always broken alive on the wheel: but such is the fury of their desperation, that three out of four are necessarily destroyed in attempting to secure them.

MUD IGUANA. See MURÆNA.

MUFFEL, in chemistry, a vessel much used in some metallurgic operations. In figure it represents an oblong arch or vault, the hinder part of which is closed by a semicircular plane, and the lower part or floor of which is a rectangular plane. It is a little oven that is placed horizontally in assay and enamelling furnaces, so that its open side corresponds with the door of the fire-place of the furnace. Under this arched oven small cupels or crucibles are placed; and the substances contained are thus exposed to heat without contact of fuel, smoke, or ashes.

MUFTI, the chief of the ecclesiastical order, or primate of the mussulman religion. The authority of the mufti is very great in the Ottoman empire; for even the sultan himself, if he would preserve any appearance of religion, cannot, without hearing his opinion, put any person to death, or so much as inflict any corporal punishment. In all actions, especially criminal ones, his opinion is required, by giving him a writing in which the case is stated under feigned names; which he subscribes with the words, *He shall*, or *Shall not be, punished*. Such outward honour is paid to the mufti, that the grand signior himself rises up to him, and advances seven steps to meet him when he comes into his presence. He alone has the honour of kissing the sultan's left shoulder, whilst the prime vizer kisses only the hem of his garment. When the grand signior addresses any writing to the mufti, he gives him the following titles: *To the esad, the wisest of the wise, instructed in all knowledge, the most excellent of excellents, abstaining from things unlawful, the spring of virtue and of true science, heir of the prophetic doctrines, resolver of the problems of faith, revealer of the orthodox articles, key of the treasures of truth, the light to the doubtful allegories, strengthened with the grace of the supreme legislator of mankind, may the Most High God perpetuate thy virtues!* The election of the mufti is solely in the grand signior, who presents him with a vest of rich sables, &c. If he is convicted of treason, or any great crime, he is put into a mortar kept for that purpose in the Seven Towers at Constantinople, and pounded to death.

MUGGLETONIANS, a religious sect which arose in England about the year 1657; so denominated from their leader Ludowick Muggleton, a journeyman taylor, who, with his associate Reeves, set up for great prophets, pretending, as it is said, to have an absolute power of saving and damning whom they pleased; and giving out that they were the two last witnesses of God that should appear before the end of the world.

MUGIL, the MULLET; in ichthyology, a genus of fishes belonging to the order of abdominales. The lips are membranaceous, the inferior one being carinated inwards; they have no teeth; the branchiostege membrane has seven crooked rays; the opercula are smooth and round; and the body is of a whitish colour. There are two species, distinguished by the number of rays in the back-fin.

The mullet is justly ranked by Aristotle among the *pisces littorales*, or those that prefer the shores to the full sea; they are found in great plenty on several of the sandy coasts of Britain, and haunt in particular those small bays that have influxes of fresh water. They come in great shoals, and keep rooting like hogs in the sand or mud, leaving their traces in form of large round holes. They are very cunning; and when surrounded with a net, the whole shoal frequently escapes by leaping over it; for when one takes the lead, the others are sure to follow. This circumstance is observed by Oppian; who also informs us, that if these fishes fail to get over at the first leap, they never attempt a second, but lie without motion as if they resigned themselves to their fate. Mr Pennant says he is uncertain whether this last observation holds good or not: however, Oppian had good opportunity of examining those fish, as they sometimes swarm on the coasts of the Mediterranean. Near Martegues, in the south of France, abundance of mullets are taken in weres made of reeds placed in the shallows. Of the milts of the males, which are there called *allectants*, and of the roes of females, which are called *botar*, is made botargo. The materials are taken out entire, covered with salt for four or five hours, then pressed a little between two boards or stones, washed, and at last dried in the sun for 13 or 14 days.

This fish was sometimes made the instrument of a horrible punishment for unfortunate gallants. It was used both at Athens and Rome; but it is very doubtful whether it was a legal punishment or not. By Horace it is mentioned in the following lines:

> Discincta tunica fugiendum est, ac pede nudo;
> Ne nummi pereant, aut PYGA, aut denique fama.
> SAT. II. lib. i. 132.

The mullet is an excellent fish for the table, but at present not a fashionable one. The albula * is caught in great quantities about the Bahama islands at the times they go in shoals to spawn; and is there esteemed very good eating.

* Plate CCCXV.

MUGWORT, in botany; a species of ARTEMISIA. An infusion of this plant in white wine, or a bath made of it, has been always esteemed an emmenagogue, and useful in difficult parturition. The leaves, when young and tender, are frequently made use of by the Highlanders of Scotland as a pot herb. The country-people in Sweden drink a decoction of them for the ague.

MUID, a large measure in use among the French, for things dry. The muid is no real vessel used as a measure, but an estimation of several other measures; as the septier, mine, minot, bushel, &c.

MUID, is also one of the nine casks, or regular vessels used in France, to put wine and other liquors in. The muid of wine is divided into two demi-muids, four quarter muids, and eight half quarter muids containing 36 septiers.

MULATTO, a name given to those who are begotten by a negro man on a white woman, or by an white man on a negro woman.

MULBERRY, in botany. See MORUS.

Mulberry-Cyder, a name given by the people of Devonshire, and some other parts of England, to a sort of Cyder rendered very palatable by an admixture of mulberry juice in the making: they choose for the purpose the ripest and blackest mulberries, and pressing out their juice and mixing it with a full-bodied cyder at the time of the grinding and pressing, give just so much of it as adds a perceptible flavour. It is very worthy the attention of people who live in other countries, where strong and good cyder is made, that this renders it a sort of wine much more agreeable than any other English liquor, and might be brought into general use, to the great advantage of the dealer. The colour of this liquor resembles that of the brightest red wine, and the flavour of the mulberry never goes off. Phil. Transf. N° 133.

MULCT, a fine of money laid upon a man who has committed some fault or misdemeanour.

MULE, in zoology, a mongrel kind of quadruped, usually generated between an ass and a mare, and sometimes between a horse and a she-ass; but the signification of the word is commonly extended to every kind of animal produced by a mixture of two different species. There are two kinds of these animals; one from the he-ass and mare, the other from the horse and the she-ass. We call them indifferently *mules*, but the Romans distinguished them by proper appellations. The first kind are the best and most esteemed: as being larger, stronger, and having least of the ass in their disposition. The largest and stoutest asses, and the fairest and finest mares, are chosen in those countries where these creatures are most in use; as in Spain, Italy, and Flanders. In the last especially, they succeeded in having very stately mules from the size of their mares, some of them 16 and some 17 hands high, which are very serviceable as sumpter-mules in the army. But since the Low countries are no longer under the dominion of Spain, they breed fewer mules. These creatures are very much commended for their being stronger, surer footed, going easier, being more cheaply maintained, and lasting longer than horses. They are commonly of a black-brown, or quite black, with that shining list along the back and cross the shoulders which distinguishes asses. In former times they were much more common in Britain than at present; being often brought over in the days of Popery by the Italian prelates. They continued longest in the service of millers; and are yet in use among them in some places, on account of the great loads they carry on their back. As they are capable of being trained for riding, bearing burdens, and for draught, there is no doubt that they might be usefully employed in many different services. But they are commonly found to be vicious, stubborn, and obstinate to a proverb; which whether it occasions or is produced by the ill usage they meet with, is a point not easily settled. Whatever may be the case of asses, it is allowed that mules are larger, fairer, and more serviceable in mild than in warm climates. In the British American colonies, both on the continent and in the islands, but especially in the latter, they are much used and esteemed; so that they are frequently sent to them from England, suffer less in the passage, and die much seldomer than horses, and commonly yield, when they arrive, no inconsiderable profit.

It has commonly been asserted, that animals produced by the mixture of two heterogeneous species are incapable of generating, and thus perpetuating the monstrous breed; but this, we are informed by M. Buffon, is now discovered to be a mistake. Aristotle, says he, tells us, that the mule engenders with the mare, and that the junction produces an animal which the Greeks call *hinnus*, or *ginnus*. He likewise

Mule.

wise remarks, that the she mule easily conceives, but seldom brings the fœtus to perfection. But the most remarkable and well attested instance of this fact, is mentioned in a letter read by M. d'Alembert before the academy of sciences, which informed him that a she-mule in the island of St Domingo had brought forth a foal. The fact was attested by persons of the most unquestionable veracity; and other instances, though not so well authenticated, are adduced by our author. We may therefore, continues M. Buffon, consider it as an established fact, that the he-mule can generate and the she-mule produce. Like other animals, they have a seminal liquor, and all the organs necessary to generation. But mongrel animals are always less fertile and more tardy than those of a pure species. Besides, mules have never produced in cold climates, seldom in warm regions, and still more seldom in temperate countries. Hence their barrenness, without being absolute, may be regarded as positive; since their productions are so rare, that a few examples can be only collected.

The translator of Buffon's works, in a note on the passage above quoted, has given a remarkable and well authenticated instance of the prolific powers of a she-mule in the north of Scotland. Having heard that a mule belonging to Mr David Tullo farmer in Auchtertyre in the county of Forfar, had some years ago brought forth a foal, he transmitted a few queries to be put to Mr Tullo; and requested that his answers might be legally attested before a magistrate. This request was cheerfully complied with; and the following is an exact copy of the queries, answers, and attestations.

Interrogatories to be put to Mr Tullo tenant in Auchtertyre, parish of Newtyle, and county of Forfar, with his answers thereto.

1mo, Had you ever a she-mule? At what period? Is it true that the mule had a foal? and what time was she covered; and when did she foal?—Answered by Mr Tullo: that he bought a she-mule about 20 years ago: That she was constantly in season for a horse: That, about some years thereafter, he gave her a horse; and that she thereafter gave him a foal, about the 10th of June. The mule's price was L. 4, 5s. Sterling.

2do, What was the colour of the foal? Was there any thing particular in its figure?—Answer: The foal was exactly the colour of its mother, inclined to black, with a very large head, big ears, and small tail; and the declarant thinks, had its head been weighed when foaled, it would have weighed nearly as much as its body.

3tio, How long was the animal allowed to live?—Answer: The next day after the mule foaled, it was sent, with its mother, to the Loch of Lundie, in order to let the foal die, as the declarant could not want the mule's work, and the mother seemed not fond of the foal: That it was accordingly left, and the next day came to Auchtertyre, about two miles distance, over a hill, with the cattle of Auchtertyre, that had been grazing near to that place, and was drowned in a ditch the day following.

4to. Was its skin preserved, or the head, or any other bones of the skeleton? Could any part thereof be still found? Answered: Neither the skin nor any part of the skeleton was preserved, nor can be now had; though the declarant has often regretted the not preserving the foal, as its mother always performed any work that a horse of 15l. value could do.

Mule. Mulhausen.

5to, Is the mother still alive? What is her age?—Answer: The mother died about eight years ago, of an epidemic cold that was raging among the horses in this country: the mule had little or no milk after foaling, and the foal got some cows milk: And this is all that he remembers of the matter. DAVID TULLO.

Auchtertyre. 4th Feb. 1780. We James Small tenant in Burmouth, and Robert Ramsay tenant in Newtyle, hereby certify, That we have often seen the mule above described; and we know that she had a foal, as is narrated by David Tullo.

JAMES SMALL. ROB. RAMSY.

Ballantyne-house, 4th Feb. 1780. The within interrogatories were put to David Tullo tenant in Auchtertyre, anent the mule he had, and the foal she produced; to which he gave the answers subjoined to each query, and signed them; as did James Small and Robert Ramsay, attesting the truth thereof, in presence of GEORGE WATSON, J. P.

The original attestation is in the possession of the translator; and he lately transmitted notorial or authenticated copies of it to the count de Buffon, and to Thomas Pennant, Esq; of Downing, in Flintshire.

MULES, among gardeners, denote a sort of vegetable monsters produced by putting the farina fœcundans of one species of plant into the pistil or utricle of another.

The carnation and sweet-william being somewhat alike in their parts, particularly their flowers, the farina of the one will impregnate the other, and the seed so enlivened will produce a plant differing from either. An instance of this we first had in Mr Fairchild's garden at Hoxton; where a plant is seen neither sweet-william nor carnation, but resembling both equally: this was raised from the seed of a carnation that had been impregnated by the farina of the sweet-william. These couplings being not unlike those of the mare with the ass, which produce the mule, the same name is given them; and they are, like the others, incapable of multiplying their species.

This furnishes a hint for altering the property and taste of any fruit, by impregnating one tree with the farina of another of the same class; *e. gr.* a codlin with a pear-main, which will occasion the codlin so impregnated to last a longer time than usual, and to be of a sharper taste. Or if the winter-fruits be fecundated with the dust of the summer kinds, they will ripen before their usual time. And from this accidental coupling of the farina of one with another, it may possibly be, that an orchard where there is variety of apples, even the fruit gathered from the same tree differ in their flavour, and in the season of maturity. It is also from the same accidental coupling that the numberless varieties of fruits and flowers raised every day from seed proceed.

Wild or Fecund MULE. See EQUUS, p. 712.

MULHAUSEN, an imperial and Hanseatic town of Germany in Upper Saxony, and in Thuringia, under the protection of the elector of Saxony; seated in in a fertile country, on the river Urnstrutht, 15 miles north east of Eisenach, and 45 east by south of Cassel, E. Long. 10. 49. N. Lat. 51. 13.

Mulhausen, a considerable town of Germany, in Alsace, and capital of a republic in alliance with the Swiss. It is populous, well built, and adorned with handsome public structures; seated in a pleasant fertile country, on an island formed by the river Ill, 15 miles north-west of Basle, and 20 east of Befort. E. Long. 7. 24. N. Lat. 47. 48.

MULIER, in law, signifies the lawful issue born in wedlock, though begotten before. The mulier is preferred to an elder brother born out of matrimony; as for instance, if a man has a son by a woman before marriage, which issue is a bastard, and afterwards marries the mother of the bastard, and they have another son, this second son is mulier and lawful, and shall be heir of the father; but the other can be heir to no person *. By the civil law, where a man has issue by a woman, if after that he marries her, the issue is mulier.

* See the article Bastard.

MULL, one of the Western Islands of Scotland, about 25 miles long, and as much in breadth. It is in general rocky and barren, not producing a sufficient quantity of corn for the inhabitants; but a great number of cattle are annually exported, which with the fishings and a considerable quantity of kelp are the only articles of commerce. It is deeply indented with bays and creeks, forming in several parts good natural harbours. There are no villages except Tobermorey, near the northern point of the island, where a fishing station has been lately erected. The island was originally part of the dominions of the Lords of the Isles; but in after-times it became part of the possessions of the ancient and valiant family of Macleans, who still retain one-half. The other is the litigated property of the duke of Argyle, whose ancestor possessed himself of it in 1674, on account of a debt; but after the courts of law had made an adjudication in his favour, he was obliged to support their decree by force of arms. The ruins of several ancient castles are seen on this island.

Mull of Cantyre. See Cantyre.

Mull of Galloway. See Galloway.

MULLEIN, See Verbascum.

MULLER or Regiomontanus (John), a celebrated astronomer of the 15th century, was born at Koningshoven in Franconia in 1436, and acquired great reputation by publishing an abridgment of Ptolemy's Almagest, which had been begun by Purback. He went to Rome to perfect himself in the Greek tongue, and to see the Cardinal Bassarion; but finding some faults in the Latin translations of George de Trebizond, that translator's son assassinated him in a second journey he made to Rome in 1476, where Pope Sextus IV. had provided for him the archbishopric of Ratisbon, and had sent for him to reform the calendar. Others say that he died of the plague.

Muller (John) a noted engraver, who flourished about the year 1600, and had been bred under Henry Goltzius, whose style he closely imitated. The facility with which he handled the graver (for he worked with that instrument only) cannot be sufficiently expressed; his works must be seen, to convey a proper idea of it to the mind. His engravings are valuable, as productions of a very extraordinary nature; exclusive of which they have a prodigious share of merit. Among his most estimable performances may be mentioned, 1. The hand writing on the wall, a middling-sized plate lengthwise, from his own composition. 2. The adoration of the wise men, the same, from the same. Fine impressions of both these prints are very rare. 3. The resurrection of Lazarus, a large plate lengthwise, from Abraham Bloemart. He engraved also several much esteemed portraits.

Muller, or *Mullar*, denotes a stone flat and even at bottom, but round at top; used for grinding of matters on a marble.—The apothecaries use mullers to prepare many of their testaceous powders; and painters for their colours, either dry or in oil.

Muller is an instrument used by the glass-grinders; being a piece of wood, to one end whereof is cemented the glass to be ground, whether convex in a bason, or concave in a sphere or bowl.—The muller is ordinarily about six inches long, turned round: the cement they use is composed of ashes and pitch. See Grinding.

MULLERAS, a town of Germany, in the circle of Upper Saxony, and marquisate of Brandenburg, seated 38 miles south of Berlin, upon a canal which joins the Oder and the Spree. This canal is 15 miles in length, 10 yards in breadth, and seven feet in depth. It was eight years in making, and since that time the cities of Hamburg and Breslaw have carried on great trade by water. E. Long. 14. 50. N. Lat. 52. 21.

MULLET, in ichthyology. See Mugil.

Mullet, or *Mollet*, in heraldry, a bearing in form of the rowel of a spur, which it originally represented.

MULLINGAR, a borough or mannor in the county of Westmeath, and province of Leinster, in Ireland, 30 miles from Dublin. It is the shire town of that county, and has a barrack for two troops of horse. It returns two members to parliament; patron the earl of Granard. This is a post town. N. Lat. 53. 30. W. Long. 7. 50. Within a few miles of it are the ruins of a church, and also those of a castle. It is situated on the river Feyle. It holds a great wool fair, and is a place of good trade. In 1227, the priory of St Mary, formerly known by the name of *The House of God of Mullingar*, was founded here by Ralph de Petyt bishop of Meath, for regular canons of the order of St Augustin. A Dominican friary was also founded here in 1237 by the family of Nugent; some ruins of which still remain. In 1622, the friars of Multifarnham began to erect a house here for friars of the order of St Francis, but it was never completed. Fairs are held here 6th April, 4th and 5th July, 29th August, and 11th November.

MULLUS, the Surmullet, in ichthyology, a genus of fishes belonging to the order of Thoracici. See Plate CCCXV. This fish was highly esteemed by the Romans, and bore an exceedingly high price. The capricious epicures of Horace's days valued it in proportion to its size; not that the larger were more delicious, but that they were more difficult to be got. The price that was given for one in the time of Juvenal

venal and Pliny is a ſtriking evidence of the luxury and extravagance of the age:

Mullum ſex millibus emit
Æquantem ſane paribus ſeſtertia libris *. Juv. Sat. IV.

The laviſh ſlave
Six thouſand pieces for a mullet gave,
A ſeſterce for each pound. Dryden.

* L. 48. 8 s. 9 d.

Pennant. But Aſinius Celer, a man of conſular dignity, gave a ſtill more unconſcionable ſum; for he did not ſcruple beſtowing 8000 *nummi*, or 64 l. 11 s. 8 d. for a fiſh of ſo ſmall a ſize as the mullet: for, according to Horace, a *mullus trilibris*, or one of three lb. was a great rarity; ſo that Juvenal's ſpark muſt have had a great bargain in compariſon of what Celer had. But Seneca ſays, that it was not worth a farthing except it died in the very hand of your gueſt; that ſuch was the luxury of the times, that there were ſtews even in the eating-rooms, ſo that the fiſh could at once be brought from under the table, and placed on it; and that they put the mullets in tranſparent vaſes, that they might be entertained with the various changes of its rich colour while it lay expiring. Apicius, a wonderful genius for luxurious inventions, firſt hit upon the method of ſuffocating them in the exquiſite Carthaginian pickle, and afterwards procured a rich ſauce from their livers.—This is the ſame gentleman whom Pliny, in another place, honours with the title of *Nepotum omnium altiſſimus gurges;* an expreſſion too forcible to be rendered in our language. The body of this fiſh is very thick, and covered with large ſcales; beneath them the colour is a moſt beautiful roſy red, the changes of which under the thin ſcales gave that entertainment to the Roman epicures as abovementioned: the ſcales on the back and ſides are of a dirty orange; thoſe on the noſe a bright yellow; the tail a reddiſh yellow.

MULTIPLE, in arithmetic, a number which comprehends ſome other ſeveral times: thus 6 is a multiple of 2, and 12 is a multiple of 6, 4, and 3; comprehending the firſt twice, the ſecond thrice, &c.

Action of MULTIPLEPOINDING, in Scots law. See Law, n° clxxxiii. 24.

MULTIPLICAND, in arithmetic, the number to be multiplied by another. See Arithmetic.

MULTIPLICATION, in general, the act of increaſing the number of any thing.

Multiplication, in arithmetic, is a rule by which any given number may be ſpeedily increaſed, according to any propoſed number of times. See Arithmetic.

Multiplication, in algebra. See Algebra, p. 401.

MULTIPLICATOR, or Multiplier, in arithmetic, the number by which any other is multiplied, or the number of times it is ſuppoſed to be taken.

MULTIPLICATUS flos, a luxuriant flower, whoſe petals are multiplied ſo as to exclude a part of the ſtamina.

A multiplied luxuriant flower differs from a full one, the higheſt degree of luxuriance, in that the petals of the latter are ſo multiplied as to exclude all the ſtamina: whereas thoſe of the former are only repeated or multiplied, two, or three, or four times, as to the excluſion of only a ſmall part of the eſſential organs.

MULTIPLYING-glass, in optics, a glaſs wherewith objects appear increaſed in number. See (the *Index* ſubjoined to) Optics.

MULTURE, in Scots law, a certain ſtipulated quantity of meal given as payment to the proprietor or tackſman of a mill for grinding the corn; and all corn ground on farms thirled to the mill is obliged to pay multure whether the corn be ground at that mill or elſewhere.

MULVIA, a river of Barbary in Africa, which riſes in the mountains of Atlas, and divides the empire of Morocco from that of Algiers, and then falls into the Mediterranean, to the weſtward of Marſalquiver.

MUM, a kind of malt-liquor much drank in Germany, and chiefly brought from Brunſwick, which is the place of moſt note for making it. The proceſs of brewing mum, as recorded in the town-houſe of that city, is as follows. Take 63 gallons of water that has been boiled till one-third part is conſumed, and brew it with ſeven buſhels of wheaten malt, one buſhel of oat-meal, and one buſhel of ground beans. When it is tunned, the hogſhead muſt not be filled too full at firſt: as ſoon as it begins to work, put into it three pounds of the inner rind of fir, one pound of the tops of fir and beech, three handfuls of carduus benedictus, a handful or two of the flower of roſa ſolis: and burnet, betony, marjoram, avens, pennyroyal, and wild thyme, of each an handful aad an half; of elder flowers, two handfuls or more; ſeeds of cardamum bruiſed, 30 ounces; barberries bruiſed, one ounce: when the liquor has worked a while, put the herbs and ſeeds into the veſſel; and, after they are added, let it work over as little as poſſible; then fill it up: laſtly, when it is ſtopped, put into the hogſhead ten new-laid eggs unbroken; ſtop it up cloſe, and uſe it at two years end. The Engliſh brewers, inſtead of the inner rind of fir, uſe cardamum, ginger, and ſaſafras; and alſo add elcampane, madder, and red ſanders.

MUMIA. See Pissaphaltum.

MUMMIUS (L.), a Roman conſul ſent againſt the Achæans, whom he conquered B. C. 147. He deſtroyed Corinth, Thebes, and Chalcis, by order of the ſenate, and obtained the ſurname of *Achaicus* from his victories. He did not enrich himſelf with the ſpoils of the enemy, but returned home without any increaſe of fortune. He was ſo unacquainted with the value of the paintings and works of the moſt celebrated artiſts of Greece which were found in the plunder of Corinth, that he ſaid to thoſe who conveyed them to Rome, that if they loſt them or injured them, they ſhould make others in their ſtead.

MUMMY, a body embalmed or dried, in the manner uſed by the ancient Egyptians; or the compoſition with which it is embalmed. There are two kinds of bodies denominated *mummies*. The firſt are only carcaſes dried by the heat of the ſun, and by that means kept from putrefaction: theſe are frequently found in the ſands of Libya. Some imagine, that theſe are the bodies of deceaſed people buried there on purpoſe to keep them entire without embalming; others think they are the carcaſes of travellers who have been overwhelmed by the clouds of ſand raiſed by the hurricanes frequent in thoſe deſarts. The ſecond kind of mummies are bodies taken out of the catacombs near Cairo, in which the Egyptians depoſited their dead after embalming. See Embalming.

We have two different ſubſtances preſerved for medicinal uſe under the name of *mummy*, though both in ſome degree of the ſame origin. The one is the dried and preſerved fleſh of human bodies, embalmed with myrrh and ſpices; the other is the liquor running from ſuch mummies, when nearly prepared, or when affected by great heat or damps. The latter is ſometimes in a liquid, ſometimes of a ſolid form, as it is preſerved in vials well ſtopped, or ſuffered to dry and harden in the air. The firſt kind of mummy is brought to us in large pieces, of a lax and friable texture, light and ſpungy, of a blackiſh brown colour, and often damp and clammy on the ſurface: it is of a ſtrong but diſagreeable ſmell. The ſecond kind of mummy, in its liquid ſtate, is a thick, opaque, and viſcous fluid, of a blackiſh colour, but not diſagreeable ſmell. In its indurated ſtate, it is a dry ſolid ſubſtance, of a fine ſhining black colour, and cloſe texture, eaſily broken, and of a good ſmell; very inflammaeble, and yielding a ſcent of myrrh and aromatic ingredients while burning. This, if we cannot be content without medicines from our own bodies, ought to be the mummy uſed in the ſhops; but it is very ſcarce and dear; while the other is ſo cheap, that it will always be moſt in uſe.

All theſe kinds of mummies are brought from Egypt. But we are not to imagine, that any body breaks up the real Egyptian mummies, to ſell them in pieces to the druggiſts, as they make a much better market of them in Europe whole, when they can contrive to get them. What our druggiſts are ſupplied with, is the fleſh of executed criminals, or of any other bodies the Jews can get, who fill them with the common bitumen, ſo plentiful in that part of the world; and adding a little aloes, and two or three other cheap ingredients, ſend them to be baked in an oven, till the juices are exhaled, and the embalming matter has penetrated ſo thoroughly that the fleſh will keep and bear tranſporting into Europe. Mummy has been eſteemed reſolvent and balſamic: but whatever virtues have been attributed to it, ſeem to be ſuch as depend more upon the ingredients uſed in preparing the fleſh than in the fleſh itſelf; and it would ſurely be better to give thoſe ingredients without ſo ſhocking an addition.

There are found in Poland a kind of natural mummies, or human bodies preſerved without the aſſiſtance of art. Theſe lie in conſiderable numbers in ſome of the vaſt caverns in that country. They are dried with the fleſh and ſkin ſhrunk up almoſt cloſe to the bones, and are of a blackiſh colour. In the wars which ſeveral ages ago laid waſte that country, it was common for parties of the weaker ſide to retire into theſe caves, where their enemies, if they found them out, ſuffocated them by burning ſtraw, &c. at the mouth of the cavern, and then left the bodies; which, being out of the way of injuries from common accidents, have lain there ever ſince.

Mineral Mummy. See Pissaphaltum.

Mummy, among gardeners, a kind of wax uſed in grafting and planting the roots of trees, made in the following manner: Take one pound of black pitch, and a quarter of a pound of turpentine; put them together into an earthen pot, and ſet them on fire in the open air, holding ſomething in your hand to cover and quench the mixture in time, which is to be alternately lighted and quenched till all the nitrous and volatile parts be evaporated. To this a little common wax is to be added; and the compoſition is then to be ſet by for uſe.

MUMPS. See Medicine-*Index*.

MUNDA, an ancient town of Spain, in the kingdom of Granada, ſeated on the declivity of a hill, at the bottom of which runs a river. W. Long. 4. 13. N. Lat. 48. 15.

This city was anciently famous for a victory gained by Cæſar over the two ſons of Pompey, who had collected an army in Spain after the defeat of their father at Pharſalia. See *(Hiſtory of)* Rome.

The Pompeys poſted their army advantageouſly on a riſing ground, whereof one ſide was defended by the city of Munda, and the other by a ſmall river which watered the plain, and by a marſh; ſo that the enemy could not attack them but in front. Cæſar likewiſe drew up his troops with great art, and having advanced a little way from his camp, ordered them to halt, expecting the enemy would abandon their advantageous poſt, and come to meet him. But as they did not ſtir, Cæſar made as if he intended to fortify himſelf in that poſt; which induced the young general, who looked upon this as a ſign of fear, to advance into the plain, and attack the enemy before they could ſecure themſelves with any works. Pompey's army was by far the moſt numerous; for it conſiſted of 13 legions, 6000 horſe, and an incredible number of auxiliaries, among whom were all the forces of Bocchus king of Mauritania, commanded by his two ſons, both youths of great valour and bravery. Cæſar had 80 cohorts, three legions, to wit, the third, the fifth, and the tenth, and a body of 8000 horſe. As the enemy drew near, Cæſar betrayed a great deal of uneaſineſs and concern, as if he were doubtful of the ſucceſs, knowing he was to engage men no way inferior in valour and experience to his own, and commanded by officers who had on many occaſions given ſignal proofs of their bravery and conduct. Cneius, the elder of the two brothers, was generally looked upon as an able commander; and Labienus, who had revolted, eſteemed ſcarce inferior to himſelf.

However, the dictator, deſirous to put an end to the civil war, either by his own death or that of his rivals, gave the ſignal for the battle, and fell upon the enemy with his uſual vigour and reſolution. At the firſt onſet, which was dreadful, the auxiliaries on both ſides betook themſelves to flight, leaving the Romans to decide their quarrel by themſelves. Then the legionaries engaged with a fury hardly to be expreſſed; Cæſar's men being encouraged by the hopes of putting an end to all their labours by this battle, and thoſe of Pompey exerting themſelves out of neceſſity and deſpair, ſince moſt of them expected no quarter, as having been formerly pardoned. Never was victory more obſtinately diſputed. Cæſar's men, who had been always uſed to conquer, found themſelves ſo vigorouſly charged by the enemy's legionaries, that they began to give ground; and though they did not turn their backs, yet it was manifeſt that ſhame alone kept them in their poſts. All authors agree, that Cæſar had never been in ſo great danger; and he himſelf, when he came back to his camp, told his friends, that he had often fought for victory, but this was the firſt time he had ever fought for life. Thinking himſelf abandoned ed by fortune, which had hitherto favoured him, he had ſome thoughts of ſtabbing himſelf with his own ſword, and by a voluntary death preventing the diſgrace of a defeat; but returning ſoon to himſelf, and concluding it would be more to his reputation to fail by the enemy's hand at the head of his troops, than, in a fit of deſpair, by his own, he diſmounted from his horſe, and ſnatching a buckler from one of his legionaries, he threw himſelf like a man in deſpair into the midſt of the enemy; crying out to his men, *Are you not aſhamed to deliver your general into the hands of boys?* At theſe words, the ſoldiers of the tenth legion, animated by the example of their general, fell upon the enemy with freſh vigour, and made a dreadful havock of them. But in ſpite of their utmoſt efforts, Pompey's men ſtill kept their ground, and though greatly fatigued, returned to the charge with equal vigour, Then the Cæſarians began to deſpair of victory; and the dictator, running through the ranks of his diſheartened legionaries, had much ado to keep them together. The battle had already laſted from the riſing to the ſetting of the ſun, without any conſiderable advantage on either ſide.

At length a mere accident decided the diſpute in favour of the dictator. Bogud, a petty, king of Mauritania, had joined Cæſar ſoon after his arrival in Spain, with ſome ſquadrons of Numidian horſe; but, in the very beginning of the battle, being terrified at the ſhouting of the ſoldiers, intermingled with groans, and the claſhing of their arms, he had abandoned his poſt, and retired with the auxilliaries under his command to a riſing ground at a ſmall diſtance from the enemy's camp. There he continued the whole day an idle ſpectator of the battle that was fought in the plain. But towards the evening, partly out of ſhame and partly out of compaſſion for his friend Cæſar, he reſolved to fall upon Pompey's camp; and accordingly flew thither with all the forces he had with him. Labienus, appriſed of his deſign, haſtened after him to the defence of the camp; which Cæſar obſerving, cried to his legionaries, *Courage, fellow-ſoldiers! the victory at length is ours; Labienus flies.* This artifice had the deſired effect: Cæſar's men, believing that Labienus was truly fled, made a laſt effort, and charged the wing he commanded ſo briſkly, that after a moſt obſtinate diſpute they put them to flight.

Though the enemy's left wing was thus entirely defeated, the right wing, where the elder Pompey commanded ſtill kept their ground for ſome time. Pompey diſmounting from his horſe fought on foot like a private man in the firſt line, till moſt of his legionaries being killed, he was forced to ſave himſelf by flight from falling into the enemy's hands. Part of his troops fled back to their camp, and part took ſhelter in the city of Munda. The camp was immediately attacked, and taken ſword in hand; and as for the city, Cæſar, without loſs of time, drew a line of circumvallation round it. This victory was gained on the 16th of the kalends of April, *i. e.* according to our way of counting, on the 17th day of March, when the Dionyſian feſtival, or the Liberalia, were celebrated at Rome; the very day, as Plutarch obſerves, in which Pompey the Great, four years before, had ſet out for the war. In this action Pompey loſt 30,000 men; among whom were the famous Labienus, Attius Varus, and 3000 Roman knights. Seventeen officers of diſtinction were taken, and all the enemy's eagles and enſigns, together with Pompey's faſces, which he had aſſumed as governor of Spain. On Cæſar's ſide only 1000 men were killed and 500 wounded.

MUNDIC, or MARCASITE. See MARCASITE.

MUNDINGOES, the name of a people who live on the ſides of the river Gambia in Africa, and who are of a jet black colour, ſtrong, and well made. They have a prieſt ſent over every year from one of the Cape de Verde iſlands to chriſten and marry.

MUNDUS PATENS, the open world, in Roman antiquity, a ſolemnity performed in a ſmall temple, of a round form like the world, dedicated to *Dis* and the reſt of the infernal gods. This temple was opened but three times in the year, *viz.* the 24th of Auguſt, the 4th of October, and the 7th of November During theſe days, the Romans believed hell was open; on theſe days therefore they never offered battle, liſted ſoldiers, put out to ſea, or married.

MUNICH, a town of Germany, capital of the whole duchy of Bavaria, and the reſidence of the elector. It ſtands on the Iſer, 70 miles ſouth of Ratiſbon and 214 weſt of Vienna, being one of the moſt pleaſant and populous cities of Germany for its bigneſs. The number of the inhabitants is ſaid to be about 40,000. Having been built at firſt on a ſpot of ground belonging to a convent, it had from thence in German the name of *Munchen*, i. e. *Monk's-town*, and a monk for its arms. The elector's palace here is a very grand ſtructure, conſiſting of ſeveral courts, furniſhed and adorned in the moſt magnificent manner, with tapeſtry, gilding, ſculpture, ſtatues, and paintings. It contains an amazing collection of jewels, antiquities, and curioſities. The great hall is 118 feet long and 52 broad; and the ſtair-caſe leading to it, from top to bottom, of Marble and gold. In the hall of antiquities are 354 buſts and ſtatues of jaſper and porphyry, braſs and marble. In this palace alſo is a library, containing a vaſt collection of books, and many valuable manuſcripts, in moſt languages, ancient and modern; and a chamber of rarities, among which is the picture of a bravo or aſſaſſin, who is ſaid to have committed 345 murders with his own hand, and to have been accomplice in or privy to 400 more. The treaſury in the chapel contains alſo a vaſt number of pictures, precious ſtones, medals, veſſels of gold and ſilver,, &c. Among other curioſities, here is a cherry-ſtone with 140 heads diſtinctly engraven upon it. The gardens of the palace are alſo very fine, and it is ſaid a ſecret paſſage leads from it to all the churches and convents in the town. There is a great number of other fine buildings in this city, public and private, particularly the riding-houſe, town-houſe, opera-room, the Jeſuits college, the large edifice for tournaments, the churches, convents, fountains, &c. Its manufactures are thoſe of ſilk, particularly velvet, woollen cloths, and tapeſtry; and it has two annual fairs, at which great quantities of ſalt, wine, &c. are ſold. The ſtreets are broad and regular; and moſt of the houſes well built, and painted on the outſide. The market place is extremely beautiful. Not far from Munich are four other palaces, with fine gardens, belonging to the elector, *viz.* thoſe of Sleiſheim, Nymphenburg, Dauchau, and Starenberg. The firſt and laſt

last are about three leagues from the capital; the second about half a league; and the third about two, at a market-town of the same name.

Munich (Count de), was the favourite of the Czarina Ann, and was concerned in all the events of her reign. Being appointed general of her armies, he gained great advantages over the Crim Tartars, beat the Turks, A. D. 1739, in an engagement near Choczim, and took that city together with Jassi the capital of Moldavia. He was afterwards prime minister to the Czar Iwan VI. but in a short time after he was accused of employing the power which his office conferred on him to gratify his own ambition and private resentment. The Empress Elisabeth brought him to trial, and he was condemned to lose his life A. D. 1742. This sentence was mitigated to banishment into Siberia, whither many of the victims of his power had been exiled. He was recalled by Peter III. A.D. 1762, and declared field-marshal. Upon the death of this prince, the Empress Catharine II. appointed him director-general of the ports of the Baltic. He died on the 8th of October 1767, at the age of 84.

MUNICIPAL, in the Roman civil law, an epithet which signifies invested with the rights and privileges of Roman citizens. See Municipium.

Municipal, among us, is applied to the laws that obtain in any particular city or province. And those are called *municipal officers* who are elected to defend the interest of cities, to maintain their rights and privileges, and to preserve order and harmony among the citizens; such as mayors, sheriffs, consuls, &c.

MUNICIPES, an appellation given by the Romans to the inhabitants of the *municipia* or municipal cities. See Municipiem.

MUNICPIUM, in Roman antiquity, a corporation, borough, or enfranchised city or town, where the inhabitants enjoyed their own laws and customs, and at the same time were honoured with the privileges of Roman citizens; but then this privilege generally reached no farther than the bare title. Some indeed, by particular merit, obtained the liberty of votes, which occasioned that distinction of *municipium sine suffragio*, and *municipium cum suffragio* —The inhabitants of the *municipium sine suffragio*, were called barely *Romani*, but those of the *municipium cum suffragio* were called *cives Romani*.

The difference between proper citizens of Rome and the inhabitants of the municipium may be thus expressed. The proper citizens of Rome were, 1. Registered in the census; 2. Had the right of suffrage and of bearing honours; 3. Were assessed in the poll-tax; 4. Served in the legions; 5. Used the Roman laws and religion; 6. Were called *Quirites* and *populus Romanus*: Whereas the municipes enjoyed the three first of these privileges but were denied the three last.

MUNITION, the provisions with which a place is furnished in order for defence? or that which follows a camp for its subsistence.

Munition Ships, are those that have store on board in order to supply a fleet of men of war at sea. In an engagement, all the munition-ships and victuallers attending the fleet take their station in the rear of all the rest, they are not to engage in the fight, but to attend to such directions as are sent them by the admiral.

MUNSTER (Sebastion), a learned writer, was born at Ingleheim, and became a Cordelier; but having embraced Luther's sentiments, he quitted that order in 1529, and retired to Heidelberg, and afterwards to Basil, where he taught with reputation. He was a man of great candour, and void of ambition; and was so well skilled in geography, the mathematics, and the Hebrew tongue, that he was surnamed the *Esdras* and the *Strabo of Germany*. His Latin translation of the bible is esteemed. He was the first who wrote a Chaldee grammar and lexicon; he also published a treatise on cosmography, and several other works. He died of the plague at Basil in 1552, aged 63.

Munster, in Latin *Monomia*, and in Irish *Moun*, the most southerly province of Ireland; bounded on the north by Leinster and Connaught, and on the east, west, and south, by the ocean. It contains the counties Cork, Clare, Kerrey, Limerick, Tipperary, and Waterford; and 3,289,932 Irish plantation acres, 740 parishes, 63 baronies, and 26 boroughs. It is about 125, miles long, and 120 broad: and its principal town is Cork. Its ancient name was *Mumhan*; and in latter ages it was divided into *Desmond* or south Munster, *Ormond* or east Munster, and *Thomond* or north Munster. It lies between 51. 15. and 53. 0. N. Lat. and 7. 10. to 10. 30 W. Long.

Munster, a territory of Germany, in the circle of Westphalia; bounded on the north by Embden and Oldenburg, on the south by the county of Mark and duchy of Westphalia, on the west by the county of Bentheim and the United provinces, and on the east by the bishoprics of Osnaburg and Paderborn together with the county of Ravensberg. It is the largest of all the Westphalian bishoprics, being in length about 80 miles, and in breadth from 20 to 60. It is divided into 13 bailiwicks; and though in general but a barren county, has some fruitful plains, with woods, and quarries of stone. The inhabitants, excepting a few of the nobility and gentry, are all Roman Catholics; though Lutheranism had once a considerable footing here. The bishop, who is generally also elector of Cologne, has a revenue from hence of about 70,000 pounds, and can maintain 8000 men. In consequence of an unjust custom, unknown in the rest of the empire, he is heir to all strangers who die in the country without children. In the matricula he is rated at 30 foot and 118 horse; or 832 florins monthly in lieu of them. His chapter consists of 40 canons, who are all noble.

Munster, a city of Germany, capital of a bishopric of the same name and of all Westphalia, stands at the conflux of the river Aa with the Ems, in E. Long. 7. 49. N. Lat. 52. 0. It is of a circular form, large, and well fortified both by nature and art. It has a fine citadel called the *Brille*, erected by a bishop named *Bernard van Galen* in order to awe the burghers. The dean and chapter now elect the bishop; but till the beginning of the 13th century he was nominated by the emperor. This city has been rendered famous by three remarkable transactions. 1. By the peace concluded here 1648, which put an end to a war of 30 years; occasioned by the persecuting spirit of bigotted papists, who chose rather to plunge their country into all the calamities of war than allow liberty of conscience to the Protestants. By this peace, however,

ever, they consented, much against their inclination to grant them a toleration. 2. By the disorders and disturbances occasioned here in 1553, by a parcel of enthusiasts, headed by a taylor called *John of Leyden* from the place of his birth, who turned out the magistrates, and took possession of the city, where they perpetrated the most horrid villanies and cruelties. 3. For the noble, though unsuccessful, efforts it made in defence of its liberties against the tyranny and usurpation of the above-mentioned turbulent and bloody-minded bishop, Bernard van Galen. In this city are a great number of convents and other religious houses, many of them stately piles, and surrounded with beautiful gardens.

MUNYCHIA, or *Munychyus Portus*, (anc. geog.), a village and port of Athens, nearer to the city, less than, and fortified in the same manner with the Piræus, to the east of which it lay, or between it and the promontory Sunium, at the mouth of the Ilissus. Strabo says it was an eminence in form of a peninsula, at the foot of which stood three harbours, anciently encompassed with a wall, taking within its extent the Piræus and other harbours, full of docks, with the temple of Diana, Munychia; taking its name from *Mynichus* the founder of the temple.

Munchyia, an anniversary solemnity observed at Athens in honour of Diana, on the 16th of the month Munychion. Cakes were offered on the occasion called αμφιφωντες.

MUNYCHION, the tenth month of the Athenian year, containing 29 days, and answering to the latter part of our March and the beginning of April. It was so called from the festival Munychia, which was observed in this month. See Month and Munychya.

MUPHTI. See Mufti.

MURÆNA, or Eel, in ichthyology; a genus of fishes, belonging to the order of apodes. The head is smooth; there are ten rays in the membrane of the gills; the eyes are covered with a common skin: and the body is cylindrical and slimy. There are seven species, distinguished by their fins, tails, &c. The most remarkable are,

1. The *anguilla*, or common eel, is very frequent in most fresh waters, ponds, ditches, and rivers: according to Mr Pennant, it is the most universal of fish; yet is scarce ever found in the Danube, though very common in the lakes and rivers of Upper Austria.

The eel is very singular in many things relating to its natural history, and in some respects borders on the nature of the reptile tribe. It is known to quit its element, and during night to wander along the meadows, not only in order to change its habitation but also for the sake of prey, feeding on snails, as it passes along. During winter it beds itself deep in the mud, and continues in a state like the serpent-kind. It is very impatient of cold, and will eagerly take shelter in a wisp of straw flung into a pond in severe weather, which has sometimes been practised as a method of taking them. Albertus affirms, that he has known eels to take shelter in a hay-rick; yet all perished through excess of cold. It has been observed in a river of England called the *Nyne*, there is a variety of small eel, with a lesser head and narrower mouth than the common kind, that is found in clusters in the bottom of the river, and is called the *bed-eel:* these are sometimes roused up by the violent floods, and are never found at that time with meat in their stomach.

Eels are extremely voracious, and destructive to the fry of others. No fish lives so long out of water as the eel; and it is so extremely tenacious of life, that its parts will move a considerable time after they are flayed and cut to pieces. They vary much in their colours, from a sooty hue to a light olive green: and those which are called *silver eels* have their bellies white, and a remarkable clearness throughout. Besides these, there is a variety of this fish known in the river Thames by the name of *grigs*, and about Oxford by that of *grigs* or *gluts*. These are scarce ever seen near Oxford in the winter; but appear in spring, and bite readily at the hook, which common eels in that neighbourhood will not. They have a larger head, a blunter nose, thicker skin, and less fat, than the common sort; neither are they so much esteemed, nor do they often exceed three or four pounds in weight.—Common eels grow to a large size, sometimes weighing 15 or 20 pounds; but that is extremely rare. Mr Dale indeed, in the Philosophical Transactions, and some others, bring instances of eels much exceeding that size; but Mr Pennant suspects them to have been congers, since the enormous fish they describe have all been taken at the mouths of the Thames or Medway. The Romans held eels very cheap, probably on account of their likeness to snakes. On the contrary, the luxurious Sybarites were so fond of these fish, as to exempt from tribute of every kind persons who sold them.

There is scarce any animal the generation of which has puzzled the learned more than this. Aristotle first broached an opinion that eels were of no sex, nor did propagate their species like other animals, but were equivocally gendered of the mud; and as wild and absurd a system as this is, there have not been wanting many, even in these latter and more enlightened times, who have given into it. But there is now no room to doubt that all animals are produced by the copulation of parents like themselves; and the finding of eels in new ponds is easily accounted for from the above mentioned circumstance of their migration. Dr Plot, and many others, have given accounts of whole droves of them leaving one ditch or pond to go to another.

Though the learned world at this time generally allows that eels are produced like other animals by parents of their own kind, yet there remain many doubts about the manner in which the generation is performed. Some allow the eels to be, like the generality of other animals, of different sexes in the different individuals; and others affirm that they are all hermaphrodites, each having the parts of generation of both sexes. ' Rondeletius affirms that they are of both sexes; and Mr Allen, who has given a very curious paper concerning them in the Philosophical Transactions, is of the same opinion; and both say, that the parts of the sexes may be discovered on a careful inspection; and some are found to be males, and others females; but these parts are, in both sexes they say, buried in a large quantity of fat; and they are of opinion, that hence proceeded the mistake of Aristotle and his followers, who, not being able to find those parts, concluded that they did not exist at all. Among those who allow the eel to be produced, like other animals, from animal-parents which have the sexes, some are of opinion that they are viviparous, and

and others that they are oviparous; but Mr Chartwynd seems to have determined this controversy by observing, that if the aperture under the belly of the eel, which looks red in the month of May, be cut open at that time, the young eels will be seen to come forth alive after the operation. Mr Lewenhoeck says, that he found an uterus in every eel he examined: and therefore concludes that they are hermaphrodites; and he supposes that they have no male parts of generation like those of other animals; but that the office of these is performed by a liquor analagous to the male seed of animals, which is contained in certain glands, situated in the inside of the uterus itself.

Eels have sometimes been met with in recent ponds, made at such a distance from any other water that we cannot reasonably suppose them to have migrated thither over land. But in these cases there is reason to believe, that the ponds have been supplied with them by the aquatic fowls of prey, in the same manner as vegetation is spread by many of the land-birds, either by being dropped, as they carry them to feed their young, or by passing quick through their bodies, as is the case with herons.

2. The *conger*, or conger-eel, grows to a vast size. Dr Borlase informs us, that they are sometimes taken near Mount's-bay of 100 lb. weight; and Mr Pennant assures us, that he has heard of some taken near Scarborough that were 10 feet and a half long, and 18 inches in circumference in the thickest part. They differ from the common eel in the following particulars: 1. Their colour in general is more dark. 2. Their eyes much larger in proportion.—3. The irides of a bright silvery colour. 4. The lower jaw is rather shorter than the upper. 5. The inside-line is broad, whitish, and marked with a row of small spots. 6. The edges of the dorsal and anal fins are black. 7. They have more bones than the common eel, especially along the back quite to the head. 8. They grow to a much larger size.

Congers are extremely voracious, preying on other fish, and on crabs at the time they have lost their shell and are in a soft state. They and eels in general are also particularly fond of carcases of any kind, being frequently found lodged in such as are accidentally taken up.

The conger eels probably generate like the fresh-water species. Innumerable quantities of what are supposed to be their fry come up the Severn about the month of April, preceding the shads, which it is conjectured migrate into that river to feed on them; they are called *elvers*. They swarm during their season, and are taken in a kind of a sieve made of hair-cloth fixed to a long pole; the fisherman standing on the edge of the water during the tide, puts in his net as far as he can reach, and drawing it out again, takes multitudes at every sweep, and will take as many during one tide as will fill a bushel. They are dressed, and reckoned very delicate.

These fish are an article of commerce in Cornwall; numbers are taken on that coast, and exported to Spain and Portugal, particularly to Barcelona.—Some are taken by a single hook and line, but (because that way is tedious, and does not answer the expence of time and labour) they are chiefly caught by *bulters*, which are strong lines 500 feet long, with 60 hooks, each eight feet asunder, baited with pilchards or mackarels; the bulters are sunk to the ground by a stone fastened to them: sometimes such a number of these are tied together as to reach a mile. The fishermen are very fearful of a large conger, lest it should endanger their legs by clinging round them; they therefore kill them as soon as possible by striking them on the navel. They are afterwards cured in this manner: They are slit, and hung on a frame till they dry, having a considerable quantity of fat, which it is necessary should exsude before they are fit for use. It is remarkable that a conger of 100 weight will waste by drying to 24lb; the people therefore prefer the smallest, possibly because they are soonest cured. During the process there is a considerable stench; and it is said that in the fishing villages the poultry are fed with the maggots that drop from the fish. The Portuguese and Spanairds use those dried congers after they have been ground into a powder, to thicken and give a relish to their soups. They are sold for about 40 shillings the quintal, which weighs 126lb. A fishery of congers, says Mr Pennant, would be of great advantage to the inhabitants of the Hebrides. Perhaps they would at first undertake it with repugnancy, from their absurd aversion to the eel kind.

3. The *siren*, or mud niguana, a singular animal, first observed by Dr Garden of Charlestown, and afterwards described by Mr Ellis in the Philosophical Transactions for 1766. It has gills, fins, and two feet; and is in length from 31 to 40 inches. It is an inhabitant of South Carolina, where it is found in swampy and muddy places, by the sides of pools, and under the trunks of old trees that hang over the water, and feeds on serpents. The feet appear like little arms and hands, each furnished with four fingers, and each finger with a claw. "The head is something like an eel, but more compressed; the eyes are small and placed as those of the eel are. This smallness of the eye best suits an animal that lives so much in mud. The nostrils are very plainly to be distinguished: these, with the gills, and remarkable length of the lungs, show it to be a true amphibious animal.—The mouth is small in proportion to the length of the body; but its palate and inside of the lower jaw are well provided with many rows of pointed teeth; with this provision of nature, added to the sharp exterior bony edges of both the upper and under jaw, the animal seems capable of biting and grinding the hardest kind of food. The skin, which is black and full of small scales, resembles shagreen. These scales are of different sizes and shapes, according to their situation; but all appear sunk into its gelatinous surface; those along the back and belly are of an oblong oval form, and close set together; in the other parts they are round, and more distinct. Both the parts are mottled with small white spots, and have two distinct lines composed of small white streaks continued along from the feet to the tail. The fin of the tail has no rays, and is no more than an adipose membrane like that of the eel."

Dr Garden, in a letter to Mr Ellis, mentions a remarkable property of this animal, which is, that his servant endeavouring to kill one of them by dashing it it against the stones, it broke into three or four pieces. Linnæus, from the descriptions sent him, made it a new genus named *Syren*, of a new order *Meantes*, of the class amphibia. But from this class both the order *Meantes* and that of *Nantes* have been lately expunged; and Gmelin has reduced the syren to a species of the present genus. Its place here, however, seems still of doubtful propriety; as Gmelin himself acknowledges in the Preface to his edition of the Systema Naturæ. For Campfer, having lately * had an opportunity to dissect the syren, has discovered, that on each side of the head it is furnished with three true gills, separated from each other by membranes having tooth-like appendages; that the mouth is armed with strong and firmly planted teeth; that the heart has only one ventricle; and that the abdomen is filled with very long and capacious intestines; From all these circumstance, he concludes, that this animal ought to be considered as a fish of the order *Branchiostegi*;—while in other respects it is more nearly allied to the genus *Muræna*, of the order *Apodes*; although it differs materially from the other species of that genus, by having only three notched bones in the gills, and from the pectoral fins being each divided into four finger-like appendages,

Plate CCCXV.

* Kerr's Translation.

MURAL, something belonging to a wall; which the Latins call *murus*,

Mural-Crown, among the ancient Romans. See Crown.

Mural-Arch, is a wall, or walled arch, placed exactly in the plane of the meridian, *i. e.* upon the meridian line, for the fixing of a large quadrant, sextant, or other instrument, to observe the meridian altitudes, &c. of the heavenly bodies.

Tycho Brahe was the first who used a mural arch in his observations: after him Hevelius, Mr Flamstead, De la Hire, &c. used the same means. See Astronomy.

MURALT (N— de), a native of Switzerland, travelled through a great part of Europe with the views of a philosopher. He published a collection of *Lettres sur les Francois et sur les Anglois*, 12mo, 2 vols. 1726, which met with great success, though they are written in a vague and superficial manner. Some other works which he published are below mediocrity, He died about the year 1750.

MURENT (Emanuel), a much-admired landscape painter, was born at Amsterdam in 1622. He had the happiness to be a disciple of Philip Wouwermans, from whom he acquired that warmth and brilliancy of colouring, and that exquisite pencil, which have rendered him deservedly eminent. His subjects were views in Holland, villages, towns, cities, ruins of houses, and decayed castles? all of them exactly sketched after nature, and so exquisitely finished, that every minute part of a building was perfectly discernible, and even every particular stone or brick might be counted by the assistance of a convex glass. But this demanded so much patience and time, that it was impossible for him to paint many pictures, and on that account they are exceedingly scarce, and sold for such prices as must place them out of the reach of all ordinary purchasers. He died in 1700.

MURANUM, (anc. geog.), a town on the confines of Lucania. Now *Morano*; a citadel in the Calabria Citra, at the springs of the Sybaris, midway between the Sinus Tarentinus to the east, and the Tuscan sea to the west. Supposed to have arisen from the ruins of Syphæum, a town of the Bruttii mentioned by Livy.

MURATORI (Lewis Anthony), a learned and celebrated Italian writer, born at Vignoles, in the territory of Bologna, in 1672. He early discovered an extreme fondness for the learned languages and sciences; and this was seconded by an excellent education. After having completed his first studies, he embraced the state of an ecclesiastic; and applied himself to polite literature, philosophy, theology, civil law, antiquities, and other sciences; by which means he became in a manner universally learned. He was scarce 22 years of age when he was made librarian of the Ambrosian library at Milan. In 1700 the duke of Modena, his sovereign recalled him, and made him his librarian, and keeper of the archives of his duchy. Muratori discharged this double employment during the rest of his life, and had no other benefice than the provostship of Santa Maria del Pomposa. He acquired the esteem of the learned throughout Europe, who had recourse to him for the lights they wanted. He became an associate to the Academies of the Arcades of Rome, Della Crusca, and Colomberia of Florence, the Academy of Etrusca at Cortona, the Royal Society of London, and of the imperial Academy of Olmutz; and died in 1750. He wrote a great number of learned works; the principal of which are,—1. *Anecdota*, or a collection of pieces taken from the Ambrosian library, 2 vols 4to, with learned notes and dissertations. 2. A treatise on the perfection of the Italian poetry, 2 vols 4to. 3. *Anecdota Græca*, 3 vols 4to. 4. A genealogical history of the house of Modena, 2 vols folio. 5. An excellent collection of the writers of the Italian history, 27 vols folio, with learned notes. 6. Another collection, under the title of *Antiquitates Italicæ*. 7. A collection of ancient inscriptions, under the title of *Novus Thesaurus*, 6 vols folio. 8. The annals of Italy, 12 vols 4to, in Italian, &c. 9. Letters, dissertations, Italian poems, &c.

MURCIA, the pagan goddess of idleness.—The name is taken from *murcus* or *murcidus*, an obsolete word, signifying a dull, slothful, or lazy person.—The statues of this goddess were always covered with dust and moss, to express her idleness and negligence. She had a temple in Rome at the foot of the Aventine mount.

Murcia, a kingdom in Spain, bounded on the north by New Castile, on the east by the kingdom of Valencia, on the west by Andalusia and Granada, and on the south by the Mediterranean Sea. It is about 62 miles in length, and 58 in breadth; and its principal river is Segura. The soil is dry, because it seldom rains, and therefore it produces little corn or wine; but there is plenty of oranges, citrons, lemons, olives, almonds, mulberries, rice, pulse, and sugar. It has also a great deal of silk. It was taken from the Moors in 1265. The air is very healthful.

Murcia, a large handsome, and populous town of Spain, capital of a kingdom of the same name. It is a bishop's see, and contains six parishes. The cathedral is a most superb edifice, with the stairs of the steeple so contrived that a man may ride up to the top, Murder. top, either on horseback or in a coach. It is situated in a pleasant plain, which abounds in fine gardens about the city, in which are the best fruits in Spain. It is seated on the river Segura, in W. Long. 0. 36. N. Lat. 37. 48.

MURDER, or Murther, the act of killing another with violence and injustice. The word comes from the Saxon *morth* "death;" which some will have to signify a violent death; whence the barbarous Latin *murdrum* and *mordrum*.

Among the number of popular errors, is the notion which has obtained, that the dead body would bleed in the presence or upon the touch of the murderer.

The crime of murder is punished with death in almost all nations.

Murder, or *Murther*, in law, is thus defined or rather described, by Sir Edward Coke: "When a person, of sound memory or discretion, unlawfully killeth any reasonable creature in being, and under the king's peace, with malice aforethought, either express or implied." The best way of examining the nature of this crime will be by considering the several branches of this definition.

1. It must be committed by a person *of sound memory and discretion;* for lunatics or infants are incapable of committing any crime; unless in such cases where they show a consciousness of doing wrong, and of course a discretion or discernment between good and evil.

2. Next, it happens when a person of such sound discretion *unlawfully killeth*. The unlawfulness arises from the killing without warrant or excuse; and there must also be an actual killing to constitute murther; for a bare assault, with intent to kill, is only a great misdemesnor, though formerly it was held to be murder. The killing may be by poisoning, striking, starving, drowning, and a thousand other forms of death, by which human nature may be overcome. Of these the most detestable of all is poison; because it can of all others be the least prevented, either by manhood or forethought. And therefore, by the stat. 22 Hen. VIII. c. 9. it was made treason, and a more grievous and lingering kind of death was inflicted on it than the common law allowed; namely, *boiling to death*; but this act did not live long, being repealed by 1 Edw. VI. c. 12. There was also by the ancient common law, one species of killing held to be murder, which may be dubious at this day, as there hath not been an instance wherein it has been held to be murder for many ages past, viz. bearing false witness against another, with an express premeditated design to take away his life, so as the innocent person be condemned and executed. The Gothic laws punished in this case both the judge, the witnesses, and the prosecutor; and, among the Romans, the *lex Cornelia de saccariis*, punished the false witness with death, as being guilty of a species of assassination. And there is no doubt but this is equally murder *in foro conscientiæ* as killing with a sword; though the modern law (to avoid the danger of deterring witnesses from giving evidence upon capital prosecutions, if it must be at the peril of their own lives) has not yet punished it as such. If a man, however, does such an act, of which the probable consequence may be and eventually is, death; such killing may be murder, although no stroke be

Blackst. Comment.

struck by himself, and no killing may be primarily intended: as was the case of the unnatural son who exposed his sick father to the air against his will, by reason whereof he died; and of the harlot, who laid her child under leaves in an orchard, where a kite struck it and killed it. So too, if a man hath a beast that is used to do mischief; and he, knowing it, *suffers* it to go abroad, and it kills a man; even this is manslaughter in the owner: but if he had purposely *turned it loose*, though barely to frighten people and make what is called *sport*, it is with us (as in the Jewish law) as much murder as if he had incited a bear or or a dog to worry them. If a physician or surgeon gives his patient a potion or plaster to cure him, which, contrary to expectation kills him, this is neither murder nor manslaughter, but misadventure; and he shall not be punished criminally, however liable he might formerly have been to a civil action for neglect or ignorance: but it hath been holden, that if it be not a *regular* physician or surgeon who administers the medicine, or performs the operation, it is manslaughter at the least. Yet Sir Matthew Hale very justly questions the law of this determination; since physic and salves were in use before licensed physicians and surgeons; wherefore he treats this doctrine as apocryphal, and fitted only to gratify and flatter licentiates and doctors in physic; though it may be of use to make people cautious and wary how they meddle too much in so dangerous an employment. In order also to make the killing murder, it is requisite that the party die within a year and a day after the stroke received, or cause of death administered; in the computation of which the whole day upon which the hurt was done shall be reckoned the first.

3. Farther: The person killed must be "*a reasonable creature in being, and under the king's peace,*" at the time of the killing, Therefore to kill an alien, a Jew, or an outlaw, who are all under the king's peace or protection, is as much murder as to kill the most regular-born Englishman; except he be an alien-enemy, in time of war. To kill a child in its mother's womb, is now no murder, but a great misprision: but if the child be born alive, and dieth by reason of the potion or bruises it received in the womb, it seems, by the better opinion, to be murder in such as administered or gave them. As to the murder of bastard-children, see Bastard.

4. Lastly, the killing must be committed "*with malice aforethought,*" to make it the crime of murder. This is the grand criterion which now distinguishes murder from other killing; and this malice prepense *malitia præcogitata*, is not so properly spite or malevolence to the deceased in particular, as any evil design in general; the dictate of a wicked, depraved, and malignant heart; *un disposition a faire un male chose:* and it may be either *express*, or *implied*, in law. Express malice is when one, with a sedate deliberate mind and formed design, doth kill another: which formed design is evidenced by external circumstances discovering that inward intention; as lying in wait, antecedent menaces, former grudges, and concerted schemes to do him some bodily-harm. This takes in the case of deliberate dueling, where both parties meet avowedly with an intend to murder: thinking it their duty, as gentlemen, and claiming it as their right, to wanton

 with

Murder.

with their own lives and those of their fellow-creatures; without any warrant or authority from any power either divine or human, but in direct contradiction to the laws both of God and man: and therefore the law has justly fixed the crime and punishment of murder on them, and on their seconds also. Yet it requires such a degree of passive valour to combat the dread of even undeserved contempt, arising from the false notions of honour too generally received in Europe, that the strongest prohibitions and penalties of the law will never be entirely effectual to eradicate this unhappy custom, till a method be found out of compelling the original aggressor to make some other satisfaction to the affronted party, which the world shall esteem equally reputable as that which is now given at the hazard of the life and fortune, as well of the person insulted, as of him who hath given the insult. Also, if ever upon a sudden provocation one beats another, in a cruel and unusual manner, so that he dies, though he did not intend his death, yet he is guilty of murder by express malice; i. e. by an express evil design, the genuine sense of *malitia*. As when a park-keeper tied a boy that was stealing wood to a horse's tail, and dragged him along the park; when a master corrected his servant with an iron bar, and a schoolmaster stamped on his scholar's belly, so that each of the sufferers died; these were justly held to be murders, because the correction being excessive, and such as could not proceed but from a bad heart, it was equivalent to a deliberate act of slaughter. Neither shall he be guilty of a less crime who kills another in consequence of such a wilful act as shows him to be an enemy to all mankind in general; as going deliberately, and with an intent to do mischief, upon a horse used to strike, or coolly discharging a gun among a multitude of people. So if a man resolves to kill the next man he meets, and does kill him, it is murder, although he knew him not; for this is universal malice. And if two or more come together to do an unlawful act against the king's peace, of which the probable consequence might be bloodshed; as to beat a man, to commit a riot, or to rob a park, and one of them kills a man; it is murder in them all, because of the unlawful act, the *malitia præcogitata*, or evil intended beforehand.

Also in many cases where no malice is expressed, the law will imply it: as, where a man wilfully poisons another, in such a deliberate act the law presumes malice, though no particular enmity can be proved. And if a man kills another suddenly, without any, or without a considerable provocation, the law implies malice; for no person, unless of an abandoned heart, would be guilty of such an act upon a slight or no apparent cause. No affront, by words or gestures only, is a sufficient provocation, so as to excuse or extenuate such acts of violence as manifestly endanger the life of another. But if the person so provoked had unfortunately killed the other, by beating him in such a manner as showed only an intent to chastise and not to kill him, the law so far considers the provocation of contumelious behaviour, as to adjudge it only manslaughter, and not murder. In like manner, if one kills an officer of justice, either civil or criminal, in the execution of his duty, or any of his assistants endeavouring to conserve the peace, or any private person endeavouring to suppress an affray or apprehend a felon, knowing his authority or the intention with which he interposes, the law will imply malice, and the killer shall be guilty of murder. And if one intends to do another felony, and undesignedly kills a man, this is also murder. Thus if one shoots at A and misses him, but kills B, this is murder; because of the previous felonious intent, which the law transfers from one to the other. The same is the case, where one lays poison for A, and B, against whom the prisoner had no malicious intent, takes it, and it kills him, this is likewise murder. So also if one gives a woman with child a medicine to procure abortion, and it operates so violently as to kill the woman, this is murder in the person who gave it. It were endless to go through all the cases of homicide, which have been adjudged, either expressly or impliedly, malicious; these therefore may suffice as a specimen; and we may take it for a general rule, that all homicide is malicious, and of course amounts to murder, unless where justified by the command or permission of the law; excused on a principle of accident or self-preservation; or alleviated into manslaughter, by being either the involuntary consequence of some act, not strictly lawful, or (if voluntary) occasioned by some sudden and sufficiently violent provocation. And all these circumstances of justification, excuse, or alleviation, it is incumbent upon the prisoner to make out, to the satisfaction of the court and jury: the latter of whom are to decide whether the circumstances alleged are proved to have actually existed; the former, how far they extend to take away or mitigate the guilt. For all homicide is presumed to be malicious, until the contrary appeareth upon evidence.

The punishment of murder, and that of man-slaughter, were formerly one and the same; both having the benefit of clergy: so that none but unlearned persons, who least knew the guilt of it, were put to death for this enormous crime. But now, by several statutes, the benefit of clergy is taken away from murderers through malice prepense, their abettors, procurers, and counsellors. In atrocious cases it was frequently usual for the court to direct the murderer, after execution, to be hung upon a gibbet in chains near the place where the fact was committed; but this was no part of the legal judgment; and the like is still sometimes practised in the case of notorious thieves. This, being quite contrary to the express command of the Mosaical law, seems to have been borrowed from the civil law; which, besides the terror of the example, gives also another reason for this practice, viz. that it is a comfortable sight to the relations and friends of the deceased. But now, in England, it is enacted by statute 25 Geo. II. c. 37. that the judge, before whom any person is found guilty of wilful murder, shall pronounce sentence immediately after conviction, unless he sees cause to postpone it; and shall in passing sentence direct him to be executed on the next day but one (unless the same shall be Sunday, and then on the Monday following), and that his body be delivered to the surgeons to be dissected and anatomized; and that the judge may direct his body to be afterwards hung in chains, but in nowise to be buried without dissection. And, during the short but awful interval between sentence and execution, the prisoner shall be kept alone, and sustained with only bread and water. But a power is allowed to the judge, upon good and sufficient cause, to respite the execution, and relax the other restraints of this act. See farther, PARRICIDE, and *Petit Treason*.

MURDERERS, or *Murdering Pieces*, in a ship, are small pieces of ordinance, either of brass or iron, which have chambers put in at their breeches. They are used at the bulk-heads of the fore-castle, half-deck, or steerage, in order to clear the deck, on the ship's being boarded by an enemy.

MURENA. See MURÆNA.

MURENGERS, two officers of great antiquity in the city of Chester, annually chosen out of the aldermen, to see that the walls are kept in repair, and to receive a certain toll and custom for the maintenance thereof.

MURET (Mark Anthony Francis), in Latin *Muretus*, was born at Muret, near Limoges. in 1526. He acquired a perfect knowledge of the Greek and Latin tongues without any instructor, and became one of the most learned men of his time. After having taught some time in Provence, he was made a professor at Paris in the same college with Turnebus and Buchanan. In 1554 he went into Italy; and in 1563 was professor of law, philosophy, and history, at Rome, where he died in 1585. His principal works are, 1. Excellent notes on Terence, Horace, Catullus, Tacitus, Cicero, Sallust, Aristotle, Xenophon, &c. 2. *Orationes*. 3. *Variæ Lectiones, Poemata, Hymni Sacri*. 4. *Disputationes in Lib. I. Pandectorum, de Origine Juris, &c.* 5. *Epistolæ, Juvenilia Carmina, &c.* Most of Muret's works have been printed in the Venice edition of 1737, in 5 vols 8vo.

MUREX, in zoology, a genus of insects belonging to the order of vermes testacea. This animal is of the snail-kind: the shell consists of one spiral valve, rough, with membranaceous furrows; and the aperture terminates in an entire canal, either straight, or somewhat ascending. There are 60 species, particularly distinguished by peculiarities in their shells, &c.

From a species of murex was obtained the famous Tyrian dye so much valued by the ancients. This, however, has long been superseded by the use of the cochineal. One of the shells producing the dye was a kind of buccinum; but the finest, or Tyrian purple, was got from the murex. These species of shells are found in various parts of the Mediterranean. Immense heaps of them are to be seen about Tarentum to this day, evincing one place where this precious liquor was extracted. See Plate CCCXXII.

In the accounts of a Spanish philosopher it is mentioned, that on the coasts of Guayaquil and Gautimala in Peru the murex is also found. The shell which contains it adheres to the rocks that are washed by the sea: it is of the size of a large walnut. The liquor may be extracted two ways; some kill the animal after they have drawn it out of the shell; then press it with a knife from head to tail; separate from the body the part where the liquor is collected, and throw away the rest. When this operation, after being repeated on several snails, has afforded a certain quantity of fluid, the thread intended to be dyed is dipped in it, and the process is finished. The colour, which is at first of the whiteness of milk, becomes afterwards green, and is not purple till the thread is dry. Those who disapprove of this method, draw the fish partly out of the shell, and, squeezing it, make it yield a fluid which serves for dying: they repeat this operation four times at different intervals, but always with less success. If they continue it, the fish dies. No colour at present known, says the Abbé Raynal, can be compared to this, either as to lustre, liveliness, or duration. It succeeds better on cotton than wool, linen, or silk.

MUREX, a caltrap or iron instrument, with sharp points projecting in every direction, used by the Romans as a defence against the enemy's horse. It was so called, probably, because the points bore some resemblance to the spines and tubercles with which the shell of the fish murex is surrounded.

MURGI, or MURGIS (anc. geog.), the last town of Bætica, next the Tarraconensis: the Urce of Ptolemy. Now *Muxara*, a port-town of Granada, on the Mediterranean. W. Long 1° 50′. N. Lat. 37° 6′.

MURIA, alimentary salt. See SALT.

MURINA, or MURINES, a delicious sweet wine, medicated with spices, and the usual drink of the ladies of antiquity.

MURILLO (Bartholomew-Stephen), a celebrated painter, was born at Pilas near Seville, in 1613. Having shown a very early inclination to painting, he was instructed by his uncle John del Castillo, an artist of some note, whose subjects were fairs and markets; in which style Murillo painted several pictures while he continued with that master; but his principal knowledge in the art was derived from Velasquez, who directed his studies, and frequently retouched his designs. Many writers assert, that he studied at Rome, and improved himself excessively in that city. But Velasco, a Spanish author, affirms that he never was in Italy; but arrived at the excellence he possessed by copying the works of Titian, Rubens, and Vandyck, which were at Madrid, and the Escurial; and also by studying after the antique statues, which are in the Royal collections. However, he became an excellent painter, and was employed by the king of Spain to execute several historical pictures, which raised his reputation through every province of his own country. Those paintings being afterwards sent to Rome as a present to the pope, the Italians were so much pleased with his performances, that they called him a second Paul Veronese. In Spain he designed and finished several grand altar-pieces, for the churches and convents at Madrid, Seville, Cordova, Cadiz, and Granada; and some of his compositions are in the churches of Flanders. But notwithstanding his genius, taste, and abilities, qualified him to execute subjects of history with general applause; yet his favourite subjects were beggar-boys, as large as life, in different actions and amusements; which he usually designed after nature, and gave them a strong and good expression. His original pictures of those subjects have true merit, and are much esteemed, many of them being admitted into the most capital collections of the English nobility; but of those, there are abundance of copies, which, to the dishonour of the artist, are sold as originals to injudicious purchasers. He died in 1685.

MURRAIN, or GARGLE, a contagious disease among cattle. The symptoms are, a hanging down and

and ſwelling of the head, abundance of gum in the eyes, rattling in the throat, a ſhort breath, palpitation at the heart, ſtaggering, a hot breath, and a ſhining tongue. In order to prevent this diſeaſe, the cattle ſhould ſtand cool in ſummer, and have plenty of good water: all carrion ſhould be ſpeedily buried; and as the feeding of cattle in wet places, on rotten graſs and hay, often occaſions this diſeaſe, dry and ſweet fodder ſhould be given them.

MURRAY, a county of Scotland, extending by the coaſt from the river Spey on the eaſt to Beauly on the weſt, which is the boundary of the province of Roſs. It ſends two members to parliament, and is an earldom in a branch of the Stuart family.

According to the account of the reverend Mr Shaw miniſter of Elgin, in anſwer to ſome queries of Mr Pennant, the country produces wheat, barley, oats, rye, peaſe, and beans. Of theſe, in plentiful years, upwards of 20,000 bolls are exported, beſides ſerving the county itſelf and ſome of the Highland counties. Some hemp is alſo cultivated, and a great deal of flax; of which linen is made, not only for home-conſumption, but a conſiderable quantity of linen-yarn is exported. Great quantities of potatoes are alſo cultivated. Several hundreds of black cattle are alſo exported from the Highlands of Murray, but few or none from the Low lands.—Peculiar to this province is a kind of wood, called *red ſaugh*, or *ſallow;* which is no leſs beautiful than mohogany. It is much more firm and tough than mahogany, and reſembles the lighter-coloured kind of that wood. It receives a fine poliſh, but is very ſcarce, growing on rocks. But there are great foreſts of firs and birches, which our author thinks are the remains of the Sylva Caledonia. Here alſo is found a remarkable root, called by the natives *carmele:* it grows in heaths and birch-woods to the bigneſs of a large nut; and ſometimes there are four or five roots joined together by fibres. It has a green ſtalk and ſmall red flowers. Dido ſpeaking of the Caledonians, ſays, *Certum cibi genus parant ad omnia, quem ſi ceperint quantum eſt unius fabæ magnitudo, minime eſurire aut ſitire ſolent.* Cæſar alſo tells us of a root called *chara*, which his ſoldiers mixed with milk and made into bread when in want of proviſion, which greatly relieved them. This root, Mr Shaw thinks, is the ſame with the *carmele* or *ſweet root* of Murray. He informs us, that he hath often ſeen it dried, and kept for journeys through hills where no proviſion was to be had: he has likewiſe ſeen it pounded and infuſed; the liquor makes a more agreeable and wholeſome liquor than mead. It grows in ſuch plenty, that a cart-load of it can eaſily be gathered.

Murray is interſected by the rivers Spey, Loſſey, Findern, Nairn, Neſs, and Beauly. The river of Spey, riſing on the borders of Lochaber, is more than 60 Scots, or 100 Engliſh miles long, but too rapid to be navigable. Upon this river great floats of fir and birch-wood are carried down to the Frith; the float is guided by a man ſitting on a *courach*. This veſſel is of an oval ſhape, about four feet long and three feet broad; a ſmall keel from head to ſtern; a few ribs croſs the keel, and a ring of pliable wood round the lip of it; the whole covered with the rough hide of an ox or horſe. The rower ſits on a tranſverſe ſeat in the middle, and holds in his hand a rope, the end of which is tied to the float, and with the other hand he manages a paddle, keeps the float in deep water, and brings it to ſhore when he pleaſes. In this province alſo is Loch Neſs, remarkable for its never freezing. There are many other lakes in this country, of which one called *Dundelchack* is remarkable in that it is never covered with ice before the month of January; but after that time one night's ſtrong froſt covers it all over. On the eaſt ſide of Loch Neſs, a large mile above the loch, is the waterfall of Foher, where the river *Feach-len* falls over a ſteep rock about 80 feet high; and a thick fog riſes from the place where it falls, occaſioned by the violent daſhing of the water. There is a conſiderable ſalmon-fiſhery on the rivers Spey, Findorn, Neſs, and Beauly, which ſerves the towns and country, beſides exporting to the value of 12,000l. annually.

There are many natural caves in the hills of this country, which formerly were the receptacles of thieves and robbers and now afford ſhelter to hunters and ſhepherds in ſtormy weather. The moſt remarkable mountain is Carngern in Strathſpey. In it are found a particular kind of ſtones well known to the lapidaries. They are of blue, green, yellow, and amber colours; ſome ſo large as to make ſnuff-boxes, or ſmall cups; ſome of hexagonal or pentagonal figures, and tapering to a point at each end. The mountain of Benalar, in Badenoch, is by Mr Shaw reckoned to be the higheſt land in Scotland, as waters flowing from it fall into the ſea at Dundee, Inverlochy, and Garmoch in Murray.

MURRHINE, MURRHINUS, Μοῤῥινος, in antiquity an appellation given to a delicate ſort of ware brought from the eaſt, whereof cups and vaſes were made, which added not a little to the ſplendour of the Roman banquets.

Critics are divided concerning the matter of the pocula, or vaſa murrhina, murrina, or murrea. Some will have them to have been the ſame with the Britiſh porcelain or china-ware.

The generality hold them to have been made of ſome precious kind of ſtone, which was found chiefly, as Pliny tells us, in Parthia, but more eſpecially in Carmania. Arrian tells us that there was a great quantity of them made at Dioſpolis in Egypt. This he calls another ſort of murrhina work; and it is evident, from all accounts that the murrhina of Dioſpolis was a ſort of glaſs-ware made in imitation of the porcelain or murrha of India. There is ſome difference in the accounts given by Pliny and Martial of the murrhina vaſa. The firſt author ſays, that they would not bear hot liquors, but that only cold ones were drank out of them. The latter, on the other hand, tells us, that they bore hot liquors very well. If we credit Pliny's account, their porcelain was much inferior to the Britiſh in this particular. Some conjecture them to have been of agate, others of onyx, others of coral. Baronius, doubtleſs, was fartheſt out of the way, when he took them to be made of myrrh, congealed and hardened. Some have ſuppoſed theſe veſſels to be made of cryſtal; but this is contrary to the account of all the ancients. The Greeks had the words κρυςαλλος for cryſtal, and σμυρνα for myrrh, very common among them; and therefore, if theſe veſſels had been made of either

Mus. of these substances, they would in some places have called them smyrna or crystalina. On the contrary, the most correct among them call them murrhina or morrina. The cups made of crystal; which were also in use at those times, were called crystallina, and these murrhina or murrhæa, by way of keeping up the distinction; and Martial tells us, that the stone they were made of was spotted or variegated, calling them pocula maculosæ murræ. And Statius mentions the crystalline and murrhine cups in the same sentence, but as different things, not the same. Arrian mentions also the λιθος μορρια; which his interpreters censure as an error of the copies, and would alter into myrrha, the name of the gum myrrh.

Pompey is recorded as the first who brought these murrhine vessels out of the east, which he exhibited in his triumph, and dedicated to Jupiter Capitolinus. But private persons were not long without them. So fond, in effect, did the Roman gentry grow of them, that a cup which held three sextaries was sold for 70 talents. T. Petronius, before his death, to spite Nero (or as Pliny expresses it, *ut mensam ejus exhæredaret*, to disinherit his table), broke a bason, *trulla murrhina*, valued at 300 talents, on which that emperor had set his heart.

MUS, in zoology: A genus of quadrupeds belonging to the order of *Glires;* the characters of which are these: The upper foreteeth are wedge-shaped; there are three grinders, sometimes, (though rarely) only two, on each side of the jaws; and the clavicles or collar-bones are complete. In the new edition of the *Systema Naturæ*, by Dr Gmelin, the numerous species of this genus have been distributed into different groupes or divisions, distinguished by some particular character common to the individuals of each.—The first division consists of,

I. Myocastores, or *Beaver-rats*, the individuals of which have the tail *flattened* laterally at the end.

1. The coypus, or webbed beaver-rat, has a thick hairy tail of a moderate length, and the hind feet webbed. It is an inhabitant of Chili, where it frequents the water. It has a strong resemblance, both in colour and shape, to the otter; but is allied to the murine tribe by the number and arrangement of its teeth.

2. The zibethicus, or musquash, with a long sharp-pointed tail, and the feet not webbed. This has been already described under the article Castor, of which it was ranked as a species in the former editions of Linnæus. In fact, it does resemble the beaver in the form of the body and flat scaly tail, as well as in its manners and economy. In size, however, and length of tail, it comes nearer to the brown rat; but in its general appearance, and in the short hairy ears, it resembles the water-rat.

II. Mures, or *Rats* and *Mice;* having *round* tails, some naked and some hairy.

1. The piloris, or musk cavy, with a naked tail blunt at the end, and covered with scales. There are two varieties: one with the body of an uniform whitish colour; the other with the upper parts tawny, and the under parts white. The former inhabits Ceylon, and the latter the West Indies. They are nearly of the size of a rabbit: they both burrow in the ground; sometimes infest houses like the rat; and have a strong flavour of musk.

2. The caraco has a naked tail, long, scaly, and somewhat blunt; the body is of a brown grey colour, and the hind feet are very slightly webbed. It inhabits the eastern parts of Siberia, and probably Chinese Tartary and the northern provinces of China; burrowing like the rabbit, near the banks of rivers.—It swims remarkably well, and even infests houses.—The body and head are six inches in length, and the tail four and a half. Mus. Plate CCCXIX. fig. 20.

3. The americanus, or American rat, has a long naked, and scaly tail; the head is long-shaped with a narrow pointed nose, the upper jaw being much longer than the lower; the ears are large and naked. It is larger than the black, and smaller than the brown rat; its colour is of a deep brown, inclining to ash on the belly, and the fur is course and harsh. It is probably this species which is said (Kalm's Trav. ii. 48,) to live among the stones and clefts of rocks, in the blue mountains of Virginia, at a distance from the peopled part of the country, which comes out only at night, and makes a terrible noise.

4. The decumanus, or brown rat, has a long, naked, scaly tail; the upper parts of the body are of a light brown, mixed with a tawny and ash colour, the lower parts dirty white. The head and body measure about nine inches; and the length of the tail, which consists of 200 rings, is seven and a half. The whiskers are larger than the head; and the eyes are large, black, and prominent. The fore-feet have four toes, with a small claw in place of the fifth or thumb. It inhabits India and Persia, and has only been known in Europe in the present century. They dwell in burrows which they dig in the banks of rivers; and frequent towns, aqueducts, drains, necessaries, stables, barns, gardens, fields, and houses. They swim and dive with great dexterity; feed on vegetables, grain, fruits, and even destroy poultry; and are hunted eagerly by cats, dogs, and ferrets. They lay up stores of acorns, beech-mast, and other provisions in their holes; in which the males remain during winter, except in fine weather, without hybernating; but the females and their young live mostly in barns and out-houses in that season. They often emigrate from one place to another in great companies. The female produces three times in the year, having 12 or 15, even 18 or 19, at a litter. The bite of this creature is not only severe but dangerous, the wound being immediately attended with great swelling, and is a long time in healing. These animals are so bold as to turn upon those who pursue them, and fasten on the stick or hand of such as offer to strike them. This species is supposed to be the mus caspicus of Ælian †, which he says was nearly as large as the ichneumon and made periodical visits in vast multitudes to the countries which border on the Caspian, swimming boldly over the rivers, holding by each others tails. Plate CCCXVII. fig. 5.

† Hist. c. 17.

5. The rattus, black or common rat, has an almost naked scaly tail, which is very small, has 250 distinct rings, and is eight inches long. The head and body measure seven inches in length: the upper parts are a deep black grey, and the under parts ash-coloured. There are four toes, and a small claw in place of the fifth, on each fore foot, and five on the hind feet. This species inhabits India, Persia, and Europe except its most northern parts; from hence it has been carried Fig. 11.

to

Mus. to Africa and America; and is frequent in Otaheite, though less common in the other islands of the southern ocean. Of late years it has greatly diminished in Europe, and is even in many places extirpated, in consequence of the introduction of the brown species, which destroys the black rats; though little is gained by the exchange, the brown having the same dispositions, with greater strength and abilities for doing mischief. It is the most pernicious of any of our smaller quadrupeds. Meat, corn, paper, clothes, furniture, in short every convenience of life is a prey to this destructive creature. Nor are its devastations confined to these; for it will make equal havock among poultry, rabbits, or young game; nay, it has been known to gnaw the extremities of infants when asleep. It is a domestic animal, residing very frequently in houses, barns, or granaries and it is furnished with fore teeth of such strength as enable it to force its way through the hardest wood or the oldest mortar. It makes a lodge either for its days residence or a nest for its young near a chimney; and improves the warmth of it, by forming there a magazine of wool, bits of cloth, hay, or straw. It lodges also in cielings, and in the void spaces between the wall and the wainscotting. From these lurking-places the rats issue in quest of food, and transport thither every substance they can drag, forming considerable magazines especially when they have young to provide for. The female has ten teats, and brings forth several times in a year, but always in the summer season. The litter generally consists of five or six; and in spite of poison, traps, and cats, they thus multiply in such a degree as sometimes to do a great deal of damage. In old country-houses where grain is kept and where the vicinity of barns and magazines facilitates their retreats, they often increase so prodigiously, that the possessors are obliged to remove and desert their habitations, unless the rats happen to destroy each other; an event which frequently takes place, for these creatures when pinched for food devour each other. When a famine happens by reason of too many being crowded into one place, the strong kill the weak, open their heads, and first eat the brain and then the rest of the body. Next day the war is renewed, and continues in the same manner till the most of them are destroyed; which is the reason why these animals, after being extremely troublesome for some time, disappear all at once and do not return for a long time. Rats are extremely lascivious: they squeak during their amours, and cry when they fight. They soon learn their young to eat; and when they begin to issue from the hole, their mother watches, defends, and even fights with the cats in order to save them. A large rat is more mischievous than a young cat, and nearly as strong: the rat uses her fore-teeth; and the cat makes most use of her claws; so that the latter requires both to be vigorous, and accustomed to fight, in order to destroy her adversary. The weasel, though smaller, is a much more dangerous and formidable enemy to the rat, because he can follow it into its retreat. Their strength being nearly equal, the combat often continues for a long time, but the method of using their arms is very different. The rat wounds only by reiterated strokes with his fore-teeth, which are better formed for gnawing than biting; and being situated at the extremity of the lever or jaw, they have not much force. But the weasel bites cruelly with the whole jaw; and instead of letting go its hold, sucks the blood from the wounded part, so that the rat is always killed.—The rat was first introduced into America by the Europeans in 1544, and is now the pest of all that continent. In the neighbourhood of the lower parts of the river Volga, there is a small variety of this species found in the deserts, which does not weigh above six or seven drams. Mus.

6. The muscalus, or common mouse, has a very long, scaly, and almost naked tail; the fore feet have each four toes; the hind feet five, the fifth or thumb having no claw; the hand and body measure three inches and a half in length; the upper parts are tawny, and the lower parts whitish or ash-coloured. This little animal, which inhabits all parts of the world, lives almost entirely in houses, and follows mankind for the sake of their provisions. It feeds on almost every thing, such as grain, bread, cheese, butter, oil, and every kind of food used by mankind, and drinks little; it is of mild and gentle manners, exceedingly timid, and very quick in all its motions. The mouse never issues from his hole but in quest of food, and runs in again upon the least alarm. It goes not, like the rat, from house to house, unless forced, and is not near so destructive. It is capable also of being tamed to a certain degree, though not so perfectly as other animals. It has many enemies, from whom it can escape only by its agility and minuteness. Owls, birds of prey, cats, weasels, hedge-hogs, and even rats make war upon the mice, so that they are destroyed by millions; yet the species still subsists by its amazing fecundity. They bring forth at all seasons, and several times in the year; the litter generally consists of five or six; and in less than 15 days the young disperse, and are able to provide for themselves. Aristotle tells us, that having shut up a pregnant mouse in a vessel, along with plenty of grain, he found in a short time after 120 mice, all sprung from the same mother. Plate CCCXVIII fig. 2.

Several varieties of mice as to colour are found, some being altogether black, some yellowish, some spotted with white, some of a white colour with ash-coloured spots, and the most beautiful of all, and the least common, are entirely white, with red eyes; but as these agree in every other circumstance, it is unnecessary to describe them more at large.

7. The sylvaticus, or long-tailed field-mouse, is larger than the common mouse, measuring from the end of the nose to the setting on of the tail four inches and an half, the tail four inches; the upper parts of the body are of a yellowish brown; the breast is yellow, and the belly white: the tail is covered with short hair. The fore feet have four toes each: the hind feet five. These animals are found in fields, gardens, and shrubberies. In some places they are called *bean-mice*, from the havock they make among beans when first sown. They feed also on nuts, acorns and grain, of which they amass quantities, not proportioned to their wants, but to the capacity of the place where it is deposited, insomuch that a single animal will collect more than a bushel. Thus they provide for other animals as well as themselves; the hog comes in for a share, and the great damage done Fig. 6.

to

to the fields by these creatures, in rooting up the ground, is chiefly owing to their search after the concealed hoards of the field-mice. M. Buffon informs us, that he has often seen great damage done to the plantations by the field-mice. They carry off the new sown acorns; by following the furrow of the plough, they dig up one after another, not leaving a single seed. This happens chiefly in those seasons when the acorns are scarce; not finding a sufficient quantity in the woods, they come in quest of them in the cultivated fields, and often carry off such quantities that they corrrupt in their magazines. These creatures according to the same author, do more mischief in a nursery of trees than all the birds and other animals put together. The only way to prevent this damage is to lay traps at ten paces asunder, through the extent of the sown field. No other apparatus is necessary than a roasted wall-nut placed under a flat stone, supported by a stick. The animals come to eat the wal-nut which they prefer to acorns; and as it is fixed to the stick, whenever they touch it, the stone falls down and crushes them to death. The same expedient M. Buffon also made use of with success against the short-tailed field-mouse, which also destroys acorns. In this way he found that upwards of 100 were taken each day, from a piece of ground consisting only of about 40 French appents. From the 15th of November to the 4th of December, above 2000 were caught in this manner. Their numbers gradually diminished till the frost became severe, which is the time they retire into their holes to feed on their magazines. In autumn they are most numerous; for if provisions fail during the winter they devour one another. The long-tailed mice eat also the short tailed species, and even thrushes, blackbirds, &c. which they find entangled in snares. They first eat the brain, and then the rest of the body, M. Buffon once kept a dozen of these mice in a cage, and furnished them with food every morning at eight o'clock. One day they were neglected for about a quarter of an hour, when one of their number was eaten up by the rest; next day another suffered the same fate; and in a few days only one remained; all the others had been killed, and partly devoured; and even the survivor himself had his feet and tail mutilated. These animals are very prolific, producing more than once a-year, and bring nine or ten at a birth. They generally make the nest for their young very near the furface and often in a thick tuft of grass. During winter they frequent barns, stables, and outhouses.

8. The messorius, harvest mouse, or less long tailed field mouse, is a very small species, or perhaps rather a variety of the former; and inhabits Hampshire, where it is very numerous, particularly during harvest. They form their nest above the ground, between the straws of the standing corn, and sometimes in thistles; it is of a round shape, and composed of the blades of corn. They bring about eight young ones at a time These never enter houses; but are often carried, in the sheaves of corn, into ricks; and 100 of them have frequently been found in a single rick on pulling it down to be housed. Those that are not thus carried away in the sheaves, shelter themselves during winter under ground and burrow deep, forming a warm bed for themselves of dead grass. They are the smallest of the British quadrupeds; the length from nose to tail is only two inches and a half; the tail two inches, and the weight one sixth of an ounce. They are more slender than the other long-tailed field-mouse; and their back of a fuller red, inclining to the colour of a dormouse.

9. The agrarius, or rustic mouse, is about three inches long, and scarcely weighs half an ounce; the tail is only about half the length of the body and head; the upper part of the body is of a yellowish colour, with a dark line along the back; the belly and the legs are white; the head is oblong, with a sharp nose, and small ears lined with fur; the hind legs have each a dusky circle just above the foot. It inhabits Russia, and is found in Silesia, rarely in Germany. This species is migratory: and wanders about often in vast multitudes, doing immense injury to the corn: It burrows in the ground, forming a long gallery just below the surface, and a little elevated, leading to a larger chamber, in which considerable quantities of grain and seeds are stored up for winter provision. Plate CCCXIX, fig 3.

10. The minutus, or minute mouse, has the upper parts of the body of a deep tawny or ferruginous colour, and the under parts whitish. It is about half the size of the common mouse, the tail being scarcely two inches long, the female is smaller than the male, and less elegant in her colours; the nose is somewhat sharp; the face is dusky, with some whiteness at the corners of the mouth; the ears are small, and almost laid in the fur; the feet are grey. This species inhabits Russia; where it is found in the corn-fields and in barns, and is plentiful in birch-woods: it seems to wander about without any fixed places for its nest; and much greater numbers of males are found than of females, Fig. 1.

11. The vagus, or wandering mouse, is between two and three inches long; the colour of the upper parts of the body is a pale ash, waved with black, and having a black line along the middle of the back; the ears are large, oval, naked, and plaited. The legs are very slender, and the whitish, having some toes and a conical excrescence before; and five behind. all armed with long claws: the tail is longer than the body, very slender, prehensile at the end, of an ash colour above and whitish below; the head is oblong with a blunt nose reddish at the tip, having yellow fore-teeth, and only two grinders on each side in the upper-jaw. The female has eight teats.—This species inhabits the deserts of Tartary and Siberia, as high as the Ural, Irtish, Oby, and Jenisei. Is frequent in the birch woods, and lives in fissures of rocks, under stones, and in hollows of trees; feeding chiefly on seeds, and likewise on small animals of the same genus. It wanders about in great flocks, migrating from one place to another in the night; hybernates during winter, and is of a very chilly nature, so as even to become torpid and fall asleep, in a round form in the cold nights of the month of June. It has carnivorous inclinations. Fig. 9.

12. The betulinus or beech-mouse has a considerable resemblance to the wandering mouse, but is somewhat smaller. The upper parts of the body are tawny, with a black line along the back, the under parts whitish or pale ash-colour, the nose is sharp, Fig. 15.

with

Mus. with a red tip; the ears are ſmall, oval, plaited, brown, and briſtly at the ends; the limbs are very ſlender, with long and very ſeparable toes; the tail is ſlender and much longer than the body. This ſpecies inhabits the birch woods in the deſart plains of Iſchim and Baraba, and between the Oby and Jeniſei. It lives ſolitary, frequenting the hollows of decayed trees. It runs up trees readily, and faſtens on their branches with its tail; and by means of its ſlender fingers or toes, it can faſten even to a very ſmooth ſurface. It is a very tender animal, ſoon growing torpid in cold weather; and its voice is very weak.

Plate CCCXVIII fig. 15. 13. The pumilio, or dwarf-mouſe, is of a browniſh aſh colour, with the fore-head and nape of the neck black, and having four black lines along the back meeting at the tail. It is ſcarcely two inches long, the tail is about two-thirds of the length of the body, and the whole animal, even when ſteeped many months in ſpirits, hardly weighs four ſcruples. The body is ſomewhat flattened; the regions of the eyes, the ears, and the noſe, are of a paler colour than the reſt of the body; all the feet have five toes, the thumb or inner toe of the fore feet being very ſmall, but diſtinctly furniſhed with a claw; the legs and feet are ſtrongly made; the tail is almoſt naked, and of a pale aſh-colour. This ſpecies, which was firſt deſcribed by Dr Sparrman, inhabits the foreſts of Sitſicamma near Ilangen river, 200 hours journey from the Cape of Good Hope.

Plate CCCXIX. fig. 16. 14. The ſaxatilis, or rock mouſe, is about four inches long, and weighs nearly nine drams; the tail is hairy, an inch and a half in length, of a brown colour above, and white beneath; the head is oblong, with a longiſh noſe, and oval downy ears, brown at the edges; the limbs are ſtrong; and the tail is thinly covered with hair; the upper parts of the body are of a brown colour, ſlightly mixed with yellowiſh or grey; the ſides are rather inclined to the latter colour; the belly is of a light aſh or whitiſh; the feet and legs are blackiſh; the ſnout is duſky, and ſurrounded with a ſlender white ring. This ſpecies is an inhabitant of the eaſtern parts of Siberia beyond lake Baikal, and of the deſerts of Mongul Tartary.—It burrows in the fiſſures of rocks, forming a winding oblique paſſage, which afterwards branches out into ſeveral others pointing downwards, and ending in a chamber, in which is a bed or neſt of ſoft herbs. It feeds chiefly on the ſeeds of the aſtragalus.

Plate CCCXVIII fig. 13. 15. The amphibious, or water-rat, with a long tail; the upper parts of the body being covered with black hair mixed with yellowiſh, and the under parts aſh-coloured; the ears ſcarcely appear above the fur; the feet have three toes on each, and the rudiments of a fourth. This ſpecies of which there are ſeveral varieties, differing in the toes and in the colour, inhabits the whole of Europe, the northern parts of Aſia as far as the icy ſea, and North America.—They dwell chiefly near waters, forming burrows in their ſteep banks; about ponds and wet ditches; likewiſe in marſhy places, meadows, and gardens; feeding on roots, herbs, and ſhrubs; and on frogs, craw-fiſh, inſects, ſmall fiſh, and the fry of larger ones. They ſwim and dive with great facility, and live much in the water. They are very fierce, and bite bitterly. The fleſh of theſe animals is reckoned very delicate by ſome of the more ſavage inhabitants of the Ruſſian empire; and is eaten by the French along with that of the otter during lent. The female is ſmaller than the male, and has a greater yellowneſs of colour; ſhe has eight teats, four of which are placed on the breaſt and four on the belly. They procreate about the end of winter, at which time they ſmell ſtrongly of muſk, and produce as far as eight young ones in the month of April.

Plate CCCXIX. fig. 2. 16. The alliarius, or garlic mouſe, has a ſhort tail; the ears rather large, and ſomewhat hairy; the body aſh coloured on its upper parts, and whitiſh underneath. The head and body meaſure ſomewhat more than four inches, the tail ſcarcely an inch and a half. This ſpecies inhabits Siberia, about the rivers Jeniſei, Kan, Lena, and Angara; and feeds on the roots of garlic, of which it lays up large ſtores in ſubterraneous burrows.

Fig. 8. 17. The rutilus, or red mouſe, has a ſhort tail; the ears are longer than the fur, which is tawny red on the back, light grey and yellow on the ſides, and whitiſh on the belly. The head and body meaſures about four inches, and the tail one.—This ſpecies inhabits Siberia, from the Oby as far as Kamtſchatka, and within the Arctic circle. It lives in holes and in hollows of trees; feeding on grain, and ſometimes on animals of the ſame genus. It comes often into houſes and barns, eating almoſt of every thing which comes in its way, but is particularly fond of fleſh. It is very lively, and runs about even on the ſnow the whole winter.

Plate CCCXVIII fig. 8. 18. The arvalis, or meadow-mouſe, is from three to ſix inches long, the female being much longer than the male, and the tail is little more than an inch: the head is large, with a blunt noſe, ſhort ears almoſt hid in the fur, and prominent eyes; the upper parts of the body are of a mixed ferruginous and black colour; the belly is deep aſh, and the legs and feet duſky;—the tail is terminated by a ſmall tuft of hair. There is a variety which is almoſt black.—This ſpecies inhabits all Europe, Siberia, Hircania, and Newfoundland; dwelling in buſhy places, corn-fields, meadows, and gardens, chiefly near waters; living on grain, nuts, acorns, and walnuts, which it collects into ſubterraneous burrows: but it appears to prefer corn to every other food. When the grain is ripe, they aſſemble from all quarters, and often do great damage by cutting the ſtalks of corn in order to come at the ears. They follow the reapers, and eat up all the fallen and neglected grain. When the gleanings are devoured, they flock to the new-ſown fields, and deſtroy the crop of the enſuing year. In winter moſt of them retire into the woods, where they feed upon filberts, acorns, and the ſeeds of trees. In particular years they appear in numbers ſo immenſe, that they would deſtroy every thing if they continued long: but they always kill and eat one another during a ſcarcity of proviſions. They beſides are devoured by the long-tailed field-mice, by foxes, wild cats, and weaſels. Theſe creatures are often carried home in the ſheaves of corn, and 100 of them have been found in houſing a rick. In ſuch caſes it has been obſerved, that the dogs devoured all the mice of this ſort they could find, rejecting the common kind; and, on the contrary, the cats would touch none but the laſt. The female produces ſeveral feveral times a year, and brings from eight to twelve young at a birth: it has a ftrong affection for them; one that was feduced into a wire-trap by placing its brood in it, was fo intent on fostering them, that it appeared quite regardlefs of its captivity. In Newfoundland, thefe mice are very deftructive to gardens; but feldom do much damage in this way in Britain.

Plate cccxix. fig. 13. 19. The focialis, or focial moufe, with a very fhort flender tail, and naked, rounded, and very fhort ears; the fore feet have each three toes and the rudiments of a fourth; the upper parts of the body are light-grey; the fides, fhoulders, and belly, are white. The head and body are fomewhat more than three inches long, the tail half an inch. This fpecies inhabits the fandy deferts between the Volga and Ural, near the Cafpian fea, and in the mountains of Hircania.—They live in pairs, or in families, confifting of a male and a female with their young ones; and of thefe families vaft numbers live together, the whole country being covered with little hills of earth thrown out of their burrows. They feed moftly on tulip roots; and are preyed on by weafels, polecats, crows, and otters. They fwarm chiefly in fprings, and rarely appear in autumn, at which feafon it is fuppofed they migrate, or take fhelter among the bufhes.

Fig. 12. 20. The œconomous, or economic moufe, in its general form, refembles the meadow-moufe; but the body is rather longer and the belly larger. The ears are naked and hid in the fur; the colour is tawny; and the fore-feet have each three toes with the rudiments of a fourth. The head and body meafure four inches and a quarter, the tail fomewhat more than an inch. This fpecies inhabits Siberia, from the river Irtifh eaftwards, in Kamtfchatka, and under the Arctic circle. They are called by Dr Pallas *mures œconomi*, from their curious way of living. They dwell moftly in damp foils, forming burrows, with many chambers and numerous entrances, immediately under the turf. In thefe they lay up magazines of various vegetable food, chiefly bulbous roots; which they fpread out in funny days to dry, and never touch them but in winter, living all fummer on berries and other vegetables. The Kamtfchatkans hold thefe animals in great regard, and never deftroy their hoards; they take away only part, and leave fome caviare or other fubftance to fupport them in its ftead. This fpecies fometimes emigrates in vaft multitudes, keeping a ftraight courfe, like the lemmus, even over rivers; and are much infefted on their march by birds, fifh, wild hogs, foxes, and other wild beafts. They begin their March from about the river Pengin in fpring, and about the middle of July reach Ochotfka and Judoma, at a vaft diftance; and return in October. The Kamtfchatkans are much alarmed at their migrations which portend rainy weather and a bad chace; and when they find them lying weak and fpent with fatigue after croffing a river, give them every affiftance in their power. The Tfchutfki are not fo much attached to this animal, and make ufe both of their winter ftores and of their carcafes as food.

21. The gregalis, or gregarious moufe, has a fhort tail; the ears are longer than the fur; the fore-feet have each three toes and the rudiments of a fourth; the fur is dark afh-coloured on the upper parts, and whitifh below. This fpecies is lefs than the economic moufe, and longer than the focial; the female being five inches long and the male four. It inhabits the eaftern parts of Siberia, where it dwells in arid places, forming burrows with numerous openings directly under the fod; thefe lead to chambers in which it lays up large ftores of roots, efpecially thofe of the lilium pomponii and garlic: It eats fitting up.

22. The laniger, or woolly moufe, with woolly fur of an afh-colour, inhabits Peru and the north parts of Chili. It burrows in the earth, is very docile and cleanly, and is eafily tamed; it lives on bulbous roots, efpecially onions; the female breeds twice a-year, and brings five or fix young ones at each litter. It is about fix inches long, with a fhort nofe, and fmall fharp-pointed ears; the fur is very long and exceedingly fine, almoft like the threads of a fpider's web, and was formerly employed as the very fineft fpecies of wool by the Peruvians.

23. The langurus or rambling moufe, has hardly any tail; the ears are fhorter than the fur; the fore-feet have each three toes, and the rudiments of a fourth; the upper parts of the body are afh-coloured mixed with dufky, and having a black line along the back. The head is long, with rough and fwelling lips; the limbs are fhort and flender; and the length of the body and head is between three and four inches. This fpecies inhabits the defarts near the rivers Ural, Irtifh, and Jenifei.—Each individual forms a round neft of dried grafs in a burrow, having an oblique and a perpendicular entrance. They feed chiefly on the dwarf iris; but eat all kinds of grain, and devour other fpecies of this genus, as well as one another. They fleep very much, in a rolled-up form, and are very flow in their motions, like the marmot; but do not become torpid in winter. This fpecies is very falacious; the males fight together for the females, and the conqueror generally devours the vanquifhed. The female fmells of mufk when in feafon, produces feveral times in the year, and brings five or fix young ones at a birth. They migrate in great troops; whence the name of rambling mice, which is given them by the Tartars. Fig. 17.

24. The torquatus, collared or ringed moufe, has a very fhort tail, with a tuft of hard briftles at the end, which is blunt: the ears are fhorter than the fur; the feet have each five toes; the fur is ferruginous, varied with grey, yellow, and dufky, having a whitifh collar round the neck, and a dark line along the back. The head and body are fomewhat more than three inches long, the tail fcarcely one inch. It inhabits the northern parts of the Uralian mountains, and the marfhes near the frozen ocean; feeding chiefly on the lichen rangiferinus, lichen nivalis, and polygonus viviparus: thefe articles of food are ftored up in burrows, having numerous paffages, which it digs under the turfy foil. This fpecies is migratory, and refembles the lemmus in its manners. Fig. 4.

25. The lemmus, or lemming, has a very fhort tail: The head is pointed, having very long whifkers, fix of the hairs on each fide being longer and ftronger than the reft; the mouth is fmall, having two very long fore-teeth in each jaw, and the upper lip is divided; the eyes are fmall and black; the ears are fhorter than the fur, rounded, and reclined backwards; the fore-legs are very fhort, having four flender hairy toes Plate cccxvii. fig. 2.

Mus. toes on each, and a long ſharp claw like a cock's ſpur in place of the fifth or thumb; the hind-feet have five toes; the ſkin is very thin, and the upper parts of the body are black and tawny, diſpoſed in irregular blotches; the belly is white tinged with yellow. The length from noſe to tail is about five inches; of the tail, half an inch. This ſingular animal inhabits the mountains of Norway and Lapland. They feed on graſs, the catkins of the dwarf birch, the lichen rangiferinus, or rein-deer liver wort, and other ſuch vegetable productions; in ſummer they form ſhallow burrows under the turf, and in winter they make ſimilar long paſſages under the ſnow in queſt of food; for as they do not lay up magazines, and do not hybernate, they are obliged to ſearch for proviſions in the vigorous winter of theſe northen climates. When they foreſee, by ſome wonderful inſtinct of nature, the approach of a very ſevere winter, they leave their northern haunts in autumn, and emigrate in immenſe multitudes into the lower parts of Norway and Sweden, keeping a ſtraight line in ſpite of every obſtacle, moving moſtly in the night-time, and making prodigious havoc of every vegetable they are able to reach. In this journey, which takes place at uncertain intervals, though generally about every ten years, they are deſtroyed by eagles, hawks, foxes, and other animals of prey, and numbers are drowned in paſſing rivers or lakes, which never interrupt their courſe, even proceeding on into the ſea: from all theſe concurring cauſes very few live to return to their native mountains, and thus a check is put to to their ravages, as it takes years to repair their numbers ſufficiently for another invaſion. They are bold and fierce, ſo as even to attack men and animals, if they meet them in their courſe; and bite ſo hard as to allow themſelves to be carried a conſiderable way, hanging by their teeth to a ſtick, before they will quit their hold. The female breeds ſeveral times in the year, producing five or ſix young at a birth: ſometimes they bring forth during their migration, when they carry their young in their mouth or on their back.

There is a variety, the Sibiricus, or Siberian lemming, of a ſmaller ſize, and more uniform tawny colour, than the above. It inhabits the northern parts of the Uralian chain of mountains, and on the river Oby. It differs greatly in manners from the former: for it lays up in its burrows large ſtores of proviſions to ſerve during winter; whence it is probable that it does not migrate like the Norwegian kind.

There are nine or ten other ſpecies belonging to this diviſion.

III. Criceti, or *Hamſters*; having pouches on the cheeks, and ſhort hairy tails.

Plate cccxix. fig. 10. 1. The acredula, or Siberian hamſter, has large oblong oval furrowed ears; the upper parts of the body are of a yellowiſh and brown aſh-colour, the under parts hoary. The head and body meaſure four inches, and the tail near one. This ſpecies inhabits the diſtrict of Orenburgh in Siberia, near the Yaik or Ural. It lives in burrows, which it quits only in the night to ſeek for food: The Coſſacks ſay that it migrates out of the deſarts in vaſt multitudes; but Dr Pallas ſuſpects this to be a miſtake.

Plate cccxviii. fig. 1. 2. The M. cricetus Germanicus, or German hamſter, is the moſt deſtructive of the whole rat-tribe. The males are about ten inches long, and the tail about three, but the females are ſcarcely more than half ſo large; the former weigh from 12 to 16 ounces: while the latter ſeldom exceed from four to ſix ounces; The head is thick, with a blunt noſe, and numerous whiſkers, large full black eyes, and large rounded open ears; uſually the head and back are of a reddiſh brown colour, with red cheeks; the ſides are paler, with three white ſpots; the breaſt, upper part of the fore-legs and belly, are black; the feet are large and white, having four toes, and a claw inſtead of a fifth toe on the fore-feet, and five toes on each hind foot: The colour varies; ſometimes though rarely, they are found entirely white or yellowiſh, or white with black ſpots on the back; ſometimes the ſnout is white, and the forehead aſh-coloured, or the lower jaw of a white colour. There is a variety (the black German hamſter) which is entirely black, excepting the tip of the noſe, edges of the ears, and the feet, which are white. This ſpecies inhabits Siberia, the ſouth of Ruſſia, Poland, Sclavonia, Hungary, Sileſia, Bohemia, and Germany beyond the Rhine, eſpecially in Thuringia.—Each individual forms a ſubteraneous burrow, conſiſting of ſeveral chambers, with two holes or entrances leading from the ſurface; one of theſe is perpendicular and the other, in which the excrements are lodged, is oblique; the holes of the females have ſeveral perpendicular openings, and each young one of her family is lodged in a ſeparate chamber: The chambers which are ſet apart for the lodging of themſelves and young are lined with ſtraw or graſs; the reſt are larger, and are appropriated for containing magazines of grain, beans, peaſe, lintſeed, vetches, and other ſuch ſeeds, each in a ſeparate cell. The chambers of the older animals are dug ſeveral feet deep, while thoſe of the younger ones ſeldom exceed a foot under the ſurface. The hamſter ſleeps during the winter like the marmots; when in a torpid ſtate, neither reſpiration nor any kind of feeling can be perceived. The heart, however, beats 15 times in a minute, which has been diſcovered by opening the cheſt. The blood continues to be fluid, but the inteſtines are not irritable; even an electrical ſhock does not awake him; but in the open air he never becomes torpid. When dug up in his ſtate of torpidity, the hamſter is found with his head bent under his belly between the two fore-legs, and thoſe behind reſt upon his muzzle. The eyes are ſhut; and when the eye-lids are forced open, they inſtantly cloſe again, The members are ſtiff, like thoſe of a dead animal, and the whole body feels as cold as ice. When diſſected during this ſtate, he ſeems to feel very little; ſometimes indeed he opens his mouth as if he wanted to reſpire; but his lethargy is too ſtrong to admit of his awakening entirely. This lethargy hath been abſcribed ſolely to a certain degree of cold; which indeed may be true with regard to dormice, bats, &c. But experience ſhows, that, in order to render the hamſter torpid, he muſt alſo be excluded from all communication with the external air; for when he is ſhut up in a cage filled with earth and ſtraw, and expoſed in winter to a degree of cold ſufficient to freeze the water, he never becomes torpid: but when the cage is ſunk four or five feet under ground, and well ſecured againſt the acceſs of the air, at the end of eight or ten days he is equally torpid as

Fig. 4.

Mus. if he had been in his own burrow. If the cage is brought up to the surface, the hamster will awake in a few hours, and resume its torpid state when put below the earth. The experiment may be repeated with the same success as long as the frost continues. We have a farther proof that the absence of the air is one of the causes of torpidity in the hamster; for when brought up from his hole in the coldest weather, and exposed to the air, he infallibly awakes in a few hours. This experiment succeeds as well in the night as in the day; which shows that light has no share in producing the effect. It is curious to observe the hamster passing from a torpid to an active state. He first loses the rigidity of his members, and then makes a profound respiration, but at long intervals. His legs begin to move, he opens his mouth and utters disagreeable and rattling sounds. After continuing these operations for some time, he opens his eyes, and endeavours to raise himself on his legs. But all these movements are still reeling and unsteady, like those of a man intoxicated with liquor. He, however, reiterates his efforts till he is enabled to stand on his legs. In this attitude he remains fixed, as if he meant to reconnoitre and repose himself after his fatigue; but he gradually begins to walk, eat, and act in his usual manner. This passage from a torpid to an active state requires more or less time, according to the temperature of the air. When exposed to a cold air, he sometimes requires more than two hours to awake; and in a more temperate air he accomplishes his purpose in less than one hour. It is probable that, when the hamster is in his hole, this change is performed imperceptibly, and that he feels none of the inconveniences which arise from a sudden and forced reviviscence.

The hamster is a very mischievous animal; and so exceedingly fierce, that he seems to have no other passion but rage. In consequence of this, he attacks every other animal that comes in his way, without regarding the superior size or strength of his antagonist; nay, as if he was ignorant of the method of saving himself by flight allows himself to be beat to pieces with a stick rather than yield. If he seizes a man's hand, he must be killed before he quits his hold. When the hamster perceives a dog at a distance, he begins with emptying his cheek-pouches if they happen to be filled with grain, and which are so capacious as to hold a quarter of a pint English. He then blows them up so prodigiously, that the size of the head and neck greatly exceeds that of the body. Lastly, he raises himself on his hind-legs, and in this attitude darts on his enemy. If he catches hold, he never quits it but with the loss of life. But the dog generally seizes him behind, and strangles him. This ferocious temper prevents the hamster from being at peace with any other animal. He even makes war against his own species, not excepting the females. When two hamsters encounter, they never fail to attack each other, and the stronger always devours the weaker. A combat between a male and a female last longer than between two males. They begin by pursuing and biting each other; then each of them retires to a side as if to take breath; a little after, they renew the combat, and continur to fly and fight till one of them falls. The vanquished uniformly serves for a repast to the conqueror.

The hamsters copulate about the end of April; when the males enter the apartments of the females, where they remain only a few days. If two males happen to meet in the same hole, a furious combat ensues, which generally terminates in the death of the weakest. The conqueror takes possession of the female; and both, though at every other period they persecute and kill each other, lay aside their natural ferocity during the few days their amours continue. They even mutually defend each other against aggressors; and if a hole is opened about this time, the female defends her husband with the utmost fury. The females bring forth twice or thrice every year. Their litter is never fewer than six, and more frequently from 16 to 18. Their growth is very rapid. At the age of 15 days they begin to dig the earth; and soon after, the mother banishes them from her habitation: so that at the age of about three weeks they are abandoned to their own management. The mother in general discovers little affection for her offspring; and when her hole is opened, flies in the most dastardly manner, leaving her young ones to perish. Her only solicitude at that time is to provide for her own defence. With this view she digs deeper into the earth, which she performs with amazing quickness. The young would willingly follow her; but she is deaf to their cries, and even shuts the hole which she has made.

The hamsters feed upon all all kinds of herbs, roots, and grains, which the different seasons produce, and even eat the flesh of such animals as they can conquer. They are particularly fond of places where liquorice grows, and feed much on its seeds. Their pace is very slow, and they do not climb; but they dig with vast quickness, and will gnaw through piece of wood an inch and a half thick in a very short time. As they are not adapted for long journeys, their magazines are first stocked with the provisions which are nearest their abode. This is the reason why some of the chambers are frequently filled with one kind of grain only. When the harvest is reaped, they go to a greater distance in quest of provisions and carry every article they can find, without distinction to ther granary. To facilitate the transportation of their food, nature has furnished them with two pouches in the inside of each cheek. On the outside, these pouches are membranous, smooth, and shining; and in the inside there are a great many glands, which secrete a certain fluid, to preserve the flexibility of the parts, and to enble them to resist any accidents which may be occasioned by the roughness or sharpness of particular grains. Each of these receptacles is capable of containing an ounce and an half of grain, which, on his return to his lodgings, the animal empties, by pressing his two fore-feet against his cheeks. When we meet a hamster having his cheeks filled with provisions, it is easy to seize him with the hand, without the risk of being bitten; because in this condition he has not the free motion of his jaws. But if he is allowed a little time, he soon empties his pouches, and stands upon his defence. The quantity of provisions found in the holes depends on the age and sex of the inhabitant. The old hamsters frequently amass 100 pounds of grain; but the young and the females content themselves with a quantity much smaller. Their object

object in laying up provisions, is not to nourish them during winter, which they pass in sleep, and without eating; but to support them after they awake in the spring, and previous to their falling into a torpid state, which resembles a profound sleep. At the approach of winter, the hamsters retire into their subterraneous abodes; the entrance to which they shut up with great address. Here the animal reposes, in the situation already described, upon a bed of straw, and in this state he is commonly dug up. They are preyed on by polecats, weasels, cats, dogs, foxes, and birds of prey; and are proscribed by man, on account of their devastations. In winter the peasants generally go a *hamster-nesting* as they call it; the retreat is known by a small eminence of earth raised near the oblique passage formerly described. The peasants dig down till they discover the hoard, and are generally well paid for their trouble; as they often find two bushels of corn, besides the skins of the animals, which are valuable furs: and it is remarkable, that the hair sticks so fast to the skin, that it cannot be plucked off without the utmost difficulty. In some seasons the hamsters are so numerous, that they occasion a dearth of corn. In one year about 11,000 skins, in a second 54,000, and in a third year 80,000, were brought to the town-house of Gotha, to receive a reward for their destruction. They are likewise destroyed by means of a paste formed of honey and flour boiled up with arsenic or powdered hellebore.

Plate CCCXIX. fig. 11.

3. The arenarius, or sand-hamster, has the upper parts of the body hoary; the sides, belly, limbs, and tail, pure white. It inhabits the sandy desarts of Baraba, on the river Irtish, in Siberia. The head is large, with a longish snout and a sharp nose, having very long whiskers, very large pouches, and great oval brownish ears; the body is short and thick, being about four inches long, and the tail rather more than one; the fur is very soft; the fore feet have only four toes each, the hind feet five, all the claws being white. This animal is very fierce and untameable: it forms burrows, like the preceding species; is chiefly active at night, and feeds mostly upon leguminous plants.

Fig. 7.

4. The songarus, or songar hamster, has the upper parts of the body of a grey ash-colour, marked with a black line along the back; the sides of the head and body are varied with large white and dark brown spots: the feet and belly are white. It is about three inches long, with a very short, thick, blunt, and hairy tail, little more than one-third of an inch in length. It inhabits the desert of Baraba, near the Irtish, in Siberia; where, like its congeners, it digs chambers for the reception of provisions. It is not, however, so fierce as some other species of the hamsters; but may be tamed when caught young, and grows very familiar.

There are two or three other species belonging to this division.

Fig. 18.

5. The phæus, or rice-hamster, has the upper parts of the body of a hoary ash colour, with long dusky hairs along the back; the sides whitish; the circumference of the mouth, breast, belly, and extremities of the limbs, pure, white. It is about three inches and a half long, and the tail scarcely one inch.—This species inhabits about Zarizyn in the desarts of Siberia, and in the mountains of the north of Persia; where it does vast mischief in the rice fields. It is often caught in traps during winter, near stables and other out-houses, and never becomes torpid.

Fig. 14.

6. The furunclus, or Baraba hamster, has the upper parts of the body of a cinereous yellow, with a black streak on the back; the under parts dirty white. It is about three inches long, and the tail near one. This species inhabits Dauria, Siberia in the desart of Baraba, towards the Ob, between the Onon and Argum, and in the Chinese empire near lake Dalai; living chiefly on the seeds of the astragulus and atriplex; but its manners are unknown.

IV. Myotalpæ †, or *Mole-rats*. These have no external ears, very small eyes, and a very short tail or none. They live entirely under ground like the moles.

† Kerr—Mures subterranei, Gmelin.

Plate CCCXIX. fig. 3.

1. The talpina, or Russian mole-rat, is of a dusky colour; has a very short tail, scarce appearing beyond the fur; and no external ears: the fore-teeth are long, extended from the mouth, and wedge-shaped: the eyes are very small, and hid in the fur: the feet have five toes; the fore feet are very strong, flat, and formed for digging. It is about four inches long, and in the general form resembles the water rat. As to colour the head, back, and sides are dusky, and the belly and limbs white. There is a variety (the *nigra*), which is entirely black.—This species inhabits the plains of Russia and Western Siberia, scarcely extending beyond the Irtish, and never beyond the Oby. It is fond of a turfy soil, avoiding sandy or muddy places; and digs holes like those of the hamster, which it lines with soft grass, and fills with bulbous roots, throwing up hillocks of earth all along the tracks; each individual has its separate burrow: It works only in the night, and seldom comes out except in the season of love. Its sight is very weak in the day-time. It feeds chiefly on the roots of tulips, tuberose lathyrus, and tuberose phlomis. It procreates about the beginning of April, at which time it smells strongly of musk; and the females produce three or four young at a litter.

Plate CCCXVIII fig. 9.

2. The capensis, or Cape mole-rat, is of a dark brown colour tinged yellowish, with the fore-part of the face, orbits, and regions of the ears, white: It has a very short tail, and no external ears; and is about five inches and a half long. It inhabits the Cape of Good Hope, where it infests the gardens.

3. The maritima, or African mole-rat, is of a pale brownish ash colour mixed with yellowish on the upper parts, the sides and under parts paler: the tail is very short; and there are no external ears. It inhabits the sand hills adjacent to the sea at the Cape of Good Hope; and resembles the former species, but is much larger, measuring 12 or 13 inches long, and the head is more lengthened. It forms burrows in the sand like those of rabbits; and digs with surprising celerity. It runs slowly; but is very fierce, and bites severely. It feeds chiefly on the roots of ixiæ, antholyzæ, gladioli, and irides; and is reckoned good eating.

Fig. 16.

4. The aspalax, or Daurian mole-rat, is of a dirty yellow ash-colour on the upper parts, and whitish ash on the lower: has a very short tail, and no external ears; the eyes are very small, and deep seated; the feet have each five toes, the claws of the fore feet being very long.—This species inhabits Dauria, and Siberia beyond the Irtish, between the Alei and Tscharysch rivers.

Mus.

rivers. It digs very long burrows in the black turfy soil or firm sand, throwing up numerous hillocks, which extend over a considerable surface; it works both with its feet and nose, and sometimes with its teeth. It feeds chiefly on the roots of bulbous plants. This species varies in size, those of Dauria being near nine inches long, while those farther east are scarcely six.

Plate cccxviii fig. 7.

5. The typhlus, or blind mole-rat, is of a reddish ash colour; and has no tail, external ears, or apparent eyes; the feet have each five toes; and the fore-teeth are broad. The body and head measure between seven and eight inches: the mouth is continually gaping, with short wrinkled fore-teeth above, and very long ones below, likewise furrowed or wrinkled, none of them being hid by the lips: the body is covered with short, soft, and close set fur, which is of a dusky colour at the bottom, with the ends of a rusty brown mixed with ash-colour; the legs are very short, having five toes on each foot armed with short claws, and slightly connected by a short membrane at their bases. This species inhabits the southern parts of Russia, from Poland to the Volga. Each individual forms burrows under the turfy soil of very considerable extent, with many lateral passages, and throws out the earth at different distances, in large hillocks sometimes two yards in circumference, and proportionally high. It works with its snout, feet, rump, and even with its teeth; and digs with great celerity, especially when frightened, in which case it digs directly downwards. When irritated, it snorts, gnashes its teeth, raises its head in a menacing posture, and bites with great severity. It feeds on roots, especially those of the bulbous chærophyllum. It is entirely blind, though it has the rudiments of very small eyes, which are covered over with a continuation of the skin; but it possesses the senses of touch and hearing in a very eminent degree, to make up for the loss of sight. It breeds in spring and summer; and the female, which has two teats, brings from two to four young ones at a birth.

The *Marmot*, *Agouti*, *Guinea-pig*, *Cavey*, *Jerboa*, *Dormouse*, &c. which were formerly comprehended under the present genus in the Linnæan arrangement, have, in consequence of more accurate investigation, been lately disjoined, and distributed under four new genera, *Myoxus*, *Arctomys*, *Dipus*, and *Cavia**. But as we are past the alphabetical order in which the three last of those genera should have been introduced, we must still describe the above animals (excepting the first) in this place; observing, however, to distinguish them according to their new generic arrangement.

* See Gmelin's edition of the Systema Naturæ; and the very elaborate and more ample edition in English, publishing by Kerr.

I. Myoxus, or *Dormouse*. See Myoxus, the *Marmot*.

II. Arctomys, the *Marmot*; the characters of which genus are: There are two wedge-like cutting teeth in each jaw; the grinders are five above, and four below, on each side; and there are perfect clavicles or collar-bones.

Plate cccxvii. fig. 7.

1. The marmotto, or common marmot, has short round ears; gibbous cheeks; a short hairy tail; the upper parts of the body of a dusky brown colour, and the lower parts reddish. The body and head measure 16 inches, the tail six. This species inhabits the summits of the Alps and Pyrenean mountains, in dry places where there are no trees. It is more subject to be rendered torpid by cold than any other. In the end of September, or beginning of October, he retires into his hole, from which he comes not out till the beginning of April. His retreat is capacious, broader than long, and very deep, so that it can contain several marmots without any danger of corrupting the air. With their feet and claws, which are admirably adapted for the purpose, they dig the earth with surprising quickness, and throw it behind them. It is not a hole, or a straight or winding tube, but a species of gallery made in the form of a Y, each branch of which has an aperture, and both terminate in one where the animal lodges. As the whole is made on the declivity of a mountain, the innermost part alone is on a level. Both branches of the Y are inclined, and the one is used for depositing the excrements of the animals, and the other for their going out and coming in. The place of their abode is well lined with moss and hay, of which they make ample provision during the summer. It is even affirmed, that this labour is carried on jointly; that some cut the finest herbage, which is collected by others, and that they alternately serve as vehicles for transporting it to their dens. One, it is said, lies down on his back, allows himself to be loaded with hay, extends his limbs, and others trail him in this manner by the tail, taking care not to overset him. These repeated frictions are assigned as the reason why the hair is generally rubbed off their backs. But it is more probable, that this effect is produced by their frequent digging of the earth. But, whatever may be in this, it is certain that they dwell together, and work in common at their habitations, where they pass three-fourths of their lives. Thither they retire during rain or upon the approach of danger; and never go out but in fine weather, and even then to no great distance. One stands centinel upon a rock, while the others sport on the grass, or are employed in cutting it to make hay. When the centinel perceives a man, an eagle, a dog, &c. he alarms the rest with a loud whistle, and is himself the last to enter the hole. They make no provisions for winter; nor have they in that season any occasion for them, as lying asleep all that time. As soon as they perceive the first approaches of the sleeping season, they set to work in shutting up the two entrances of their habitation; and this they perform with such labour and solidity, that it is easier to dig the earth any where else than in the parts they have fortified. They are at this time very fat, weighing sometimes 20 pounds; and they continne to be plump for three months; but afterwards they gradually decay, and are extremely emaciated at the end of winter. When discovered in their retreats, they are found rolled up in the form of a ball, covered with hay; and they are carried off in so torpid a state, that they may be killed without seeming to feel pain. When taken young, they may be rendered nearly as tame as our other domestic animals. They are able to walk on their hind-feet, sit up often on their haunches; and carry food to their mouths with their fore-feet. They learn to seize a stick, to dance, to perform various gesticulations, and to obey the voice of their master. Like the cat, the marmot has an antipathy against dogs. When he begins to be familiar in the house, and perceives that

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that he is protected by his master, he attacks and bites dogs of the most formidable kind. Though not so large as a hare, he is stouter, and his strength is aided by a peculiar suppleness and dexterity. With his fore-teeth, which are pretty long, he bites most cruelly: he attacks not, however, either dogs or men unless previously irritated. If not prevented, he gnaws furniture and stuffs; and when confined, pierces even through wood. His voice resembles the murmuring of a young dog when caressed or in a sporting humor; but when irritated or frighted, he makes a whistling noise, so loud and piercing, that it hurts the ear. The marmots eat every thing presented to them: as flesh, bread, fruit, roots, pot-herbs, may-bugs, grasshoppers, &c. but milk and butter they prefer to every other aliment. Though less inclined to theft than the cat, they endeavour to slip into the dairy, where they drink great quantities of milk, making, like the cat, a murmuring noise expressive of pleasure. Milk is also the only liquor that is agreeable to them; for they rarely drink water, and they refuse wine. They procreate but once a-year, and the female, after three or four weeks, produces two, three, or four young. The growth of their young is very quick; they live only nine or ten years, and the species is neither numerous nor much diffused. They are easily caught when on plain ground, but with difficulty in their holes, as they dig deeper when in danger of being taken, except in winter when torpid; at which time they are caught in great numbers. They are searched for partly on account of their flesh, which is tender and delicate; partly for their skins: and partly for their fat which is esteemed medicinal by the inhabitants of the Alps: but they are chiefly taken by the Savoyards for the purpose of being exposed as shows through various parts of Europe. The marmot would make very good eating, if it had not always a disagreeable flavour, which cannot be concealed but by strong seasonings.

Plate CCCXVII fig. 6.

2. The monax, or American marmot, is about the size of a rabbit. It has short rounded ears: the nose and cheeks are bluish; the body is of a deep brown colour; the tail is longish, and very hairy. This species inhabits the warmer states of North America and the Bahamas. It forms holes in the clefts of rocks and under the roots of trees, in which it passes the winter in a torpid state; though it is uncertain if those of the Bahamas hybernate, as the climate of these islands is very mild. It feeds on vegetables; and its flesh is very good, resembling that of a pig.

Plate CCCXIX, fig. 23.

3. The bobac, or Polish marmot, is of a greyish colour, mixed with long dusky hairs on the upper parts of the body, the under parts yellowish; It has small oval ears, small eyes, a hairy straight tail, and the fore-feet have each a claw in place of the thumb or fifth toe. The head and body measure sixteen inches, the tail four and a half. This species inhabits the dry and sunny places of the mountains, from the Boristhenes through the temperate climes of Asia as far as China and Kamtschatka. It forms very deep burrows, in which societies of 20 or more live together, each individual having a particular nest at the bottom of the common gallery, which is often three or four yards deep, and from which numerous galleries or passages branch off to the several apartments. They go about in search of food in the morning and middle of the day, placing a centinel to give warning of approaching danger. The bobac is a timid animal, and feeds only on vegetables. chiefly oleracious plants. It sits up on the hams, and carries its food with the fore paws to its mouth, and defends itself in the same posture. It may be easily tamed even when old; it then eats cabbages or bread, and laps milk; but refuses to drink water. In summer it feeds voraciously; but remains torpid all winter, except when kept in very warm places; and even then it eats very little; and escapes if possible, that it may get to some place proper for hybernating; but returns to its master in spring. The flesh resembles that of a hare, though rank; the fat is used for dressing leather and furs; and the skins are employed for clothing by the Russians. The female has eight teats; and probably brings forth early, as by the month of June the young ones are half grown.

Plate CCCXVII, figs. 1, &c. 4

4. The citillus, or earless marmot, is of a variable colour, has a convex head, no external ears, and a short hairy tail. This species inhabits the southern parts of Russia as far as Kamtschatka, and the islands between Asia and America; is found in Persia and China; but is now rarely met with in the rest of Europe. They dwell in open, high, dry, and uncultivated places, preferring turfy and loamy soils, near the high roads, and never frequent bogs or woods. Each individual has its separate burrow, in which, for provision in the beginning aud end of winter, it lays up magazines of grain, tender vegetables, and berries; sometimes though rare, the carcases of mice and small birds are added. In the middle of winter these animals lie torpid during the greatest severity of the frost. From the very beginning of spring, as soon as the weather becomes mild, they go out in the day time in quest of food, which they eat sitting on their haunches, carrying it in their fore paws to the mouth. The male is very easily tamed; but the female is fiercer, more given to bite, and is less easily made tame; she goes between there and four weeks with young, and brings forth from three to eight young ones about the beginning of May. The fur is very good in the spring, and the flesh is reckoned tolerable. They are preyed on by polecats, weasels, hawks, carrion crows, and cranes.

This animal varies considerably both in size and colour, being sometimes as large as the common marmot, and sometimes not larger than the water-rat. In general the colour is of a yellowish ash on the upper parts, and dirty white on the belly, (the *zizel* of Buffon); sometimes it is variegated either with waves or small spots of white, (the souslik of the same author.) Some are white on the upper parts, and waved with tawny or yellow, being pale yellow on the yellow parts of the body, and having a longish tail, with shed hair like that of a squirrel; others are of a grey colour on the upper parts of the body, spotted with white; the under parts being of a yellowish white, with white orbits, and the face, between the eyes and the nose, of a brownish yellow, with a short tail.

Fig. 8,

5. The empetra, or Canadian marmot, is of a mixed grey colour on the upper parts of the body; the lower parts orange: having short rounded ears, and a hairy tail. It is rather larger than a rabbit, and the tail is about two inches and a half long; the head is round, with a blunt nose, and short rounded ears; the cheeks

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are full, and of a grey colour: the face is dusky, with a black nose: the hair on the back is grey at the roots, black in the middle, and whitish at the tips; the belly and legs are of an orange colour; the feet are black and naked, having four long, slender, divided toes, and the rudiments of a thumb on each fore foot, and five similar on each behind, all armed with pretty strong claws. This animal was described by Mr Pennant from a living specimen in possession of Mr Brooks, which was very tame, and made a hissing noise. It inhabits Canada, Hudson's Bay, and the other northern parts of America.

Five or six other species of arctomys, some of them suspected to be only varieties, are described by Kerr.

III. Dipus, or *Jerboa*. There are two fore-teeth in each jaw: the tail is long, and tufted at the end: but the most striking characteristic of this genus is the enormous length of the hind feet and extreme shortness of the fore-paws. From this conformation, instead of walking or running on all fours, they leap or hop on the hind-feet like birds, making prodigious bounds, and only use the fore paws for burrowing, or for carrying their food to the mouth like squirrels. From this peculiarity of conformation, the kanguru, G. xix. sp. 15. and Philip's opossum, sp. 16, of the same genus (Mr Kerr observes), ought to have been arranged with this genus of the jerboa; but from a rigid adherence to artificial system, they are by Dr Gmelin ranked with the genus opossum on account of the number and arrangement of their teeth. See the article Didelphis.

1. The jaculus, or common jerboa, has four toes on all the feet, and a claw in place of a thumb or fifth toe on each fore-foot. The body is somewhat more than seven inches long, and the hind legs and thighs are longer than the body. The upper parts are of a pale tawny colour, and the under parts white; the ears and feet are flesh coloured. The female has eight distantly placed teats. These animals inhabit Egypt Arabia, Calmuck Tartary, and southern Siberia They frequent firm hard ground, and fields covered with grass and herbs, where they form burrows of several yards long in a winding direction, leading to a large chamber about half a yard below the surface; and from this a second passage is dug to within a very little of the surface, by which they can escape when threatened with danger. When at rest they sit with their hind legs bent under their belly, and keep the fore legs so near the throat as hardly to be perceptible. They eat grain and herbage like the hare. Their dispositions are mild, and yet they can never be perfectly tamed. Two that were kept in a house in London borrowed almost through the brick-wall of the room where they were; they came out of their hole at night for food: and when caught were much fatter and sleeker than when confined to their box.

This Animal is eaten by the Arabs, who call it the *lamb of the children of Israel*. It has been particularly noticed and described by Mr Bruce in his Abyssinian Travels *, He says it inhabits the smoothest places of the desart, especially those where the soil is fixed gravel. In this it burrows, and has its hole divided into many apartments. It seems, however, to be afraid of the ground falling in upon it, as it chooses always to dig under the roots of some bushy plant or shrub. It particularly delights in those places which are frequented by the cerestes or horned viper, though it would appear that the serpent sometimes preyed upon it; for Mr Bruce tells us that he once saw a jerboa taken out of the belly of a female viper big with young, and almost consumed by the digestive powers of the animal. It is a very cleanly creature, and keeps its hair always in excellent order. It jumps about with great agility, in which it is assisted by its long tail, which we should suppose would rather be a hinderance to it. The Arabs of the kingdom of Tripoli in Africa teach their greyhounds to hunt the Antelope, by learning them first to catch jerboas; and so agile are the latter, that Mr Bruce has often seen, in a large court-yard or inclosure, the greyhound employed a quarter of an hour before he could kill his diminutive adversary; and had he not been well trained, so that he made use of his feet as well as his teeth, he might have killed two antelopes in the time he could have killed one jerboa. This animal is very fat, and the flesh well coloured: the buttocks, thighs, and part of the back, are roasted and eaten by the Arabs, as already mentioned, and taste almost exactly like a young rabbit, but without the strong smell of the latter. It is said, that the flesh dried in the air is very nourishing, and prevents costiveness; so that it seems endowed also with medical qualities. The animal is found in most parts of Arabia and Syria, and in all parts of the southern desart of Africa, but no where in such plenty as in the Cyrenaicum or Pentapolis. In his journey thither, Mr Bruce employed several Arabs, together with his own servants, to kill these animals with sticks, that their skins might not be hurt with shot. Having got them dressed in Syria in Greece, and sewed together, making use of the tail, as in ermine, for the lining of a cloak, he found they had a very good effect, making a finer and glossier appearance the longer they were worn.

* Vol. V. p. 121.

Bochart thinks this animal is the *Saphon* of holy writ, and displays a vast deal of learning on the subject. But this opinion is refuted by Mr Bruce, who observes, that the saphon is gregarious, and builds in rocks; being likewise distinguished for its feebleness, which it supplies by its wisdom; and none of these characters apply to the jerboa: "therefore (says Mr Bruce) though he chews the cud in common with some others, and was in great plenty in Judea, so as to be known to Solomon, yet he cannot be the saphon of Scripture." He supposes with great probability, that it is the crearure termed the *mouse*, Isa. lxvi. 17; and says that in the Arabic version the word is expresly translated *jerboa*. See the article Saphon.

2. The sagitta, or Arabian jerboa, has three toes on the hind feet, and no thumb or fifth toe on the fore-paws. It is only about six inches long, and the tail rather shorter than the body; the soles of the hind feet and bottom of the toes are covered with a very thick coat of hair; the head is more rounded than that of the preceding animal, and the ears are much longer than the head. It inhabits Arabia, and near the Irtish in Siberia, where it frequents the sandy plains.

The two following are distinguished as different species by Mr Pennant, though Dr Gmelin seems not to have considered them as distinct from the preceding.

A. The

Plate CCCXVIII. fig. 6. A. The ægyptius, or Egyptian Jerboa, has three toes only on the hind feet; and four toes with a ſcarcely apparent thumb or fifth toe, furniſhed with a claw on the fore-paws.

This animal Mr Pennant ſuppoſes to be the *mus bipes* of the ancients, *mus ſagitta* of Pallas, *jerbo* of Buffon, and *daman Iſrael* of the Arabs. He ſays that it inhabits Egypt, Barbary, Paleſtine, the deſarts between Baſora and Aleppo, the ſandy tracks between the Don and Volga, and the hills ſouth of the Irtiſh.

Fig. 17. B. The ſibricius, or Siberian jerboa, with three toes on the hind feet, and two ſpurious toes ſome way up the legs; five toes on the fore feet, the thumb or fifth toe having no nail. Of this ſpecies Mr Pennant diſtinguiſhes four varieties, the major, medius, minor, and pumilio; differing in ſize, colour, &c.. But they all (he ſays) agree in manners. They burrow in hard ground, clay, or indurated mud; not only in high and dry ſpots, but even in low and ſalt places. They dig their holes with great celerity, not only with their fore-paws but with their teeth, and flinging the earth back with their hind feet ſo as to form a heap at the entrance. The burrows are many yards long, but not above half a yard deep. Theſe run obliquely; and end in a large ſpace or neſt, the receptacle of the fineſt herbs. They have uſually but one entrance; yet by a wonderful ſagacity they work from their neſt another paſſage to within a very ſmall ſpace of the ſurface, which in caſe of neceſſity they can burſt through, and ſo eſcape.

They ſleep rolled up with their head between their thighs: At ſun-ſet they come out of their holes, clear them of the filth, and keep abroad till the ſun has drawn up the dews from the earth. On approach of any danger they immediately take to flight, with leaps of a fathom in height, and ſo ſwiftly that a man well mounted can hardly overtake them. They ſpring ſo nimbly, that it is impoſſible to ſee their feet touch the ground. They do not go ſtraight forward, but turn here and there till they gain a burrow, whether it is their own or that of another. When ſurpriſed, they will ſometimes go on all fours, but ſoon recover their attitude of ſtanding on their hind legs like a bird: even when undiſturbed, they uſe the former attitude; then riſe erect, liſten, and hop about like a crow. In digging or eating they drop on their fore legs; but in the laſt action will often ſit up and eat like a ſquirrel. They are eaſily tamed; and ſeek always a warm corner. They foretel cold or bad weather by wrapping themſelves cloſe up in hay; and thoſe which are at liberty ſtop up the mouths of their burrows. In a wild ſtate they live much on oleraceous plants: the ſmall ſtature of the pumilio is attributed to its feeding on ſaline plants. Thoſe of the middle ſize, which live beyond the lake Baikal, feed on the bulbs of the *lilium pomponium*, and they gnaw the twigs of the *robinia caragana*. When confined, they will not refuſe raw meat or the entrails of fowls.—They are the prey of all leſſer rapacious beaſts; and the Arabs, who are forbidden all other kinds of mice, eſteem theſe the greateſt delicacies. The Mongols have a notion that they ſuck the ſheep: certain it is they are during night very frequent among the flocks, which they diſturb by their leaps. Theſe animals breed often in the ſummer; in the ſouthern parts in the beginning of May; beyond Baikal not till June. They bring perhaps eight at a time, as they have ſo many teats. They ſleep the whole winter without nutriment. About Aſtracan, they will ſometimes appear in a warm day in February; but return to their holes on the return of cold.

3. The cafer, or Cape jerboa, has four toes on the hind-feet and five on the paws; the tail is very hairy, and tipt with black.—This ſpecies, which inhabits the Cape of Good Hope, is larger than any of the foregoing, being 14 inches long, the tail 15, the ears three. It is called *aerdmannetie*, or little earth man, and *ſpringen haas*, or leaping hare, by the Dutch at the Cape. It has a grunting voice; is very ſtrong, and leaps 20 or 30 feet at one bound. It burrows with its fore-feet; and ſleeps ſitting on its hind legs, with the knees ſeparated, the head between, and holding its ears with the fore-paws over its eyes. It is eaten by the natives; and is caught by pouring water into its hole, which forces it to come out.

4. The meridianus, Caſpian jerboa, or long-legged mouſe, has five toes behind and three before, with the rudiments of a thumb or inner toe. It is five inches long, and the tail three.—This ſpecies inhabits the ſandy deſarts between the Ural and Volga, near the Caſpian. It forms burrows, with three entrances, about a yard in depth; and feeds chiefly on the ſeeds of the pterococci and aſtragali. Plate CCCXIX. fig. 6.

5. The lamaricinus, or marſh jerboa, has five toes behind and three before, with the rudiments of a fourth; the tail is obſcurely annulated. The body and head meaſure about five inches and a half in length; the tail is about the ſame length.—This ſpecies inhabits the ſalt marſhes near the Caſpian ſea; and is ſuppoſed to feed on the fruit of the tamarix and nitrarium, which grow in theſe marſhes. Under the roots of theſe trees it forms very deep burrows, which have two entrances. It is a very elegant little animal. There are two or three other ſpecies of this genus. Fig. 19.

IV. The Cavia, or *Cavy;* a genus which ſeems to hold a middle place between the murine and the leporine quadruped. The characters are: there are two wedge-like cutting teeth in each jaw, and eight grinders in both jaws: the fore-feet are furniſhed with four or five toes: the hind feet with three, four, or five each: the tail is either very ſhort or entirely wanting: there are no clavicles or collar-bones.

1. The paca, or ſpotted cavy, has five toes on all the feet; and the ſides are marked with rows of grey or pale yellow ſpots. The body and head meaſure about two feet in length; the tail is like a ſmall button, and ſo extremely ſhort as to be hardly apparent; the mouth is very ſmall, and the upper lip is divided; the noſtrils are very large, and the muzzle is garniſhed with long whiſkers; the ears are ſhort and roundiſh; the eyes are large, prominent, and browniſh; the two cutting teeth in each jaw are very long and of great ſtrength; the hind legs are longer than the fore.—This ſpecies inhabits Braſil, Guiana, and probably all the warmer parts of America. It lives in fenny places near rivers, burrowing in the ground, and keeping its hole exceedingly clean, to which it has always three diſtinct outlets: It grows very fat, and is eſteemed a great delicacy. The female has Plate CCCXVII. fig. 13.

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 two teats situated between the hind thighs, and has only a single young one at a litter.—It is difficult to take this animal alive. When surprised in its hole, which the hunters lay open both before and behind, it defends itself, and even bites fiercely. It is however, easily accustomed to a domestic life. Unless industriously irritated, it is gentle and tractable, fond of adulation, and licks the hands of the person who caresses it. It knows those who take care of it, and readily distinguishes their voices. When gently stroaked on the back, it stretches itself out, lies down on its belly, by a small cry expresses its acknowledgement, and seems to ask a continuance of the favour: but if seized in a rough manner, it makes very violent efforts to escape. When kept in a wooden cage or box, this animal remains perfectly tranquil during the day, especially when plentifully supplied with food. It seems even to have an affection for its retreat as long as the day lasts; for, after feeding, it retires spontanously into it. But when night approaches, by perpetual restlessness and agitation, and by tearing the bars of its prison with its teeth, it discovers a violent desire of getting out. Nothing of this kind happens during the day, unless it has occasion for some natural evacuation, for it cannot endure the smallest degree of dirtiness in its little apartment; and when about to void its excrements, always retires to the most distant corner it can find. When its straw begins to smell, it often throws it out, as if it meant to demand fresh litter. This old straw it pushes out with its muzzle, and goes in quest of rags or paper to replace it. In a female cavy, the following extraordinary instance of cleanliness was observed. A large male rabbit being shut up with her when she was in season, she took an aversion to him the moment he voided his excrement in their common apartment. Before this she was very fond of him; licked his nose, ears and body; and allowed him to take almost the whole food that was given her. But as soon as the rabbit had infected the cage with his ordure, she retired into the bottom of an old press, where she made a bed with paper and rags, and returned not to her old lodging till she saw it neat, and freed from the unclean guest which had been presented to her.

2. The agouti, which is about the size of a rabbit, has a very short tail; four toes on the fore feet, and three on the hind ones; the upper parts of the body of a brownish colour mixed with red and black, the rump orange, and the belly yellowish. Of this species there are three varieties mentioned by authors, viz. the lesser cunicularis or long-nosed cavy, which is about the size of a rabbit; the leporina or larger rabbit, called the *java hare*, or *javan cavy*, which is as large as a hare; and the americana, which seems to be but little known. They all inhabit South America and the West India Islands; dwelling in hollow trees, or burrowing in the ground. They search for their food, which is entirely vegetable, during the day, and carry it home with them to their dwellings: when feeding they sit on their hind legs, and carry their food with the fore-paws to the mouth. They grow very fat and are very good eating, their flesh being white and savoury like that of a rabbit. They breed frequently in the same year, the female bringing three, four or five young ones at a birth. They

Plate CCCXVII fig. 10, 11.

grunt like pigs are very voracious, and when fat, their flesh is white like that of a rabbit, but dry. What food they cannot immediately consume they hoard in their retreats, and eat at their leisure. Their pace is hopping like that of a hare or rabbit; they beat the ground like them with their feet, when angry; they stop and listen to the sound of music; and they take shelter when pursued, in their holes, or in hollow trees.—They are hunted with dogs. When one of them is forced among the cut sugar canes, he is soon taken; because these grounds being generally covered a foot thick with straw and leaves, at each leap he sinks in this litter, so that a man may overtake and slay him with a baton. He commonly runs very nimbly before the dogs; and when he gains his retreat, he lies squat, and remains obstinately in his concealment. The hunters are obliged to chace him out by filling his hole with smoke. The animal, half suffocated, utters mournful cries; but never issues forth unless when pushed to the last extremity. His cry, which he often repeats when disturbed or irritated, resembles that of a small hog If taken young he is easily tamed, and goes out and returns of his own accord.

3. The cobaya or restless cavy, has four toes on the fore and three on the hind-feet, with no tail: it is about seven inches in length; and the whole body is white, usually variegated with irregular orange and black blotches. This species inhabits Brasil; but its manners in a wild state are not mentioned by authors. In a domestic state, as they appear in Europe, they are very restless and make a continual noise.—They feed on all kinds of herbs; but especially on parsley, which they prefer to grain or bread; and they are likewise fond of apples and other fruits. They eat precipitately like the rabbit, little at a time, but very often. Buffon says they never drink; but Gmelin, that they drink water. Their voice is commonly a kind of grunt like a young pig; when engaged in their amours, it resembles the chirp of a bird; and when hurt, they emit a sharp cry, They are of a tame and gentle, but stupid disposition. The female breeds at two months old, bringing from four or five to ten or twelve young ones at a birth, though she has only two teats; and breeds very often during the year, as she goes but three weeks with young, and takes the male 12 or 15 days after littering. As they breed so fast their multitudes would be innumerable, if there were not so many enemies which destroy them. They cannot resist either cold or moisture: when cold, they assemble and crowd close together; in which case they often all perish together. They are also devoured in great numbers by cats, and many are killed by the males. Rats are said to avoid their haunts. They are called in England *Guinea-pigs*, from their being supposed to come from that country. Fig. 5.

4. The magellanica, or Patagonian cavy, has hardly any tail; the sides of the nose are garnished with tufts of curly hair and long numerous whiskers. This species inhabits the country about Port Desire in Patagonia, and is of considerable size, sometimes weighing 26 pounds. It has the same manners with the rest of the genus; it sits on its hind legs, burrows in the ground, and feeds on vegetables. The flesh is very white, and has an excellent flavour. Fig. 12.

5. The

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Plate CCCXVII

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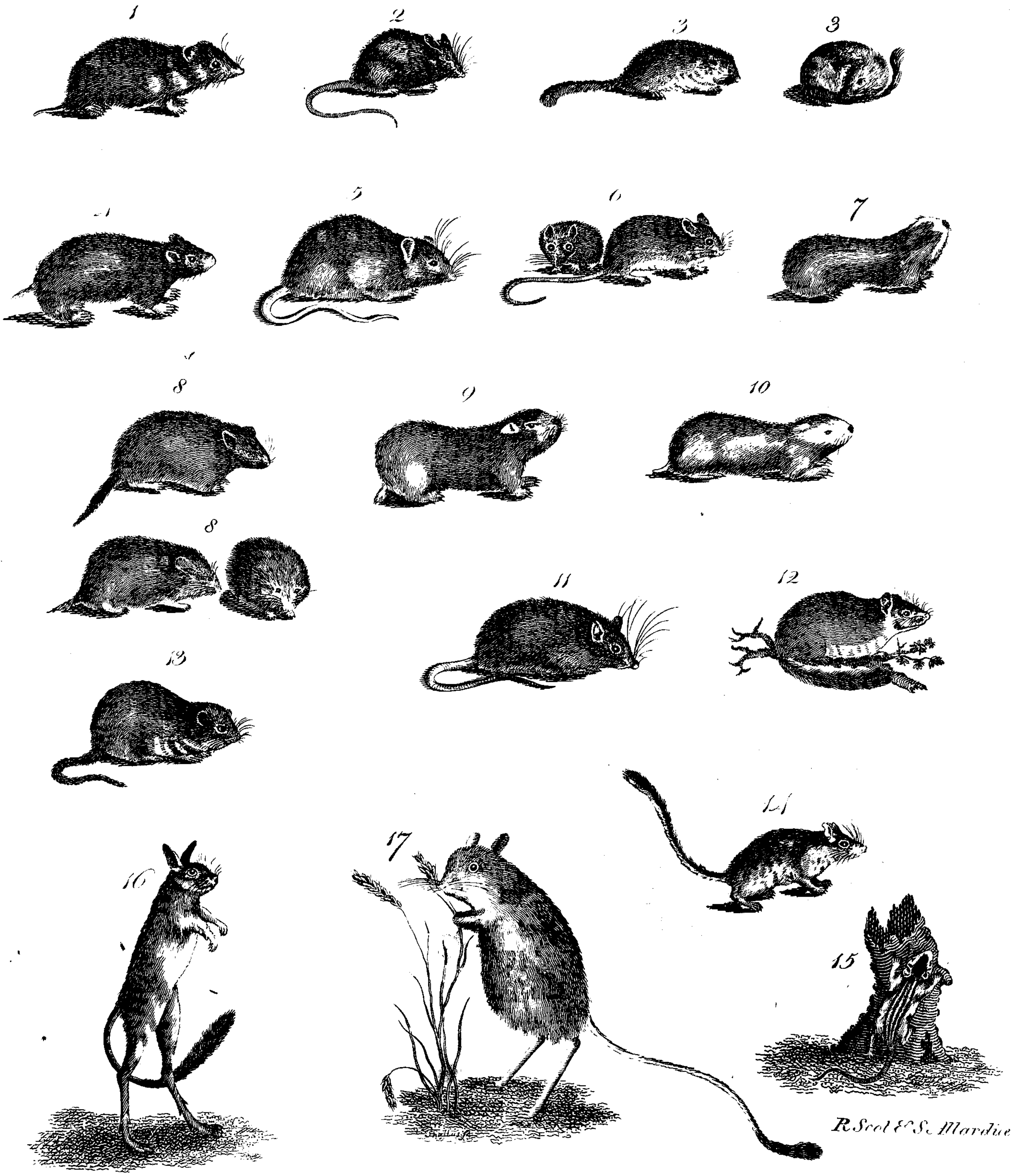
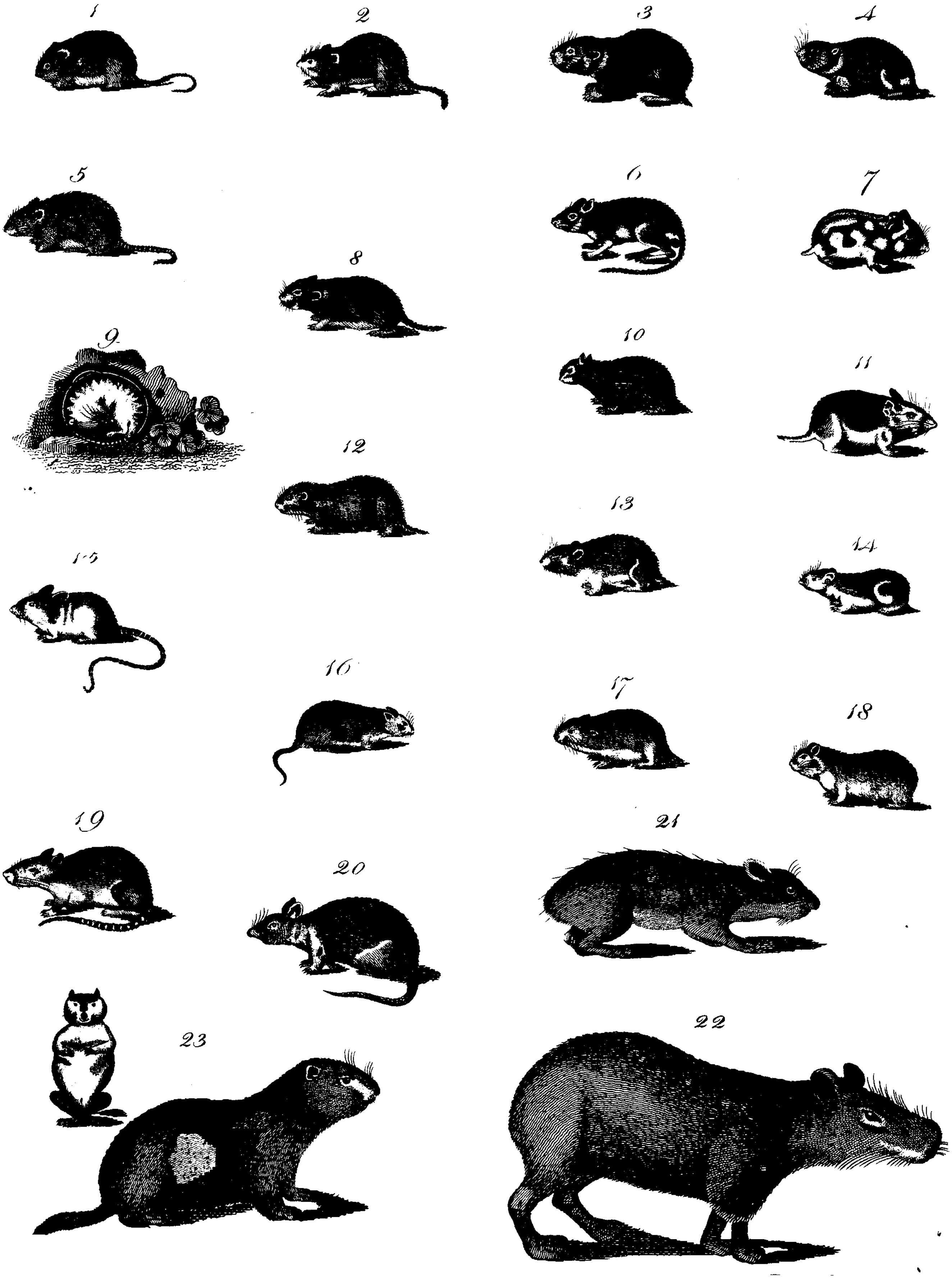
Plate CCCXVIII



Mus Plate CCCXIX



Mus. Plate CCCXIX. fig. 22. 5. The capybara, or thick nosed tapir, has no tail; the hind feet have each three webbed toes. The length of the animal, when full grown, is above two feet and a half: the head and nose are very large and thick; having small, erect, rounded, naked ears, and large black eyes: and the nose is garnished with numerous black whiskers: in each jaw are two large strong fore-teeth, and eight grinders; the legs are short, having the toes connected by a web, and their extremities are guarded with a kind of hoofs instead of claws; the neck is short and thick; the hair is short, rough and harsh, like bristles, being longer on the back, and most of them are yellowish in the middle and black at both ends.—This species inhabits the eastern side of South America, from the isthmus of Darien to Brazil and Paraguay; living in fenny woods near the large rivers, such as the Amazons, Oroonoko, and Plata. They swim and dive remarkably well, and keep for a long time under water. They catch fish at night with great dexterity, and bring them on shore to eat them; which they do sitting on the hind legs, and holding the food in the fore-paws like the apes. They likewise live on fruits and vegetables, especially the sugar cane, and feed only in the night. They keep together in large herds, making a great noise like the braying of asses, and do vast mischief in gardens. They grow very fat; and the flesh is eaten, being tender, but has an oily and fishy flavour. In the breeding season, one male and one female live together, and the female only produces a single one at a birth. These animals are easily rendered tame, and become very familiar.

Plate CCCXVII. fig. 3. 6. The acuschy, or olive cavy, has a short tail; the upper parts of the body are of an olive colour, the under parts whitish. This species inhabits Guiana, Cayenne, and Brasil.—It is about the size of an half-grown rabbit, is easily tamed, and is reckoned very delicate food. The female brings one, sometimes two at a litter. This animal resembles the agouti, but is uniformly smaller, has a tail of some length, and is of a different colour. It inhabits the woods, living on fruits; abhors water; and sometimes, though rarely, makes a cry like that of the restless cavy.

There are five or six other species described by authors as belonging to the cavy genus. Two of them, however, have been lately marked by Dr Gmelin under a new genus, *Hyrax;* which, as there was not an opportunity of introducing it in the order of the alphabet, we shall here subjoin together with the descriptions of the species as given by Mr Kerr.

V. Hyrax, or *ashkoko*. There are two broad and distant fore-teeth above; four contiguous, broad, flat, notched fore-teeth below; and four large grinders on each side in both jaws. The fore feet have four toes, the hind feet only three. There is no tail; and the clavicles are wanting.

Fig. 9. 1. The capensis, or cape ashkoko, "has flat nails on all the toes, except one toe of each hind-foot which is armed with a sharp pointed claw. It inhabits the Cape of Good Hope.—This animal is about the size of a rabbit, being about 15 inches long; the head is short, with the back part very thick, and the snout very short and blunt; the eyes are small; the ears are oval and open, brown, woolly, and half hid in the fur; the legs are very short, the upper joints of both being concealed beneath the skin; the hind legs are rather longer than the fore; the feet are large, black, and naked; the body is short, thick, and contracted, with a prominent belly, and is covered with a soft woolly fur of a yellowish brown or greyish colour, hoary at the roots; the sides are of a dirty whitish grey; and along the back is a brownish stripe: this fur is interspersed with longer and coarser black hairs; and a few very coarse long bristles. The fore-feet have four short, scarce divided, thick toes, furnished with flat nails; the two outer toes of the hind-feet are similar, but the inner toe is longer, and has a sharp claw. This animal has a sharp voice, and acute sense of hearing; its gait is very wavering and unsteady, owing to the shortness of its thighs and unequal length of the hind and fore legs: notwithstanding of which it is very active and moves by leaps: it is very cleanly living entirely on vegetable food, drinks little, is fond of heat and burrows in the ground. In manners and general appearance, this animal resembles the marmot and cavy; in the conformation of its toes it has some analogy with the maucauco; but from the circumstances of the teeth it cannot be ranked with the last; and the peculiarity of the feet has caused Dr Gmelin to separate it from both of the former."

Plate CCCXIX. fig. 21. 2. The syriacus, or Syrian ashkoko, (Bruce, Schreber), "has soft tender nails on all the toes. It inhabits Syria and Ethiopia.—The body of this is more lengthened than that of the former, and the snout more oblong. The fur is of a reddish grey colour like that of the wild rabbit, the throat, breast, and belly, being white; all over the body a number of long, strong and polished hairs are scattered among the fur. The body and head of the individual described by Mr Bruce measured 17 inches. The ears are broad, open, and rounded; each side of the mouth is garnished with long whiskers. In walking, which is performed creeping low with the belly almost touching the ground, the hind feet are used as far as the heel. All the toes have short, broad, weak, flat nails, except the inner toe of the hind foot, which is provided with a flat crooked nail somewhat longer than the rest; the soles of the feet are formed of fleshy naked protuberances, divided by furrows. It lives mostly about the mouths of caves or clefts in rocks; is gregarious; feeds entirely on vegetables; is mild, feeble, timid, and easily tamed, and has no voice or cry. Mr Bruce is of opinion, that this animal is the gannim or Daman Israel of the Arabs, and the saphan of sacred scriptures, which has erroneously been translated *the rabbit.*—Its flesh is very white, but is not eaten by the Abyssinians or Mahometans. The same celebrated traveller is of opinion that it ruminates or chews the cud."

Musa. MUSA, the plantain-tree: A genus of the monœcia order, belonging to the polyandria class of plants; and in the natural method ranking under the eighth order, *Scitamineæ*. The calyx of the male hermaphrodite is a spatha or sheath; the corolla is dipetalous; the one petal erect and quinquedentate; the other nectariferous, concave, and shorter; there are six filaments; five of which are perfect; one style; the germen inferior and abortive. The female hermaphrodite has the calyx, coralla, filaments, and pistil of the male hermaphrodite, with only one filament perfect; the berry is oblong, and three-angled below. The most remarkable species are, 1. The *paradisaica*, or plantain; 2. The *musa sapientum*, or banana-tree. See Plate CCCXX.

The first sort is cultivated in all the islands of the West Indies, where the fruit serves the Indians for bread; and some of the white people also prefer it to most other things, especially to the yams and cassada bread. The plant rises with a soft stalk 15 or 20 feet high; the lower part of the stalk is often as large as a man's thigh, diminishing gradually to the top, where the leaves come out on every side;—these are often eight feet long, and from two to three feet broad, with a strong fleshy midrib, and a great number of transverse veins running from the midrib to the borders. The leaves are thin and tender, so that where they are exposed to the open air, they are generally torn by the wind: for as they are large, the wind has great power against them: these leaves come out from the centre of the stalk, and are rolled up at their first appearance; but when they are advanced above the stalk, they expand and turn backward. As these leaves come up rolled in the manner before-mentioned, their advance upward is so quick that their growth may almost be discerned by the naked eye; and if a fine line is drawn across level with the top of the leaf, in an hour's time the leaf will be near an inch above it. When the plant is grown to its full height, the spikes of flowers will appear in the centre, which is often near four feet in length, and nods on one side. The flowers come out in bunches: those in the lower part of the spike being the largest; the others diminish in their size upward. Each of these bunches is covered with a spath or sheath of a fine purple colour, which drops off when the flowers open. The upper part of the spike is made up of male or barren flowers, which are not succeeded by fruit, but fall off with their covers. The fruit or plantains are about a foot long, and an inch and a half or two inches diameter: it is at first green, but when ripe of a pale-yellow colour. The skin is tough; and within is a soft pulp of a luscious sweet flavour. The pikes of fruit are often so large as to weigh upwards of 40 lb. The fruit of this sort is generally cut before it is ripe. The green skin is pulled off, and the heart is roasted in a clear fire for a few minutes; and frequently turned: it is then scraped, and served up as Bread. Boiled plantains are not so palatable. This tree is cultivated on a very extensive scale in Jamaica; without the fruit of which, Dr Wright says, the island would scarce be habitable, as no species of provision could supply their place. Even flour or bread itself would be less agreeable, and less able to support the laborious negroe, so as to enable him to do his business or to keep in health. Plantains also fatten horses, cattle, swine, dogs, fowls, and other domestic animals.

The leaves being smooth and soft are employed as dressings after blisters. The water from the soft trunk is astringent, and employed by some to check diarrhœas. Every other part of the tree is useful in different parts of rural economy. The leaves are used for napkins and table cloths, and are food for hogs.

The second sort differs from the first, in having its stalks marked with dark purple stripes and spots.—The fruit is shorter, straighter, and rounder; the pulp is softer, and of a more luscious taste. It is never eaten green; but when ripe it is very agreeable, either eaten raw or fried in slices as fritters; and is relished by all ranks of people in the West Indies.

Both the above plants were carried to the West Indies from the Canary islands; whither, is believed, they had been brought from Guinea, where they grow naturally. They are also cultivated in Egypt, and in most other hot countries, where they grow to perfection in about 10 months from their first planting to the ripening of their fruit. When their stalks are cut down, there will several suckers come up from the root, which in six or eight months will produce fruit; so that by cutting down the stalks at different times, there is a constant succession of fruit all the year.

In Europe there are some of these plants preserved in the gardens of curious persons, who have hot-houses capacious enough for their reception, in many of whom they have ripened their fruit very well; but as they grow very tall and their leaves are large they require more room in the stove than most people care to allow them. They are propagated by suckers, which come from the roots of those plants which have fruited; and many times the younger plants, when they are stinted in growth, will also put out suckers.

The fruit of the banana-tree is four or five inches long, of the size and shape of a middling cucumber, and of a high, grateful flavour: the leaves are two yards long, and a foot broad in the middle; they join to the top of the body of the tree, and frequently contain in their cavities a great quantity of water which runs out, upon a small incision being made into the tree, at the junction of the leaves. Bananas grow in great bunches, that weigh a dozen pounds and upward. The body of the tree is so porous as not to merit the name of wood; the tree is only perennial by its roots, and dies down to the ground every autumn.

When the natives of the West Indies (says Labat) undertake a voyage, they make provision of a paste of banana; which, in case of need, serves them for nourishment and drink: for this purpose they take ripe bananas; and having squeezed them through a fine sieve, form the solid fruit into small loaves, which are dried in the sun or in hot ashes, after being previously wrapped up in the leaves of Indian flowering-reed.—When they would make use of this paste they dissolve it in water, which is very easily done; and the liquor, thereby rendered thick, has an agreeable acid taste imparted to it, which makes it both refreshing and nourishing.—The banana is greatly esteemed, and even venerated, by the natives of Madeira, who term it the *forbidden fruit*, and reckon it a crime almost inexpiable to cut it with a knife; because, after dissection, it exhibits, as they pretend, a similitude of our Saviour's crucifixion; and to cut the fruit open with a knife, is, in their apprehension, to wound his sacred image.

Some authors have imagined, that the banana-tree was that of the leaves of which our first parents made themselves aprons in Paradise. The sacred text, indeed, calls the leaves employed for that purpose *fig-leaves;* and Milton, in a most beautiful but erroneous description, affirms the bearded or Bengal fig to have been the tree alluded to. But besides that the fruit of the banana is often by the most ancient authors called

Musa.

called a *fig*, its leaves, by reaſon of their great ſize and ſolidity, were much more proper for a veil or covering than thoſe of the Bengal fig, which are ſeldom above ſix or eight inches long and three broad. On the other hand, the banana leaves being three, four, and five feet long, and proportionally broad, could not fail to be pitched upon in preference to all others; eſpecially as they might be eaſily joined, or ſewed together, with the numerous thread-like filaments that may, with the utmoſt facility, be peeled from the body of this tree.

Some have ſuppoſed the Abyſſinian plant *enſete* to be a ſpecies of muſa. It is ſaid to be a native of the province of Narea, where it grows in the great marſhes and ſwamps for which that province is remarkable, owing to the many rivers which originate in that country, and have but a ſmall declivity to the ocean. This plant, as well as the coffee-tree, is ſaid to have been unknown in Abyſſinia before the arrival of the Galla, who imported them both along with them. It comes to great perfection about Gondar; but the principal plantations of it are in that part of Maitſha and Gouth, to the weſt of the Nile, where it is almoſt the ſole food of the Galla who inhabit that country. Maitſha is almoſt entirely on a dead level; ſo that the rains ſtagnate and prevent the ſowing of grain. Were it not for the enſete, therefore, the Galla would have ſcarce any vegetable food. Mr Bruce * thinks that the enſete may have been cultivated in ſome of the gardens of Egypt about Roſetto, but that it was not a native of the country. He ſtrongly controverts the opinion that this plant is a ſpecies of muſa. "It is true (ſays he), the leaf of the banana reſembles that of the enſete: it bears figs, and has an excreſcence from its trunk, which is terminated by a conical figure, chiefly differing from the enſete in ſize and quantity of parts; but the figs of the banana are of the ſize and figure of a cucumber, and this is the part which is eaten. This fig is ſweet, though mealy, and of a taſte highly agreeable. It is ſuppoſed to have no ſeeds, though in fact there are four ſmall black ſeeds belonging to every fig. But the figs of the enſete are not eatable: they are of a ſoft tender ſubſtance: watery, taſteleſs, and in colour and conſiſtence reſembling a rotten apricot: they are of a conical form, crooked a little at the lower end; about an inch and an half in length, and an inch in breadth where thickeſt. In the inſide of theſe is a large ſtone half an inch long, of the ſhape of a bean or caſhew-nut, of a dark-brown colour; and this contains a ſmall ſeed, which is ſedom hardened into fruit, but conſiſts only of ſkin. The long ſtalk that bears the figs of the enſete ſprings from the centre of the plant, or rather is the body or ſolid part of the plant itſelf. Upon this, where it begins to bend, are a parcel of looſe leaves; then grows the fig upon the body of the plant without any ſtalk; after which the top of the ſtalk is thickſet with ſmall leaves, in the midſt of which terminates the flower in the form of an artichoke; whereas in the banana, the flower in form of the artichoke grows at the end of that ſhoot or ſtalk, which proceeds from the middle of the plant, the upper part of which bears the row of figs. The leaves of the enſete are of a web of longitudinal fibres cloſely ſet together; the leaves grow from the bottom without ſtalks; whereas the banana is in form like a tree, and has been miſtaken for ſuch. One half of it is divided into a ſtem, the other is a head formed with leaves; and in place of the ſtem that grows out of the enſete, a number of leaves, rolled round together like a truncheon, ſhoots out of the heart of the banana, and renews the upper as the under leaves fall off; but all the leaves of the banana have a long ſtalk; this fixes them to the trunk, which they do not embrace by a broad baſe or involucrum as the enſete does.

* Travels, vol. v. p. 36.

"But the greateſt differences are ſtill remaining.—The banana has by ſome been miſtaken for a tree of the palmaceous kind, for no other reaſon but a kind of ſimiliarity in producing the fruit on an excreſcence or ſtalk growing from the heart of the ſtem: but ſtill the muſa is neither woody nor perennial; it bears the fruit but once; and in all theſe reſpects it differs from trees of the palmaceous kind, and indeed from all ſorts of trees whatever. The enſete, on the contrary, has no naked ſtem; no part of it is woody: the body of it, for ſeveral feet high, is eſculent; but no part of the banana plant can be eaten. As ſoon as the ſtalk of the enſete appears perfect and full of leaves, the body of the plant turns hard and fibrous, and is no longer fit to be eaten: before, it is the beſt of all vegetables. When boiled, it has the taſte of the beſt new wheat-bread not perfectly baked. When you make uſe of the enſete for eating, you cut it immediately above the ſmall detached roots, and perhaps a foot or two higher, as the plant is of age. The green muſt be ſtripped from the upper part till it becomes white; when ſoft, like a turnip well boiled, if eat with milk or butter, it is the beſt of all food, wholeſome, nouriſhing; and eaſily digeſted."

Our author now proceeds to conſider an hieroglyphic ſometimes met with in Egypt, viz. "the figure of Iſis ſitting between ſome branches of the banana tree, as is ſuppoſed, and ſome handfuls of ears of wheat. You ſee likewiſe the hippopotamus ravaging a quantity of the banana tree. Yet the banana is merely adventitious in Egypt: it is a native of Syria: it does not even exiſt in the low hot country of Arabia Felix; but chooſes ſome elevation in the mountains where the air is temperate; and is not found in Syria farther to the ſouthward than Lat. 34°.

For theſe reaſons Mr Bruce thinks, that the banana not being a plant of the country, "could never have entered into the liſt of their hieroglyphics; for this reaſon it could not figure any thing regular or permanent in the hiſtory of Egypt or its climate. I therefore imagine (adds he), that this hieroglyphic was wholly Ethiopian; and that the ſuppoſed banana, which, as an adventitious plant, ſignified nothing in Egypt, was only a repreſentation of the enſete; and that the record in the hieroglyphic of Iſis and the enſete-tree was ſomething that happened between harveſt, which was about Auguſt, and the time that the enſete-tree came in uſe, which was in October.—The hippopotamus is generally thought to repreſent a Nile that has been ſo abundant as to be deſtructive. When, therefore, we ſee upon the obeliſks the hippopotamus deſtroying the banana, we may ſuppoſe it meant, that the extraordinary inundation had gone ſo far as not only to deſtroy the wheat, but alſo to retard or hurt the growth of the enſete, which was to ſupply its place."

MUSÆUS,

MUSÆUS, an ancient Greek poet, was, according to Plato and Diodorus Siculus, an Athenian, the son of Orpheus, and chief of the Eleusinian mysteries instituted at Athens in honour of Ceres: or, according to others, he was the only the disciple of Orpheus: but from the great resemblance which there was between his character and talents and those of his master, by giving a stronger outline to the figure he was called his *son*, as those are styled the *children of Apollo* who cultivated the arts of which he was the tutelar god.

Musæus is allowed to have been one of the first poets who versified the oracles. He is placed in the Arundelian marbles, epoch 15. 1426 B. C. at which time his hymns are there said to have been received in the celebration of the Eluesinian mysteries. Laertius tells us, that Musæus not only composed a theogony, but formed a sphere for the use of his companions; yet as this honour is generally given to Chiron, it is more natural to suppose, with Sir Isaac Newton, that he enlarged it with the addition of several constellations after the conquest of the golden fleece. The sphere itself shows that it was delineated after the Argonautic expedition, which is described in the asterisms, together with several other more ancient histories of the Greeks, and without any thing later; for the ship Argo was the first long vessel which they had built: hitherto they had used round ships of burthen, and kept within sight of the shore; but now, by the dictates of the oracle, and consent of the princes of Greece, the flower of that country sail rapidly through the deep, and guide their ship by the stars.

Burney's History of Music.

Musæus is celebrated by Virgil in the character of hierophant, or priest of Ceres, at the head of the most illustrious mortals who have merited a place in Elysium. Here he is made the conductor of Æneas to the recess where he meets the shade of his father Anchises.

A hill near the citadel of Athens was called *Musæum*, according to Pausanias, from Musæus, who used to retire thither to meditate and compose his religious hymns; at which place he was afterwards buried. The works which went under his name, like those of Orpheus, were by many attributed to Onomacritus. Nothing remains of this poet now, nor were any of his writings extant in the time of Pausanias, except a hymn to Ceres, which he made for the Lycomides. And as these hymns were likewise set to music, and sung in the mysteries by Musæus himself in the character of priest, he thence perhaps acquired from future times the title of *musician* as well as of *poet;* the performance of sacred music being probably at first confined to the priesthood in these celebrations, as it had been before in Egypt, whence they originated. However, he is not enumerated among ancient musicians by Plutarch; nor does it appear that he merited the title of *son* and *successor to Orpheus* for his musical abilities, so much as for his poetry, piety, and profound knowledge in religious mysteries.

MUSCA, the Fly, in zoology; a genus of insects belonging to the order of diptera. The mouth is furnished with a fleshy proboscis, and two lateral lips; but it has no palpi. This genus is divided into two different sections: 1. Those with simple antennæ. 2. Those which are furnished with a lateral hair or feather. Those have downy bodies, though scarce perceptibly so; and have either a lateral plume or feather on the antennæ, or a simple hair on the side of the antennæ. The pilosæ have a few hairs scattered upon their bodies, principally upon the thorax; they have either a lateral feather or a lateral hair. Under these divisions are comprehended about 400 different species, as enumerated in Dr Gmelin's edition of the *Systema Naturæ*. "Variety (as Mr Barbut observes) runs through their forms, their structure, their organization, their metamorphoses, their manner of living, propagating their species, and providing for their posterity. Every species is furnished with implements adapted to its exigencies. What exquisiteness! what proportion in the several parts that compose the body of a fly! What precision, what mechanism in the springs and motion! Some are oviparous, others viviparous; which latter have but two young ones at a time, whereas the propagation of the former is by hundreds. Flies are lascivious troublesome insects, that put up with every kind of food. When storms impend, they have most activity, and sting with greatest force. They multiply most in hot moist climates; and so great was formerly their numbers in Spain, that there were fly-hunters commissioned to give them chace. The vapour of sulphur or arsenic destroys them; and their numbers may be reduced by taking them in phials of honeyed water, or between boards done over with honey." There are 129 species, principally distinguished by the peculiarities in their feelers.

Musca, a name given to such persons among the Romans as officiously thrust themselves into the company of their superiors and those who despised them, by finding means of getting admittance to entertainments without invitation, and without a welcome: So that *muscæ* were the same as parasites, who were frequently by the Greeks termed *Μυιαι*. See Parasite.

MUSCADINE, a rich wine, of the growth of Provence, Languedoc, Cividad, &c.—The word, as well as the liquor, is French: Some fetch its original from the *musk;* the wine being supposed to have a little of the smell of that perfume; others from *musca*, a fly," because the flies are extremely fond of its grapes; as the Latins had their *vinum apianum*, so called *ab apibus*, from the bees which fed on it.

The way of making muscadine at Frontignac is as follows: They let the muscadine grapes grow half dry on the vine; as soon as they are gathered, they tread and press them immediately, and tun up the liquor, without letting it stand and work in the fat; the lee occasioning its goodness.

MUSCHENBROECK (Peter de), a very distinguished natural philosopher and mathematician, was born at Utrecht a little before 1700. He wat first professor of these in his own university, and afterwards invited to the chair at Leyden, where he died full of reputation and honours in 1761. He was a member of several academies; particularly the Academy of Sciences at Paris. He was the author of several works in Latin, all of which show the greatest penetration and exactness in this way. He was also very consummate in the knowledge of law.

MUSCI, Mosses, one of the seven families or classes into which all vegetables are divided by Linnæus in the *Philosophia Botanica*. The ancients took the moss of trees to be the effect of a disorder or discomposure of the texture of the bark; or at most a kind of little filaments arising from the bark; but the moderns find, by several observations, that mosses are all

Musci. all real diſtinct plants, whoſe ſeed, being extremely ſmall, is incloſed in little capſulæ; which burſting of themſelves, the ſeed is carried off by the winds; till, falling into the inequalities of the bark of trees, it is there ſtopped, takes root, and feeds at the expence of the tree, as mouldineſs does on bread, &c.

What the botanical writers ſtrictly underſtand by the word *moſs*, is a claſs of plants appearing of an inferior rank to the common vegetables; the leſs perfect genera of which have been ſuppoſed to be wholly deſtitute of flower or ſeed, or any thing analogous to either, and to conſiſt of ſimple, ſimilar, and uniform parts; the genera a little above theſe have ſome diverſity of parts, and carry ſomething that looks analogous to vegetation in the common way, having a reſemblance of thoſe parts which ſerve other plants for their fructification. The more perfect genera of the moſſes not only conſiſt of different parts, but have alſo their appropriated organs containing a pulpy matter, which finally becomes dry, and aſſumes the form of a fine and ſubtile powder, compoſed of granules, each of which is either a ſeed or a granule of farina, ſerving for the propagation of the ſpecies.

The more imperfect moſſes are diſtinguiſhed from the others by their appearance to the naked eye; they are either in form of a fine lanugo or down covering the ſurface of different bodies; or elſe they appear as ſlender filaments, or foliaceous bodies, floating about in the water; or as filaments of a tougher texture, hanging down from the branches of old trees; or as little ſhrubs, or ſingle horns, growing erect on the parched earth of mountains and heathy places; or finally, as broad and foliaceous bodies ſpreading themſelves over the dry barks of trees or rocks, without any pedicle or other ſuppport.

The more perfect kinds of moſſes are found in the ſhape of ſmall but regular plants, divided into ſeveral branches, and clothed with leaves: theſe are of various forms and ſtructures; ſome being broad and thin, others ſlender as hairs; ſome pellucid, others opake; ſome ſmooth, others hairy. From the alæ of theſe leaves in ſome kinds, and from the ſummit of the ſtalks in others, there ariſe heads or capſules of various figure and ſtructure, but all unicapſular; ſome of theſe are naked, and others covered with a calyptra or hood; ſome ſtand on long pedicles, and others are placed cloſe to the ſtalks. Theſe heads are uſually called *capſulæ*, which contain their feeds or farina, and their pedicles *ſetæ*, in the *mnia*, *hypna*, *brya*, and *polytricha*, &c.

Theſe capſules in ſome are covered with a calyptra or hood; in others they are naked. Of the firſt kind are the *ſplachnum*, *polytricum*, *mnium*, *bryum*, *hypnum*, *fontinalis*, and *buxbaumia;* and of the latter ſort, the *lycopodium*, *porella*, *ſphagnum*, and *phaſcum*.

The ſubſtance with which the heads or capſules of all the moſſes are filled, reſembles either ſeeds, or the ſmall globules of the farina of flowers, which all reſemble ſeeds of particular figures in miniature. The fructifications of theſe minute plants ſeem to be either from theſe, as ſeeds falling to the earth; or, according to the opinion of ſome, they ſeem to contain only farina in the capſules, which impregnating certain bulbs or nodules in the alæ of the leaves, cauſe them to grow and vegetate, as is ſeen in ſome of the larger plants; as in the bulbs produced in the alæ of the leaves of the dentaria, and of the lilies, and ſome others. The former opinion, of the powder in the heads or capſules being actually perfect ſeeds, is the more probable, as the bulbs in the alæ of the leaves are found only in ſome of the hypna, and others of a few other genera; whereas the propagation is as quick and certain in thoſe which have none of them as in thoſe which have; and the want of female parts of fructification, which makes ſo many deſiderata in the Linnæan ſyſtem of botany, is eaſily made up, and the whole explained according to the uſual courſe of nature in other vegetables, by allowing the powder in the capſules to be real ſeeds, and the ſmall globules on the pointals ſurrounding the aperture of the capſule, the farina. Muſci.

The opinion of the moſſes growing from theſe nodules in the alæ of the leaves, or from the impregnated ends of the branches which had received the powder from the capſules, was originally founded on the obſerving that the trailing or branched hypna annually grew out in length, from the extremities of all their branches, and annually loſt as much of the old ſtalk at the root as they gained of the new at the ſummit; but it appears from farther obſervations, that they are real ſeeds which are contained in form of powder in the capſules; ſince the brya, and many others, are found growing from ſmall points or ſpots, which are aſſemblages of their minute leaves, propagated on the ground, under the old ones juſt where the powder of the capſules has fallen; and though it be allowed that the hypna and other trailing moſſes do grow from the ends of the branches, yet they may alſo be produced in form of new plants, from regular and perfect ſeeds ſhed from the capſules. It is certain that the brya are by this means propagated and ſpread into large tufts, and the other genera may alſo be ſo propagated, though they have beſide a property of increaſing by growth of the ſtalk; which ſeems no other than the property of many of the large plants to creep at the root, and ſhoot out in length greatly from the extremities of their horizontal branches, lying on or under the ground, as thoſe ſpreading parts may more properly be ſo called than roots, the fibres puſhed out from them perpendicularly into the earth being properly the roots; and it is well known that theſe plants, though they propagate themſelves thus by the root, they produce ſeed alſo like others, by which they may be equally propagated: and this analogy is to be carried yet farther; for as thoſe plants which creep by the roots produce fewer ſeeds than thoſe which are propagated only by ſeeds; ſo the hypna, which are the genus of moſſes in which this growth by the ſtalk is principally obſerved, are very thinly beſet with capſules of ſeed, and many of them produce but very few in a ſeaſon; whereas the brya, and other moſſes which have not this advantage of growing from the ends of the ſtalks, are found every year profuſely covered with capſules from every tuft; nay, there is ſcarce any branch which does not produce its capſule. Now, if theſe capſules contained only a farina capable of impregnating the nodules or the ends of the branches, it is obvious there would be as much of it required for the hypna as for any other kinds of moſſes; but if they are real and perfect ſeeds, it is no wonder that nature has given them profuſely

to

to ſuch kinds as are to be propagated only by ſeeds, and more ſparingly to thoſe which are propagated alſo by the increaſe of the branches.

To this it may finally be added, that the ferns and other epiphyllοſpermous plants approach moſt of all others to the nature of the moſſes; and though it has been ſuſpected by many that the fine powder at the back of their leaves was not ſeeds, but only a farina, yet it is now well known that it is true and perfect ſeed; ſince, under many ſpecies of them, there are conſtantly found new and ſelf-ſown plants ariſing in their firſt rudiments of leaves and figure, which have plainly grown from the duſt or powder fallen from the old plants; and as this is now found to be the caſe in regard to the ferns, probably it will alſo appear the ſame in regard to moſſes, when they have been yet farther examined than at preſent. But whether theſe grains of powder have the lobes and radicles by which the ſeeds of larger plants propagate themſelves, or whether they grow into plants like the parent ones, in the manner of the lichens, by mere expanſion, is a thing that requires farther obſervation to determine.

Some of the moſſes, it is evident, approach to the nature of the plants which have their male and female parts in the ſame flower, and others to thoſe which have them in different ones.

After all, this tribe of plants, as well as the muſhrooms, ferns, and ſea-weed, is ſtill imperfectly known. Dillenius, profeſſor of botany at Oxford, was the firſt who attempted an arrangement of them. In his *Catalogus Plantarum circa Giſſam*, publiſhed at Francfort in 1719, and afterwards in his *Hiſtoria Muſcorum*, publiſhed at Oxford in 1741, he divides the moſſes into 16 genera. This arrangement, however, includes the lichens, ſome of the fuci, and other plants which belong to very different families. The work in queſtion is, notwithſtanding, valuable, in having introduced the knowledge of upwards of 200 plants, which were unknown before Dillenius; it is, beſides, of all his works of this kind, the beſt executed, both for the deſcriptions and figures, and ſhould ſerve as a model to ſuch authors as intend to publiſh in detail the hiſtory of any particular family of plants.

Micheli, in a work intitled *Nova Plantarum Genera*, publiſhed at Florence in folio in 1629, divides the moſſes into two ſections, from the figure and ſituation of their flowers. Theſe ſections comprehend together 16 genera, amongſt which are improperly arranged, like thoſe of Dillenius, ſeveral of the lichens and other ſea-weed.

The diſcovery of the ſeeds of the moſſes, though made by Dillenius in 1719, is arrogated by Linnæus to himſelf, who did not begin to write till 1735.

In Ray's method, the moſſes form the third claſs: in Tourneſort's, they continue a ſingle genus, by the name of *muſcus*, in the firſt ſection of the 17th claſs, which comprehends the moſſes, muſhrooms, and ſome of the algæ or ſea-weed, and is diſtinguiſhed by the name of *aſpermæ*, or plants without ſeed; the ſeeds of the moſſes not having been detected by Tourneſort.

The characteriſtics of theſe plants, according to the ſexual ſyſtem, are, 1. Tops without filaments or threads. 2. The male flower, conſtituted by the preſence of the *antheræ* or tops, placed apart from the female, either on the ſame or diſtinct roots. 3. The female flowers deprived of the *piſtillum* or pointal. 4. The ſeeds devoid of both lobes (*cotyledones*) and proper coverings; ſo that they exhibit the naked embryo.

In the ſame ſyſtem, theſe plants conſtitute the ſecond order of the claſs *cryptogamia*, which contains all the plants in which the parts of the flower and fruit are wanting, or not conſpicuous. This order is ſubdivided into 13 genera, from the preſence or abſence of the calyx, which in theſe plants is a veil or cover like a monk's cawl, that is placed over the male organs or tops of the ſtamina, and is denominated *calyptra*, from the ſexes of the plants, which bear male and female flowers, ſometimes on the ſame, ſometimes on diſtinct roots; and from the manner of growth of the female flowers, which are ſometimes produced ſingly, ſometimes in bunches or cones. Theſe diſtinctions are moſtly borrowed from Dillenius, whoſe excellence in developing this part of the vegetable kingdom Linnæus very readily acknowledges.

The manner of feeding of moſſes in general may be more clearly underſtood from the deſcription of that genus of them which has been traced through all its ſtages, and to which moſt of the others, though every genus has its diſtinct fructification in ſome reſpects, yet bear a very great general analogy.

The genus already obſerved, is that called by Dr Dillenius the *hypnum*. The ſpecies of this are very numerous and common; but that particular one which was the ſubject of theſe obſervations, is the ſhort branched ſilky kind, common on old walls; and called by that author in his hiſtory *hypnum, vulgare, ſericum, recurvum, capſulis erectis cuſpidatis*.

The head of this moſs appears to the naked eye a ſmall, ſmooth, browniſh-yellow, oblong body, of about a ninth of an inch long; this is covered at its upper end with a membranaceous calyptra or hood, in ſhape reſembling an extinguiſher or a funnel inverted. When this calyptra is taken off, and the head viewed with a microſcope, the ſurface of it is ſeen to be ridged with longitudinal ſtriæ. The baſis of the head is of a deep orange colour, and more opaque than the reſt; and the top is bounded by an orange-coloured ring, ſwelling out ſomething beyond the ſurface of the contiguous parts of the head. Good glaſſes ſhow that in this head there are not wanting the parts eſſential to the fructification of what are uſually called the more perfect plants. This ring is truly a monophyllous undulated calyx, within which ariſe ſixteen pyramidal fimbriated ſtamina; theſe are of a pale greeniſh colour, and are loaded with a whitiſh oval farina. The ſtamina all bend toward each other from their baſes, and almoſt meet in a point at the tops. This is their appearance when the head is nearly ripe; and immediately under the arch formed by theſe ſtamina, is a cylindric hollow piſtillum, through which the farina makes its way, and is diſperſed among the ſeeds in the head; the fruit is a large capſule, filling every part of the membrane which ſhows itſelf on the outſide of the head, and in moſt places is contiguous to it; this capſule is filled with perfect and very beautiful ſeeds; they are round, tranſparent when unripe, but afterwards opaque, and of a very beautiful green, which colour they retain even when dried.

When this head is firſt produced from the plant, the ſtaminæ are very ſlender, and ſtand erect; the head is

Musci, Muscicapa.

is scarce any thicker than the stalk, and the calyptra covers it all over, to shield the tender substance of the farina from external injury. As the farina afterwards swells in the stamina, the seeds in the head increase also in bulk, and by their increase the head is more extended in thickness; and the stamina are by this means separated farther and farther from each other at their bases, but bend inwards toward their points, so as to form a kind of arched covering over the stigma of the pistillum, which is single; and from hence the farina falls as it ripens into the head, and impregnates the seeds.

The 11 principal genera are as follow: *Lycopodium, polytricum, bryum, selagines, usneæ, mnium, byssi, sphagnum, hypna, conservæ*, and *fontinalis*. These are found growing on the barks of trees as well as on the ground. See Plates CCCXXI and CCCXXII.

Mosses, by the inconsiderate mind, are generally deemed an useless or insignificant part of the creation. That they are not, is evident from hence; that He who made them has made nothing in vain, but on the contrary has pronounced all his works to be very good. Many of their uses we know; that they have many more which we know not, is unquestionable, since there is probably no one thing in the universe of which we dare to assert that we know all their uses. Thus much we are certain of with respect to mosses, that as they flourish most in winter, and at that time cover the ground with a beautiful green carpet, in many places which would be otherwise naked, and when little verdure is elsewhere to be seen; so at the same time they shelter and preserve the seeds, roots, gems, and embryo plants of many vegetables, which would otherwise perish; they furnish materials for birds to build their nests with; they afford a warm winter's retreat for some quadrupeds, such as bears, dormice, and the like, and for numberless insects, which are the food of birds and fishes, and these again the food or delight of man. Many of them grow on rocks and barren places, and rotting away, afford the first principles of vegetation to other plants, which could never else have taken root there. Others grow in bogs and marshes, and by continual increase and decay fill up and convert them either into fertile pastures, or into peat-bogs, the source of inexhaustible fuel to the polar regions.—They are applicable also to many domestic purposes; the lycopodiums are some of them used in dyeing of yarn, and in medicine; the sphagnum and polytrichum furnish convenient beds for the Laplanders; the hypnums are used in tiling of houses, stopping crevices in walls, packing up of brittle wares and the roots of plants for distant conveyance.—To which may be added, that all in general contribute entertainment and agreeable instruction to the contemplative mind of the naturalist, at a season when few other plants offer themselves to his view.

Musci, is likewise the name of the 56th order in Linnæus's Fragments of a natural Method. See Botany, p 470.

MUSCICAPA, or Fly-catcher, a genus of birds belonging to the order of passeres. The bill is flatted at the base, almost triangular, notched at the upper mandible, and beset with bristles; the toes (generally) divided as far as their origin.

Muscicapa.

1. The grisola, or spotted fly-catcher, is about five inches and three quarters long. The head is large of a brownish hue spotted obscurely with black; the back is of a mouse-colour: the wings and tail are dusky: the breast and belly white; the throat and sides under the wings dashed with red: the legs and feet are short and black. It is a bird of passage; appears in England in the spring, breeds there, and departs in September. It builds its nest against any part of a tree that will support it; often in the hollow caused by the decay of some large limb, hole in a wall, &c. also on old posts and beams of barns; and is found to return to the same place season after season. It lays four or five pale eggs marked with reddish. It feeds on insects, and collects them on the wing. When the young can fly, the old ones withdraw with them into thick woods, where they frolic among the top branches; dropping from the boughs frequently quite perpendicularly on the flies that sport beneath, and rising again in the same direction. It will also take its stand on the top of some stake or post, from whence it springs forth on its prey, returning still to the same stand, for many times together. They feed also on cherries, of which they seem very fond.

2. The pondiceriana, Pondicherry or Coromandel fly-catcher, is rather bigger than a sparrow. The general colour of the upper parts is a cinereous grey: the throat, breast, and belly, white: the legs black. It inhabits the coast of Coromandel; where, from the agreeableness of its song, it is called the *Indian nightingale*.

3. The flabellifera or fan-tailed fly-catcher, is in length six inches and a half: the head is black, which colour descends on the back part lower than the nape, whence it passes forward in a narrow collar to the throat; the chin, throat and sides of the neck, except where this collar passes, are white; and over the eye is a white streak like an eye-brow: the upper parts of the body are olive-brown; the under parts yellowish rust, growing whitish towards the vent: the tail is longer than the body; the two middle feathers black, the others white: the legs are dusky. This species inhabits the south isle of New Zealand; where it is seen constantly hunting after insects, and flies always with its tail in shape of a fan. It is easily tamed; and will then sit on any person's shoulder, and pick off the flies. It has a chirping kind of note; and is called by the natives *Diggo-wagh-wagh*. There is a beautiful figure of this bird in Mr Latham's Synopsis, plate xlix.

4. The caribonensis, or cat-bird, is somewhat bigger than a lark: length eight inches. Bill black: the upper parts of the body and wings are of a deep brown; the under ash-coloured; the crown of the head is black; the tail is blackish, and the legs are brown. This species is found in Virginia in the summer-season: where it frequents shrubs rather than tall trees, and feeds on insects; its cry resembles that of a cat, whence the English name given it by Catesby. See Plate CCCXX. fig. 1.

5. The crinita, or crested fly-catcher, is about the size of a lark: the head is crested, and of a dull green: the hind part of the neck and back are of the same colour; the under parts from the chin to the breast

of an ash-colour, and from thence to the vent yellow: the legs are black. This inhabits Carolina and Virginia in summer; builds there, and departs in autumn.

Fig. 3. 6. The rubricollus, purple throated fly-catcher, is about the size of a black bird; the whole plumage is black; except the chin, throat, and fore part of the neck, on which is a large bed of beautiful crimson, inclining to purple: the legs are black.—These birds inhabit Cayenne and other parts of South America; where they are found in flocks, and precede in general the toucans in their movements. They feed on fruits and insects; and are lively birds, always in action. They for the most part frequent the woods, like the toucans; and where the first are found the others are seldom far off.

7. The rubra, or summer red-bird of Catesby, is a most beautiful species, somewhat bigger than a sparrow: the bill is yellowish; the eyes are black; the legs dusky; the male is wholly of a scarlet colour, except the tips of the quill-feathers, which are of a dusky red: the colour of the female is brown tinged with yellow. It inhabits Carolina and Virginia in the summer.

This is a very numerous genus: there being about 90 other species described by authors. In the *Syst. Nat.* (Gmelin), the whole number is 92; in Mr Latham's *Index Ornithologicus*, 62 are enumerated.

MUSCLE, in anatomy. See Anatomy, Part II. sect. ii.

The motion of the muscles of animals has been thought a matter of such curiosity and importance, that an annual lecture upon it was founded by Dr Croone, one of the original members of the Royal Society at London. In consequence of this the investigation of the subject hath exercised the pens of a great number of very learned and ingenious men; notwithstanding which it still remains involved in almost as much obscurity as ever. Many curious observations, however, have been made; and as far as the laws of *dead* mechanism can be applied to a *living* machine, the investigators have been successful; but still there has been a *ne plus ultra*, a certain barrier by which their investigations have been limited, which no person has hitherto been able to pass, and which it is very improbable ever will be passed. To give an account of all the different theories which have appeared on this subject is impossible; but in the year 1788 a lecture on the subject was delivered by Dr Blane. F. R. S. of which, as it seems to contain the substance of all that can be said upon the subject, we shall here give the following abridgement.

The doctor considers as muscles not only those large masses of flesh which compose so great a part of the bulk of the body, but likewise all the minuter organs subservient to circulation, nutrition and secretion; since not only the heart itself, but the whole vascular system and the intestines, owe their action to certain powers of irritability and contractility peculiar to muscular fibres.

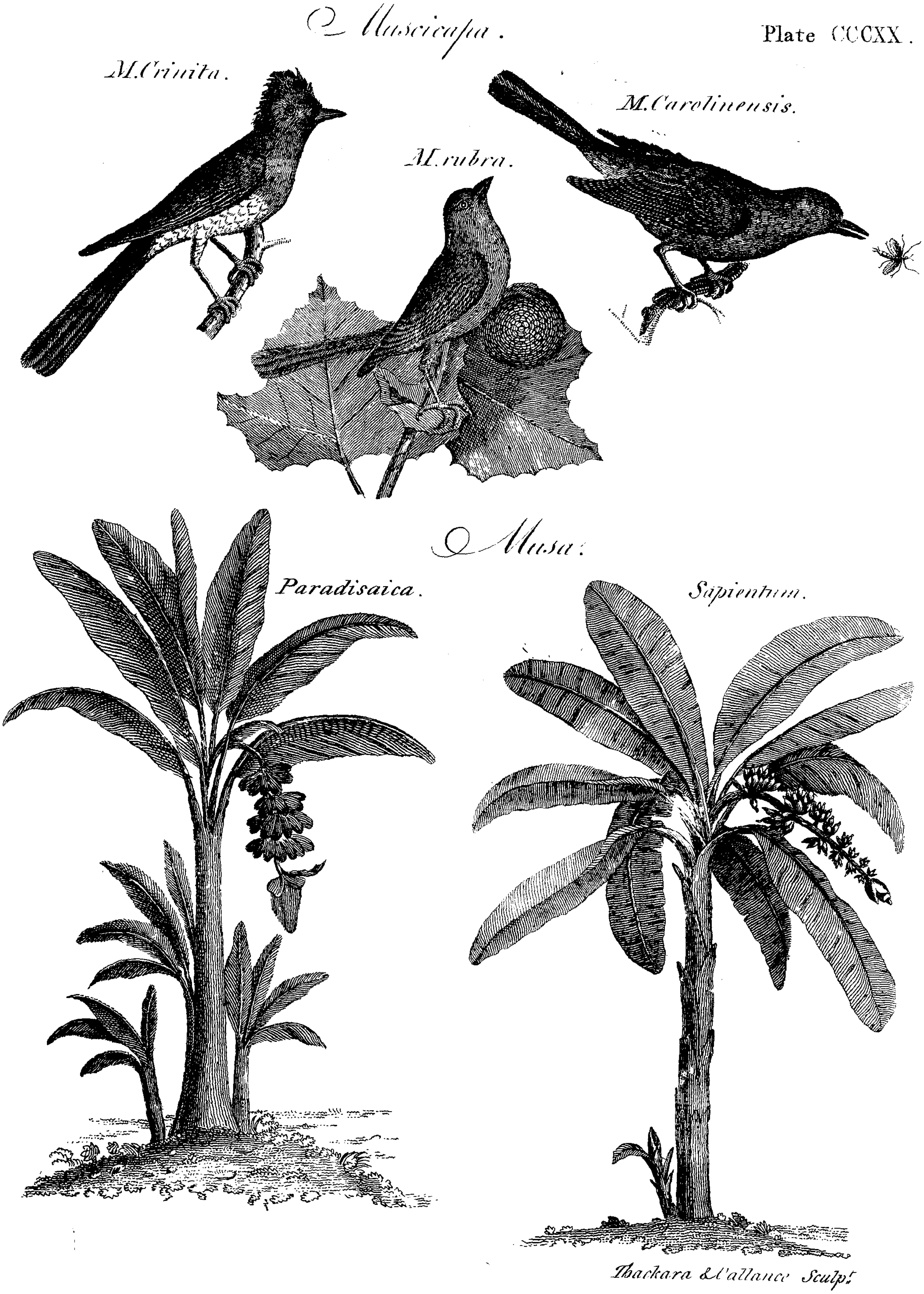
The first and most obvious considerations with respect to the muscles is the regular organization of their fibres in a parallel direction. In this they are distinguished from every other matter of a fibrous structure, whether vegetable or mineral, by a certain degree of moisture, tenacity, and elasticity, entirely peculiar to themselves.

The fibres of the muscles visible to the naked eye are composed of others discoverable by glasses, and these others of fibres still smaller; neither hath any person been able to discover the ultimately fine fibres of a muscle, which are not composed of others. Some have indeed imagined that they have been able to do this, but their observations have been found fallacious. and it is now universally allowed that the fibres are divisible beyond what the best assisted sight can trace, and that they are to all appearance uniform. In this regular and fibrous organization they resemble the crystals of salts, many of which are found composed of fibres more and more fine, and which, like those of the muscles, can never be ultimately traced.

The doctor next touches a little upon the *vis inertiæ* of matter; and, contrary to the generally received opinion of modern philosophers, considers matter as an active substance. What is called the *vis inertia*, he thinks, "is not a resistance of change from rest to motion, or from motion to rest, but a resistance to acceleration or retardation, or to change of direction." The activity of matter is further proved by the attractions and repulsions which take place universally among its parts; and every instance of motion within the cognizance of our senses, may be referred, either in itself or its cause, to some mode of attraction or repulsion. These may both be considered as one principle, being both expressive of that state of activity originally inherent in matter; and because any two particles, having affinity with each other, must either attract or repel, according to their distance, their common temperature, and other circumstances; and it is so universal an agent in nature, that some modern philosophers have made it absorb, as it were, every other power and property in matter. It is evident, however, whether this hypothesis be just or not, that the cause of muscular motion cannot be referred to mechanism, which is itself only a secondary principle. Some have had recourse to a fluid conveyed into the fibres of muscles, by which they were swelled, and thereby shortened. One of the most plausible of these hypotheses supposes this fluid to be the blood; but this is plainly *a petitio principii*; for in order to set the blood in motion, muscular motion is necessary. Other fluids have been supposed to have this effect; but even the existence of these has not been proved, and indeed the most solid objections might be brought against all the theories that have hitherto been invented.

Our author having now established it as a maxim, that the primary properties of matter, are attraction and repulsion, and that mechanism is only a secondary property, he next considers muscular motion as referable to an original law of animated matter, whereby its particles are endowed with an attractive power, for which no cause can be assigned any more than for gravitation, cohesion, or chemical affinity. If the shortening of a muscular fibre depends on this increased power of attraction between its particles, the effect will be to add to the power of cohesion in the fibre; and to determine this the Doctor made the following experiment: Having taken the flexor muscule of the thumb of a man newly dead while yet warm and flexible,

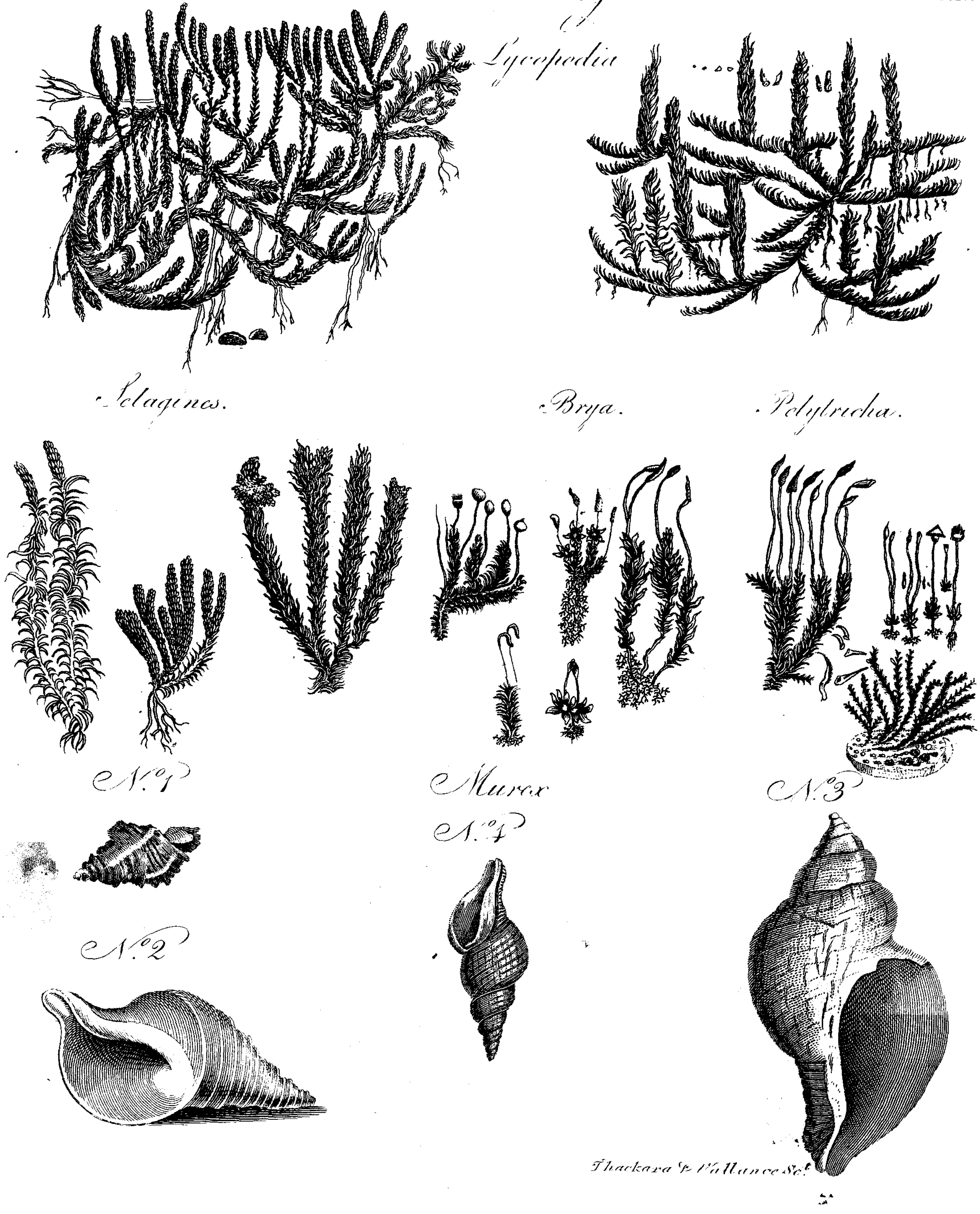
Plate CCCXX.


Muscicapa.
M.Crinita.
M.rubra.
M.Carolinensis.
Musa:
Paradisaica.
Sapientum.
Thackara & Vallance Sculpt.


Byssi
Musci & Mosses
Usneæ
Mnium
Hypna
Confervæ
Sphagnum
Fontinalis
Thackara & Vallance Sc.t

Musci Mosses

Plate CCCXXII.



Muscle. ible, he appended a weight to it, continually augmenting it until the muscle broke; and this he found was done when 26 pounds had been added: yet a living man of the same apparent strength and age could with ease lift a weight of 38 pounds by the exertions of the same muscle. "It is farther in proof of this fact (adds he), that in the case of a violent strain from muscular contraction in the living body, it is the tendon that gives way; whereas we have seen that in the dead body the muscle is the weaker of the two. It is also well known, that in cases of our exertion the muscular fibres themselves do not give way, though the strongest tendons, such as the tendo Achillis, and even bones, such as the knee-pan, are broke by their living force, which in such instances must be many times greater than the strength of the dead fibres. There is a case related in the Philosophical Transactions by Mr Amyand, wherein the os humeri was broken by an exertion of the muscles. Every one has heard of fractures happening from very slight accidents. These occur most probably from a jerk of the muscles concurring with the external violence. The sensible increase of hardness in a muscle, when in a state of contraction, may also be considered as a proof of an increased attraction of its particles to each other at that time."

The Doctor next considers whether or not a muscle, when in a state of contraction, undergoes any change of density. "Every homogeneous body (says he) possesses a certain degree of density, determined by the distance of its integrant particles. The most common means in nature by which the density of such bodies is altered, are heat and cold; the one universally producing expansion, the other condensation. Whether mechanical force has the same effects, is a point in natural philosophy not so well ascertained; for though tension and collision produce in solid elastic bodies a change of figure, which they immediately resume when the force is withdrawn, it has not been inquired whether in such cases a change of density takes place while the body is in a state of elongation or compression. Two elastic balls in the act of collision undergo a momentary change of figure, so that there must be an approximation of particles in the direction in which they are flattened; and in the elongation of an elastic cord by tension there must be an increased distance of the particles in one direction: but while these changes take place in one dimension of the respective bodies, they may be compensated by contrary changes in the other dimensions, so that the several bodies may preserve, upon the whole, the same solid contents. In order to ascertain this in the case of tension, which is the only case bearing analogy to muscular motion, I made the following experiment: I took a piece of the elastic gum, or *caoutchouck*, three inches square, and about the eighth of an inch in thickness; I procured a piece of sheet tin three inches broad and about six inches long, cut into sharp teeth at each end. The gum was first weighed in air, and found to be 380.25 grains. It was then weighed in water along with the tin, to which it was loosely attached, and the weight of both was then 758.75 grains. The gum was then stretched upon the tin by means of the teeth at each end to a surface of about five inches square, the tin being bent so as to leave a free space between it and the gum, in order that when immersed in water no air-bubbles might be entangled. In this situation, the weight of both in water was found to be 746.75 grains. Here was a difference of 12 grains, which could be owing only to a diminution of specific gravity; and in order to be sure that there was no fallacy nor inaccuracy in the experiment, the gum was immediately disengaged from one end of the tin so as to allow it to shrink; and being again weighed in this state in the water, it was found to have recovered exactly its former weight." Muscle.

From this very remarkable experiment, the Doctor argues to what may probably happen in the contraction of the muscles. "This point (he says) cannot be decided but by an experimental examination. It might be determined whether a muscle occupies most space when relaxed or when contracted, by finding its specific gravity in each of those states by means of the hydrostatical balance. But this would be found extremely difficult; for the state of contraction is very transitory, and the motion itself would produce such a disturbance as would render the result unsatisfactory. As there is this obstacle to an experiment on a living muscle, it occurred to me that it might be performed on the muscles of a fish which had undergone the operation of *crimping*, as it is called; for in consequence of dividing the muscles, by cutting them when alive, they undergo a contraction which continues after death; and upon comparing by the hydrostatical balance, portions of muscle which had been crimped with those of the opposite side of the same fish which had on purpose been saved from this operation, it did not appear that there was any difference in the specific gravity. Two trials were made; one with the masseter muscles of a skate, the other with the sides of a large trout."

To determine whether the contraction or relaxation of a living muscle made any alteration in its density, our author took one half of a living eel, and put it into a glass flask, of which the mouth was afterwards fused by a blow-pipe, and drawn out like the stem of a thermometer. The flask and tube being then filled with water, our author observed, with great attention, whether the convulsive agonies of the creature would make the fluid rise or fall; but it did neither. The tail part of the eel was made use of in this experiment, that there might be no deception from the other, which contained the organs of respiration and the air-bladder. In one of his trials, the tail portions of two eels were introduced into the flask; but though they were frequently both in convulsions at once, not the least motion of the fluid in the tube could be perceived. On this account also the Doctor made some experiments to decide the question, Whether the mere circumstance of *life* made any alteration in the gravity of bodies? His first trials were with animals of warm blood inclosed in oil-skin and close tin vessels: but not being satisfied with the accuracy of these, from the difficulty of cutting off all communication with the external air, he inclosed live eels in flasks; and having sealed them hermetically, he found that the weight of them when alive and dead was the very same.

The result of all our author's experiments is, that "the contraction of a muscle produces no change in its density, and that animal life differs from inanimate matter in this respect, as well as in most of its other properties and laws. One purpose in nature for muscles

 always

always preserving the same density may be, that as some of them act in confined cavities, inconveniences might arise from their occupying more space at one time than at another. In the extremities of crustaceous animals, for instance, which are filled with muscles, a change of density would be apt to burst them.

"Another circumstance in which the contractions of muscles differ from simple elasticity is, that the former, however frequent and violent, does not produce any heat, as collision and tension are known to do. This may admit of some cavil with regard to animals of warm blood; for one of the theories with regard to animal heat is, that it arises from the perpetual vibration of muscular fibres, particularly those of the vascular system; but this will not hold with respect to animals of cold blood, in which the actions of life are equally vigorous. The principal phenomena, therefore, of muscular motion are, the shortening of the fibres, the lateral swell, the increase of cohesion and hardness, and the unchanged density and temperature. It would appear from the two last circumstances, that the intimate motions of the particles in relation to one another must be different from what take place in the several instances of contraction and expansion of dead bodies. In the expansion arising from the action of heat and the contraction from cold, the change of density shows, that in the one case the ultimate particles must recede from each other, and in the other they must approach. The same may be said of elasticity. But as there is no alteration in the density of a muscle in passing from relaxation to contraction, this change cannot consist in the approximation of the integrant parts of the fibres, but must depend on some other circumstances in the intimate dispositions of the particles. In attempting to conceive in what this consists, the following explanation may be offered. It is probable that the regular structure of solid bodies depends on the polarity and shape of their integrant parts. Now all bodies, except such as are spherical, must have a long and a short axis; and let us imagine the fibres of muscles to be composed of spheroidal particles, we may then conceive relaxation to consist in their being disposed within their long axis in the line of their fibres and contraction to consist in their short axis being disposed more or less in that direction. This will not only account for the decurtation and uniform density, but for the lateral swell, and also for the increased hardness and cohesion; for though the particles do not approach or recede, as in bodies simply elastic, yet their power of attraction will be increased by their centres being brought nearer, and by being applied to each other by more oblate surfaces. This hypothesis accords with what has been before proved concerning the unchangeable density, for what is lost in one dimension is gained in another; and the cause for there being no increase in temperature depends probably on the same circumstance by which the density is preserved unaltered."

Thus far the Doctor has proceeded upon a plan, which may become plausible by means of an hypothesis at least; but in the prosecution of his subject he is involved in the same difficulty which has proved too hard for every other person, and which he, indeed, does not attempt to solve. This is the action of stimuli, by which the muscles are exerted to contraction, and upon which all the phenomena of life depends, and which indeed is the thing that particularly ought to be explained; but of this our author is forced to confess his entire ignorance, and to content himself with enumerating the stimuli of which he cannot explain the action. Stimuli then, according to him, are divided into internal and external. An example of the former kind is the circulation of the blood, which is kept up by an exciting influence of the blood upon the heart and vessels which contain and impel it. The earliest perceivable instance of muscular motion is the beating of the heart, as it is seen in the first rudiments of the embryo in an egg, and called the *punctum saliens*. There seems to be established by nature a certain habitude of action between the vessels and their fluids; for if a fluid even more mild than the blood, such as milk, be injected into the circulation, it will produce great disturbance; and if the blood, by being deprived of the influence of respirable air, becomes destitute of a certain property which it would naturally acquire in the act of respiration, it does not prove a stimulus to the heart.

In like manner, all the containing parts are accommodated to the nature of their respective contents.—The intestines are so calculated as to have proper motions excited in them by the aliment and the secretions which are mixed with it; and there are bodies which, though perfectly mild, such as alimentary substances of difficult digestion, yet excite more violent commotions in the stomach than other substances which are very acrimonious. The various effects of poisons in different parts of the body may also be mentioned as an illustration of the peculiar susceptibility of the several organs of the body. The poison of a viper, for instance, is perfectly innocent, not only in the receptacles of the animal which produces it, but may be taken into the stomach of any animal without the least bad effect, and only exerts its deleterious power when brought in contact with a wounded part. Some vegetable poisons, on the contrary, such as that of laurel water, prove deadly when taken into the mouth, or applied to any part of the alimentary canal, but are innocent when injected into the veins. It may be remarked also, that the receptacles of the several secreted fluids, such as the gall-bladder and bladder of urine, are so adapted to their natural contents, by a due measure of irritability, as to bear their accumulation to a certain degree, and then to expel them. We have here also a proof that irritability is not in proportion to sensibility; for both these receptacles are extremely sensible to pain and irritation from extraneous acrimony, though so moderately sensible to the acrimony of their natural contents. This disposition in the several organs to perform their natural functions, in consequence of the stimulus of the respective fluids they contain, has aptly enough been called the natural perception of these organs.

Our author now considering that the internal organs are calculated to perform their functions in consequence of certain stimuli, concludes the application of chemical and mechanical stimuli is not a mode of experiment likely to produce useful knowledge; and hence, he thinks, we may suggest the most likely means of restoring lost irritability and action to the vital functions, when suspended by suffocation, strangulation, or immersion. In these cases, he says, that all other means are far inferior to that of inflating the lungs

with

Muscle. with atmospheric air, and stroking and pressing the ribs in such a manner as to imitate natural respiration. The only other thing which he supposes to be any way useful, is the application of heat to such as have been immersed in cold water; but of cool air to those who have suffered from mephitic vapours.

The Doctor having then considered some other parts of the animal economy, enters into an investigation of the analogy between motion and sensation. "This analogy (says he) is the more exact, that the nerves seem to be the instruments of both; for not only the organs of sensation and voluntary motion, but those of involuntary motion, are supplied with nerves, and dependent upon them; for if the influence of the nerves leading to the heart or intestines is interrupted by cutting, ligature, or palsy, the function of these parts, is thereby destroyed. Thus, as there is a peculiar sensibility belonging to the several senses, so is there a peculiar irritability belonging to the several organs of motion. The intention of nature, therefore, in distributing nerves to every muscular organ, was probably in order to constitute those peculiar perceptions on which the various vital and natural functions depend. But I give this only as a conjecture; and though the nervous influence may thus *modify* irritability, there is reason to think that it does not *bestow* it."

Our author controverts the principle which has been held by some very able physiologists, that all muscular irritability depends upon a sentient principle. "There have been several instances (says he) of the production of fœtuses without the brain; and a principal fact in support of this opinion is, the existence of animals without brain or nerves. That there are such, was, I believe, first observed by Haller, and has been confirmed by Mr Hunter; who maintains farther, that the stomach is a centre or seat of life more essential to it than the brain. That the stomach should be an organ of so much consequence, seems natural enough from the importance of its function, which is that of assimilation; and life can be more immediately and completely extinguished by an injury to it, such as a blow, than by the same violence to any other part of the body. It is also well known, that the muscular fibres of animals endowed with a nervous system, will retain their irritability for some time after their separation from the brain and nerves.—It is evident likewise, from the phenomena of vegetation, that riritability may exist in nature without sensation, consciousness, or any suspicion of the existence of a nervous system. In favour of this opinion, it is farther observable, that those animals which are destitute of brain and nerves are of the class of *vermes*, the most simple in nature, having only one function, viz. that of assimilation; and therefore not requiring that variety of action, and those perceptions which are peculiar to more complex animals. Lastly, the state of an egg before incubation, and the condition of those animals which become torpid from cold, and afterwards revive, affords facts which favour this opinion; as they show that there is a certain principle of self-preservation, independent not only of the operation of the nervous system, but even of the circulation; for in this quiescent state, those portions of animal matter are preserved for a great length of time from that corruption to which they would othewise be liable, and their fluids are prevented from freezing in a degree of cold which would congeal them, were they destitute of every principle of life."

In the course of his reasoning, our author considers the nervous system not only as a mere appendage to life, but as tending to impede its operation, and shorten its existence. "Simple life (adds he) will not only survive sensation, but will survive it longer, if the animal is killed by destroying the nervous system, than if it had been destroyed by hæmorrhagy, suffocation, or other violence. If a fish, immediately upon being taken out of the water, be stunned by a violent blow on the head, or by having the head crushed, the irritability and sweetness of the muscles will be preserved much longer then if it had been allowed to die with the organs of sense entire. This is is so well known to fishermen, that they put it it in practice in order to make them longer susceptible of the operation called *crimping*. A salmon is one of the fishes least tenacious of life, insomuch that it will lose all signs of life in less than half an hour after it is taken out of the water, if suffered to die without any farther injury; but if, immediately after being caught, it receives a violent blow on the head, the muscles will show visible irritability for more than 12 hours afterwards."

To the same purpose, our author observes, that in warm-blooded animals an excessive exertion of voluntary motion immediately before death, prevents the muscles from being rigid when cold, and renders them more prone to putrefaction. Thus, if an ox is killed immediately after being overdrove, the carcase will not become stiff when it grows cold, nor is it capable of being preserved by means of salt. In confirmation of the same hypothesis also, our author observes, that in some disorders of the brain, such as hydrocephalus, and apoplectic palsy, in which the functions of the brain are suspended, the office of digestion is sometimes better performed than in health.

From all this our author concludes, along with Mr Hunter, that the exercise of sensation is inimical to life, and that a sort of fatigue is induced by this as well as by voluntary motion; "so that all that intercourse carried on through the nerves, whether *towards* the brain in the case of sensation, or *from* the brain in acts of volition, tends to wear out the animal powers. And, as intense and long continued thought, thought not terminating in any outward action, tends also to produce an inability for farther exertions, it would appear that the brain or sensorium is more particularly the organ which is subject to that species of sufferance called *fatigue*. From these facts we perceive the necessity of sleep, which consists in a temporary suspension of sensation, volition, and thought, and is a resource of nature, whereby the powers of life recover themselves after satiety and fatigue, which are provided as guards to warn us when nature is in danger of being strained, either by repletion or over-exertion; and it is evident that such barriers were absolutely necessary, in order to set bounds to operations which are only occasionally requisite, and which would otherwise depend on the caprice of the will. The exercise of sensation and voluntary motion in a moderate degree is conformable to the intention of nature, and therefore salutary; and it is only when they are ex-

cessive

Muscle. ceffive that they tend to wear out the powers of life, and more efpecially if thefe are not duly recruited by fleep. It follows, from the fame principle, that when life is threatened by certain difeafes, of which the chief fymptom is irritation, any means by which fenfation, whether natural or morbid, and mufcular motion, whether voluntary, or involuntary, convulfive or fpafmodic, can be foothed or fufpended, will prove falutary, by allowing the powers of life to rally as it were, and to recover themfelves. In this confifts the operation of narcotic medicines, fuch as opium; — which, in complaints both of a general and local nature, proves ufeful, not merely as a palliative by the removal of temporary pain or fpafm, or by procuring fleep, but as a principal inftrument of recovery, by allowing the powers of life to exert their natural action, in confequence of the removal of irritation."

In treating this fubject, the Doctor confiders the effects of opium as affecting fimple or fenfative life; and to determine this, he made the following experiments: Having made a folution of opium in water he put into one portion of it fome found living eels, and others with their heads bruifed; and in a number of trials it was found that the found eels generally died much fooner than the bruifed ones. This, however was the cafe only when the folution was of a certain degree of ftrength, fuch as half a grain of opium at leaft to an ounce of water; for when only about half this ftrength, the found eels lived much longer, the time being then protracted to that in which the bruifed eels would have died merely in confequence of their injury; but it muft be obferved, that even the wounded ells died confiderably fooner than when put into plain water.

From all this, our author concludes, that "the great maffes of mufcle in the trunk and extremities of the body are the inftruments of the mind in acting upon external bodies; and we may therefore rank in the lift of ftimuli the nervous power by which the will and the paffions excite external motions. This is a function fufficiently important for the nerves, without admitting them as the principle on which irritability depends."

Having difclaimed all inquiry into the connection between mufcular motion and volition, the Doctor proceeds to confider the effects of the different paffions upon the mufcles. Though thefe are diftinct from the motions directly produced by the will, yet he confiders them among thofe arifing from confcioufnefs; "for there are emotions of the mind which have vifible and powerful effects upon the heart and vafcular fyftem, which are organs entirely out of the reach of the will. Not to mention the well-known effects of grief, fear, and joy, which affect the whole circulation, there are certain paffions and fentiments which produce partial and local effects. Thefe are eftablifhed by nature, either to anfwer fome important purpofe in nature, as in the cafe of the congeftion of the fluids in the parts of generation in confequence of the venereal appetite, or to ferve as natural expreffions, as in the cafe of blufhing or weeping. One of the moft ftriking effects of the paffions upon mufcular action, is the influence they have upon the ftrength or mechanical force of the voluntary mufcles. Fear produces debility almoft amounting to palfy. Courage and ardour of mind, on the contrary, add to the natural ftrength. When the mind is agitated by fome interefting object, and calls upon the body for an extraordinary exertion to effect its end, the mufcles are thereby enabled, as it were by magic, to perform acts of ftrength of which they would be entirely incapaple in cold-blood. In circumftances of danger, for inftance, where life or honour are at ftake, exertions are made for overcoming mechanical refiftence which feem incredible, and would be impoffible, were not the mind in a fort of phrenzy; and it is truly admirable in the economy of nature, that an idea in the mind fhould thus in a moment augment the powers of motion and infpire additional refources of ftrength adequate to the occafional calls of life. The great increafe of ftrength in maniacs is alfo referable to the paffions of the mind. Thefe confiderations would almoft lead us to doubt whether or not the accounts we have of the great feats of ftrength afcribed to individuals in the heroic ages be fabulous or not. It is alfo worthy of remark, that, in great and lafting exertions of ftrength to which men are impelled by active and generous affections, fatigue is not induced in the fame proportion by many degrees as by the fame quantity of mufcular action in the cool and deliberate actions of common life."

Muscle.

Having thus difcuffed the fubject of *internal* ftimuli, our author next proceeds to take notice of the fecond clafs, viz. fuch as are *external*. Thefe are either immediate or remote, viz. fuch as are excited by mechanical means, or by acrimony directly and artificially applied to a mufcular fibre; or fuch as occur in the inftances of fympathy, and in the cafe of thofe inftincts which nature has inftituted for the purpofe of felf-prefervation in brutes, and in the early part of human life. "There are certain habitudes (fays he) between outward ftimuli and the moving powers whereby natural propenfities are conftituted equally neceffary to the fupport of life as the internal functions. Thus, in a new born animal, the firft contact of the external air excites the act of refpiration, and the contact of the nipple excites the act of fucking; both of which actions are abfolutely neceffary to the maintenance of life, and require the nice co-operation of a great number of mufcles prior to all experience. Actions of this kind are called *inftinctive;* but though different from thofe of voluntary motion, they neverthelefs run into one another; fo that what was at firft merely inftinctive, may afterwards become a matter of deliberate choice. The fame mufcles are the inftruments of both; and they differ from the mufcles obeying the internal ftimuli, fuch as the heart, in being liable to fatigue, and thereby concurring with the exercife of fenfation and of thought, in rendering fleep neceffary. There are no mufcles except thofe of refpiration, of which the conftant action is neceffary to life, and which are void of confcioufnefs in their ordinary exercife, but which are yet in fome meafure under the controul of the will. The principal end anfwered by this power of the will over the mufcles of refpiration in man, is to form and regulate the voice. But though inftinctive motions are in fome cafes convertible into thofe which are voluntary, they ought by no means to be confounded together; for even thofe animals which are deftitute of brain and nerves, are capable of actions evidently of the inftinctive kind.—

A leech

A leech, for inſtance, being brought into contact with a living animal, is impelled by an inſtinct of its nature to faſten upon it, and ſuck its blood. There is ſomething very ſimilar to this even in vegetables, as in the caſe of tendrils and creeping plants being ſtimulated by the contact of other bodies to cling round them in a particular direction *.

*See Vegetable Motion.

Beſides theſe obſervations on the inferior animals, our author brings ſome experiments to ſhow, that inſtinctive actions, even in animals furniſhed with a brain and nerves, do not depend on ſenſation. Having divided the ſpinal marrow of a live kitten a few days old, he irritated the hind-paws by touching them with a hot wire. By this the muſcles of the poſterior extremities were thrown into contractions, ſo as to produce the motion of ſhrinking from the injury; and the ſame effects were obſerved in another kitten of which the head was entirely ſeparated from the body. In repeating this experiment he found, that when the ſpinal marrow was cut through between the lumbar vertebræ and os ſacrum, the poſterior extremities loſt their irritability, but the tail reſumed it. Even the head retained its irritability after it was cut off; as appeared by touching the ears with a hot wire, or by pricking them: "and (ſays our author) as the extremities are alſo irritable, it will not be ſaid that conſciouſneſs and ſenſation exiſt in two ſeparated portions of the body."

The effects of habit are then conſidered; and the concluſion from the doctor's reaſoning upon this ſubject is, that "there is a *co-ordinance*, or pre-eſtabliſhed harmony, as it were, between the faculties of animals and the laws of external matter, which is the foundation of all the inſtinctive habits of animals, as well as the rational conduct of man."

To the law of habit have been referred the effects of certain contagions, ſuch as that of the ſmall-pox, which do not produce their effect more than once in life. With reſpect to this he obſerves, "that upon whatever principle this property of the animal economy depends, it is an undoubted fact, that theſe morbid poiſons, after exciting a certain degree of diſturbance, and a certain ſeries of diſeaſed actions, no longer make any impreſſion on the powers of life, otherwiſe there could be no ſuch thing as recovery; for at the time in which a perſon begins to recover from the ſmall-pox, the poiſon actually preſent in the circulating ſyſtem is multiplied infinitely beyond what it was when it excited the diſeaſe. The conſtitution has therefore at that time, with reſpect to this acrimony, acquired an inſenſibility, or rather want of irritability; and this it preſerves ever afterwards. This, however, holds only with regard to thoſe morbid poiſons which excite febrile affections, and ſeems to be a neceſſary proviſion of nature to guard againſt ſuch noxious principles as are generated within the body itſelf."

Having laſtly conſidered the effects of *irritation* upon the human body, the Doctor goes on to conſider a very remarkable property of living muſcles, viz. that of their being in a conſtant ſtate of tenſion, more or leſs, independent of any temporary ſtimulus. This is evident from what happens when any muſcle is cut; for then there is an immediate retraction of the ſeparated parts: and that this is their natural ſtate is farther proved by the ſpontaneous motion which takes place in conſequence of the relaxation of an antagoniſt muſcle, as when the mouth is drawn to one ſide in conſequence of hemiplegia. Some degree of tenſion indeed is neceſſary for the performance of the natural motions of the muſcles, whether voluntary or involuntary; and the vigour with which the ſeveral actions are performed depends on the due degree of this tone.

This tone of muſcles is every where maintained by a certain counteracting mechanical power; the great muſcles are kept on the ſtretch by the bones, the heart and veſſels by the maſs of fluids, and the inteſtines by the aliments taken in, and their other contents. Diſeaſes of various kinds may ariſe from the different degrees of this tenſion, and the vaſcular ſyſtem is more apt to be affected by different degrees of tenſion than any other part of the body; and our author conſiders what is called a *nervous* habit as one of the effects of want of tenſion. He likewiſe attributes to the different degrees of tenſion, more than to any thing elſe, the great difference of conſtitutions obſervable among mankind. He obſerves alſo that the tenſion of the muſcles is greatly affected by ſympathy. "This (ſays he) is particularly obſerved in the blood-veſſels and inteſtines; for a relaxation in theſe will produce a like affection in every other part of the animal ſyſtem. With regard to the inteſtines, it may be mentioned among other proofs, that it is common for perſons in a ſtate of great weakneſs to be affected by ſyncope and even inſtantaneous death, in the act of evacuating the bowels. It ſeems to be from a like cauſe that a temporary lowneſs is produced by an abſceſs being opened.

The Doctor concludes his ſubject with conſidering the muſcles as mechanical powers. "As they conſtitute the ſtrength of animals, it may be proper to conſider the relation of their ſtrength to their bulk, and the relation of the bulk and ſtrength of the body to the denſity and coheſion of its own materials; and to the bulk, denſity, and coheſion of the external inanimate bodies with which it is converſant.

"It has been demonſtrated by Galileo, that in ſimilar unequal bodies, of a cylindrical or priſmatic ſhape, ſuch as the limbs of animals nearly are, the ratio of their efforts to break by their own weight is in the quadruplicate ratio of their lengths; but that the reſiſtance they make to the ſame force is only in the triplicate ratio of their lengths. It follows from this, that in order to endow the limbs of animals with the ſame relative force, it is not only neceſſary that the bones ſhould poſſeſs an increaſed proportion of thickneſs, in order to give an adequate increaſe of what may be called the dead ſtrength; but a ſimilar increaſe of living ſtrength is neceſſary, by a ſuitable addition of muſcular power, in order to keep pace with the increaſed ſize of the bones. Now we obſerve, in fact, that in the large-ſized animals, ſuch as the bull and the elephant, the thickneſs both of their bones and muſcles becomes greater in proportion to the length of their limbs than in the ſmaller animals, and they are therefore of a leſs elegant form. But nature has not carried this ſo far as to compenſate for the diſadvantage ariſing from the increaſe of ſize; for the greater animals have not the ſame proportional ſtrength, in relation to their bulk, that the ſmaller animals have. It has been computed that a flea can draw from 70 to 80 times its own weight, whereas a horse cannot with ease draw more than three times his own weight. This disproportion between size and strength is very observable in different individuals of the human species; for tall men are not muscular, even in the simple proportion of their stature."

Our author now proceeds to assign some reasons why the stature of mankind in general is not larger than we see it. Some observations upon this subject are made under the article GIANT, where it is attempted to show, that by increasing the proportional strength of the materials, the size of the human body might have been augmented in any proportion. To this, however, the Doctor replies, that "had the bones been harder, they would not have been calculated for the common duration of life, the effect of which being to increase their hardness and dryness, they must be endowed originally with a certain degree of softness and succulence: and, with regard to muscles, a degree of hardness much greater than they possess would have been incompatible with their contractility." But this reasoning does not seem to be conclusive. The bones of a lion are said to be much harder than those of any other animal; yet we do not find that these creatures are liable to any kind of disease in consequence of this superior hardness. Neither is any inconvenient degree of hardness in the muscles a necessary consequence of their increased strength; for silk, though equally soft and flexible, nay much more so than hemp or flax, is nevertheless much stronger; and we cannot by any means doubt, that if men had formerly been of a larger stature than they are at present, the materials of their bones and muscles might have been proportionably stronger, without the least injury or impediment to any of the operations of life.

When we consider the manner in which the muscles act upon the bones into which they are inserted, we may be apt to think that nature has been very prodigal of mechanical power; for considering the bones as levers, the muscles act upon them at a very great disadvantage, being always inserted much nearer the fulcrum than the weight to be raised. Thus the two muscles of the arm, named *biceps* and *brachiæus internus*, in order to support in the hand a weight of one pound with the fore-arm at right angles to the humerus, must exert a power equal to ten pounds. Another circumstance also which tends to waste the power, is the obliquity with which they are inserted into their bones; so that the greater part of the force is expended in pressing one bone against another at the articulation, and only a small part of it in making the flexures and extensions. These disadvantages, however, are compensated by a number of conveniences which could not have been obtained on any other plan. We must distinguish between those actions which consist in pressure and those which depend on percussion; for as the momentum of this last depends on velocity, it is evident that there must be a great advantage from the insertion of the tendon being near the centre of motion, as greater velocity with less expence of contraction will thus be communicated to the extremity. The muscles, for instance, which are attached to the *olecranon*, in performing those actions with the hand which require rubbing, act with a disadvantage exactly proportional to the inequality of the distance from their insertion to the joint of the elbow, and that from the same joint to the hand. This is an act of pressure. But in the case of percussion, as in the action of using a hammer, there is an evident advantage resulting from the velocity communicated to the extremity; for in order to have produced the same velocity, with the insertion at a greater distance from the centre of motion, a much greater degree of contraction would have been necessary: and our author shows that fatigue principally depends on a contraction of the muscles. "If any one (says he) will take the trouble of comparing the fatigue of the biceps muscle, in bearing a weight in the hand with the elbow-joint bent to a right angle with that of bearing the same weight for the same length of time with the joint at an acute angle, he will be sensible how much the degree of fatigue depends on the extent of contraction; and, by attending to the relative situation of muscular fibres, it will appear, that Nature, in distributing the fibres of muscles obliquely, has had it in view not only to increase their number, but to save contraction."

In considering the actions of the various muscles in producing the different actions of the body, we find scarce one produced that can be called direct. In some instances, we find two muscles, or two sets of muscles, co-operating, so that the motion effected by them shall be in the diagonal of their direction. This is the case of the oblique muscles of the abdomen in some of their actions, and of the intercostal muscles in all theirs. Sometimes different portions of the same muscle combine in like manner to produce a similar effect: and in all the long muscles, however simple their origin and insertion may be, there is an internal obliquity of their fibres with regard to one another; for these do not run from end to end, but there are parts of the tendon running into the belly of the muscle, so as to divide it into penniform and rhomboidal portions. This distribution of the fibres takes off from the length; but as it takes place in those cases where the origin and insertion are at a considerable distance, this can be afforded: and this, as well as the waste of power, in consequence of oblique action, is more than compensated by the increased strength from the fibres being multiplied; for, in consequence of this structure, there is an extent of tendon afforded sufficient for the insertion of a greater number of fleshy fibres.

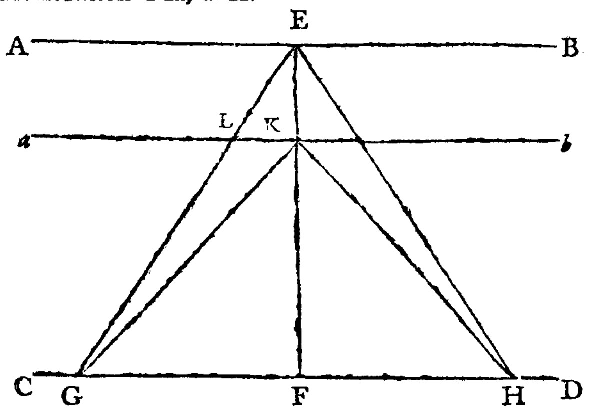
The Doctor illustrates this principle in the mechanism of muscular action from the example of fish; a species of animals which exert greater muscular powers than any others. "The muscles of most fish (says he) consist of regular series of oblique short fibres, forming those strata which every one must have observed in their muscular substance. Their motions are more simple and limited than those of land-animals, but much more vigorous; for a fish in the sea has to make its way through a medium about 1000 times more dense than air, and with more rapidity than those which inhabit the land. Nature, therefore, instead of giving them muscles whose fibres would run straight from one end of their body to the other, has multiplied their numbers, by distributing them into short and oblique portions. I have seen the sword of a sword-fish sticking in a plank, which it had penetrated from side to side: and when it is considered

that

Muſcle.

that the animal was then moving through ſo denſe a medium, and in the ſame direction with the ſhip, we muſt form a high conception of its muſcular power."

Laſtly, our author gives a mathematical demonſtration, that by the obliquity of the muſcles a very conſiderable quantity of contraction is ſaved, and conſequently a proportional degree of fatigue prevented.—" Let the line AB (ſays he) in the annexed diagram, repreſent a moveable bone, and the line CD a fixed bone parallel to it. Let FE, perpendicular to theſe lines, repreſent a muſcle acting in its own direction, and the lines GE, HE, repreſent two muſcles acting obliquely, and producing by a diagonal action the ſame effect as the other. If the bone AB be brought to the ſituation $a\,b$ by the action of the muſcle FE, the muſcle will then be in the ſituation FK. If the bone is brought in the ſame ſituation by the action of the muſcles GE, HE, theſe muſcles will then be in the ſituation GK, HK.



" The propoſition to be demonſtrated is, that the line GK bears a greater proportion to the line GE, than the line FK does to line FE; for FK is to FE as GL is to GE (Euc. Elem. B. vi. Prop. 2.); and the angle ELK being leſs than a right angle, the angle GLK, which is adjacent to it, muſt be greater than a right angle; and the angle GKL being in the ſame triangle with GLK, muſt be leſs than a right angle. The line GK, therefore, which ſubtends the greater angle, is greater than the line GL, ſubtending the leſſer, and therefore bears a greater proportion to GE. But the line GL is to GE as FK is to FE; and therefore GK bears a greater proportion to GE than FK does to FE; that is, the fibres of the muſcles acting obliquely, ſuffer a leſs proportional decurtation than thoſe of the muſcle acting directly.

" It is farther obvious, that the more oblique the action becomes, the greater ſaving there will be of contraction; for in moving the line $a\,b$ towards CD, the line FK diminiſhes in a ſwifter ratio than the line GK; and when the former has vaniſhed, the latter is in the ſituation GF."

Beſides theſe advantages in point of diminiſhing fatigue, there are others relating to the ſhape of the members. Thus, if the inſertions of the muſcles had been at a great diſtance from the joints, they muſt upon every occaſion have paſſed like bow-ſtrings from one bone to the other, and the limbs muſt have been exceedingly clumſy and unwieldy; all the motions muſt alſo have been extremely ſlow: and notwithſtanding the ſuperior ſtrength which people would then have enjoyed, it is very plain that they would ſcarce have been fit for any of the offices of life which they now perform.

Muſcle || Muſes.

Muscle, in zoology. See Mytulus.

MUSCOVY. See Russia.

Muscovy-Glaſs, or Glimmer. See Mica.

MUSCULUS, a military machine, made uſe of by the Romans to cover and protect the ſoldiers while they approached and undermined the walls of beſieged places, or filled the ditches. It ſeems to have reſembled the teſtudo in form, but was ſmaller in ſize. See Testudo.

MUSEIA, were Grecian feſtivals in honour of the Muſes, celebrated with games every fifth year, particularly by the Theſpians. The Macedonians alſo obſerved a feſtival of the ſame name in honour of Jupiter and the Muſes, which laſted for nine days, and was celebrated with ſtage plays, ſongs, and poetical compoſitions.

MUSES, certain fabulous deities among the Pagans, ſuppoſed to preſide over the arts and ſciences; for this reaſon it is uſual for the poets, at the beginning of a poem, to invoke theſe goddeſſes to their aid.

The muſes were originally only ſingers and muſicians in the ſervice of Oſiris, or the great Egyptian Bacchus, under the inſtruction and guidance of his ſon Orus; but in ſucceeding times they were called the *daughters of Jupiter and Mnemoſyne* or *Memory*.

Theſe are the only pagan divinities whoſe worſhip has been continued through all ſucceeding changes in the religion and ſentiments of mankind. Profeſſors of every liberal art in all the countries of Europe ſtill revere them; particularly the poets, who ſeldom undertake the ſlighteſt work without invoking their aid.

Sir Iſaac Newton tells us, that the ſinging women of Oſiris were celebrated in Thrace by the name of the *Muſes*; and that the daughters of Pierius, a Thracian, imitating them, were celebrated by the ſame name.

Diodorus Siculus informs us, that Alcman of Meſſene, a lyric poet who flouriſhed in the 27th Olympiad, 670 years B. C. makes them the daughters of Uranus and Terra. It has been aſſerted by ſome ancient writers, that at firſt they were only three in number, but Homer, Heſiod, and other profound mythologiſts, admit of nine (A).

In his hymn to Apollo, Homer ſays,

——By turns the *nine* delight to ſing.

And Heſiod, in his theogony, names them all.—They are ſaid ſeverally to preſide over ſome art or ſcience, as muſic, poetry, dancing, aſtronomy. By ſome they are called *virgins*, becauſe the virtues of education appear unalterable: they are called *muſes* from a Greek word which ſignifies to explain myſteries, becauſe they have taught things the moſt curious and

Burney's Hiſt. of Muſic.

(A) It has beeen ſaid, that when the citizens of Sicyon directed three ſkilful ſtatuaries to make each of them ſtatues of the three Muſes, they were all ſo well executed, that they did not know which to chooſe, but erected all the nine, and that Heſiod and Homer only gave them names.

Muses.

and important to know, and which are above the comprehension of vulgar minds. Each of their names is said to include some particular allegory; *Clio*, for instance, has been thus called, because those who are praised in verse acquire immortal fame; *Euterpe*, on account of the pleasure accruing to those who hear learned poetry; *Thalia* implies for ever flourishing; *Melpomene*, that her melody insinuates itself into the inmost recesses of the soul; *Terpsichore* marks the pleasure which those receive who are versed in the liberal arts; *Erato* seems to indicate, that the learned command the esteem and friendship of all mankind; *Polyhymnia*, that many poets are become immortal by the number of hymns which they have addressed to the gods; *Urania*, that those whom she instructs elevate their contemplations and celebrity to the heavens and the stars; and lastly, the exquisite voice of *Calliope* has acquired her that appellation, as the inventress and guardian of eloquence and rhetoric.

An epigram of Callimachus gives the attributes of the muses in as many lines.

> *Calliope* the deeds of heroes sings;
> Great *Clio* sweeps to history the strings;
> *Euterpe* teaches mimes their silent show;
> *Melpomene* presides o'er scenes of wo;
> *Terpsichore* the flute's soft pow'r displays;
> And *Erato* gives hymns the gods to praise;
> *Polymnia's* skill inspires melodious strains;
> *Urania* wise, the starry course explains;
> And gay *Thalia's* glass points out where folly reigns.

This epigram does not however, exactly correspond with the ideas of other poets, or of the ancient painters, in characterising the attributes of the muses. The ancients had numberless ingenious and fanciful ideas concerning the muses, which we have not room to recite.—"It seems (says the Abbe Barthelemi*) as if the first poets, enchanted with the beauties of nature, occasionally were led to invoke the nymphs of the woods, hills, and fountains; and that yielding to the prevailing taste for allegory, they gave them names relative to the influence they might be supposed to have over the productions of the mind. At first three muses only were admitted, Melete, Mneme, and Aœde: that is to say, the meditation or reflection necessary to study; memory which records illustrious deeds; and song which accompanies their recital. In proportion as improvement was made in the art of versification, its characters and effects were personified, the number of the muses increased, and the names they now received referred to the charms of poetry, its celestial origin, the beauty of its language, the pleasure and gaity it inspires, the song and dance which add to it new charms, and the glory with which it is crowned. Afterwards were associated with them the Graces, whose employment it is to embellish poetry, and Love who is so frequently its object. These ideas took birth in a barbarous country, in Thrace, where Orpheus, Linus, and their disciples, suddenly appeared in the midst of ignorance. The muses were honoured there on the Pierian mount, and extending their dominion, successively took their stations on Pindus, Parnassus, Helicon, and all those solitary places where the painters of nature, surrounded by the most pleasing images, experience the divine glow of inspiration."

* Travels of Anacharsis, vol. iii. p. 261.

Pythagoras, and afterwards Plato, make the muses the soul of the planets in our system; from whence the imaginary music of the spheres.

Museum || Mushroom.

MUSEUM, a name which originally signified a part of the palace of Alexandria, which took up at least one-fourth of the city. This quarter was called the *museum*, on account of its being set apart for the muses and the study of the sciences. Here were lodged and entertained the men of learning; who were divided into many companies or colleges, according to the sciences of which they were the professors; and to each of these houses or colleges was allotted a handsome revenue. The foundation of this establishment is attributed to Ptolemy Philadelphus, who here placed his library. Hence the word *museum* is now applied to any place set apart as a repository for things that have an immediate relation to the arts.

The museum at Oxford, called the *Ashmolean museum*, is a noble pile of building, erected at the expence of the university, at the west end of the theatre, at which side it has a magnificent portal, sustained by pillars of the Corinthian order. The front, which is to the street, extends about 60 feet, where there is this inscription over the entrance in gilt characters, *Museum Ashmoleanum, schola naturalis historiæ, officina chymicha*. It was begun in 1679, and finished in 1683, when a valuable collection of curiosities was presented to the university by Elias Ashmole, Esq: which were the same day reposited there; several accessions have been since made to the museum; among which are hieroglyphics, and other Egyptian antiquities, an entire mummy, Roman antiquities, altars, medals, lamps, &c. and a variety of natural curiosities.

The British museum in London is a large, beautiful, and magnificent building, the noblest cabinet of curiosities in the world. See the article London, nº 155.

MUSGRAVE (Dr William), a learned physician and antiquary, was born at Charlton-Musgrave in Somersetshire, about the year 1657; and studied at New-college, Oxford. Having distinguished himself by his knowledge in his profession, and his skill in natural philosophy, he was elected fellow of the Royal Society; and being made secretary in 1684, he continued the Philosophical Transactions from nº 167 to nº 178 inclusive. After having taken his degrees in physic, and being admitted a fellow of the college of physicians, he went and settled at Exeter, where he practised physic with great reputation and success. Being a man of extensive learning, he composed, at his leisure hours, several curious and valuable works; as, 1. *De arthritide anomala sive interna dissertatio*, 2. *De arthritide symptomatica dissertatio*. 3. *Julii Vitalis epitaphium, cum commentario*. 4. *De legionibus epistola*. 5. *De aquilis Romanis epistola*. 6. *Inscriptio Terraconensis, cum commentario*. 7. *Geta Britannicus*, &c.—8. *Belgium Britannicum*. This learned physician died in 1721.

MUSHROOM, in botany. See Agaricus and Lyncurius.

To try the quality of mushrooms:—Take an onion, and stripe the outer skin, and boil it with your mushrooms: if the onion become blue or black, there are certainly dangerous ones amongst them; if it remain white, they are good.

MUSIC;

MUSIC;

1 Definition. THE art of combining sounds in a manner agreeable to the ear. This combination may be either simultaneous or successive: in the first case, it constitutes harmony; in the last melody. But though the same sounds, or intervals of sound, which give pleasure when heard in succession, will not always produce the same effect in harmony; yet the principles which constitute the simpler and more perfect kinds of harmony, are almost, if not entirely the same with those of melody. By *perfect harmony*, we do not here mean that plenitude, those complex modifications of harmonic sound, which are admired in practice; but that harmony which is called *perfect* by theoricians and artists: that harmony which results from the coalescence of simultaneous sounds produced by vibrations in the proportions of thirds, fifths, and octaves, or their duplicates.

The principles upon which these various combinations of sound are founded, and by which they are regulated, constitute a science, which is not only extensive but profound, when we would investigate the principles from whence these happy modifications of sound result, and by which they are determined; or when we would explore the sensations, whether mental or corporeal, with which they affect us. The ancient definitions of music are not proportioned in their extent to our present ideas of that art; but M. Rousseau betrays a temerity highly inconsistent with the philosophical character, when from thence he infers, that their ideas were vague and undetermined. Every soul susceptible of refinement and delicacy in taste or sentiment, must be conscious that there is a music in action as well as in sound; and that the ideas of beauty and decorum, of harmony and symmetry, are, if we may use the expression, equally constituent of visible as of audible music. Those illustrious minds, whose comprehensive prospects in every science where taste and propriety prevail took in nature at a single glance, would behold with contempt and ridicule those narrow and microscopic views of which alone their successors in philosophy have discovered themselves capacious. With these definitions, however, we are less concerned, as they bear no proportion to the ideas which are now entertained of music. Nor can we follow M. Rousseau, from whatever venerable sources his authority may be derived in adopting his Egyptian etymology for the word *music*. The established derivation from *Musa* could only be questioned by a paradoxical genius. That music had been practised in Egypt before it was known as an art in Greece, is indeed a fact which cannot be questioned; but it does not thence follow that the Greeks had borrowed the name as well as the art from Egypt. If the art of music be so natural to man that vocal melody is practised wherever articulate sounds are used, there can be little reason for deducing the idea of music from the whistling of winds through the reeds that grew on the river Nile. And indeed, when we reflect with how easy a transition we may pass from the accents of speaking to diatonic sounds; when we observe how early childen adapt the language of their amusements to measure and melody, however rude; when we consider how early and universally these practices take place—there is no avoiding the conclusion, that the idea of music is connatural to man, and implied in the original principles of his constitution. We have already said, that the principles on which it is founded, and the rules by which it is conducted, constitute a science. The same maxims when applied to practice form an art: hence its first and most capital division is into *speculative* and *practical* music.

Speculative music is, if we may be permitted to use the expression, the knowledge of the nature and use of those materials which compose it; or, in other words, of all the different relations between the high and low, between the harsh and the sweet, between the swift and the slow, between the strong and the weak, of which sounds are susceptible: relations which, comprehending all the possible combinations of music and sounds, seem likewise to comprehend all the causes of the impressions which their succession can make upon the ear and upon the soul.

Practical music is the art of applying and reducing to practice those principles which result from the theory of agreeable sounds, whether simultaneous or successive; or, in other words, to conduct and arange sounds according to the proportions resulting from consonance, from duration and succession, in such a manner as to produce upon the ear the effect which the composer intends. This is the art which we call *composition* *. With respect to the actual production of sounds by voices or instruments, which is called *execution*, this department is merely mechanical and operative; which, only presupposing the powers of sounding the intervals true, of exactly proportioning their degrees of duration, of elevating or depressing sounds according to those gradations which are prescribed by the tone, and to the value required by the time, demands no other knowledge but a familiar acquaintance with the characters used in music, and a habit of expressing them with promptitude and facility.

* See Composition.

Speculative music is likewise divided into two departments; *viz.* the knowledge of the proportions of sounds or their intervals, and that of their relative durations; that is to say, of measure and of time.

The first is what among the ancients seem to have been called *harmonical* music. It shows in what the nature of air or melody consists; and discovers what is consonant or discordant, agreeable or disagreeable, in the modulation. It discovers, in a word, the effects which sounds produce on the ear by their nature, by their force, and by their intervals; which is equally applicable to their consonance and their succession.

The second has been called *rhythmical*, because it treats of sounds with regard to their time and quantity. It contains the explication of their continuance, of their proportions, of their measures whether long or

 short,

short, quick or slow, of the different modes of time and the parts into which they are divided, that to these the succession of sounds may be conformed.

Practical music is likewise divided into two departments, which correspond to the two proceeding.

That which answers to *harmonical* music, and which the ancients called *melopée*, teaches the rules for combining and varying the intervals, whether consonant or dissonant, in an agreeable and harmonious manner.

The second, which answers to the *rhythmical* music, and which they called *rhythmopée*, contains the rules for applying the different modes of time, for understanding the feet by which verses were scanned, and the diversities of measure; in a word, for the practice of the rythmus.

Music is at present divided more simply into *melody* and *harmony*; for since the introduction of *harmony* the proportion between the length and shortness of sounds, or even that between the distance of returning cadences, are of less consequence amongst us. For it often happens in modern languages, that the verses assume their measures from the musical air and almost entirely lose the small share of proportion and quantity which in themselves they possess.

By melody the successions of sound are regulated in such a manner as to produce pleasing airs. See MELODY.

Harmony consists in uniting to each of the sounds, in a regular succession, two or more different sounds, which simultaneously striking the ear sooth it by their concurrence. See HARMONY.

Music, accoring to Rousseau, may be, and perhaps likewise ought to be, divided into the *physical* and the *imitative*. The first is limited to the mere mechanism of sounds, and reaches no farther than the external senses, without carrying its impressions to the heart, and can produce nothing but corporeal sensations more or less agreeable. Such is the music of songs, of hymns, of all the airs which only consist in combinations of melodious sounds, and in general all music which is merely harmonious.

It may, however be questioned, whether every sound, even to the most simple, is not either by nature or by early and confirmed association, *imitative*. If we may trust our own feelings, there is no such thing in nature as music which gives mechanical pleasure alone. For if so, it must give such pleasure as we receive from tastes, from odours, or from other grateful titillations; but we absolutely deny that there are any musical sensations or pleasures in the smallest degree analogous to these. Let any piece of music be resolved into its elementary parts and their proportions, it will then easily appear from this analysis that sense is no more than the vehicle of such perceptions, and that mind alone can be susceptible of them. It may indeed happen from the number of the performers and the complication of the harmony, that meaning and sentiment may be lost in the multiplicity of sounds; but this, though it may be harmony, loses the name of *music*.

The second department of this division, by lively and accentuated inflections, and by sounds which may be said to speak, expresses all the passions, paints every possible picture, reflects every object, subjects the whole of nature to its skilful imitations, and impresses even on the heart and soul of man sentiments proper to affect them in the most sensible manner. This, continues he, which is the genuine lyric and theatrical music, was what gave double charms and energy to ancient poetry; this is what, in our days, we exert ourselves in applying to the drama, and what our singers execute on the stage. It is in this music alone, and not in harmonics or the resonance of nature, that we must expect to find accounts of those prodigious effects which it formerly produced.

But, with M. Rousseau's permission, all music which is not in some degree characterised by these pathetic and imitative powers, deserves no better name than that of a *musical jargon*, and can only be effectuated by such a complication and intricacy of harmony, as may confound, but cannot entertain the audience. This character therefore, ought to be added as essential to the definition of music; and it must be attributed to our neglect of this alone, whilst our whole attention is bestowed on harmony and execution, that the best performances of our artists and composers are heard with listless indifference and oscitation, nor even can conciliate any admirers, but such as are induced, by pedantry and affectation, to pretend what they do not feel. Still may the curse of indifference and inattention pursue and harrow up the souls of every composer or performer, who pretends to regale our ears with this musical legerdemain, till the grin of scorn, or the hiss of infamy, teach them to correct this depravity of taste, and entertain us with the voice of nature!

Whilst moral effects are sought in the natural effects of sound alone, the scrutiny will be vain, and disputes will be maintained without being understood: but sounds, as representatives of objects, whether by nature or association, introduce new scenes to the fancy and new feelings to the heart; not from their mechanical powers, but from the connection established by the author of our frame between sounds and the objects which either by natural resemblance or unavoidable association they are made to represent.

It would seem that music was one of those arts which were first discovered: and that vocal was prior to instrumental music, if, in the earliest ages there was any music which could be said to be purely instrumental. For it is more than probable, that music was originally formed to be the vehicle of poetry; and of consequence, though the voice might be supported and accompanied by instruments, yet music was never intended for instruments alone.

We are told by ancient authors, that all the laws, whether human or divine, exhortations to virtue, the knowledge of the characters and actions of gods and heroes, the lives and atchievments of illustrious men were written in verse, and sung publicly by a quire to the sound of instruments; and it appears from the Scriptures, that such from the earliest times was the custom among the Israelites. Nor was it possible to find means more efficacious for impressing on the mind of man the principles of morals, and inspiring the love of virtue. Perhaps, however, this was not the result of a premeditated plan; but inspired by sublime sentiments and elevation of thought, which in accents that were suited and proportioned to their celestial nature endeavoured to find a language worthy of themselves and expressive of their grandeur.

It merits attention, that the ancients were duly sensible

sible of the value and importance of this divine art, not only as a symbol of that universal order and symmetry which prevails through the whole frame of material and intelligent nature, but as productive of the most momentous effects both in moral and political life. Plato and Aristotle, who disagreed almost in every other maxim of politics, are unanimous in their approbation of music, as an efficacious instrument in the formation of the public character and in conducting the state; and it was the general opinion, that whilst the gymnastic exercises rendered the constitution robust and hardy, music humanised the character, and softened those habits of roughness and ferocity by which men might otherwise have degenerated into savages. The gradations by which voices were exerted and tuned, by which the invention of one instrument succeeded to another, or by which the principles of music were collected and methodised in such a manner as to give it the form of an art and the dignity of a science, are topics so fruitful of conjecture and so void of certainty, that we must leave them to employ minds more speculative and inventions more prolific than ours, or transfer them to the *History* of Music as a more proper place for such disquisitions. For the amusement of the curious, Rousseau in his *Musical Dictionary*, Plates C and N, has transcribed some fragments of Grecian, Persian, American, Chinese, and Swiss music, with which performers may entertain themselves at leisure. When they have tried the pieces, it is imagined they will be less sanguinely fond than that author of ascribing the power of music to its affinity with the national accents where it is composed. This may doubtless have its influence; but there are other causes more permanent and less arbitrary to which it owes its most powerful and universal charms.

The music now most generally celebrated and practised is that of the Italians, or their successful imitators. The English from the invasion of the Saxons, to that more late though lucid era in which they imbibed the art and copied the manner of the Italians, had a music which neither pleased the soul nor charmed the ear. The primitive muse of the French deserves no higher panegyric. Of all the barbarous nations, the Scots and Irish seem to have possessed the most affecting original music. The first consists of a melody characterised by tenderness: It melts the soul to a pleasing pensive langour. The other is the native expression of grief and melancholy. Tassoni informs us, that in his time a prince from Scotland had imported into Italy a lamentable kind of music from his own country; and that he himself had composed pieces in the same spirit. From this expressive though laconic description, we learn, that the character of our national music was even then established; yet so gross is our ignorance and credulity, that we ascribe the best and most impassioned airs which are extent among us to David Rizzio; as if an Italian Lutanist, who had lived so short a time in Scotland, could at once, as it were by inspiration, have imbibed a spirit and composed in a manner so different from his own. It is yet more surprising that Geminiani should have entertained and published the same prejudice, upon the miserable authory of popular tradition alone; for the fact is authenticated by no better credentials. The primitive music of the Scots may be divided into the *martial*, the *pastoral*, and the *festive*. The *first* consists either in marches, which were played before the chieftains, in imitation of the battles which they fought, or in lamentations for the catastrophes of war and the extinction of families. These wild effusions of natural melody preserve several of the rules prescribed for composition. The strains, though rude and untutored, are frequently terrible or mournful in a very high degree. The port or march is sometimes in common, sometimes in treble time; regular in its measures, and exact in the distance between its returning cadences; most frequently, though not always, loud and brisk. The *pibroch*, or imitation of battles, is wild, and abrupt in its transitions from interval to interval and from key to key; various and desultory in its movements: frequent irregular in the return of its cadences; and in short, through the whole, seems inspired with such fury and enthusiasm, that the hearer is irresistibly infected with all the rage of precipitate courage, notwithstanding the rudeness of the accents by which it is kindled. To this the *pastoral* forms a striking contrast. Its accents are plaintive, yet soothing; its harmony generally flat; its modulations natural and agreeable; its rhythmus simple and regular; its returning cadences at equal distance; its transitions from one concinnous interval to another, at least for the most part; its movements slow, and may be either in common or treble time. It scarcely admits of any other harmony than that of a simple bass. A greater number of parts would cover the air and destroy the melody. To this we shall add what has been said upon the same subject by Dr Franklin. Writing to Lord K———, he proceeds thus:

"Give me leave, on this occasion, to extend a little the sense of your position, 'That melody and harmony are separately agreeable, and in union delightful;' and to give it as my opinion, that the reason why the Scotch tunes have lived so long, and will probably live for ever (if they escape being stifled in modern affected ornament), is merely this, that they are really compositions of melody and harmony united, or rather that their melody is harmony. I mean, the simple tunes sung by a single voice. As this will appear paradoxical, I must explain my meaning. In common acceptation, indeed, only an agreeable *succession* of sounds is called *melody;* and only the *coexistence* of agreeable sounds, *harmony*. But since the memory is capable of retaining for some moments a perfect idea of the pitch of a past sound, so as to compare it with the pitch of a succeeding sound, and judge truly of their agreement or disagreement, there may and does arise from thence a sense of harmony between the present and past sounds, equally pleasing with that between two present sounds. Now the construction of the old Scotch tunes is this, that almost every succeeding emphatical note is a third, a fifth, an octave, or in short some note that is in concord with the preceding note. Thirds are chiefly used, which are very pleasing concords. I use the word *emphatical*, to distinguish those notes which have a stress laid on them in singing the tune, from the lighter connecting notes that serve merely, like grammar-articles in common speech, to tack the whole together.

"That we have a most perfect idea of a sound just past, I might appeal to all acquainted with music, who

who know how easy it is to repeat a sound in the same pitch with one just heard. In tuning an instrument, a good ear can as easily determine that two strings are in unison by sounding them separately, as by sounding them together; their disagreement is also as easily, I believe I may say more easily and better distinguished when sounded separately; for when sounded together, though you know by the beating that one is higher than the other, you cannot tell which it is. I have ascribed to memory the ability of comparing the pitch of a present tone with that of one past. But if there should be, as possibly there may be, something in the ear similar to what we find in the eye, that ability would not be entirely owing to memory. Possibly the vibrations given to the auditory nerves by a particular sound may actually continue for some time after the cause of these vibrations is past, and the agreement or disagreement of a subsequent sound become by comparison with them more discernible. For the impression made on the visual nerves by a luminous object will continue for 20 or 30 seconds."

After some experiments to prove the permanency of visible impressions, he continues thus:

"Farther, when we consider by whom these ancient tunes were composed, and how they were first performed, we shall see that such harmonical successions of sounds was natural and even necessary in their construction. They were composed by the minstrels of those days, to be played on the harp accompanied by the voice. The harp was strung with wire, which gives a sound of long continuance; and had no contrivance like that of the modern harpsichord, by which the sound of the proceding note can be stopt the moment a succeeding note begins. To avoid actual discord, it was therefore necessary that the succeeding emphatic note should be a cord with the preceding, as their sounds must exist at the same time. Hence arose that beauty in those tunes that has so long pleased, and will please for ever, though men scarce know why. That they were originally composed for the harp, and of the most simple kind, I mean a harp without any half-notes but those in the natural scale, and with no more than two octaves of strings, from C to C, I conjecture from another circumstance; which is, that not one of these tunes, really ancient, has a single artificial half-note in it; and that in tunes where it is most convenient for the voice to use the middle notes of the harp, and place the key in F, there the B, which if used should be a B flat, is always omitted, by passing over it with a third. The connoisseurs in modern music will say I have no taste: but I cannot help adding, that I believe our ancestors, in having a good song, distinctly articulated, sung to one of those tunes, and accompanied by the harp, felt more real pleasure than is communicated by the generality of modern operas, exclusive of that arising from the scenery and dancing. Most tunes of late composition, not having this natural harmony united with their melody, have recourse to the artificial harmony of a bass, and other accompanying parts. This support, in my opinion, the old tunes do not need, and are rather confused than aided by it. Whoever has heard *James Oswald* play them on his violincello, will be less inclined to dispute this with me. I have more than once seen tears of pleasure in the eyes of his auditors: and yet I think, even *his* playing those tunes would please more if he gave them less modern ornament."

As these observations are for the most part true and always ingenious, we need no other apology for quoting them at length. It is only proper to remark, that the transition in Scots music by consonant intervals, does not seem, as Dr Franklin imagines, to arise from the nature of the instruments upon which they played. It is more than probable, that the ancient British harp was not strung with wire, but with the same materials as the Welch harps at present. These strings have not the same permanency of tone as metal: so that the sound of a preceding emphatic note must have expired before the subsequent accented note could be introduced. Besides, they who are acquainted with the manœuvre of the Irish harp, know well that there is a method of discontinuing sounds no less easy and effectual than upon the harpsichord. When the performer finds it proper to interrupt a note, he has no more to do but return his finger gently upon the string immediately struck, which effectually stops its vibration.

That species of Scots music which we have distinguished by the name of *festive* seems now limited to reels and country-dances. These may be either in common or treble time. They most frequently consist of two strains: each of these contains eight or twelve bars. They are truly rhythmical; but the mirth which they excite seems rather to be inspired by the vivacity of the movement, than either by the force or variety of the melody. They have a manœuvre and expression peculiar to themselves, which it is impossible to describe, and which can only be exhibited by good performers.

Thus far we have pursued the general idea of music. We shall, after the history, give a more particular detail of the science from Monsieur D'Alembert.

HISTORY OF MUSIC.

2 No accurate accounts of the state of music in the earliest ages of the world.

MUSIC is capable of a variety so infinite, so greatly does the most simple differ from the most complex, and so multiplied are the degrees between these two extremes, that in no age could the incidents respecting that fascinating art have been few or uninteresting. But, that accounts of these incidents should have been handed down to us, scanty and imperfect, is no matter of surprise, when we recollect that the history of music is the history only of sounds, of which writing is a very inadequate medium; and that men would long employ themselves in the pleasing exercise of cultivating music before they possessed either the ability or the inclination to record their exertions.

No accurate traces, therefore, of the actual state of music, in the earlier ages of the world, can be discerned. Our ideas on the subject have no foundation firmer than conjecture and analogy.

It is probable, that among all barbarous nations some degree of similarity is discernible in the style of

their

their music. Neither will much difference appear during the first dawnings of civilization. But in the more advanced periods of society, when the powers of the human mind are permitted without obstacle to exert their native activity and tendency to invention, and are at the same time affected by the infinite variety of circumstances and situations which before had no existence, and which in one case accelerate, and in another retard; then that similarity, once so distinguishable, gives place to the endless diversity of which the subject is capable.

3 Music not the invention of any one man.

The practice of music being universal in all ages and all nations, it would be absurd to attribute the invention of the art to any one man. It must have suffered a regular progression, through infancy, childhood, and youth, before it could arrive at maturity, The first attempts must have been rude and artless; perhaps the first flute was a reed of the lake.

No nation has been able to produce proofs of antiquity so indisputable as the Egyptians; it would be vain, therefore, to attempt tracing music higher than the history of Egypt.

4 Egyptian music.

By comparing the accounts of Diodorus Siculus and of Plato, there is reason to suppose, that in very ancient times the study of music in Egypt was confined to the priesthood, who used it only on religious and solemn occasions; that, as well as sculpture, it was circumscribed by law: that it was esteemed sacred, and forbidden to be employed on light or common occasions; and that innovation in it was prohibited: but what the style or relative excellence of this very ancient music was, there are no traces by which we can form an accurate judgment. After the reigns of the Pharaohs, the Egyptians fell by turns under the dominion of the Ethiopians, the Persians, the Greeks, and the Romans. By such revolutions, the manners and amusements of the people, as well as their form of government, must have been changed. In the age of the Ptolemies, the musical games and contests instituted by those monarchs were of Greek origin, and the musicians who performed were chiefly Greek.

The most ancient monuments of human art and industry, at present extant at Rome, are the obelisks brought thither from Egypt, two of which are said to have been erected by Sesostris at Heliopolis, about 400 years before the siege of Troy. These were by the order of Augustus brought to Rome after the conquest of Egypt. One of them called *guglia rotta*, or the broken pillar, which during the sacking of the city in 1527 was thrown down and broken, still lies in the Campus Martius. On it is seen the figure of a musical instrument of two strings, and with a neck. It resembles much the calascione still used in the kingdom of Naples.

5 An Egyptian musical instrument.

This curious relict of antiquity is mentioned, because it affords better evidence than, on the subject of ancient music, is usually to be met with, that the Egyptians, at so very early a period of their history, had advanced to a considerable degree of excellence in the cultivation of the arts. By means of its neck, this instrument was capable, with only two strings, of producing a great number of notes. These two strings, if tuned fourths to each other, would furnish that series of sounds called by the ancients *heptachord*, which consists of a conjunct tetrachord as B, C, D, E; E, F, G, A; if tuned fifths, they would produce an octave, or two disjunct tetrachords. The calascione is tuned in this last manner. The annals of no nation other than Egypt, for many ages after the period of the obelisk at Heliopolis, exhibit the vestige of any contrivance to shorten strings during performance by a neck or finger-board. Father Montfaucon observes, that after examining 500 ancient lyres, harps, and citharas, he could discover no such thing.

Egypt indeed seems to have been the source of human intelligence, and the favourite residence of genius and invention. From that celebrated country did the Greeks derive their knowledge of the first elements of those arts and sciences in which they afterwards so eminently excelled. From Greece again did the Romans borrow their attainments in the same pursuits. And from the records of those different nations have the moderns been enabled to accomplish an improvement so wonderful in literature.

6 The Egyptian Hermes the inventor of the lyre.

The Hermes or Mercury of the Egyptians, firnamed *Trismegistus*, or *thrice illustrious*, who was, according to Sir Isaac Newton, the secretary of Osiris, is celebrated as the inventor of music. It has already been observed, that no one person ought strictly to be called the inventor of an art which seems to be natural to, and coeval with, the human species; but the Egyptian Mercury is without doubt intitled to the praise of having made striking improvements in music, as well as of having advanced in various respects the civilization of the people, whose government was chiefly committed to his charge. The account given by Apollodorus of the manner in which he accidentally invented the lyre, is at once entertaining and probable, "The Nile (says Apollodorus), after having overflowed the whole country of Egypt, when it returned within its natural bounds, left on the shore a great number of dead animals of various kinds, and among the rest a tortoise; the flesh of which being dried and wasted by the sun, nothing remained within the shell but nerves and cartilages, and these being braced and contracted by the drying heat became sonorous. Mercury, walking along the banks of the Nile, happened to strike his foot against this shell; and was so pleased with the sound produced, that the idea of a lyre started into his imagination. He constructed the instrument in the form of a tortoise, and strung it with the dried sinews of dead animals."

How beautiful to conceive the energetic powers of the human mind in the early ages of the world, exploring the yet undiscovered capabilities of nature, and directed to the inexhaustible store by the finger of God, in the form of accident!

7 The single flute of Egyptians.

The monaulos, or single flute, called by the Egyptians photinx, was probably one of the most ancient instruments used either by them or any other nation. From various remains of ancient sculpture, it appears to have been shaped like a bull's horn, and was at first, it may be supposed, no other than the horn itself.—Before the invention of flutes, as no other instrument except those of percussion were known, music must have been little more than metrical. When the art of refining and lengthening sounds was first discovered, the

the power of music over mankind, from the agreeable surprise occasioned by soft and extended notes, was probably irresistible. At a time when all the rest of the world was involved in savage ignorance, the Egyptians were possessed of musical instruments capable of much variety and expression---Of this the astonishing remains of the city Thebes still subsisting afford ample evidence. In a letter from Mr Bruce, ingrossed in

8 The Theban harp of Egypt.

Dr Burney's History of Music, there is given a particular description of the Theban harp, an instrument of extensive compass, and exquisite elegance of form. It is accompanied with a drawing taken from the ruins of an ancient sepulchre at Thebes, supposed by Mr Bruce to be that of the father of Sesostris.

On the subject of this harp, Mr Bruce makes the following striking observation. "It overturns all the accounts of the earliest state of ancient music and instruments in Egypt, and is altogether, in its form, ornaments, and compass, an incontestible proof, stronger than a thousand Greek quotations, that geometry, drawing, mechanics, and music, were at the greatest perfection when this harp was made; and that what we think in Egypt was the invention of arts was only the beginning of the æra of their restoration."

Indeed, when the beauty and powers of this harp, along with the very great antiquity of the painting which represents it, are considered, such an opinion as that which Mr Bruce hints at, does not seem to be devoid of probability.

It cannot be doubted that during the reigns of the Ptolemies, who were voluptuous princes, music must have been much cultivated and encouraged. The father of Cleopatra, who was the last of that race of kings, derived his title of auletes, or flute-player, from his excessive attachment to the flute. Like Nero he used to array himself in the dress of a tibicen, and exhibit his performance in the public musical contests.

Some authors, particularly Am. Marcellinus and M. Pau, refuse to the Egyptians, at any period of their history, any musical genius, or any excellence in the art; but the arguments used to support this opinion seem to be inconclusive, and the evidences of the opposite decision appear to be incontestible.

9 Hebrew music.

The sacred Scriptures afford almost the only materials from which any knowledge of Hebrew music can be drawn. In the rapid sketch, therefore, of an ancient music which we mean to exhibit, a very few observations are all which can properly be given to that department of our subject.

Moses, who led the Israelites out of Egypt, was educated by Pharaoh's daughter in all the literature and elegant arts cultivated in that country. It is probable, therefore, that the taste and style of Egyptian music would be infused in some degree into that of the Hebrews. Music appears to have been interwoven through the whole tissue of religious ceremony in Palestine. The priesthood seem to have been musicians hereditarily and by office. The prophets appear to have accompanied their inspired effusions with music; and every prophet, like the present improvisatori of Italy, seems to have been accompanied by a musical instrument.

Music, vocal and instrumental, constituted a great part of the funeral ceremonies of the Jews. The pomp and expence used on these occasions advanced by degrees to an excessive extent. The number of flute-players in the processions amounted sometimes to several hundreds, and the attendance of the guests continued frequently for 30 days †.

† Josephus, L. 3. c. 9.

The Hebrew language abounds with consonants, and has so few vowels, that in the original alphabet they had no characters. It must, therefore, have been harsh and unfavourable to music. Their instruments of music were chiefly those of percussion; so that both on account of the language and the instruments, the music must have been coarse and noisy. The vast numbers of performers too, whom it was the taste of the Hebrews to collect together, could with such language and such instruments produce nothing but clamour and jargon. According to Josephus, there were 200,000 musicians at the dedication of Solomon's temple. Such are the circumstances from which only an idea of Hebrew music can be formed; for the Jews neither ancient nor modern have ever had any characters peculiar to music; and the melodies used in their religious ceremonies have at all times been entirely traditional.

10 coarse and noisy.

11 Grecian music.

Cadmus, with the Phœnician colony which he led into Greece, imported at the same time various arts into that country. By the assistance of his Phœnician artificers, that chief discovered gold in Thrace and copper at Thebes. At Thebes that metal is still termed *cadmia*. Of these materials, and of iron, they formed to themselves armour and instruments of war. These they struck against each other during their dances at sacrifices, by which they first obtained the idea of music. Such is the account given of the origin of that species of music in Greece produced by instruments of percussion. The invention of wind instruments in Greece is attributed to Minerva; and to the Grecian Mercury is assigned, by the poets and historians of that country, the honour of many discoveries probably due to the Egyptian Hermes, particularly the invention of stringed instruments. The lyre of the Egyptian Mercury had only three strings; that of the Grecian seven: the last was perhaps no more than an improvement on the other. When the Greeks deified a prince or hero of their own country, they usually assigned him an Egyptian name, and with the name bestowed on their new divinity all the actions, attributes, and rites of the original.

The Grecian lyre, although said to have been invented by Mercury, was cultivated principally by Apollo, who first played upon it with method, and accompanied it with the voice. The celebrated contest between him and Marsyas is mentioned by various authors; in which, by conjoining the voice with his lyre (a combination never before attempted), his music was declared superior to the flute of Marsyas. The progress of the lyre, according to Diodorus Siculus, is the following. "The muses added to the Grecian lyre the string called *mese;* Linus that of lichanos; and Orpheus and Thamyras those strings which are named hypate and parhypate." It has been already mentioned, that the lyre invented by the Egyptian Mercury had but three strings; by putting these circumstances together, we may perhaps acquire some knowledge of the progress of music, or at least of the extension of its scale in the highest antiquity. *Mese*, in the Greek music, is the fourth sound of the second tetrachord

12 Progress of the Grecian lyre.

tetrachord of the great system and first tetrachord invented by the ancients, answering to our A, on the fifth line in the base. If this sound then was added to the former three, it proves that the most ancient tetrachord was that from E in the base to A; and that the three original strings in the Mercurian and Apollonian lyre were tuned E, F, G, which the Greeks call *hypate meson, parhypate meson*, and *meson diatonos*; the addition, therefore, of *mese* to these completed the first and most ancient tetrachord E, F, G, A. The string lichanos again being added to these, and answering to our D on the third line in the base, extended the compass downwards, and gave the ancient lyre a regular series of five sounds. The two strings hypate and parhypate, corresponding with our B and C in the base, completed the heptachord or seven sounds b, c, d, e, f, g, a; a compass which received no addition till after the days of Pindar.

It might perhaps be expected, that in a history of Greek music something ought to be said concerning the muses Apollo, Bacchus, and the other gods and demi-gods, who in the mythology of that country appear to have promoted and improved the art. But such a discussion would be too diffusive, and involve too much foreign matter for the plan we have chosen to adopt. We cannot avoid, however, making a few observations on the poems of Homer, in so far as connected with our subject. It has been imagined, with much appearance of probability, that the occupation of the first poets and musicians of Greece resembled that of the Celtic and German bards and the scalds of Iceland and Scandinavia. They sung their poems in the streets of cities and in the palaces of princes. They were treated with high respect, and regarded as inspired persons. Such was the employment of Homer. His poems, so justly celebrated, exhibit the most authentic picture that can be found in the annals of antiquity, although perhaps somewhat highly coloured, of the times of which he wrote and in which he lived. Music is always named throughout the Iliad and Odyssey with rapture; but as in these poems no mention is made of instrumental music unaccompanied with poetry and singing, a considerable share no doubt of the poet's praises is to be attributed to the poetry. The instruments most frequently named are the lyre, the flute, and the syrinx. The trumpet appears not to have been known at the siege of Troy, although it had come to be in use in the days of Homer himself. From the time of Homer till that of Sappho, there is almost a total blank in literature. Only a few fragments remain of the works of those poets and musicians whose names are preserved as having flourished between those periods (†). During the century which elapsed between the days of Sappho and those of Anacreon, no literary productions are preserved entire.— From Anacreon to Pindar there is another chasm of near a century. Subsequent to this time, the works still extant of the three great tragic poets, Æschylus, Sophocles, and Euripides, together with those of Plato, Aristotle, Aristoxenus, Euclid, Theocritus, Callimachus, Polybius, and many others, produced all within a space less than 300 years, distinguish this illustrious and uncommon period as that in which the whole powers of genius seem to have been exerted to illuminate and instruct mankind in future ages. Then it was that eloquence, poetry, *music*, architecture, history, painting, sculpture, like the spontaneous blossoms of nature, flourished without the appearance of labour or of art.

13 Occupation of the first poets and musicians in Greece.

The poets, as well epic as lyric and elegiac, were all likewise musicians; so strictly connected were music and poetry for many ages. It would afford amusement to collect the biographical anecdotes of these favourites of genius, and to assign to each the respective improvements made by him in music and poetry; but our limits do not admit of so extensive a disquisition; for which, therefore, reference must be made to the editors and commentators of these authors, and to the voluminous histories of music lately published.

14 The invention of musical characters.

The invention of notation and musical characters marked a distinguished æra in the progress of music. There are a diversity of accounts respecting the person to whom the honour of that invention is due; but the evidences seem to preponderate in favour of Terpander, a celebrated poet and musician, to whose genius music is much indebted. He flourished about the 27th Olympiad, or 671 years before Christ.

Before that valuable discovery, music being entirely traditional, must have depended much on the memory and taste of the performer.

There is an incident mentioned in the accounts handed down to us of the Olympic games, which may serve in some degree to mark the character of music at the time in which it happened. Lucian relates that a young flute-player named Harmonides, at his first public appearance in these games, began a solo with so violent a blast, on purpose to *surprise* and *elevate* the audience, that he *breathed his last breath into his flute*, and died on the spot. When to this anecdote, wonderful to us, and almost incredible, is added the circumstance, that the trumpet-players at these public exhibitions expressed an excess of joy when they found their exertions had neither rent their cheeks nor burst their blood-vessels, some idea may be formed of the noisy and vociferous style of music which then pleased; and from such facts only can any opinion be obtained of the actual state of ancient music.

15 Vociferous music of the Greeks.

In whatever *manner* the flute was played on, there is no doubt that it was long in Greece an instrument of high favour, and that the flute-players were held in much estimation. The flute used by Ismenias, a celebrated Theban musician, cost at Corinth three talents, or L. 581. 5s. If, says Xenophon, a bad flute-player would pass for a good one, he must, like the *great flute-players*, expend large sums on *rich furniture*, and appear in public *with a great retinue of servants*.

16 Extravagance of the ancients with respect to music.

The ancients, it appears, were not less extravagant in gatifying the ministers of their pleasures than ourselves.

(†) Hesiod lived so near to Homer, that it has been disputed which of them is the most ancient. It is now, we believe, universally admitted, that the palm of antiquity is due to Homer; but we consider them as having both flourished in the same æra.

selves. Amœbæus, a harper, was paid an Attic talent, or L.193, 15s. *per* day for his performance (‡).

It is proper to add, that the celebrated musicians of Greece who performed in public were of *both* sexes; and that the beautiful Lamia, who was taken captive by Demetrius, in the sea engagement in which he vanquished Ptolemy Soter, and who herself captivated her conqueror, as well as many other elevated female spirits, are recorded by ancient authors in terms of admiration, and of whom, did our limits here admit of biography, we would treat with pleasure. The philosophers of Greece, whose capacious minds grasped every other object of human intelligence, were not inattentive to the theory of music, or the philosophy of sound. This department of science became the source of various sects, and of much diversity of opinion.—The founders of the most distinguished sects were Pythagoras and Aristoxenus. Of their theories, mention is made in the Appendix to this article.

17 Roman music.

Like every other people, the Romans, from their first origin as a nation, were possessed of a species of music which might be distinguished as their own. It appears to have been rude and coarse, and probably was a variation of the music in use among the Etruscans and other tribes around them in Italy: but as soon as they began to open a communication with Greece, from that country, with their arts and philosophy, they borrowed also their music and musical instruments. No account, therefore, of Roman music is to be expected that would not be a repetition of what has been said on the subject of the music of Greece.

18 Vanity of Nero with respect to music.

The excessive vanity of Nero with respect to music, displayed in his public contentions for superiority with the most celebrated professors of the art in Greece and Rome, is known to every one conversant in the history of Rome. The solicitude with which that detestable tyrant attended to his voice is curious, and will throw some light on the practices of singers in ancient times. He was in use to lie on his back, with a thin plate of lead on his stomach. He took frequent emetics and cathartics, abstained from all kinds of fruit and such meats as were held to be prejudicial to singing. Apprehensive of injuring his voice, he at length desisted from haranguing the soldiery and the senate; and after his return from Greece established an officer (Phonascus) to regulate his tones in speaking.

19 Sacred music.

Most nations have consented in introducing music into their religious ceremonies. That art was early admitted into the rites of the Egyptians and Hebrews; and that it constituted a considerable part of the Grecian and Roman religious service, appears from the writings of many ancient authors. The same pleasing art soon obtained an introduction into the Christian church, as the Acts of the Apostles discover in many passages. There remain no specimens of the music employed in the worship of the primitive Christians; but probably it was at first the same with that used in the Pagan rites of the Greeks and Romans. The practice of chanting the psalms was introduced into the western churches by St Ambrose, about 350 years after Christ. In the year 600, the method of chanting was improved by St Gregory the Great. The Ambrosian chant contained four modes. In the Gregorian the number was doubled. So early as the age of Constantine the Great, prior to either of the periods last mentioned, when the Christian religion first obtained the countenance of power, instrumental music came to be introduced into the service of the church.

20 Introduced into the English church.

In England, according to bishop Stillingfleet, music was employed in the church-service, first by St Augustine, and afterwards much improved by St Dunstan, who was himself an eminent musician, and who is said to have first furnished the English churches and convents with the organ. The organ, the most majestic of all instruments, seems to have been an improvement of the hydraulican or water organ of the Greeks.—The first organ seen in France was sent from Constantinople in 757, as a present to king Pepin from the emperor Constantine Copromymus VI. In Italy, Germany, and England, that instrument became frequent during the 10th century.

During the dark ages no work of genius or taste in any department of science seems to have been produced in any part of Europe; and except in Italy, where the cultivation of music was rather more the object of attention, that art was neglected equally with all others. There has always been observed a correspondence in every country between the progress of music and the cultivation of other arts and sciences. In the middle ages, therefore, when the most fertile provinces of Europe were occupied by the Goths, Huns, Vandals, and other barbarous tribes, whose language was as harsh as their manners were savage, little perfection and no improvement of music is to be looked for. Literature, arts, and refinements, were encouraged more early at the courts of the Roman pontiffs than in any other country; and owing to that circumstance it is, that the scale, the counterpoint, the best melodies, the dramas religious and secular, the chief graces and elegancies of modern music, have derived their origin from Italy. In modern times, Italy has been to the rest of Europe what ancient Greece was to Rome. The Italians have aided the civilization of their conquerors, and enlightened the minds of those whose superior prowess had enslaved them.

21 The great improvements in music had their origin in Italy.

Having mentioned counterpoint, it would be improper not to make one or two observations on an invention which is supposed to have been the source of great innovation in the practice of music. Counterpoint, or music in parts, seems to be an invention purely modern. The term harmony meant in the language of antiquity what is now understood by melody. Guido, a monk of Arezzo in Tuscany, is, in the general opinion, supposed to have entertained the first idea of counterpoint about the year 1022: an art which, since his time, has experienced gradual and imperceptible improvements, far exceeding the powers or comprehension of any one individual. The term *counterpoint*, or *contra punctum*, denotes its own etymology and import. Musical notation was at one time performed by small points; and the present mode is only

21 Counterpoint.

(‡) Roscius gained 500 sestertia, or L.4036 : 9 : 2 d. Sterling *per* annum.

only an improvement of that practice. Counterpoint, therefore, denotes the notation of harmony or music in parts, by points opposite to each other. The improvements of this important acquisition to the art of music kept pace at first with those of the organ; an instrument admirably adapted to harmony: And both the one and the other were till the 13th century employed chiefly in sacred music. It was at this period that secular music began to be cultivated.

Before the invention of characters for time, music in parts must have consisted entirely of *simple counterpoint*, or note against note, as it is practised in psalmody. But the happy discovery of a time-table extended infinitely the powers of combined sounds. The ancients had no other resource to denote time and movement in music except two charcters (— ‿), equivalent to a long and a short syllable. But time is of such importance in music, that it can impart meaning and energy to the repetition of the same sound: without it variety of tones has no effect with respect to gravity and acuteness. The invention of the time-table is attributed by almost all the writers on music of the last and present century to John de Muris, who flourished about the year 1330. But in a manuscript of John de Muris himself, bequeathed to the Vatican library by the Queen of Sweden, that honour seems to be yielded to Magister Franco, who appears to have been alive as late at least as 1083. John de Muris, however, who there is some cause to believe was an Englishman, though not the inventor of the *cantus mensurabilis*, did certainly by his numerous writings greatly improve it. His tract on the *Art of Counterpoint* is the most clear and useful essay on the subject of which those times can boast.

22 The invention of the time table.

In the 11th century, during the first crusade, Europe began to emerge from the barbarous stupidity and ignorance which had long overwhelmed it. While its inhabitants were exercising in Asia every species of rapine and pious cruelty, art, ingenuity, and reason, insensibly civilized and softened their minds. Then it was that the poets and songsters, known by the name of *Troubadours*, who first appeared in Provence, instituted a new profession; which obtained the patronage of the count of Poictou, and many other princes and barons who had themselves cultivated music and poetry with success. At the courts of their munificent patrons the troubadours were treated with respect. The ladies, whose charms they celebrated, gave them the most generous and flattering reception. The success of some inspired others with hopes, and excited exertions in the exercise of their art; impelling them towards perfection with a rapidity which the united force alone of emulation and emolument could occasion. These founders of modern versification, constructing their songs on plans of their own, classical authority, either through ignorance or design, was entirely disregarded. It does not appear, however, during the cultivation and favour of Provençal literature, that any one troubadour so far outstripped the rest as to become a model of imitation. The progress of taste must ever be impeded by the ignorance and caprice of those who cultivate an art without science or principles.

23 Troubadours.

During almost two centurie after the arrangement of the scale attributed to Guido, and the invention of the time-table ascribed to Franco, no remains of secular music can be discovered, except those of the troubadours or Provençal poets. In the simple tunes of these bards no time indeed is marked, and but little variety of notation appears; it is not difficult, however, to discover in them the germs of the future melodies, as well as the poetry of France and Italy. Had the poetry and music of the troubadours been treated of in an agreeable manner by the writers who have chosen that subject, it would have been discovered to be worthy of attention; the poetry, as interesting to literatue; the melody to which it was sung, as curious to the musical historian.—Almost every species of Italian poetry is derived from the Provençals. *Air*, the most captivating part of secular vocal music. seems to have had the same origin. The most ancient strains that have been spared by time, are such as were set to the songs of the troubadours. The Provençal language began to be in favour with poets about the end of the 10th century. In the 12th it became the general vehicle, not only of poetry, but of prose, to all who were ignorant of Latin. And these were not the laity only. At this period *violars*, or performers on the vielle or viol, *juglars* or flute-players, *musars* or players on other instruments, and *comics* or comedians, abounded all over Europe. This swarm of poet-musicians, who were formerly comprehended in France under the general titles of *jongleurs*, travelled from province to province singing their verses at the courts of princes. They were rewarded with cloaths, horses, arms, and money. Jongleurs or musicians were employed often to sing the verses of troubadours, who themselves happened to be deficient in voice or ignorant of music. The term *troubadour*, therefore, implies poetry as well as music. The jongleurs, menetriers, strollers, or minstrels, were frequently musicians, without any pretensions to poetry. These last have been common at all times, but the troubadour or bard has distinguished a particular profession, either in ancient or modern times, only during the early dawnings of literature.

In the 13th century the songs were on various subjects; moral, merry, amorous: and at that time melody seems to have been little more than plain song or chanting. The notes, were square, and written on four lines only like those of the Romish church in the cliff C, and without any marks for time. The movement and embellishments of the air depended on the abilities of the singer. Since that time, by the cultivation of the voice modern music has been much extended, for it was not till towards the end of St Lewis's reign that the fifth line began to be added to the stave. The singer always accompanied himself with an instrument in unison.

24 The harp the favourite instrument of the Troubadours.

As the lyre is the favourite instrument in Grecian poetry, so the harp held the same place in the estimation of the poets who flourished in the period of which we at present speak. A poet of the 14th century, Machau, wrote a poem on the subject of the harp alone, in which he assigns to each of its 25 strings an allegorical name; calling one *liberality*, another *wealth*, &c.

25 The viol or violin.

The instrument which frequently accompanied, and indeed disputed the pre-eminence with the harp, was the viol. Till the 16th century this instrument was furnished with frets; after that period it was reduced to four strings: and still under the denomination of *violin* holds the first place among treble instruments. The viol was played with a bow, and differed entirely from the vielle, the tones of which were produced by the friction of a wheel; the wheel performed the part of a bow.

British harpers were famous long before the conquest. The bounty of William of Normandy to his *joculator* or bard is recorded in the doomsday book. The harp seems to have been the favourite instrument in Britain for many ages, under the British, Saxon, Danish, and Norman kings. The *fiddle*, however, is mentioned so early as 1200 in the legendary life of St Christopher. The ancient privileges of the minstrels at the fairs of Chester are well known in the history of England.

The extirpation of the bards of Wales by Edward I. is likewise too familiar an incident to be mentioned here. His persecuting spirit, however seems to have been limited to that principality; for we learn, that at the ceremony of knighting his son, a *multitude of minstrels* attended.

In 1315, during the reign of Edward II. such extensive privileges were claimed by the minstrels, and so many dissolute persons assumed that character, that it became necessary to restrain them by express laws.

26
St Cecilia.

The father of our genuine poetry, who in the 14th century enlarged our vocabulary, polished our numbers, and with acquisitions from France and Italy augmented our store of knowledge (Chaucer), entitles one of his poems The History of St Cecilia; and the celebrated patroness of music must no doubt be mentioned in a history of the art. Neither in Chaucer, however, nor in any of the histories or legendary accounts of this Saint, does any thing appear to authorise the religious veneration paid to her by the votaries of music; nor is it easy to discover whence it has arisen. As an incident relative to the period of which we speak, it may be mentioned, that, according to Spelmann, the appellation of *Doctor* was not among the degrees granted to graduates in England sooner than the reign of King John, about 1207; although, in Wood's history of Oxford, that degree is said to have been conferred, even in music, in the reign of Henry II. It is known that the title was created on the continent in the 12th century; and as, during the middle ages, music was always ranked among the seven liberal arts, it is likely that the degree was extended to it.

27
Origin of the degree of Mus. D.

After the invention of printing, an art which has tended to disseminate knowledge with wonderful rapidity among mankind, music, and particularly counterpoint, became an object of high importance. The names of the most eminent composers who flourished in England, from that time to the Reformation, were, Fairfax, William of Newark, Sheryngham, Turges, Banister, Tudor, Taverner, Tye, Johnson, Parsons; to whom may be added John Marbeck, who set the whole English cathedral service to music.

28
Scottish music.

Before this period Scottish music had advanced to a high degree of perfection. James I. was a great composer of airs to his own verses; and may be considered as the father of that plaintive melody which in Scotch tunes is so pleasing to a taste not vitiated by modern affectation. Besides the testimony of *Fordun* and *Major*, who may be suspected of being under the influence of national prejudice, we have that of Alessandro Tessani, to the musical skill of that accomplished prince. "Among us moderns (says this foreigner) we may reckon *James king of Scotland*, who not only composed many sacred pieces of vocal music, but also of himself *invented a new kind of music, plaintive and melancholy, different from all others*; in which he has *been imitated* by Carlo Gesueldo prince of Venosa, who in our age has improved music with new and admirable inventions."

Under such a genius in poetry and music as king James I. it cannot be doubted that the national music must have been greatly improved, We have seen that he composed several anthems, or vocal pieces of *sacred music*, which shows that his knowledge of the science must have been very considerable. It is likewise known, that organs were by him introduced into the cathedrals and abbeys of Scotland, and choir-service brought to such a degree of perfection, as to fall little short of that established in any country of Europe.—By an able antiquary † of the present age, the great era of music as of poetry, in Scotland, is supposed to have been from the beginning of the reign of James I. down to the end of the reign of James V. During that period flourished *Gavin Douglas* bishop of Dunkeld, *Ballenden* archdeacon of Murray, *Dunbar*, *Henryson*, *Scott*, *Montgomery*, *Sir David Lindsey*, and many others, whose fine poems have been preserved in Banatyne's Collection, and of which several have been published by Allan Ramsay in his *evergreen*.

† See Tytler's Dissertation on the Scotch Music, vol. i. of Transactions of the Society of Antiquaries in Scotland.

Before the Reformation, as there was but one religion, there was but one kind of sacred music in Europe, plain chant, and the descant built upon it.—That music likewise was applied to one language only, the Latin. On that account, the compositions of Italy, France, Spain, Germany, Flanders, and England, kept pace in a great degree with each other in style and excellence. All the arts seem to have been the companions, if not the produce, of successful commerce, and to have pursued the same course. Like commerce, they appeared first in Italy, then in the Hanseatic towns, next in the Netherlands; and during the 16th century, when commerce became general, in every part of Europe.

29
In the 16th century music an indispensable part of education.

In the 16th century music was an indispensable part of polite education; all the princes of Europe were instructed in that art. There is a collection preserved in manuscript called *Queen Elizabeth's Virginal Book*. If her majesty was able to execute any of the pieces in that book, she must have been a great player; a month's practice would not be sufficient for any master now in Europe to enable him to play one of them to the end. *Tallis*, singularly profound in musical composition, and *Bird* his admirable scholar, were two of the authors of this famous collection.

During the reign of Elizabeth, the genus and learning of the British musicians were not inferior to any on the continent; an observation scarcely applicable at any other period of the history of this country. Sacred music was the principal object of study all over Europe.

The most eminent musical theorists of Italy, who flourished in the 16th century, were, Franchinus Gaferius, or Gafforio of Lode, Pietro Aaron of Florence, 30 Eminent musicians in Italy during the 16th century.

rence, Lodovico, Fogliano, Giov. Spataro, Giov. Maria da Terentio Lanfranco, Steffano Uanneo, Anton. Francisco Done, Luigi Dentice, Nicolo Vicentino, and Gioseffo Zarlino, the most general, voluminous, and celebrated theorist of that period.

Vincentio Galilei, a Florentine nobleman, and father of the great Galileo Galilei.

Maria Artuse of Bologna, Oraseo Tegrini, Pietro Pontio, and Lodovico Zacconi.

The principal Roman authors were, Giovanni Anmuccia, Giovanni Pierluigi da Palestrina, justly celebrated; Ruggiero Giovanelli, Luca Marenzio, who brought to perfection madrigals, the most cheerful species of secular music.

Of the Venetians, Adrian Willaeri is allowed to be at the head.

At the head of the Neapolitans is deservedly placed Rocco Rodio.

At Naples, too, the illustrious dilettante, Don Carlo Gesualdo prince of Venosa, is highly celebrated. He seems, however, to have owed much of his fame to his high rank.

Lombardy would also furnish an ample list of eminent musicians during the 16th century, of whom our limits will not admit of a particular enumeration:—The chief of them were, Constanzo Porta, Gastoldi, Biffi, Cima, Vocchi, and Monteverde.

At Bologna, besides Artusi already mentioned, Andrea Rota of the same city appears to have been an admirable contrapunctist.

Francisco Corteccia, a celebrated organist and composer, and Alessandro Striggio, a lutanist and voluminous composer, were the most eminent Florentines.

31 In Germany.

The inhabitants of the extensive empire of Germany have long made music a part of general education.—They hold the place, next Italy, among the most successful cultivators of the art. During the 16th century, their most eminent composers of music and writers on the subject were, Geo. Reischius, Michael Roswick, Andreas Ornithorparchus, Paul Hofhaimer, Luspeinius, Henry Loris or Lorit, Faber, Fink, Hofman, and many others whom it would be tedious to mention; and for a particular account of whose treatises and compositions we must refer to more voluminous histories of music.

32 In France.

In France, during the 16th century, no art except the art of war made much progress in improvement.—Ronsard, Baif, Goudimel, Claud le Jeune, Caurroy, and Maudit, are the chief French musicians of that period.

33 Spain.

In Spain, music was early received into the circle of sciences in the universities. The musical professorship at Salamanca was founded and endowed by Alforzo the Wise, king of Castile.

One of the most celebrated of the Spanish musicians was Francis Salinas, who had been blind from his infancy. He was a native of Burgos.

D. Cristofero Morales, and Tomaso Lodovico da Vittorio, deserve likewise to be mentioned; and to mention them is all we can attempt; the purpose of which is, to excite more minute inquiry by those who may choose to investigate the subject particularly.

34 The Netherlands.

The Netherlands, likewise, during the period of which we have been speaking, produced many eminent composers; of whom we may mention Verletot, Gombert, Arkadelt, Berchem, Richefort or Ricciafort, Crequilon Le Cock or Le Coq, Canis, Jacob Clemens Non Papa, Pierre Manchicourt, Baston, Kerl, Rore, Orlando di Lasso, and his sons Ferdinand and Rodolph.

35 Musical composers in England during the 17th century.

In the 17th century, the musical writers and composers who acquired fame in England, were, Dr Nathaniel Giles, Thomas Tomkins, and his son of the same name; Elway Bevin, Orlando Gibbons, Dr William Child, Adrian Batten, Martin Pierson, William Lawes, Henry Lawes, Dr John Wilson, John Hilton, John Playford, Captain Henry Cook, Pelham Humphrey, John Blow, William Turner, Dr Christopher Gibbons, Benjamin Rogers, and Henry Purcell. Of these, Orlando Gibbons, Pelham Humphrey, and Henry Purcell, far excelled the rest.

About the end of the reign of James I. a music-lecture or professorship was founded in the university of Oxford by Dr William Hychin.

In the reign of Charles I. a charter was granted to the musicians of Westminster, incorporating them, as the king's musicians, into a body politic, with powers to prosecute and fine all who, except themselves, should "attempt to make any benefit or advantage of music in England or Wales:" powers which in the subsequent reign were put in execution.

About the end of the reign of Charles II. a passion seems to have been excited in England for the violin, and for pieces expresly composed for it, in the Italian manner (*). Prior to 1600, there was little other music except masses and madrigals, the two principal divisions of sacred and secular music; but from that time to the present, dramatic music becomes the chief object of attention. The music of the church and of the chamber continued indeed to be cultivated in Italy with diligence, and in a learned and elaborate style, till near the middle of the century; yet a revolution in favour of melody and expression was preparing, even in sacred music, by the success of dramatic composition, consisting of recitation and melodies for a single voice. Such melodies began now to be preferred to music of many parts; in which canons, fugues, and full harmony, had been the productions which chiefly employed the master's study and the hearer's attention.

36 Mean state of the opera in the beginning of the present century.

So late as the beginning of the present century, according to Riccoboni, the performers in the operas of Germany, particularly at Hamburg, "were all tradesmen or handicrafts; your shoemaker (says he) was often the first performer on the stage; and you might have bought fruit and sweatmeats of the same girls,

(*) The most celebrated violin players of Italy, from the 16th century to the present time, have been Farina, M. Angelo Rossi, Bassani the violin-master of Corelli, the admirable Angelico Corelli himself, Torelli, Alberti, Albenoni, Tessarini, Vivaldi, Geminiani one of the most distinguished of Corelli's scholars. Tartini, Veracini, Barbella, Locatelli, Ferrari, Martini, Poccherini, and Giardini.

girls, whom the night before you had seen in the characters of Armida or Semiramis. Soon, however, the German opera arose to a more respectable situation; and even during the 17th century many eminent composers flourished in that country.

The list of great musicians which France produced during the early part of the same century is not numerous. Music seems to have been but little cultivated in that country, till the operas of Lulli, under the powerful patronage of Louis XIV. excited public attention.

The favourite singing-master and composer of France, about the middle of the 17th century, was Michael Lambert. John Baptist Lulli, soon after this time, rose from the rank of a menial servant to fame, opulence, and nobility, by his skill in musical compositions. The celebrated singer La Rochois was taught singing and acting by Lulli.

37 Curious anecdotes of a French singer.

La Maupin the successor of La Rochois, on account of her extraordinary character and romantic adventures, deserves to be mentioned. She was equally fond of both sexes, fought and loved like a man, resisted and fell like a woman. She eloped from her husband with a fencing-master, of whom she learnt the small sword; she became an excellent fencer. At Marseilles she became enamoured of a young lady, whom she seduced: on account of this whimsical affection the lady was by her friends confined in a convent. La Maupin obtained admission into the same convent as a novice: she set fire to the convent, and in the confusion carried off her favourite. At Paris, when she appeared on the stage in 1695, Dumeni a singer having affronted her, she put on mens clothes, and insisted on his drawing his sword and fighting her: when he refused, she caned him, and took from him his watch and snux-box as trophies of her victory. At a ball given by Monsieur brother of Louis XIV. she again put on mens clothes; and having behaved impertinently to a lady, three of the lady's friends, supposing La Maupin to be a man, called her out: she killed them all; and returning coolly to the ball, told the story to Monsieur, who obtained her pardon. She became afterwards mistress to the elector of Bavaria. This prince quitting her for the countess of Arcos, sent her by the count, husband of that lady, a purse of L.40,000 livres: she threw it at the count's head, telling him, it was a recompence worthy of such a scoundrel and cuckold as himself. At last, seized with a fit of devotion, she recalled her husband, and spent the remainder of her life in piety. She died in 1707 at the age only of 34.

38 Chief composers for the church in England.

The English musician whom we last mentioned was the celebrated Purcell: after his time the chief composers for the church were Clarke, Dr Holden, Dr Creyghton, Tucker, Aldrich, Golwin, Weldon, Dr Crofts, Dr Green, Boyce, and Nares; to whom may be added John Stanley, who attained high proficiency in music, although from two years old totally deprived of sight.

The annals of modern music have hitherto furnished no event so important to the progress of the art as the invention of recitative or dramatic melody; a style of music which resembles the manner of the ancient rhapsodists.

39 First musical drama.

The *Orfeo* of Politian was the first attempt at musical drama. It was afterwards perfected by Metastasio. No musical dramas similar to those afterwards known by the names of *opera* and *oratorio*, had existence in Italy before the beginning of the 17th century. It was above the 1600, or a little before that time, that eunuchs were first employed for singing in Italy.

40 First singing eunuchs.

There seem to have been no *singing* eunuchs in ancient times, unless the galli or archigalli, priests of Cybele, were such. Castration has, however, at all times been practised in eastern countries, for the purpose of furnishing to tyrannic jealousy guards of female chastity; but never, so far as modern writers on the subject have discovered, merely to preserve the voice, till about the end of the 16th century.

At Rome, the first public theatre opened for the exhibition of musical dramas, in modern times, was *il Torre de Nona*, where in 1671 Giasone was performed. In 1679, the opera of *Dou è Amore*, set by the famous organist Bernardo Pasquini, was represented at *Nilla Sala de Signori Capranica;* a theatre which still subsists. In the year 1680, *L'Onesta negl'Amore* was exhibited; the first dramatic composition of the elegant, profound, and original Alessandro Scarlatti.

The inhabitants of Venice have cultivated and encouraged the musical drama with more zeal and diligence than the rest of Italy, during the end of the last and beginning of the present century; yet the opera was not established in Venice before the year 1637; in that year the first regular drama was performed: it was Andromeda.

41 Opera of Berenice.

In 1680 the opera of Berenice was exhibited at Padua with such astonishing splendour as to merit notice. There were choruses of 100 virgins, 100 soldiers, 100 horsemen in iron armour, 40 cornets of horse, 6 trumpeters on horseback, 6 drummers, 6 ensigns, 6 sackbuts, 6 great flutes, 6 minstrels playing on Turkish instruments, 6 others on octave flutes, 6 pages, 3 sergeants, 6 cymbalists. There were 12 huntsmen, 12 grooms, 6 coachmen for the triumph, 6 others for the procession, 2 lions led by two Turks, 2 elephants by two others; Berenice's triumphal car drawn by 4 horses, 6 other cars with prisoners and spoils drawn by 12 horses, 6 coaches. Among the scenes and representations in the first act were, a vast plain with two triumphal arches, another plain with pavilions and tents, and a forest for the chace: in act third, the royal dressing-room completely furnished, stables with 100 live horses, portico adorned with tapestry, and a stupendous palace in perspective. At the end of the first act were representations of every kind of chace, wild boar, stag, deer, bears. At the end of the third act, an enormous globe, descended as from the sky, divided itself into other globes suspended in the air, and ornamented with emblematical figures of time, fame, honour, &c.

Early in the last century, machinery and decoration usurped the importance due to poetry and music in such exhibitions.

Few instances occur of musical dramas at Naples till the beginning of the present century. Before the time of the elder Scarlatti, it seems as if Naples had been less fertile in great contrapuntists, and less diligent in the cultivation of dramatic music, than any other state of Italy. Since that time all the rest of Europe

Europe has been furniſhed with compoſers and performers from that city.

42 French and Engliſh opera.

The word *opera* ſeems to have been familar to Engliſh poets from the beginning of the laſt century. *Stilo recitativo*, a recent innovation even in Italy, is mentioned by Ben Johnſon ſo early as 1617. From this time it was uſed in maſques, occaſionally in plays, and in cantatas before a regular drama wholly ſet to muſic was attempted. By the united abilities of Quinault and Lulli, the opera in France had ariſen to high favour. This circumſtance afforded eucouragement to ſeveral attempts at dramatic muſic in England by Sir William D'Avenant and others, before the muſic, language, or performers of Italy were employed on our ſtage. Pieces, ſtyled *dramatic operas*, preceded the Italian opera on the ſtage of England. Theſe were written in Engliſh, and exhibited with a profuſe decoration of ſcenery and habits, and with the beſt ſingers and dancers that could be procured: Pſyche and Circe, are entertainments of this kind: the Tempeſt and Macbeth were acted with the ſame accompaniments.

During the 17th century, whatever attempts were made in muſical drama, the language ſung was always Engliſh. About the end of that century, however, Italian ſinging began to be encourag·d, and vocal as well as inſtrumental muſicians from that country began to appear in Britain.

The firſt muſical drama, performed wholly after the Italian manner in recitative for the dialogue or narrative parts, and meaſured melody for the airs, was Arſinoe queen of Cyprus, tranſlated from an Italian opera of the ſame name, written by Stanzani of Bologna. The Engliſh verſion of this opera was ſet to muſic by Thomas Clayton, one of the royal band, in the reign of William and Mary. The ſingers were all Engliſh, Meſſrs Hughes, Leveredge, and Cook; Mrs Tofts, Mrs Croſs, and Mrs Lyndſey. The tranſlation of Arſinoe, and the muſic to which it is ſet, are execrable; yet ſuch is the charm of novelty, that this miſerable performance, deſerving neither the name of a drama by its poetry, nor of an opera by its muſic, ſuſtained 24 repreſentations, and the ſecond year 11.

Operas, notwithſtanding their deficiences in poetry, muſic, and performance (no foreign compoſer or eminent ſinger having yet arrived), became ſo formidable to our actors at the theatres, that it appears from the Daily Courant, 14th January 1707, a ſubſcription was opened "for the encouragement of the comedians actin in the Haymarket, and to enable them to keep the diverſions of plays under a ſeparate intereſt from operas."

Mr Addiſon's opera of Roſamond appeared about this time; but the muſic ſet by Clatyon is ſo contemptible, that the merit of the poetry, however great, could not of itſelf long ſupport the piece. The choice of ſo mean a compoſer as Clayton, and Mr Addiſon's partiality to his abilities, betray a want of muſical taſte in that elegant author.

The firſt truly great ſinger who appeared on the ſtage of Britain was *Cavalier Nicolino Grimaldi*, commonly known by the name of *Nicolini*. He was a Neapolitan; and though a beautiful ſinger indeed, was ſtill more eminent as an actor. In the Tatler, n° 115. the elegance and propriety of his action are particularly deſcribed †. Recently before his appearance, *Valentini Urbani* and a female ſinger called *The Barroneſs*, arrived. Margarita de l'Epini, who afterwards married Dr Pepuſch, had been in this country ſome time before.

† See alſo Spectator, vol. i. n°. 13.

The firſt opera performed *wholly in Italian*, and *by Italian ſingers* was *Almahide*. As at preſent, ſo at that time, operas were generally performed twice a week.

43 Arrival of Handel in England.

The year 1710 is diſtinguiſhed in the annals of muſic by the arrival in Britain of George Frederick Handel. Handel had been in the ſervice of the elector of Hanover, and came firſt to England on a viſit of curioſity. The fame of this great muſician had penetrated into this country before he himſelf arrived in it: and Aaron Hill, then in the direction of the Haymarket theatre, inſtantly applied to him to compoſe an opera. It was Rinaldo; the admirable muſic of which he produced entirely in a fortnight. Soon after this period appeared, for the firſt time as an opera ſinger, the celebrated Mrs Anaſtaſia Robinſon. Mrs Robinſon, who was the daughter of a portrait painter, made her firſt public exhibitions in the concerts at York-buildings; and acquired ſo much the public favour, that her father was encouraged to take a houſe in Golden Square, for the purpoſe of eſtabliſhing weekly concerts and aſſemblies, in the manner of *Converſazioni*, which became the reſort of the moſt polite audiences.

Soon after Mrs Robinſon accepted of an engagement at the Opera, where her ſalary is ſaid to have been L. 1000, and her other emoluments equal to that ſum. She quitted the ſtage in conſequence of her marriage with the gallant earl of Peterborough, the friend of Pope and Swift. The eminent virtues and accompliſhments of this lady, who died a few years ago at the age of 88, entitled her to be mentioned even in a compend too ſhort for biography. The conducting of the opera having been found to be more expenſive than profitable, it was entirely ſuſpended from 1717 till 1720, when a fund of L. 50,000 for ſupporting and carrying it on was ſubſcribed by the firſt perſonages of the kingdom. The ſubſcribers, of whom king George I. was one, for L. 1000, were formed into a ſociety, and named *The Royal Academy of Muſic*. Handel was commiſſioned to engage the performers; for that purpoſe he went to Dreſden, were Italian operas were at that time performed in the moſt ſplendid manner at the court of Auguſtus elector of Saxony, then king of Poland. Here Handel engaged Seneſino-Berenſtadt, Boſchi, and the Duranſtanti.

44 Progreſs of the opera under his management.

In the year 1723, the celebrated Franceſca Cuzzoni appeared as a firſt-rate ſinger; and two years afterwards arrived her diſtinguiſhed rival Signora Fauſtina Bordoni.

In a cantabile air, though the notes Cuzzoni added were few, ſhe never loſt an opportunity of enriching the cantilena with the moſt beautiful embeliſhments. Her ſhake was perfect. She poſſeſſed a creative fancy; and ſhe enjoyed the power of occaſionally accelerating and retarding the meaſure in the moſt artificial and able manner, by what is in Italy called *tempo rubato*. Her high notes were unrivalled in clearneſs and ſweetneſs. Her intonations were ſo juſt and ſo fixed, that it seemed as if she had not the power to sing out of tune.

Faustina Bordoni, wife of the celebrated Saxon composer Hasse, invented a new kind of singing, by running divisions, with a neatness and velocity which astonished all who heard her. By taking her breath imperceptibly, she had the art of sustaining a note apparently longer than any other singer. Her beats and trills were strong and rapid; her intonation perfect. Her professional perfections were enhanced by a beautiful face, fine symmetry of figure, and a countenance and gesture on the stage which indicated an entire intelligence and possession of the several parts allotted to her.

These two angelic performers excited so signally the attention of the public, that a party spirit between the abettors of the one and of the other was formed, as violent and as inveterate almost as any of those that had ever occurred relative to matters either theological or political; yet so distinct were their styles of singing, so different their talents, that the praise of the one was no reproach to the other.

In less than seven years, the whole L. 50,000 subscribed by the Royal Academy, besides the produce of admission to non-subscribers, was expended, and the governor and directors of the society relinquished the idea of continuing their engagements; consequently, at the close of the season 1727, the whole band of singers dispersed. The next year we find Senesino, Faustina, Balde, Cuzzoni, Nicolini, Farinelli, and Bosche, at Venice.

Handel, however, at his own risk, after a suspension of about a twelvemonth, determined to recommence the Opera; and accordingly engaged a band of performers entirely new. These were Signor Bernacchi, Signora Merighi, Signora Strada, Signor Anibale Pio Fabri, his wife, Signora Bertoldi, and, John Godfrid Reimschnider.

45 Invention of the oratorio, and its introduction into England

The sacred musical drama, or oratorio, was invented early in the 14th century. Every nation in Europe seems first to have had recourse to religious subjects for dramatic exhibitions. The oratorios had been common in Italy during the last century; they had never been *publicly* introduced in England till Handel, stimulated by the rivalship of other adventurers, exhibited in 1732 his oratorios of Esther, and of Acis and Galatea, the last of which he had composed 12 years before for the duke of Chandos's chapel at Cannons. The most formidable opposition which Handel met with in his conduct of the Italian opera was a new theatre for exhibiting these operas, opened by subscription in Lincoln's-inn Fields, under the conduct of Nicola Porpora, a respectable composer. A difference having occurred between Handel and Senesino, Senesino had for some time deserted the Haymarket, where Handel managed, and was now engaged at the rival theatre of Lincoln's-inn Fields. To supply the place of Senesino, Handel brought over *Giovanni Carestini*, a singer of the most extensive powers. His voice was at first a powerful and clear soprano; afterwards it changed into the fullest, finest, deepest, counter-tenor that has perhaps ever been heard. Carestini's person was tall, beautiful, and majestic. He rendered every thing he sung interesting by energy, taste, and judicious embelishment. In the execution of difficult divisions from the chest, his manner was articulate and admirable. It was the opinion of Hasse, as well as other eminent professors, that whoever had not heard Carestini, was unacquainted with the most perfect style of singing. The opera under the direction of Porpora was removed to the Haymarket, which Handel had left. Handel occupied the theatre of Lincoln's-inn Fields; but his rivals now acquired a vast advantage of attraction, by the accession of Carlo Broschi detto Farinelli to their party, who at this time arrived. This renowned singer seems to have transcended the limits of all anterior vocal excellence. No vocal perfomer of the present century has been so unanimously allowed to possess an uncommon power, sweetness, extent, and agility of voice, as Farinelli. Nicolini, Senesino, and Carestini, gratified the eye as much by the dignity, grace, and propriety of their action and deportment, as the ear, by the judicious use of a few notes within the limits of a small compass of voice; but Farinelli, without the assistance of significant gestures or graceful attitudes, enchanted and astonished his hearers, by the force, extent, and mellifluous tones of the mere organ, when he had nothing to execute, articulate, or express. Though during the time of singing he was as motionless as a statue, his voice was so active that no intervals were too close, too wide, or too rapid, for his execution.

Handel having lost a great part of his fortune by the opera, was under the necessity of trying the public gratitude in a benefit, which was not disgraced by the event: the theatre, for the honour of the nation, was so crowded, that he is said to have cleared L. 800.

46 Opera in England given up.

After a fruitless attempt by Heidegger, the coadjutor of Handel in the conduct of the opera, and patentee of the King's Theatre in Haymarket, to procure a subscription for continuing it, it was found necessary to give up the undertaking.

It was about this time that the statue of Handel was erected in Vauxhall, at the expence of Mr Tyers, proprietor of those gardens.

The next year (1739) Handel carried on oratorios at the Haymarket, as the opera there was suspended. The earl of Middlesex now undertook the troublesome office of *impresario* of the Italian opera. He engaged the King's theatre, with a band of singers from the continent almost entirely new. Caluppi was his composer. Handel, almost ruined, retired at this time to Ireland, where he remained a considerable time. In 1744, he again attempted oratorios at the King's theatre, which was then, and till 1746, unoccupied by the opera, on account of the rebellion.

47 Revived.

The arrival of Giardini in London this year forms a memorable æra in the instrumental music of England. His powers on the violin were unequalled. The same year Dr Croza, then manager of the opera, eloped, leaving the performers, and innumerable trades-people his creditors. This incident put an end to operas of all kinds for some time.

This year a comic opera, called *Il Filosopho di Campagna*, composed by Caluppi, was exhibited, which surpassed in musical merit all the comic operas performed in England till the *Bicona Figliula*. Signora Paganini acquired such fame by the airs allotted to her in that piece, that the crowds at her benefit were beyond example. Caps were lost, gowns torn in pieces,

pieces, and ladies in full dress, without servants or carriages, were obliged to walk home, amidst the merriment of the spectators on the streets.

48 1764 and 1765. Manzoli. At this period the arrival of Giovanni Manzoli marked a splendid æra in the annals of musical drama, by conferring on serious opera a degree of importance to which it had seldom yet arisen since its establishment in England. Manzoli's voice was the most powerful and voluminous soprano that had been heard since the time of Farinelli: his manner of singing was grand, and full of taste and dignity.

49 Tenducci. At this time Tenducci, who had been in England some time before, and was now returned much improved, performed in the station of second man to Manzoli.

50 1769. Guadagni. Gaetano Guadagni made a great figure at this time. He had been in this country early in life (1748), as serious-man in a burletta troop of singers. His voice was then a full and well-toned counter-tenor; but he sung wildly and carelessly. The excellence of his voice, however, attracted the notice of Handel, who assigned him the parts in his oratorios the Messiah and Samson, which had been originally composed for Mrs Cibber. He quitted London for the first time about 1753. The highest expectations of his abilities were raised by fame before his second arrival, at the time of which we treat. As an actor he seems to have had no equal on any stage in Europe. His figure was uncommonly elegant and noble; his countenance replete with beauty, intelligence, and dignity; his attitudes were full of grace and propriety. Those who remembered his voice when formerly in England were now disappointed: it was comparatively thin and feeble; he had now changed it to a soprano, and extended its compass from six or seven notes to fourteen or fifteen. The music he sung was the most simple imaginable; a few notes with frequent pauses, and opportunities of being liberated from the composer and the band, were all he required. In these effusions, seemingly extemporaneous, he displayed the native power of melody unaided by harmony or even by unisonous accompaniment: the pleasure he communicated proceeded principally from his artful manner of diminishing the tones of his voice, like the dying notes of the Æolian harp. Most other singers affect a swell, or *messa de voce*; but Guadagni, after beginning a note with force, attenuated it so delicately that it possessed all the effect of extreme distance. During the season 1770 and 1771, Tenducci was the immediate successor of Guadagni. This performer, who appeared in England first only as a singer of the second or third class, was during his residence in Scotland and Ireland so much improved as to be well received as first man, not only on the stage of London but in all the great theatres of Italy.

It was during this period that dancing seemed first to gain the ascendant over music by the superior talents of Mademoiselle Heinel, whose grace and execution were so perfect as to eclipse all other excellence.

51 1774: Miss Davies. In the first opera performed this season (*Lucco Vero*) appeared Miss Cecilia Davies, known in Italy by the name of L'Inglesina. Miss Davies had the honour of being the first English woman who had ever been thought worthy of singing on any stage in Italy. She even performed with eclat the principal female characters on many of the great theatres of that country. Gabrielli only on the Continent was said to surpass her. Her voice, though not of great volume, was clear and perfectly in tune; her shake was open and distinct, without the sluggishness of the French cadence. The flexibility of her throat rendered her execution equal to the most rapid divisions.

Next season introduced Venanzio Ravygini, a beautiful and animated young man; a composer as well as a singer.—His voice was sweet, clear, flexible; in compass more than two octaves. 52

The season 1775 and 1776 was rendered memorable by the arrival of the celebrated *Caterina Gabrielli*, styled early in life *La Couchetina*, being the daughter of a cardinal's cook at Rome. Caterina Gabrielli. She had, however, in her countenance and deportment no indications of low birth. Her manner and appearance depicted dignity and grace. So great was her reputation before her arrival in England for singing and for caprice, that the public expecting perhaps in both too much, were unwilling to allow her due praise for her performance, and were apt to ascribe every thing she did to pride and insolence. Her voice, though exquisite, was not very powerful. Her chief excellence having been the neatness and rapidity of her execution, the surprise of the public must have been much diminished on hearing her after Miss Davies, who sung many of the same songs in the same style, and with a neatness so nearly equal, that common hearers could distinguish no difference. The discriminating critic, however, might have discovered a superior sweetness in the natural tone of the Gabrielli's voice, an elegance in the finishing of her musical periods or passages, an accent and precision in her divisions, superior not only to Miss Davies, but to every other singer of her time. In slow movements her pathetic powers, like those in general of performers most renowned for agility, were not exquisitely touching. She now resides at Bologna. 53

About the time of which we have been treating, the proprietors of the Pantheon ventured to engage the *Agujari* at the enormous salary of L. 100 *per* night, for singing two songs only! Agujari at the Pantheon. *Lucrezia Agujari* was a truly wonderful performer. The lower part of her voice was full, round, and of excellent quality; its compass amazing. She had two octaves of fair natural voice, from A on the fifth line in the bass to A on the sixth line in the treble, and beyond that in *alt* she had in early youth more than another octave. She has been heard to ascend to B b *in altissimo*. Her shake was open and perfect; her intonation true; her execution marked and rapid; the style of her singing, in the natural compass of her voice, grand and majestic. 54

In 1776 arrived Anna Pozzi, as successor to the Gabrielli. Anna Pozzi. She possessed a voice clear, sweet, and powerful; but her inexperience, both as an actress and as a singer, produced a contrast very unfavourable to her when compared with so celebrated a performer as Gabrielli. Since that time, however, Pozzi, with more study and knowledge, has become one of the best and most admired female singers in Italy.

After the departure of Agujari for the second and last time, the managers of the Pantheon engaged the 55 *Georgi* as her successor. Her voice was exquisitely fine, Georgi.

but totally uncultivated. She is now employed as the firſt woman in the operas of the principal cities of Italy.

56 **Roncaglia and Danze.** During the ſeaſons 1777 and 1778, the principal ſingers at the opera in London were Frandeſco Roncaglia and Franceſca Danze, afterwards Madame Le Brun.

Roncaglia poſſeſſed a ſweet-toned voice; but of the three great requiſites of a complete ſtage-ſinger, pathos, grace, and execution, which the Italians call *cantabile*, *grazioſa*, and *bravura*, he could lay claim only to the ſecond. His voice, a *voce de camera*, when confined to the *grazioſa* in a room, leaves nothing to wiſh for.

Danze had a voice well in tune, a good ſhake, great execution, prodigious compaſs, with great knowledge of muſic; yet the pleaſure her performance imparted was not equal to theſe accompliſhments: but her object was not ſo much pathos and grace, as to ſurpriſe by the imitation of the tone and difficulties of inſtruments.

57 **Pacchierotti.** This year *Gaſparo Pacchierotti* appeared in London, whither his high reputation had penetrated long before. The natural tone of his voice is intereſting, ſweet, and pathetic. His compaſs downwards is great, with an aſcent up to B b, and ſometimes to C *in alt*. He poſſeſſes an unbounded fancy, and the power not only of executing the moſt difficult and refined paſſages, but of inventing embelliſhment entirely new. *Ferdinando Bertoni*, a well-known compoſer, came along with Pacchierotti to Britain.

58 **Dancing gains the aſcendant over muſic at the opera houſe.** During the laſt ten years, dancing has become an important branch of the amuſements of the opera-houſe. Mademoiſelle Heinel, M. Veſtris le Jeune, Mademoiſelle Baccelli, had, during ſome years, delighted the audience at the opera; but on the arrival of M. Veſtris l'Aine, pleaſure was exchanged for ecſtaſy. In the year 1781, Pacchierotti had by this time been ſo frequently heard that his ſinging was no impediment to converſation; but while the elder Veſtris was on the ſtage, not a breathing was to be heard. Thoſe lovers of muſic who talked the loudeſt while Pachierotti ſung, were in agonies of terror leſt the graceful movements of Veſtris, *le dieu de la dance*, ſhould be diſturbed by audible approbation. Since that time, the moſt mute and reſpectful attention has been paid to the manly grace of Le Picq, and the light fantaſtic toe of the younger Veſtris; to the Roſſis, the Theodores, the Coulons, the Hillingſburgs; while the ſlighted ſingers have been diſturbed, not by the violence of applauſe, but the clamour of inattention.

59 **Commemoration of Handel in Weſtminſter Abbey.** The year 1784 was rendered a memorable era in the annals of muſic by the ſplendid and magnificent manner in which the birth and genius of Handel were celebrated in Weſtminſter Abbey and the Pantheon, by five performances of pieces ſelected from his own works, and executed by a band of more than 500 voices and inſtruments, in the preſence and under the immediate auſpices of their majeſties and the firſt perſonages of the kingdom. The commemoration of Handel has been ſince eſtabliſhed as an annual muſical feſtival for charitable purpoſes; in which the number of performers and the perfection of the performances have continued to increaſe. In 1785 the band, vocal and inſtrumental, amounted to 616; in 1786 to 741; in 1787 to 806.

Dr Burney publiſhed An Account of the Muſical Performances in Commemoration of Handel, for the benefit of the Muſical Fund. The members and guardians of that fund are now incorporated under the title of *Royal Society of Muſicians*. See Handel.

This year Pacchierotti and his friend Bertoni left England. About the ſame time our country was deprived of the eminent compoſer Sacchini, and Giardini the greateſt performer on the violin then in Europe.

60 **Excellence of Madam Mara.** As a compenſation for theſe loſſes, this memorable year is diſtinguiſhed by the arrival of Madam Mara, whoſe performance in the commemoration of Handel in Weſtminſter Abbey inſpired an audience of 3000 of the firſt people of the kingdom, not only with pleaſure but with ecſtaſy and rapture.

61 **Rubinelli.** In 1786 arrived *Giovanni Rubinelli*. His voice is a true and full contralto from C in the middle of the ſcale to the octave above. His ſtyle is grand; his execution neat and diſtinct; his taſte and embelliſhments new, ſelect, and maſterly.

62 **A new dance by M. Noverre.** In 1788 a new dance, compoſed by the celebrated M. Noverre, called *Cupid and Pſyche*, was exhibited along with the opera *La Locandiera*, which produced an effect ſo uncommon as to deſerve notice. So great was the pleaſure it afforded to the ſpectators, that Noverre was unanimouſly brought on the ſtage and crowned with laurel by the principal performers. This, though common in France, was a new mark of approbation in England.

63 **Marcheſi.** This year arrived Signor Luige Marcheſi, a ſinger whoſe talents have been the ſubject of praiſe and admiration on every great theatre of Europe. Marcheſi's ſtyle of ſinging is not only elegant and refined in an uncommon degree, but often grand and full of dignity, particularly in his recitative and occaſional low notes. His variety of embelliſhment and facility of running extempore diviſions are wonderful. Many of his graces are elegant and of his own invention.

64 **Diſcriminated characters of Pacchierotti, Rubinelli, and Marcheſi.** The three greateſt Italian ſingers of the preſent times are certainly Pacchierotti, Rubinelli, and Marcheſi. In diſcriminating the ſeveral excellencies of theſe great performers, a very reſpectable judge, Dr Burney, has particularly praiſed the ſweet and touching voice of Pacchierotti; his fine ſhake, his exquiſite taſte, his great fancy, and his divine expreſſion in pathetic ſongs: Of Rubinelli's voice, the fulneſs, ſteadineſs, and majeſty, the accuracy of his intonations, his judicious graces: Of Marcheſi's voice, the elegance and flexibility, his grandeur in recitative, and his boundleſs fancy and embelliſhments.—Having mentioned Dr Burney, we are in juſtice bound to acknowledge the aid we have derived from his hiſtory; a work which we greatly prefer to every other modern production on the ſubject. During the latter part of the preſent century many eminent compoſers have flouriſhed on the continent; ſuch as Jomelli, the family of the Bachs, Gluck, Haydn, and many others, whoſe different ſtyles and excellencies would well deſerve to be particulariſed, would our limits permit.

65 **Sovereign princes dilettanti.** With the ſame regard to brevity, we can do no more than juſt mention the late king of Pruſſia, the late elector of Bavaria, and prince Lobkowitz, as eminent dilettanti of modern times.

Beſides the opera-ſingers whom we have mentioned, our

66 Singers on theatres and in public gardens.

our theatres and public gardens have exhibited ſingers of conſiderable merit. In 1730, Miſs Rafter, afterwards the celebrated Mrs Clive, firſt appeared on the ſtage at Drury-lane as a ſinger. The ſame year introduced Miſs Cecilia Young, afterward the wife of Dr Arne. Her ſtyle of ſinging was infinitely ſuperior to that of any other Engliſh woman of her time.

67 Favourite muſicians.

Our favourite muſicians at this time were, Dubourg, Clegg, Clarke, and Feſting, on the violin; Kytch on the hautboy; Jack Feſting on the German flute; Baſton on the common flute; Karba on the baſſoon; Valentine Snow on the trumpet; and on the organ, Roſeingrave, Green, Robinſon, Magnus, Jack James, and the blind Stanley, who ſeems to have been preferred. The favourite playhouſe ſinger was Salway; and at concerts Mountier of Chicheſter.

As compoſers for our national theatre, Pepuſch and Galliard ſeem to have been unrivalled till 1732; when two competitors appeared, who were long in poſſeſſion of the public favour: We allude to John Frederick Lampe and Thomas Auguſtus Arne.

In 1736 Mrs Cibber, who had captivated every hearer of ſenſibility by her native ſweetneſs of voice and powers of expreſſion as a ſinger, made her firſt attempt as a tragic actreſs. The ſame year Beard became a favourite ſinger at Covent-garden. At this time Miſs Young, afterwards Mrs Arne, and her two ſiſters Iſabella and Eſther, were the favourite Engliſh female ſingers.

68 Fund for decayed muſicians.

In 1738 was inſtituted the fund for the ſupport of decayed muſicians and their families.

It was in 1745 that Mr Tyers, proprietor of Vauxhall gardens, firſt added vocal muſic to the other entertainments of that place. A ſhort time before Ranelagh had become a place of public amuſement.

69 Arrival of Giardini.

In 1749 arrived Giardini, whoſe great taſte, hand, and ſtyle in playing on the violin, procured him univerſal admiration. A few years after his arrival he formed a morning *academia* or concert at his houſe, compoſed chiefly of his ſcholars.

About this time San Martini and Charles Aviſon were eminent compoſers.

70 Style of Arne.

Of near 150 muſical pieces brought on our national theatres within theſe 40 years, 30 of them at leaſt were ſet by Arne. The ſtyle of this compoſer, if analyſed, would perhaps appear to be neither Italian nor Engliſh; but an agreeable mixture of both and of Scotch.

71 The earl of Kelly.

The late earl of Kelly, who died but a few years ago, deſerves particular notice, as poſſeſſed of a very eminent degree of muſical ſcience, far ſuperior to other dilettanti, and perhaps not inferior to any profeſſor of his time. There was no part of theoretical or practical muſic in which he was not thoroughly verſed: He poſſeſſed a ſtrength of hand on the violin, and a genius for compoſition, with which few profeſſors are gifted.

72 Abel.

Charles Frederic Abel was an admirable muſician: his performance on the viol da gamba was in every particular complete and perfect. He had a hand which no difficulties could embarraſs; a taſte the moſt refined and delicate; a judgment ſo correct and certain as never to permit a ſingle note to eſcape him without meaning. His compoſitions were eaſy and elegantly ſimple. In writing and playing an *adagio* he was ſuperior to all praiſe; the moſt pleaſing yet learned modulation, the richeſt harmony, the moſt elegant and poliſhed melody, were all expreſſed with the moſt exquiſite feeling, taſte, and ſcience. His manner of playing an adagio ſoon became the model of imitation for all our young performers on bowed inſtruments. Bartholemon, Cervetto, Cramer, and Croſdil, may in this reſpect be ranked as of his ſchool. All lovers of muſic muſt have lamented that Abel in youth had not attached himſelf to an inſtrument more worthy of his genius, taſte, and learning, than the viol de gamba, that remnant of the old cheſt of viols which during the laſt century was a neceſſary appendage of a nobleman's or gentleman's family throughout Europe, previous to the admiſſion of violins, tenors, and baſes, in private houſes or public concerts. Since the death of the late elector of Bavaria, who was next to Abel (the beſt performer on the viol de gamba in Europe), the inſtrument ſeems quite laid aſide. It was uſed longer in Germany than elſewhere; but the place of gambiſt ſeems now as much ſuppreſſed in the chapels of German princes as that of lutaniſts. The celebrated performer on the violin, Lolle, came to England in 1785. Such was his caprice, that he was ſeldom heard; and ſo eccentric was his ſtyle and compoſition, that by many he was regarded as a madman. He was, however, during his lucid intervals a very great and expreſſive performer in the ſerious ſtyle.

73 Mrs Billington.

Mrs Billington, after diſtinguiſhing herſelf in childhood as a neat and expreſſive performer on the piano-forte, appeared all at once in 1786 as a ſweet and captivating ſinger. In emulation of the Mara and other great bravura ſingers, ſhe at firſt too frequently attempted paſſages of difficulty; now, however, ſo greatly has ſhe improved, that no ſong ſeems too high or too rapid for her execution. The natural tone of her voice is ſo exquiſitely ſweet, her knowledge of muſic ſo conſiderable, her ſhake ſo true, her cloſes and embelliſhments ſo various, her expreſſions ſo grateful, that envy only or apathy could hear her without delight. The preſent compoſers, and performers of the firſt claſs, are ſo well known to the lovers of the art, that it would be needleſs and improper to mention them particularly; and to deſcribe the diſtinctive powers of Barthelemon, Cramer, Pieltain, Raimonde, and Salamon, would be too delicate a taſk for us to undertake.

[73] The Catch-club and the concert of ancient muſic.

The Catch-club at the Thatched Houſe, inſtituted in 1762 by the late earl of Eglinton, the preſent duke of Queenſberry, and others; and the concert of ancient muſic, ſuggeſted by the earl of Sandwich in 1776, have had a beneficial effect in improving the art.

We have been ſomewhat particular in our account of muſical affairs in our own country during the preſent century, as what would be moſt intereſting to general readers, and of which a well-informed gentleman would not wiſh to be ignorant. The profeſſor and connoiſſeur is not to be expected to content himſelf with diſquiſitions much more minute than thoſe of which our limits can be ſuppoſed to admit.

ELEMENTS OF MUSIC.

THEORETICAL and PRACTICAL (†).

PRELIMINARY DISCOURSE.

74 Music considered in a double view.

MUSIC may be considered, either as an art, which has for its object one of the greatest pleasures of which our senses (‡) are susceptible; or as a science, by which that art is reduced to principles. This is the double view in which we mean to treat of music in this work.

75 Progress of music like that of other arts and sciences.

It has been the case with music as with all the other arts invented by men: some facts were at first discovered by accident; soon afterwards reflection and observation investigated others; and from these facts, properly disposed and united, philosophers were not slow in forming a body of science, which afterwards increased by degrees.

The first theories of music were perhaps as ancient as the earliest age which we know to have been distinguished by philosophy, even as the age of Pythagoras; nor does history leave us any room to doubt, that from the period when that philosopher taught, the ancients cultivated music, both as an art and as a science, with great assiduity. But there remains to us much uncertainty concerning the degree of perfection to which they brought it. Almost every question which has been proposed with respect to the music of the ancients has divided the learned; and may probably still continue to divide them, for want of monuments sufficient in their number, and incontestable in their nature, from whence we might be enabled to exhibit testimonies and discoveries instead of suppositions and conjectures. In the preceding history we have stated a few facts respecting the nature of ancient music, and the inventors of the several musical instruments; but it were to be wished, that, in order to elucidate, as much as possible, a point so momentous in the history of the sciences, some person of learning, equally skilled in the Greek language and in music, should exert himself to unite and discuss in the same work the most probable opinions established or proposed by the learned upon a subject so difficult and curious. This philosophical history of ancient music is a work which might highly embellish the literature of our times. 76 The history of music a desideratum in literature.

In the mean time, till an author can be found sufficiently instructed in the arts and in history to undertake such a labour with success, we shall content ourselves with considering the present state of music, and limit our endeavours to the explication of those accessions which have accrued to the theory of music in these latter times.

There are two departments in music, melody * and harmony †. Melody is the art of arranging several sounds in succession one to another in a manner agreeable to the ear; harmony is the art of pleasing that organ by the union of several sounds which are heard at one and the same time. Melody has been known and felt through all ages: perhaps the same cannot be affirmed of harmony (§); we know not whether the ancients made any use of it or not, nor at what period it began to be practised.

* See Melody.
† See Harmony.

Not but that the ancients certainly employed in their music

(†) To deliver the elementary principles of music theoretical and practical, in a manner which may prove at once entertaining and instructive, without protracting this article much beyond the limits prescribed in our plan, appears to us no easy task. We therefore hesitated for some time, whether to try our own strength, or to follow some eminent author on the same subject. Of these the last seemed preferable. Amongst these authors, none appeared to us to have written any thing so fit for our purpose as M. D'Alembert, whose treatise on music is the most methodical, perspicuous, concise, and elegant dissertation on that subject with which we are acquainted. As it was unknown to most English readers before the former edition of this work, it ought to have all the merit of an original. We have given a faithful translation of it; but in the notes, several remarks are added, and many authors quoted, which will not be found in the original. It is a work so systematically composed, that all attempts to abridge it, without rendering it obscure and imperfect, would be impracticable. It is perhaps impossible to render the system of music intelligible in a work of less compass than that with which our readers are now presented; and, in our judgment, a performance of this kind, which is written in such a manner as not to be generally understood, were much better suppressed.

(‡) In this passage, and in the definitions of melody and harmony, our author seems to have adopted the vulgar error, that the pleasures of music terminates in corporeal sense. He would have pronounced it absurd to assert the same thing of painting. Yet if the former be no more than a mere pleasure of corporeal sense, the latter must likewise be ranked in the same predicament. We acknowledge that corporeal sense is the vehicle of sound; but it is plain from our immediate feelings, that the results of sound arranged according to the principles of melody, or combined and disposed according to the laws of harmony, are the objects of a reflex or internal sense.

For a more satisfactory discussion of this matter, the reader may consult that elegant and judicious treatise on Musical Expression by Mr Avison. In the mean time it may be necessary to add, that in order to shun the appearance of affectation, we shall use the ordinary terms by which musical sensations, or the mediums by which they are conveyed, are generally denominated.

(§) Though no certainty can be obtained what the ancients understood of harmony, nor in what manner and in what period they practised it; yet it is not without probability, that, both in speculation and practice, they

Prelim. Discourse.

music those chords which were most perfect and simple; such as the octave, the fifth, and the third; but it seems doubtful whether they knew any of the other consonances or not, or even whether in practice they could deduce the same advantages from the simple chords which were known to them, that have afterwards accrued from experience and combinations.

If that harmony which we now practise owes its origin to the experience and reflection of the moderns, there is the highest probability that the first essays of this art, as of all the others, were feeble, and the progress of its efforts almost imperceptible; and that, in the course of time, improving by small gradations, the successive labours of several geniuses have elevated it to that degree of perfection in which at present we find it.

77 The origin of arts often accidental, and their progress gradual.

The first inventor of harmony escapes our investigation, from the same causes which leave us ignorant of those who first invented each particular science; because the original inventors could only advance one step, a succeeding discoverer afterwards made a more sensible improvement, and the first imperfect essays in every kind were lost in the more extensive and striking views to which they led. Thus the arts which we now enjoy, are for the most part far from being due to any particular man, or to any nation exclusively: they are produced by the united and successive endeavours of mankind; they are the results of such continued and united reflections, as have been formed by all men at all periods and in all nations.

It might, however, be wished, that after having ascertained, with as much accuracy as possible, the state of ancient music by the small number of Greek authors which remain to us, the same application were immediately directed to investigate the first incontestable traces of harmony which appear in the succeeding ages, and to pursue those traces from period to period. The products of these researches would doubtless be very imperfect, because the books and monuments of the middle ages are by far too few to enlighten that gloomy and barbarous era; yet these discoveries would still be precious to a philosopher, who delights to observe the human mind in the gradual evolutions of its powers, and the progress of its attainments.

78 Delineations of the laws of harmony recent and imperfect.

The first compositions upon the laws of harmony which we know, are of no higher antiquity than two ages prior to our own; and they were followed by many others. But none of these essays was capable of satisfying the mind concerning the principles of harmony: they confined themselves almost entirely to the single occupation of collecting rules, without endeavouring to account for them; neither had their analogies one with another, nor their common source, been perceived; a blind and unenlightened experience was the only compass by which the artist could direct and regulate his course.

79 Its precepts not deduced from any principle till by M. Rameau.

M. Rameau was the first who began to transfuse light and order through this chaos. In the different tones procured by the same sonorous body, he found the most probable origin of harmony, and the cause of that pleasure which we receive from it. His principle he unfolded, and showed how the different phenomena of music were produced by it: he reduced all the consonances to a small number of simple and fundamental chords, of which the others are only combinations or various arrangements. He has, in short, been able to discover, and render sensible to others, the mutual dependence between melody and harmony.

80 The author's motives for writing these elements.

Though these different topics may be contained in the writings of this celebrated artist, and in these writings may be understood by philosophers who are likewise adepts in the art of music; still, however, such musicians as were not philosophers, and such philosophers as were not musicians, have long desired to see these objects brought more within the reach of their capacity: such is the intention of the treatise I now present to the public. I had formerly composed it for the use of some friends. As the work appeared to them clear and methodical, they have engaged me to publish it, persuaded (though perhaps with too much credulity) that it might be useful to facilitate the progress of initiates in the study of harmony.

This was the only motive which could have determined me to publish a book of which I might without hesitation assume the honour, if its materials had been the fruits of my own invention, but in which I can now boast no other merit than that of having developed, elucidated, and perhaps in some respects improved, the ideas of another (c).

81 Improvements of this edition.

The first edition of this essay, published 1752, having been favourably received by the world, and copies no longer to be found in the hands of booksellers, I have endeavoured to render this more perfect. The detail which I mean to give of my labour, will present the reader with a general idea of the principle of M. Rameau, of the consequences deduced from it, of the manner in which I have disposed this principle and its consequences; in short, of what is still a-wanting, and might be advantageous to the theory of this amiable art; of what still remains for the learned to contribute towards the perfection of this theory; of the rocks and quicksands which they ought to avoid in this research, and which could serve no other purpose than to retard their progress.

82 Account of the work in general.

83 Rameau's origin of harmony.

Every sonorous body, besides its principal sound, likewise exhibits to the ear the 12th and 17th major of that sound. This multiplicity of different yet concordant sounds, known for a considerable time, constitutes

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they were in possession of what we denominate *counterpoint*. Without supposing this, there are some passages in the Greek authors which can admit of no satisfactory interpretation. See the *Origin and Progress of Language*, Vol. II. Besides, we can discover some vestiges of harmony, however rude and imperfect, in the history of the Gothic ages, and amongst the most barbarous people. This they could not have derived from more cultivated countries, because it appears to be incorporated with their national music. The most rational account, therefore, which can be given, seems to be, that it was conveyed in a mechanical or traditionary manner through the Roman provinces from a more remote period of antiquity.

(c) See M. Rameau's letter upon this subject, *Merc. de Mai* 1752.

tutes the basis of the whole theory of M. Rameau, and the foundation upon which he builds the whole superstructure of a musical system*. In these our *elements* may be seen, how from this experiment one may deduce, by an easy operation of reason, the chief points of melody and harmony; the perfect† chord, as well major as minor; the two‡ tetrachords employed in ancient music; the formation of our diatonic ‖ scale; the different values § which the same sound may have in that scale, according to the turn which is given to the bass*; the alterations ¶ which we observe in that scale, and the reason why they are totally imperceptible to the ear; the rules peculiar to the mode† major; the difficulty in‡ intonation of forming three tones ‖ in succession; the reason why two perfect chords are proscribed in immediate succession in the diatonic order; the origin of the minor mode, its subordination to the mode major, and its variations; the use of discord §; the causes of such effects as are produced by different kinds of music, whether diatonic, chromatic*, or enharmonic†; the principles and laws of temperament‡. In this discourse we can only point out those different objects, the subsequent essay being designed to explain them with the minuteness and precision which they require.

* See System.
† See Chord.
‡ See Tetrachord.
‖ See Diatonic.
§ See Value.
* See Bass.
¶ See Alteration.
† See Mode.
‡ See Intonation.
‖ See Tone.
§ See Discord.
* See Chromatic.
† See Enharmonic.
‡ See Temperament.

One end which we have proposed in this treatise, was not only to place the discoveries of M. Rameau in their most conspicuous and advantageous light, but even in particular respects to render them more simple. —For instance, besides the fundamental experiment which we have mentioned above, that celebrated musician, to render the explication of some particular phenomena in music more accessible, had recourse to another experiment; I mean that which shows that a sonorous body struck and put in vibration, forces its 12th and 17th major in descending to divide themselves and produce a tremulous sound. The chief use which M. Rameau made of this second experiment was to investigate the origin of the minor mode, and to give a satisfactory account of some other rules established in harmony; and with respect to this in our first edition we have implicitly followed him: in this we have found means to deduce from the first experiment alone the formation of the minor mode, and besides to disengage that formation from all the questions which were foreign to it.

It is the same case with some other points (as the origin of the chord of the sub dominant §, and the explication of the seventh in some peculiar respects), upon which it is imagined that we have simplified, and perhaps in some measure extended, the principles of the celebrated artist.

§ See Subdominant.

We have likewise banished from this edition, as from the former, every consideration of geometrical, arithmetical, and harmonical proportions and progressions, which authors have endeavoured to find in the mixture and protraction of tones produced by a sonorous body; persuaded as we are, that M. Rameau was under no necessity of paying the least regard to these proportions which we believe to be not only useless, but even, if we may venture to say so, fallacious when applied to the theory of music. In short, though the relations produced by the octave, the fifth, and the third, &c. were quite different from what they are; though in these chords we should neither remark any progression nor any law; though they should be incommensurable one with another; the protracted tone of a sonorous body, and the multiplied sounds which result from it, are a sufficient foundation for the whole harmonic system.

84 Theoretical musicians cautioned with regard to the admission of mathematical or metaphysical principles in music.

But though this work is intended to explain the theory of music, and to reduce it to a system more complete and more luminous than has hitherto been done, we ought to caution those who shall read this treatise, that they may be careful not to deceive themselves, either by misapprehending the nature of our object, or the end which our endeavours pursue.

We must not here look for that striking evidence which is peculiar to geometrical discoveries alone, and which can be so rarely obtained in these mixed disquisitions, where natural philosophy is likewise concerned: into the theory of musical phenomena there must always enter a particular kind of metaphysics, which these phenomena implicitly take for granted, and which brings along with it its natural obscurity. In this subject, therefore, it would be absurd to expect what is called *demonstration:* it is an atchievement of no small importance, to have reduced the principal facts to a system consistent with itself, and firmly connected in its parts; to have deduced them from one simple experiment; and to have established upon this foundation the most common and essential rules of the musical art. But in another view, if here it be improper to require that intimate and unalterable conviction which can only be produced by the strongest evidence, we remain in the mean time doubtful whether it is possible to elucidate this subject more strongly.

After this declaration, one should not be astonished, that, amongst the facts which are deduced from our fundamental experiment, there should be some which appear immediately to depend upon that experiment, and others which are deduced from it in a way more remote and less direct. In disquisitions of natural philosophy, where we are scarcely allowed to use any other arguments, except such as arise from analogy or congruity, it is natural that the analogy should be sometimes more sometimes less sensible: and we will venture to assert, that such a mind must be very improper for philosophy, which cannot recognise and distinguish this gradation and the different circumstances on which it proceeds. It is not even surprising, that in a subject where analogy alone can take place, this conductress should desert us all at once in our attempts to account for certain phenomena. This likewise happens in the subject which we now treat; nor do we conceal the fact, however mortifying, that there are certain points (though their number be but small) which appear still in some degree unaccountable from our principle. Such, for instance, is the procedure of the diatonic scale in descending; the formation of the chord commonly termed the *sixth redundant** or *superfluous*, and some other facts of less importance, for which as yet we can scarcely offer any satisfactory account except from experience alone.

* See Redundant.

Thus, though the greatest number of the phenomena in the art of music appear to be deducible in a simple and easy manner from the protracted tone of sonorous bodies, one ought not perhaps with too much temerity to affirm as yet, that this mixed and protracted tone is *demonstratively* the only original principle of

Prelim. Difcourfe.

85 Rameau's primary experiment has not as yet accounted for the phenomena of music. Perhaps fome other may be neceffary.

of harmony (D). But in the mean time it would not be lefs unjuft to reject this principle, becaufe certain phenomena appear to be deduced from it with lefs fuccefs than others. It is only neceffary to conclude from this, either that by future fcrutinies means may be found for reducing thefe phenomena to this principle; or that harmony has perhaps fome other unknown principle, more general than that which refults from the protracted and compounded tone of fonorous bodies, and of which this is only a branch; or, laftly, that we ought not perhaps to attempt the reduction of the whole fcience of mufic to one and the fame principle; which, however, is the natural effect of an impatience fo frequent even among philofophers themfelves, which induces them to take a part for the whole, and to judge of objects in their full extent by the greateft number of their appearances.

In thofe fciences which were called *phyfico-mathematical* (and amongft this number perhaps the fcience of founds may be placed), there are fome phenomena which depend only upon one fingle principle and one fingle experiment: there are others which neceffarily fuppofe a greater number both of experiments and principles, whofe combination is indifpenfable in forming an exact and complete fyftem; and mufic perhaps is in this laft cafe. It is for this reafon, that, whilft we beftow on M. Rameau all due praife, we fhould not at the fame time neglect to ftimulate the learned in their endeavours to carry them ftill to higher degrees of perfection, by adding, if it is poffible, fuch improvements as may be wanting to confummate the fcience.

Whatever the refult of their efforts may be, the reputation of this intelligent artift has nothing to fear: he will ftill have the advantage of being the firft who rendered mufic a fcience worthy of philofophical attention; to have made its practice more fimple and eafy; and to have taught muficians to employ in this fubject the light of reafon and analogy.

We would the more willingly perfuade thofe who are fkilled in theory and eminent in practice to extend and improve the views of him who before them purfued and pointed out the career, becaufe many amongft them have already made laudable attempts, and have even been in fome meafure fuccefsful in diffufing new light through the theory of this enchanting art. It was with this view that the celebrated Tartini has prefented us in 1754 with a treatife of harmony, founded on a principle different from that of M. Rameau. This principle is the refult of a moft beautiful experiment (†). If at once two different founds are produced from two inftruments of the fame kind, thefe two founds

86 Tartini's experiment.

(D) The *demonftration* of the principles of harmony by M. Rameau was not thus intitled in the expofition which he prefented in the year 1749 to the Academy of Sciences, and which that Society befides approved with all the eulogiums which the author deferved; the title, as inferted in the regifter of the academy, was, "A memorial, in which are explained the foundations of a fyftem of mufic theoretical and practical." It is likewife under this title that it was announced and approved of by the Commiffioners, who in their printed report, which the public may read along with M. Rameau's memorial, have never dignified his theory with any other name than that of a *fyftem*, the only name in reality which is expreffive of its nature. M. Rameau, who after the approbation of the Academy, has thought himfelf at liberty to adorn his fyftem with the name of a *demonftration*, did not certainly recollect what the Academy has frequently declared; that, in approving any work, it was by no means implied, that the principles of that work appeared to them demonftrated. In fhort, M. Rameau himfelf, in fome writings pofterior to what he calls his *demonftration*, acknowledges, that upon particular points in the theory of the mufical art, he is under a neceffity of having recourfe to analogy and aptitude; this excludes every idea of demonftration, and reftores the theory of the mufical art exhibited by M. Romeau to the clafs in which it can only be ranked with propriety, I mean the clafs of probabilities.

(†) Had the utility of the preliminary difcourfe in which we are now engaged been lefs important and obvious than it really is, we fhould not have given ourfelves the trouble of tranflating, nor our readers that of perufing it. But it muft be evident to every one, that the cautions here given and the advices offered, are no lefs applicable to ftudents than to authors. The firft queftion here decided is, Whether pure mathematics can be fuccefsfully applied to the theory of mufic? The author is juftly of a contrary opinion. It may certainly be doubted with great juftice, whether the folid contents of fonorous bodies and their degrees of cohefion or elafticity, can be afcertained with fufficient accuracy to render them the fubjects of mufical fpeculation, and to determine their effects with fuch precifion as may render the conclufions deduced from them geometrically true. It is admitted, that found is a fecondary quality of matter, and that fecondary qualities have no obvious connection which we can trace with the fenfations produced by them. Experience therefore, and not fpeculation, is the grand criterion of mufical phenomena. For the effects of geometry in illuftrating the theory of mufic (if any will ftill be fo credulous as to pay them much attention), the Englifh reader may confult Smith's Harmonics, Malcom's Differtation on Mufic, and Pleydel's Treatife on the fame fubject inferted in a former edition of this work. Our author next treats of the famous difcovery made by Sig. Tartini, of which the reader may accept the following compendious account.

If two founds be produced at the fame time properly tuned and with due force, from their conjunction a third found is generated, fo much more diftinctly to be perceived by delicate ears as the relation between the generating founds is more fimple; yet from this rule we muft except the unifon and octave. From the fifth is produced a found unifon with its loweft generator; from the fourth, one which is an octave lower than the higheft of its generators; from the third major, one which is an octave lower than its loweft; and from the fixth

Prelim. Diſcourſe.

ſounds generate * a third different from both the others. They have inſerted in the *Encyclopedie*, under the article *Fundamental*, a detail of this experiment according to M. Tartini; and we owe to the public an information of which in compoſing this article we were ignorant; M. Rameau, a member of the Royal Society at Montpellier, had preſented to that ſociety in the year 1753, before the work of M. Tartini had appeared, a memorial printed the ſame year, and where may be found the ſame experiment diſplayed at full length. In relating this fact, which, it was neceſſary for us to do, it is by no means our intention to detract in any degree from the reputation of M. Tartini; we are perſuaded that he owes this diſcovery to his own reſearches alone: but we think ourſelves obliged in honour to give public teſtimony in favour of him who was the firſt in exhibiting this diſcovery.

* See Generate.

87 Its diſcovery originally due to Rameau.

But whatever be the caſe, it is in this experiment that M. Tartini attempts to find the origin of harmony: his book, however, is written in a manner ſo obſcure, that it is impoſſible for us to form any judgement of it; and we are told that others diſtinguiſhed for their knowledge of the ſcience are of the ſame opinion. It were to be wiſhed, that the author would engage ſome man of letters, equally practiſed in muſic and ſkilled in the art of writing, to unfold theſe ideas which he has not diſcovered with ſufficient perſpicuity, and from whence the art might perhaps derive conſiderable advantage if they were placed in a proper light. Of this I am ſo much the more perſuaded, that even though this experiment ſhould not be regarded by others in the ſame view with M. Tartini as the foundation of the muſical art, it is nevertheleſs extremely probable that one might uſe it with the greateſt advantage to enlighten and facilitate the practice of harmony.

In exhorting philoſophers and artiſts to make new attempts for the advancement of the theory of muſic, we ought at the ſame time to let them know the danger of miſtaking what is the real end of their reſearches. Experience is the only foundation upon which they can proceed; it is alone by the obſervation of facts, by bringing them together in one view, by ſhowing their dependency upon one, if poſſible, or at leaſt upon a very ſmall number of primary facts, that they can reach the end to which they ſo ardently aſpire, the important end of eſtabliſhing an exact theory of muſic, where nothing is wanting, nothing obſcure, but every thing diſcovered in its full extent, and in its proper light. The philoſopher who is properly enlightened, will not give himſelf the trouble to explain ſuch facts as are leſs eſſential to his art, becauſe he can diſcern thoſe on which he ought to expatiate for its proper illuſtration. If one would eſtimate them according to their proper value, he will only find it neceſſary to caſt his eyes upon the attempts of natural philoſophers who have diſcovered the greateſt ſkill in their ſcience; to explain, for inſtance, the multiplicity of tones produced by ſonorous bodies. Theſe ſages, after having remarked (what is by no means difficult to conclude) that the univerſal vibration of a muſical ſtring is a mixture of ſeveral partial vibrations, from thence infer, that a ſonorous body ought to produce a multiplicity of tones, as it really does. But why ſhould this multiplied ſound only appear to contain three, and why theſe three preferable to others? Some pretend that there are particles in the air, which, by their different degrees of magnitude and texture, being naturally ſuſceptible of different oſcillations, produce the multiplicity of ſound in queſtion. But what do we know of all this hypothetical doctrine? And though it ſhould even be granted, that there is ſuch a diverſity of tenſion in theſe aerial particles, how ſhould this diverſity prevent them from being all of them confounded in their vibrations by the motions of a ſonorous body? What then ſhould be the reſult, when the vibrations arrive at our ears, but a confuſed and inappretiable † noiſe, where one could not diſtinguiſh any particular ſound?

Prelim. Diſcourſe.

88 Mechanical concluſions inadequate to the ſituation of muſical phenomena.

† See Inappretiable.

89 Metaphyſical concluſions leſs adequate.

If philoſophical muſicians ought not to loſe their time in ſearching for mechanical explications of the phenomena in muſic, explications which will always be found vague and unſatisfactory; much leſs is it their province to exhauſt their powers in vain attempts to riſe above their ſphere into a region ſtill more remote from the proſpect of their faculties, and to loſe themſelves in a labyrinth of metaphyſical ſpeculations upon the cauſes of that pleaſure which we feel from harmony. In vain would they accumulate hypotheſis on hypotheſis, to find a reaſon why ſome chords ſhould pleaſe us

ſixth minor (whoſe higheſt note forms an octave with the loweſt in the third formerly mentioned) will be produced a ſound lower by a double octave than the higheſt of the leſſer ſixth; from the third minor, one whic is double the diſtance of a greater third from its loweſt; but from the ſixth major (whoſe higheſt note makes an octave to the loweſt in the third minor) will be produced a ſound only lower by double the quantity of a greater third than the higheſt; from the ſecond major, a ſound lower by a double octave from the loweſt from a ſecond minor, a ſound lower by triple the quantity of a third major than the higheſt; from the interval of a diatonic or greater ſemitone, a ſound lower by a triple octave than the higheſt; from that of a minor or chromatic ſemitone, a ſound lower by the quantity of a fifth four times multiplied than the loweſt, &c. &c. But that theſe muſical phænomena may be tried by experiments proper to aſcertain them, two hautboys tuned with ſcrupulous exactneſs muſt be procured, whilſt the muſicians are placed at the diſtance of ſome paces one from the other, and the hearers in the middle. The violin will likewiſe give the ſame chords, but they will be leſs diſtinctly perceived, and the experiment more fallacious, becauſe the vibrations of other ſtrings may be ſuppoſed to enter into it.

If our Engliſh reader ſhould be curious to examine theſe experiments and the deductions made from them in the theory of muſic, he will find them clearly explained and illuſtrated in a treatiſe called *Principles and Power of Harmony*, printed at London 1771.

us more than others. The futility of these suppositions accounts must be obvious to every one who has the least penetration. Let us judge of the rest by the most probable which has till now been invented for that purpose. Some ascribe the different degrees of pleasure which we feel from chords, to the more or less frequent coincidence of vibrations; others to the relations which these vibrations have among themselves as they are more or less simple. But why should this coincidence of vibrations, that is to say, their simultaneous impulse on the same organs of sensation, and the accident of beginning frequently at the same time, prove so great a source of pleasure? Upon what is this gratuitous supposition founded? And though one should grant it, would it not follow from thence, that the same chord should successively and rapidly affect us with contrary sensations, since the vibrations are alternately coincident and discrepant? On the other hand, how should the ear be so sensible to the simplicity of relations, whilst for the most part these relations are entirely unknown to him whose organs are notwithstanding sensibly affected with the charms of agreeable music? We may conceive without difficulty how the eye judges of relations; but how does the ear form similar judgments? Besides, why should certain chords which are extremely pleasing in themselves, such as the fifth, lose almost nothing of the pleasure which they give us, when they are altered, and of consequence when the simplicity of their relations are destroyed; whilst other chords, which are likewise extremely agreeable, such as the third, become harsh almost by the smallest alteration; nay, whilst the most perfect and the most agreeable of all chords, I mean the octave, cannot suffer the most inconsiderable change? Let us in sincerity confess our ignorance concerning the genuine causes of these effects (†). The metaphysical conjectures concerning the accoustic organs are probably in the same predicament with those which are formed concerning the organs of vision, if one may speak so, in which philosophers have even till now made such inconsiderable progress, and in all likelihood will not be surpassed by their successors.

Since the theory of music, even to those who confine themselves within its limits, implies questions from which every wise musician will abstain, with much greater reason should they avoid idle excursions beyond the boundaries of that theory, and endeavours to investigate between music and the other sciences chimerical relations which have no foundation in nature. The singular opinions advanced upon this subject by some even of the most celebrated musicians, deserve not to be rescued from oblivion, nor refuted; and ought only to be regarded as a new proof how far men of genius may deviate from truth and taste, when they engage in subjects of which they are ignorant.

The rules which we have attempted to establish concerning the track which every one ought to pursue in the theory of the musical art, may suffice to show our readers the end which we have proposed, and which we have endeavoured to attain in this Work. We have nothing to do here (for it is proper that we repeat it), we have nothing to do with the mechanical principles of protracted and harmonic tones produced by sonorous bodies; principles which till now have been explored in vain, and which perhaps may be long explored with the same success; we have still less

(†) We have as great an aversion as our author to the explication of musical phenomena from mechanical principles; yet we fear the following observations, deduced from irresistible and universal experience, evidently show that the latter necessarily depend on the former. It is, for instance, universally allowed, that dissonances grate and concords please a musical ear: It is likewise no less unanimously agreed, that in proportion as a chord is perfect, the pleasure is increased; now the perfection of a chord consists in the regularity and frequency of coincident oscillations between two sonorous bodies impelled to vibrate: thus the third is a chord less perfect than the fifth, and the fifth than the octave. Of all these consonances, therefore, the octave is most pleasing to the ear; the fifth next, and the third last. In absolute discords, the vibrations are never coincident, and of consequence a perpetual pulsation or jarring is recognized between the protracted sounds, which exceedingly hurts the ear; but in proportion as the vibrations coincide, those pulsations are superseded, and a kindred formed betwixt the two continued sounds, which delights even the corporeal sense: that relation, therefore, without recognising the aptitudes which produce it, must be the obvious cause of the pleasure which chords give to the ear. What we mean by coincident vibrations is, that while one sonorous body performs a given number of vibrations, another performs a different number in the same time; so that the vibrations of the quickest must sometimes be simultaneous with those of the slowest, as will plainly appear from the following deduction. Between the extremes of a third, the vibrations of the highest are as 5 to 4 of the lowest; those of the fifth as 3 to 2; those of the octave as 2 to 1. Thus it is obvious, that in proportion to the frequent coincidence of periodical vibrations, the compound sensation is more agreeable to the ear. Now, to inquire why that organ should be rather pleased with these than with the pulsation and tremulous motion of encountering vibrations which can never coalesce, would be to ask why the touch is rather pleased with polished than rough surfaces? or, why the eye is rather pleased with the waving line of Hogarth than with sharp angles and abrupt or irregular prominences? No alteration of which any chord is susceptible will hurt the ear unless it should violate or destroy the regular and periodical coincidence of vibrations. When alterations can be made without this disagreeable effect, they form a pleasing diversity; but still this fact corroborates our argument, that in proportion as any chord is perfect, it is impatient of the smallest alteration; for this reason, even in temperament, the octave endures no alteration at all, and the fifth as little as possible.

less to do with the metaphysical causes of those pleasing sensations which are impressed on the mind by harmony; causes which are still less discovered, and which, according to all appearances, will remain latent in perpetual obscurity. We are alone concerned to show how the chief and most essential laws of harmony may be deduced from one single experiment; and for which, if we may speak so, preceding artists have been under a necessity of groping in the dark.

With an intention to render this work as generally useful as possible, I have endeavoured to adapt it to the capacity even of those who are absolutely uninstructed in music. To accomplish this design, it appeared necessary to pursue the following plan.

90 Plan of the treatise.

To begin with a short introduction, in which are defined the technical terms most frequently used in this art; such as *chord*, *harmony*, *key*, *third*, *fifth*, *octave*, &c.

Afterwards to enter into the theory of harmony, which is explained according to M. Rameau, with all possible perspicuity. This is the subject of the *First Part*; which, as well as the introduction, presupposes no other knowledge of music than that of the names and powers of the syllables, *ut*, *re*, *mi*, *fa*, *sol*, *la*, *si*, or C, D, E, F, G, A, B, which all the world knows (†).

The theory of harmony requires some arithmetical calculations, which are necessary for comparing sounds one with another. These calculations are very short, extremely simple, and conducted in such a manner as to be sensibly comprehended by every one; they demand no operation but what is clearly explained, and which every school boy with the slightest attention may perform. Yet, that even the trouble of this may be spared to such as are not disposed to take it, I have not inserted these calculations in the body of the treatise, but transferred them to the notes, which the reader may omit, if he can satisfy himself by taking for granted the propositions contained in the work, which will be found proved in the notes.

These calculations I have not endeavoured to multiply; I could even have wished to suppress them, if it had been possible: so much did it appear to me to be apprehended that my readers might be misled upon this subject, and might either believe themselves, or at least suspect me of believing, all this arithmetic necessary to form an artist. Calculations may indeed facilitate the understanding of certain points in the theory, as of the relations between the different notes in the gammut and of the temperament; but the calculations necessary for treating of these points are so simple, and, to speak more properly, of so little importance, that nothing can require a less minute or ostentatious display. Do not let us imitate those musicians who, believing themselves geometers, or those geometers who, believing themselves musicians, fill their writings with figures upon figures; imagining, perhaps, that this apparatus is necessary to the art. The propensity of adorning their works with a false air of science, can only impose upon credulity and ignorance, and serve no other purpose but to render their treatises more obscure and less instructive. In the character of a geometer, I think I have some right to protest here (if I may be permitted to express myself in this manner) against such ridiculous abuse of geometry in music.

91 Mathematical conclusions not transferable to sensible objects without caution.

This I may do with so much more reason, that in this subject the foundations of those calculations are in some manner hypothetical, and can never arise to a degree of certainty above hypothesis. The relation of the octave as 1 to 2, that of the fifth as 2 to 3, that of the third major as 4 to 5, &c. are not perhaps the genuine relations established in nature; but only relations which approach them, and such as experience can discover. For are the results of experience any thing more but mere approaches to truth?

But happily these approximated relations are sufficient, though they should not be exactly agreeable to truth, for giving a satisfactory account of those phenomena which depend on the relations of sound; as in the difference between the notes in the gammut, of the alterations necessary in the fifth and third, of the different manner in which instruments are tuned, and other facts of the same kind. If the relations of the octave, of the fifth, and of the third, are not exactly such as we have supposed them, at least no experiments can prove that they are not so; and since these relations are signified by a simple expression, since they are besides sufficient for all the purposes of theory, it would not only be useless, but even contrary to sound philosophy, should any one incline to invent other relations, to form the basis of any system of music less easy and simple than that which we have delineated in this treatise.

The *second part* contains the most essential rules of composition*, or in other words the practice of harmony. These rules are founded on the principles laid down in the *first part*; yet those who wish to understand no more than is necessary for practice, without exploring the reasons why such practical rules are necessary, may limit the objects of their study to the *introduction* and the *second part*. They who have read the *first part*, will find at every rule contained in the *second*, a reference to that passage in the

* See Composition.

(†) The names of the seven notes used by the French are here retained, and will indeed be continued through the whole ensuing work; as we imagine, that, if properly associated with the sounds which they denominate, they will tend to impress these sounds more distinctly on the memory of the scholar than the letters C, D, E, F, G, A, B, from which characters, except in sol-fa'ing, the notes in the diatonic series are generally named in Britain. Amongst us, in the progress of intonation, the syllables *ut*, *re*, and *si*, have been omitted, by which means the teachers of church-music have rendered it still more difficult to express by the four remaining denominations the various changes of the semitones in the octave. As these artificially change their places, the seven syllables abovementioned also diversify their powers, and are variously arranged according to the intervals in which the notes they are intended to signify may be placed.

For an account of these variations, see Rousseau's Musical Dictionary, article GAMME. See also the Essay towards a Rational System of Music, by John Holden, part i. chap. 1.

Prel m. Discourse. the *first* where the reasons for establishing that rule are given.

92 Some rules, on account of their intricacy, transferred to the notes. That we may not present at once too great a number of objects and precepts, I have transferred to the notes in the second part several rules and observations which are less frequently put in practice, which perhaps it may be proper to omit till the treatise is read a second time, when the readers is well acquainted with the essential and fundamental rules explained in it.

This second part, strictly speaking, presupposes, no more than the first, any habit of singing, nor even any knowledge of music: it only requires that one should know, not even the rules and manner of intonation, but merely the position of the notes in the cleff *fa* or F on the fourth line, and that of *sol* or G upon the second: and even this knowledge may be acquired from the work itself; for in the beginning of the second part I explain the positions of the cleffs and of the notes. Nothing else is necessary but to render it a little familiar to our memory, and we shall have no more difficulty in it.

93 All the rules of composition not to be expected in an elementary essay. It would be wrong to expect here all the rules of composition, and especially those which direct the composition of music in several parts, and which, being less severe and indispensable, may be chiefly acquired by practice, by studying the most approved models, by the assistance of a proper master, but above all by the cultivation of the ear and of the taste. This treatise is properly nothing else, If I may be allowed the expression, but the rudiments of music, intended for explaining to beginners the fundamental principles, not the practical detail of composition. Those who wish to enter more deeply into this detail, will either find it in Mr Rameau's treatise of harmony, or in the code of music which he published more lately (I), or lastly in the explication of the theory and practice of music by M. Bethizi (K): this last book appears to me clear and methodical.

One may look upon it (with respect to a practical detail) as a supplement to my own performance. I do this justice to the author with so much more cheerfulness, as he is entirely unkown to me, and as his animadversions upon my work appear to me less severe than it deserved (L).

94 Nature the essential mistress of musical composition. Is it necessary to add, that, in order to compose music in a proper taste, it is by no means enough to have familiarized with much application the principles explained in this treatise? Here can only be learned the mechanism of the art; it is the province of nature alone to accomplish the rest. Without her assistance, it is no more possible to compose agreeable music by having read these elements, than to write verses in a proper manner with the Dictionary of Richelet. In one word, it is the elements of music alone, and not the principles of genius, that the reader may expect to find in this treatise.

Such was the aim I pursued in its composition, and such should be the ideas of the reader in its perusal. Once more let me add, that to the discovery of its fundamental principles I have not the remotest claim. The sole end which I proposed was to be useful; to reach that end, I have omitted nothing which appeared necessary, and I should be sorry to find my endeavours unsuccessful. Definitions.

DEFINITIONS OF SEVERAL TECHNICAL TERMS.

I. *What is meant by Melody, by Chord, by Harmony, by Interval.*

1. Melody is nothing else but a series of sounds which succeed one to another in a manner agreeable to the ear. 95 Melody, what.

2. That is called a *chord* which arises from the mixture of several sounds heard at the same time; and harmony is properly a series of chords which in their succession one to another delights the ear. A single chord is likewise sometimes called *harmony*, to signify the coalescence of sounds which that chord creates, and the sensation produced in the ear by that coalescence. We shall occasionally use the word *harmony* in this last sense, but in such a manner as never to leave our meaning ambiguous. 96 Chord and harmony, what. See interval.

3. In melody and harmony, the distance between one sound and another is called an *interval;* and this is increased and diminished as the sounds between which it intervenes are higher or lower one than the other

4. That we may learn to distinguish the intervals, and the manner of perceiving them, let us take the ordinary scale *ut, re, mi, fa, sol, la, si, UT,* C, D, E, F, G, A, B, C, which every person whose ear or voice is not extremely false naturally modulates. These are the observations which will occur to us in singing this gammut.

The sound *re* is higher or sharper than the sound *ut*, the sound *mi* higher than the sound *re*, the sound *fa* higher than the sound *mi*, &c. and so through the whole octave; so that the interval or the distance from the sound *ut* to the sound *re*, is less than the interval or distance between the sound *ut* and the sound *mi*, the interval from *ut* to *mi* is less than that between *ut* and *fa*, &c. and in short that the interval from the first to the second *ut* is the greatest of all.—To distinguish the first from the second *ut*, I have marked the last with capital letters. 97 Account of the simple intervals.

5. In general, the interval between two sounds is proportionably greater, as one of these sounds is higher or lower with relation to the other: but it is necessary to observe, that two sounds may be equally high or low, though unequal in their force. The string of a violin touched with a bow produces always a sound equally high, whether strongly or faintly struck; the sound will only have a greater or lesser degree of strength. It is the same with vocal modulation; 98 The distinction between strong and faint, or acute and grave.

(I) From my general recommendation of this code, I except the reflections on the principles of sound which are at the end, and which I should not advise any one to read.

(K) Printed at Paris by Lambert in the year 1754.

(L) That criticism and my answers may be seen in the *Journeaux Economiques* of 1752.

Definitions.

lation: let any one form a found by gradually impelling or fwelling the voice, the found may be perceived to increafe in its energy, whilft it continues always equally low or equally high.

99 Between tonic and femitonic intervals.

6. We muft likewife obferve concerning the fcale, that the intervals between *ut* and *re*, between *re* and *mi*, between *fa* and *fol*, between *fol* and *la*, between *la* and *fi*, are equal, or at leaft nearly equal; and that the intervals between *mi* and *fa*, and between *fi* and *ut*, are likewife equal among themfelves, but confift almoft only of half the former. This fact is known and recognifed by every one: the reafon for it fhall be given in the fequel: in the mean time every one may afcertain its reality by the affiftance of an experiment (A).

7. It is for this reafon that they have called the interval from *mi* to *fa*, and from *fi* to *ut*, a femitone; whereas thofe between *ut* and *re*, *re* and *mi*, *fa* and *fol*, *fol* and *la*, *la*, and *fi*, are tones.

The *tone* is likewife called a *fecond major* *, and the *femitone* a *fecond minor* †.

* See the figure marked A.
† See Interval.

8. To defcend or rife diatonically, is to defcend or rife from one found to another by the interval of a tone or of a femitone, or in general by feconds, whether major or minor; as from *re* to *ut*, or from *ut* to *re*, from *fa* to *mi*, or from *mi* to *fa*.

II. *The Terms by which the different Intervals of the Gammut are denominated.*

100 Third minor, what.

9. An interval compofed of a tone and a femitone, as from *mi* to *fol*, from *la* to *ut*, or from *re* to *fa*, is called a *third minor*.

101 Third major, what.

An interval compofed of two full tones as from *ut* to *mi*, from *fa* to *la*, or from *fol* to *fi*, is called a *third major*.

102 Fourth, what.

An interval compofed of two tones and a femitone, as from *ut* to *fa*, or from *fol* to *ut* is called a *fourth*.

103 Triton, what.

An interval confifting of three full tones, as from *fa* to *fi*, is called a *triton* or *fourth redundant*.

104 Fifth, what.

An interval confifting of three tones and a femitone, as from *ut* to *fol*, from *fa* to *ut*, from *re* to *la*, or from *mi* to *fi*, &c. is called a *fifth*.

105 Sixth minor, what.

An interval compofed of three tones and two femitones, as from *mi* to *ut*, is called a *fixth minor*.

106 Sixth major, what.

An interval compofed of four tones and a femitone, as from *ut la*, is called a *fixth major*

107 Seventh minor, what.

An interval confifting of four tones and two femitones, as from *re* to *ut* is called a *feventh minor*.

108 Seventh, major,

An interval compofed of five tones and a femitone, as from *ut* to *fi*, is called a *feventh major*..

And

(A) This experiment may be eafily tried. Let any one fing the fcale of *ut, re, mi, fa, fol, la, fi, UT,* / C, D, E, F, G, A, B, C, it will be immediately obferved without difficulty, that the laft four notes of the octave *fol, la, fi, UT,* / G, A, B, C, are quite fimilar to the firft *ut, re, mi, fa;* infomuch, that if, after having fung this fcale, one would choofe to repeat it beginning with *ut* in the fame tone which was occupied by *fol* in the former fcale, the note *re* of the laft fcale would have the fame found with the note *la* in the firft, the *mi* with the *fi*, and the *fa* with the *ut*.

From whence it follows, that the interval between *ut* and *re* is the fame as between *fol* and *la;* between *re* and *mi*, as between *la* and *fi;* and *mi* and *fa*, as between *fi* and *ut*.

It will likewife be found, that from *re* to *mi*, from *fa* to *fol*, there is the fame interval as from *ut* to *re*. To be convinced of this, we need only fing the fcale once more; then fing it again, beginning with *ut*, in this laft fcale, in the fame tone which was given to *re* in the firft; and it will be perceived, that the *re* in the fecond fcale will have the fame found, at leaft as far as the ear can difcover, with the *mi* in the former fcale; from whence it follows, that the difference between *re* and *mi* is, at leaft as far as the ear can perceive, equal to that between *ut* and *re*. It will alfo be found, that the interval between *fa* and *fol* is, fo far as our fenfe can determine, the fame with that between *ut* and *re*.

This experiment may perhaps be tried with fome difficulty by thofe who are not inured to form the notes and change the key; but fuch may very eafily perform it by the affiftance of a harpfichord, by means of which the performer will be faved the trouble of retaining the founds in one intonation whilft he performs another. In touching upon this harpficord the keys *fol, la, fi, ut,* and in performing with the voice at the fame time *ut, re, mi, fa,* in fuch a manner that the fame found may be given to *ut* in the voice with that of the key *fol* in the harpfichord, it will be found that *re* in the vocal intonation fhall be the fame with *la* upon the harpfichord, &c.

It will be found likewife by the fame harpfichord, that if one fhould fing the fcale beginning with *ut* in the fame tone with *mi* on the inftrument, the *re* which ought to have followed *ut*, will be higher by an extremely perceptible degree than the *fa* which follows *mi:* thus it may be concluded,, that the interval between *mi* and *fa* is lefs than between *ut* and *re;* and if one would rife from *fa* to another found which is at the fame diftance from *fa* as *fa* from *mi*, he would find in the fame manner, that the interval from *mi* to this new found is almoft the fame as that between *ut* and *re*. The interval then from *mi* to *fa* is nearly half of that between *ut* and *re*.

Since then, in the fcale thus divided *ut, re, mi, fa* / *fol, la, fi, Ut,*
the firft divifion is perfectly like the laft; and fince the intervals between *ut* and *re*, between *re* and *mi*, and between *fa* and *fol*, are equal; it follows, that the intervals between *fol* and *la*, and between *la* and *fi*, are likewife equal to every one of the three intervals between *ut* and *re*, between *re* and *mi*, and between *fa* and *fol;* and that the intervals between *mi* and *fa* and between *fi* and *ut* are alfo equal, but that they only conftitute one half of the others.

Definitions.

And in ſhort, an interval conſiſting of five tones and
109 Octave, what.
two ſemitones, as from *ut* to *UT*, is called an *octave*.

A great many of the intervals which have now been mentioned, are ſtill ſignified by other names, as may be ſeen in the beginning of the ſecond part; but thoſe which we have now given are the moſt common, and the only terms which our preſent purpoſe demands.

110 Uniſon, what.

10. Two ſounds equally high, or equally low, however unequal in their force, are ſaid to be in *uniſon* one with the other.

11. If two ſounds form between them any interval, whatever it be, we ſay, that the higheſt when aſcending is in that interval with relation to the loweſt; and when deſcending, we pronounce the loweſt in the ſame interval with relation to the higheſt. Thus in the third minor *mi, ſol*, where *mi* is the loweſt and *ſol* the higheſt ſound, *ſol* is a third minor from *mi aſcending*, and *mi* is third minor from *ſol in deſcending*.

12. In the ſame manner, if, ſpeaking of two ſonorous bodies, we ſhould ſay, that the one is a fifth above the other *in aſcending*; this infers that the ſound given by the one is at the diſtance of a fifth *aſcending* from the ſound given by the other.

III. *Of Intervals greater than the Octave.*

See fig. B.

13. If, after having ſung the ſcale *ut, re, mi, fa ſol, la, ſi, UT*, one would carry this ſcale ſtill farther in aſcent, it would be diſcovered without difficulty that a new ſcale would be formed, UT, RE, MI, FA, &c. entirely ſimilar to the former, and of which the ſounds will be an octave aſcending, each to its correſpondent note in the former ſcale: thus RE, the ſecond note of the ſecond ſcale, will be an octave in aſcent to the *re* of the firſt ſcale; in the ſame manner MI ſhall be the octave to *mi*, &c. and ſo of the reſt.

Definitions.

14. As there are nine notes from the firſt *ut* to the ſecond RE, the interval between theſe two ſounds is 111
called a *ninth*, and this ninth is compoſed of ſix full Ninth, what.
tones and two ſemitones. For the ſame reaſon the interval from *ut* to FA is called an *eleventh*, and the interval between *ut* and SOL, a *twelfth*, &c.

It is plain that the *ninth* is the octave of the *ſecond*, the *eleventh* of the *fourth*, and the *twelfth* of the *fifth*, &c. 112 Eleventh and twelfth, what.

The octave above the octave of any ſound is called a *double octave*§; the octave of the double octave is called a *triple octave*, and ſo of the reſt. § See Interval and Double Octave.

The double octave is likewiſe called a *fifteenth*; and for the ſame reaſon the double octave of the third is called a *ſeventeenth*, the double octave of the fifth a *nineteenth*, &c. (B).

IV. *What is meant by Sharps and Flats.*

15. It is plain that one may imagine the five tones which enter into the ſcale, as divided each into two ſemitones; thus one may advance from *ut* to *re*, forming in his progreſs an intermediate ſound, which ſhall be higher by a ſemitone than *ut*, and lower in the ſame degree than *re*. A ſound in the ſcale is called *ſharp*, when it is raiſed by a ſemitone; and it is marked with this character ✱: thus *ut*✱ ſignifies *ut ſharp*, that is to ſay, *ut* raiſed by a ſemitone above its pitch in the natural ſcale. A ſound in the ſcale depreſſed by a ſemitone is called *flat*, and is marked thus, ♭: thus *la* ♭ ſignifies *la flat*, or *la* depreſſed by a ſemitone. 113 Sharps and flats, what. See Interval.

V. *What is meant by Conſonances and Diſſonances.*

16. A chord compoſed of ſounds whoſe union or coaleſcence pleaſes the ear is called a *conſonance*; and the ſounds which form this chord are ſaid to be conſonant 114 Conſonance, what. See Chord.

(B) Let us ſuppoſe two vocal ſtrings formed of the ſame matter, of the ſame thickneſs, and equal in their tenſion, but unequal in their length, it will be found by experience.

1ſt, That if the ſhorteſt is equal to half the longeſt, the ſound which it will produce muſt be an octave above the ſound produced by the longeſt.

2dly, That if the ſhorteſt conſtitutes a third part of the longeſt, the ſound which it produces muſt be a twelfth above the ſound produced by the longeſt.

3dly, That if it conſtitutes the fifth part, its ſound will be a ſeventeenth above.

Beſides, it is a truth demonſtrated and generally admitted, that in proportion as one muſical ſtring is leſs than another, the vibrations of the leaſt will be more frequent (that is to ſay, its departures and returns through the ſame ſpace) in the ſame time; for inſtance, in an hour, a minute, a ſecond, &c. in ſuch a manner that one ſtring which conſtitutes a third part of another, forms three vibrations, whilſt the largeſt has only accompliſhed one. In the ſame manner, a ſtring which is one half leſs than another, performs two vibrations, whilſt the other only completes one; and a ſtring which is only the fifth part of another, will perform five vibrations in the ſame time which is occupied by the other in one.

From thence it follows, that the ſound of a ſtring is proportionally higher or lower, as the number of its vibrations is greater or ſmaller in a given time; for inſtance, in a ſecond.

It is for that reaſon, that if we repreſent any ſound whatever by 1, one may repreſent the octave above by 2, that is to ſay, by the number of vibrations formed by the ſtring which produces the octave, whilſt the longeſt ſtring only vibrates once; in the ſame manner we may repreſent the twelfth above the ſound 1 by 3, the ſeventeenth major above 5, &c. But it is very neceſſary to remark, that by theſe numerical expreſſions, we do not pretend to compare ſounds as ſuch; for ſounds in themſelves are nothing but mere ſenſations, and it cannot be ſaid of any ſenſation that it is double or triple to another: thus the expreſſions 1, 2, 3, &c. employed to denominate a ſound, its octave above, its twelfth above, &c. ſignify only, that if a ſtring performs a certain number of vibrations, for inſtance, in a ſecond, the ſtring which is in the octave above ſhall double the number in the ſame time, the ſtring which is in the twelfth above ſhall triple it, &c.

Thus to compare ſounds among themſelves is nothing elſe than to compare among themſelves the numbers of vibrations which are formed in a given time by the ſtrings that produce theſe ſounds.

Definitions nant one with relation to the other. The reason of this denomination is, that a chord is found more perfect, as the sounds which form it coalesce more closely among themselves.

17. The octave of a sound is the most perfect of consonances of which that sound is susceptible; then the fifth, afterwards the third, &c. This is a fact
15 founded on experiment.

Dissonance, what. 18. A number of sounds simultaneously produced whose union is displeasing to the ear is called a *dissonance*, and the sounds which form it are said to be dissonant one with relation to the other. The second, the triton, and the seventh of a sound, are dissonants with relation to it. Thus the sounds *ut re*, *ut si*, or *fa*, *si*, &c. simultaneously heard, form a dissonance. The reason which renders dissonance disagreeable, is, that the sounds which compose it, seem by no means coalescent to the ear, and are heard each of them by itself as distinct sounds, though produced at the same time. Definitions. See Discord.

Part I. THEORY of HARMONY.

Chap I. *Preliminary and Fundamental Experiments.*

Experiment I.

19. WHEN a sonorous body is struck till it gives a sound, the ear, besides the principal sound and its octave, perceives two other sounds very high, of which one is the twelfth above the principal sound, that is to say, the octave to the fifth of that sound; and the other is the seventeenth major above the same sound, that is to say, the double octave of its third major.

20. This experiment is peculiarly sensible upon the thick strings of the violoncello, of which the sound being extremely low, gives to an ear, though not very much practised, an opportunity of distinguishing with sufficient ease and clearness the twelfth and seventeenth now in question (c).

21. The principal sound is called the *generator** ; and * See Generator.

(c) Since the octave above the sound 1 is 2, the octave below that same sound shall be $\frac{1}{2}$; that is to say, that the string which produces this octave shall have performed half its vibration, whilst the string which produces the sound 1 shall have completed one. To obtain therefore the octave above any sound, the operator must multiply the quantity which expresses the sound by 2; and to obtain the octave below, he must on the contrary divide the same quantity by 2.

It is for that reason that if any sound whatever, for instance *ut*, is denominated	1
Its octave above will be	2
Its double octave above	4
Its triple octave above	8
In the same manner its octave below will be	$\frac{1}{2}$
Its double octave below	$\frac{1}{4}$
Its triple octave below	$\frac{1}{8}$
And so of the rest.	
Its twelfth above	3
Its twelfth below	$\frac{1}{3}$
Its 17th major above	5
Its 17th major below	$\frac{1}{5}$

The fifth then above the sound 1 being the octave beneath the twelfth, shall be, as we have immediately observed, $\frac{3}{2}$; which signifies that this string performs $\frac{3}{2}$ vibrations; that is to say, one vibration and a half during a single vibration of the string which gives the sound 1.

To obtain the fourth above the sound 1, we must take the twelfth below that sound, and the double octave above that twelfth. In effect, the twelfth below *ut*, for instance, is *fa*, of which the double octave *fa* is the fourth above *ut*. Since then the twelfth below 1 is $\frac{1}{3}$, it follows that the double octave above this twelfth, that is to say, the fourth from the sound 1 in ascending, will be $\frac{1}{3}$ multiplied by 4, or $\frac{4}{3}$.

In short, the third major being nothing else but the double octave beneath the seventeenth, it follows, that the third major above the sound 1 will be 5 divided by 4, or in other words $\frac{5}{4}$.

The third major of a sound, for instance the third major *mi*, from the sound *ut*, and its fifth *sol*, form between them a third minor *mi*, *sol*; now *mi* is $\frac{5}{4}$, and *sol* $\frac{3}{2}$, by what has been immediately demonstrated: from whence it follows, that the third minor, or the interval between *mi* and *sol*, shall be expressed by the relation of the fraction $\frac{5}{4}$ to the fraction $\frac{3}{2}$.

To determine this relation, it is necessary to remark, that $\frac{5}{4}$ are the same thing with $\frac{10}{8}$, and that $\frac{3}{2}$ are the same thing with $\frac{12}{8}$: so that $\frac{5}{4}$ shall be to $\frac{3}{2}$ in the same relation as $\frac{10}{8}$ to $\frac{12}{8}$; that is to say, in the same relation as 10 to 12, or as 5 to 6. If, then, two sounds form between themselves a third minor, and that the first is represented by 5, the second shall be expressed by 6; or, what is the same thing, if the first is represented by 1, the second shall be expressed by $\frac{6}{5}$.

Theory of Harmony. and the two other sounds which it produces, and with which it is accompanied, are inclusive of its octave, called its *harmonics* §.

116 Generator what.

§ See Harmonics.

EXPERIMENT II.

22. There is no person insensible of the resemblance which subsists between any sound and its octave, whether above or below. These two sounds when heard together, almost entirely coalesce in the organ of sensation. We may besides be convinced (by two facts which are extremely simple) of the facility with which one of these sounds may be taken for the other.

Let it be supposed that any person has an inclination to sing a tune, and having at first begun this air upon a pitch too high or too low for his voice, so that he is obliged, lest he should strain himself too much, to sing the tune in question on a key higher or lower than the first; I affirm, that without being initiated in the art of music, he will naturally take his new key in the octave below or the octave above the first: and that in order to take this key in any other interval except the octave, he will find it necessary to exert a sensible degree of attention. This is a fact of which we may easily be persuaded by experience.

Another fact. Let any person sing a tune in our presence, and let it be sung in a tone too high or too low for our voice; if we wish to join in singing this air, we naturally take the octave below or above, and frequently, in taking this octave, we imagine it to be the unison (D).

CHAP. II. *The Origin of the Modes Major and Minor; of the most natural Modulation and the most perfect Harmony.*

117 Fundamental and harmonics, what.

23. To render our ideas still more precise and permanent, we shall call the tone produced by the sonorous body *ut*; it is evident, by the first experiment, that this sound is always attended by its 12th and 17th major; that is to say, with the octave of *sol*, and the double octave of *mi*.

24. This octave of *sol* then, and this double octave of *mi*, produce the most perfect chord which can be joined with *ut*, since that chord is the work and choice of nature (E).

118 Harmony reduced to chords, fifths, and octaves.

25. For the same reason, the modulation formed by *ut* with the octave of *sol* and the double octave of *mi*, sung one after the other, would likewise be the most simple and natural of all modulations which do not descend or ascend directly in the diatonic order, if our voices had sufficient compass to form intervals so great without difficulty: but the ease and freedom with which

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Thus the third minor, an harmonic sound which is even found on the protracted and coalescent tones of a sonorous body between the sound *mi* and *sol*, an harmonic of the principal sound, may be expressed by the fraction $\frac{6}{5}$

N. B. One may see by this example, that in order to compare two sounds one with another which are expressed by fractions, it is necessary first to multiply the numerator of the fraction which expresses the first by the denominator of the fraction which expresses the second, which will give a primary number; as here the numerator 5 of the fraction $\frac{5}{4}$, multiplied by 2 of the fraction $\frac{3}{2}$, has given 10. Afterwards may be multiplied the numerator of the second fraction by the denominator of the first, which will give a secondary number, as here 12 is the product of 4 multiplied by 3; and the relation between these two numbers (which in the preceding example are 10 and 12), will express the relation between these sounds, or, what is the same thing, the interval which there is between the one and the other; in such a manner, that the farther the relation between these sounds departs from unity, the greater the interval will be.

Such is the manner in which we may compare two sounds one with another whose numerical value is known. We shall now show the manner how the numerical expression of a sound may be obtained, when the relation which it ought to have with another sound is known whose numerical expression is given.

Let us suppose, for example, that the third major of the fifth $\frac{3}{2}$ is sought. That third major ought to be, by what has been shown above, the $\frac{5}{4}$ of the fifth; for the third major of any sound whatever is the $\frac{5}{4}$ of that sound. We must then look for a fraction which expresses the $\frac{5}{4}$ of $\frac{3}{2}$; which is done by multiplying the numerators and denominators of both fractions one by the other, from whence results the new fraction $\frac{15}{8}$. It will likewise be found that the fifth is $\frac{9}{4}$, because the fifth of the fifth is the $\frac{3}{2}$ of $\frac{3}{2}$

Thus far we have only treated of fifths, fourths, thirds major and minor in ascending; now it is extremely easy to find by the same rules the fifths, fourths, thirds major and minor in descending. For suppose *ut* equal to 1, we have seen that its fifth, its fourth, its third, its major and minor in ascending, are $\frac{3}{2}$, $\frac{4}{3}$, $\frac{5}{4}$, $\frac{6}{5}$. To find its fifth, its fourth, its third, its major and minor in descending, nothing more is necessary than to reverse these fractions, which will give $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{6}$.

(D) It is not then imagined that we change the value of a sound in multiplying or dividing it by 2, by 4, or by 8, &c. the number which expresses these sounds, since by these operations we do nothing but take the simple, double, or triple octave, &c. of the sound in question, and that a sound coalesces with its octave.

(E) The chord formed with the twelfth and seventeenth major united with the principal sound, being exactly conformed to that which is produced by nature, is likewise for that reason the most agreeable of all; especially when the composer can proportion the voices and instruments together in a proper manner to give this chord its full effect. M. Rameau has executed this with the greatest success in the opera of *Pygmalion* page 34 where Pygmalion sings with the chorus, *L'amour triomphe*, &c.; in this passage of the chorus, the two parts of the vocal and instrumental basses give the principal sound and its octave; the first part above, or treble, and that of the counter-tenor, produce the seventeenth major, and its octave, in descending; and in short, the second part, or tenor above, gives the twelfth.

which we can substitute its octave to any sound, when it is more convenient for the voice, afford us the means of representing this modulation.

119 Mode major, what.

26. It is on this account that, after having sung the tone *ut*, we naturally modulate the third *mi*, and the fifth *sol*, instead of the double octave of *mi*, and the octave of *sol;* from whence we form, by joining the octave of the sound *ut*, this modulation, *ut, mi, sol, ut*, which in effect is the simplest and easiest of them all; and which likewise has its origin even in the protracted and compounded tones produced by a sonorous body.

See Mode. See likewise Interval.

27. The modulation *ut, mi, sol, ut*, in which the chord *ut, mi*, is a third major, constitutes that kind of harmony or melody which we call the *mode major;* from whence it follows, that this mode results from the immediate operation of nature.

120 Mode minor, what.

28. In the modulation *ut, mi, sol*, of which we have now been treating, the sounds *mi* and *sol* are so proportioned one to the other, that the principal sound *ut* (art. 19.) causes both of them to resound; but the second tone *mi* does not cause *sol* to resound, which only forms the interval of a third minor.

29. Let us then imagine, that, instead of this sound *mi*, one should substitute between the sounds *ut* and *sol* another note which (as well as the sounds *ut*) has the power of causing *sol* to resound, and which is, however, different from the sound *ut;* the sound which we explore ought to be such, by art. 19. that it may have for its 17th major *sol*, or one of the octaves of *sol;* of consequence the sound which we seek ought to be a 17th major below *sol*, or, what is the same thing, a third major below the same *sol*. Now the sound *mi* being a third minor beneath *sol*, and the third major being (art. 9.) greater by a semitone than the third minor, it follows, that the sound of which we are in search shall be a semitone beneath the natural *mi*, and of consequence *mi*♭.

30. This new arrangement, *ut, mi*♭, *sol*, in which the sounds *ut* and *mi*♭ have both the power of causing *sol* to resound, though *ut* does not cause *mi*♭ to resound, is not indeed equally perfect with the first arrangement *ut, mi, sol;* because in this the two sounds *mi* and *sol* are both the one and the other generated by the principle sound *ut;* whereas, in the other, the sound *mi*♭ is not generated by the sound *ut;* but this arrangement *ut mi*♭, *sol*, is likewise dictated by nature (art. 19.), though less immediately than the former; and accordingly experience evinces that the ear accommodates itself almost as well to the latter as to the former.

121 Origin of mode minor.

See Mode. See also Interval.

31. In this modulation or chord *ut, mi*♭, *sol, ut*, it is evident that the third from *ut* to *mi*♭ is minor; and such is the origin of that mode which we call *minor* (F).

122 Perfect chords, what.

32. The most perfect chords then are, 1. All chords related one to another, as *ut, mi, sol, ut*, consisting of any sound of its third major, of its fifth, and of its octave. 2. All chords related one to another, as *ut mi*♭, *sol, ut*, consisting of any sound, of its third minor, of its fifth, and of its octave. In effect, these two kinds of chords are exhibited by nature: but the first more immediately than the second. The first are called *perfect chords major*, the second *perfect chords minor*.

Chap. III. *Of the Series which the Fifth requires, and of the Laws which it observes.*

123 Fundamental bass, what.

33. Since the sound *ut* causes the sound *sol* to be heard, and is itself heard in the sound *fa*, which sounds *sol* and *fa* are its two-twelfths, we may imagine a modulation composed of that sound *ut* and its two-twelfths, or, which is the same thing (art. 22.), of its two-fifths, *fa* and *sol*, the one below, the other above; which gives the modulation or series of fifths *fa, ut, sol*, which I call the *fundamental bass* of *ut* by fifths.

We shall find in the sequel (Chap. XVIII.), that there may be some fundamental bases by thirds, deduced from the two seventeenths, of which the one is an attendant of the principal sound, and of which the other includes that sound. But we must advance step by step, and satisfy ourselves at present to consider immediately the fundamental bases by fifths.

34. Thus, from the sound *ut*, one may make a transition indifferently to the sound *sol*, or to the sound *fa*.

35. One may for the same reason, continue this kind of fifths in ascending and in descending, from *ut*, in this manner:

mi♭, *si*♭, *fa, ut, sol, re, la*, &c.

And from this series of fifths one may pass to any sound which immediately precedes or follows it.

36. But it is not allowed in the same manner to pass

(F) The origin which we have here given of the mode minor, is the most simple and natural that can possibly be given. In the first edition of this treatise, I had followed M. Rameau in deducing it from the following experiment.—If you put in vibration a musical string AB, and if there are at the same time contiguous to this two other strings CF, LM, of which the first shall be a twelfth below the string AB, and the second LM a seventeenth major below the same AB, the strings CF, LM, will vibrate without being struck as soon as the string AB shall give a sound, and divide themselves by a kind of undulation, the first into three, the last into five equal parts; in such a manner, that in the vibration of the string CF, you may easily distinguish two points at rest D, E, and in the tremulous motion of the string LM four acquiescent points N, O, P, Q, all placed at equal distances from each other, and dividing the strings into three or five equal parts. In this experiment, says M. Rameau, if we represent by *ut* the tone of the string AB, the two other strings will represent the sounds *fa* and *la* ; and from thence M. Rameau deduces the modulation *fa, la* , *ut*, and of consequence the mode minor. The origin which we have assigned to the minor mode in this new edition, appears to me more direct and more simple, because it presupposes no other experiment than that of art 19, and because also the fundamental sound *ut* is still retained in both the modes, without being obliged, as M. Rameau found himself, to change it into *fa*. See fig. C.

Theory of Harmony.

124 Exception to the rule.

pass from one sound to another which is not immediately contiguous to it; for instance, from *ut* to *re*, or from *re* to *ut*: for this very simple reason, that the sound *re* is not contained in the sound *ut*, nor the sound *ut* in that of *re*; and thus these sounds have not any alliance the one with the other, which may authorize the transition from one to the other.

125 Two perfect chords in succession proscribed.

37. And as these sounds *ut* and *re*, by the first experiment, naturally bring along with them the perfect chords consisting of greater intervals *ut*, *mi*, *sol*, *ut*, *re*, *fa*※, *la*, *re*; hence may be deduced this rule, That two perfect chords, especially if they are major (G), cannot succeed one another diatonically in a fundamental bass; we mean, that in a fundamental bass two sounds cannot be diatonically placed in succession, each of which, with its harmonics, forms a perfect chord, especially if this perfect chord be major in both.

Chap. IV. *Of Modes in general.*

126 Mode in general, what.

38. A *mode*, in music, is nothing else but the order of sounds prescribed, as well in harmony as melody, by the series of fifths. Thus the three sounds *fa*, *ut*, *sol*, and the harmonics of each of these three sounds, that is to say, their thirds major and their fifths, compose all the major modes which are proper to *ut*.

127 Modes, how represented by the series of fifths.

39. The series of fifths then, or the fundamental bass *fa*, *ut*, *sol*, of which *ut* holds the middle space, may be regarded as representing the mode of *ut*. One may likewise take the series of fifths, or fundamental bass, *ut*, *sol*, *re*, as representing the mode of *sol*; in the same manner *si* ♭, *fa*, *ut*, will represent the mode of *fa*.

By this we may see, that the mode of *sol*, or rather the fundamental bass of that mode, has two sounds in common with the fundamental bass of the mode of *ut*. It is the same with the fundamental bass of the mode *fa*.

128 Principal mode, and adjuncts, what. See Adjunct.

40. The mode of *ut* (*fa*, *ut*, *sol*) is called the *principal mode* with respect to the modes of these two fifths, which are called its two *adjuncts*.

129 Modes relished in proportion as their sounds are common.

41. It is then, in some measure, indifferent to the ear whether a transition be made to the one or to the other of these adjuncts, since each of them has equally two sounds in common with the principal mode. Yet the mode of *sol* seems a little more eligible: for *sol* is heard amongst the harmonics of *ut*, and of consequence is implied and signified by *ut*; whereas *ut* does not cause *fa* to be heard, though *ut* is included in the same sound *fa*. It is hence that the ear, affected by the mode of *ut*, is a little more prepossessed for the mode of *sol* than for that of *fa*. Nothing likewise is more frequent, nor more natural, than to pass from the mode of *ut* to that of *sol*.

130 Dominant and subdominant, what. See Dominant.

42. It is for this reason, as well as to distinguish the two fifths one from the other, that we call *sol* the fifth above the generator the *dominant* sound, and the fifth *fa* beneath the generator the *subdominant*.

131 Transition to contiguous sounds, how to be managed.

43. It remains to add, as we have seen in the preceding chapter, that, in the series of fifths, we may indifferently pass from one sound to that which is contiguous: In the same manner, and for the same reason, one may pass from the mode of *sol* to the mode of *re*, after having made a transition from the mode of *ut* to the mode of *sol*, as from the mode of *fa* to the mode of *si* ♭. But it is necessary, however, to observe, that the ear which has been immediately affected with the principal mode feels always a strong propensity to return to it. Thus the further the mode to which we make a transition is removed from the principal mode, the less time we ought to dwell upon it; or rather, to speak in the terms of the art, the less ought the phrase (‡*aa*) of that mode to be protracted.

Chap. V. *Of the Formation of the Diatonic Scale as used by the Greeks.*

44. From this rule, that two sounds which are contiguous may be placed in immediate succession in the series of fifths, *fa*, *ut*, *sol*, it follows, that one may form this modulation, or this fundamental bass, by fifths, *sol*, *ut*, *sol*, *ut*, *fa*, *ut*, *fa*.

45. Each of the sounds which forms this modulation brings necessarily along with itself its third major, its fifth, and its octave; insomuch that he who, for instance, sings the note *sol*, may be reckoned to sing at the same time the notes *sol*, *si*, *re*, *sol*: in the same manner the sound *ut* in the fundamental bass brings along with it this modulation, *ut*, *mi*, *sol*, *ut*; and, in short, the same sound *fa* brings along with it *fa*, *la*, *ut*, *fa*. This modulation then, or this fundamental bass, See fig. D.

132 Formation of the Greek diatonic scale by the fundamental bass.

sol, *ut*, *sol*, *ut*, *fa*, *ut*, *fa*,

gives the following diatonic series,

si, *ut*, *re*, *mi*, *fa*, *sol*, *la*;

which is precisely the diatonic scale of the Greeks. We are ignorant upon what principles they had formed this scale; but it may be sensibly perceived, that that series arises from the bass *sol*, *ut*, *sol*, *ut*, *fa*, *ut*, *fa*; and that of consequence this bass is justly called *fundamental*, as being the real primitive modulation, that which conducts See D.

(G) I say *especially if they are major*; for in the major chord *re*, *fa*※, *la*, *re*, besides that the sounds *ut* and *re* have no common harmonical relation, and are even dissonant between themselves (Art. 18.), it will likewise be found, that *fa*※ forms a dissonance with *ut*. The minor chord, *re*, *fa*, *la*, *re*, would be more tolerable, because the natural *fa* which occurs in this chord carries along with it its fifth *ut*, or rather the octave of that fifth: It has likewise been sometimes the practice of composers, though rather by a licence indulged them than strictly agreeable to their art, to place a minor in diatonic succession to a major chord.

(‡*aa*) As the mere English reader, unacquainted with the technical phraseology of music, may be surprised at the use of the word *phrase* when transferred from language to that art, we have thought proper to insert the definition of Rousseau.

A *phrase*, according to him, is in melody a series of modulations, or in harmony a succession of chords, which form without interruption a sense more or less complete, and which terminate in a repose by a cadence more or less perfect.

conducts the ear, and which it feels to be implied in the diatonic modulation, *ſi, ut, re, mi, fa, ſol, la*, (H).

46. We ſhall be ſtill more convinced of this truth by the following remarks.

In the modulation *ſi, ut, re, mi, fa, ſol, la*, the ſounds *re* and *fa* form between themſelves a third minor, which is not ſo perfectly true as that between *mi* and *ſol* (I). Nevertheleſs, this alteration in the third minor between *re* and *fa* gives the ear no pain, becauſe that *re* and that *fa*, which do not form between themſelves a true third minor, form, each in particular, conſonances perfectly juſt with the ſounds in the fundamental baſs which correſpond with them: for *re* in the ſcale is the true fifth of *ſol*, which anſwers to it in the fundamental baſs; and *fa* in the ſcale is the true octave of *fa*, which anſwers to it in the ſame baſs.

133 Altered intervals, no objection.

47. If, therefore, theſe ſounds in the ſcale form conſonances perfectly true with the notes which correſpond to them in the fundamental baſs, the ear gives itſelf little trouble to inveſtigate the alterations which there may be in the intervals which theſe ſounds in the ſcale form between themſelves. This is a new proof that the fundamental baſs is the genuine guide of the ear, and the true origin of the diatonic ſcale.

134 Reaſons why this ſcale includes only ſeven ſounds.

48. Moreover, this diatonic ſcale includes only ſeven ſounds, and goes no higher than *ſi*, which would be the octave of the firſt: a new ſingularity, for which a reaſon may be given by the principles above eſtabliſhed. In reality, in order that the ſound *ſi*, may ſucceed immediately in the ſcale to the ſound *la*, it is neceſſary that the note *ſol*, which is the only one from whence *ſi* as a harmonic may be deduced, ſhould immediately ſucceed to the ſound *fa*, in the fundamental baſs, which is the only one from whence *la* can be harmonically deduced. Now, the diatonic ſucceſſion from *fa* to *ſol* cannot be admitted in the fundamental baſs, according to what we have remarked (art. 36.) The ſounds *la* and *ſi*, then, cannot immediately ſucceed one another in the ſcale: we ſhall ſee in the ſequel why this is not the caſe in the ſeries *ut, re, mi, fa, ſol, la, ſi, UT*, which begins upon *ut*; whereas the ſcale in queſtion here begins upon *ſi*.

135 Complection of the Greek octave. See Proſtambanomene.

49. The Greeks likewiſe, to form an entire octave, added below the firſt *ſi* the note *la*, which they diſtinguiſhed and ſeparated from the reſt of the ſcale, and which for that reaſon they called *proſtambanomene*, that is to ſay, a ſtring or note ſubadded to the ſcale, and put before *ſi* to form the entire octave.

136 The ſcale compoſed of two ſimilar conjunctive tetrachords.

50. The diatonic ſcale *ſi, ut, re, mi, fa, ſol, la*, is compoſed of two tetrachords, that is to ſay, of two diatonic ſcales, each conſiſting of four ſounds, *ſi, ut, re, mi*, and *mi, fa, ſol, la*. Theſe two tetrachords are exactly ſimilar; for from *mi* to *fa* there is the ſame interval as from *ſi* to *ut*, from *fa* to *ſol* the ſame as from *ut* to *re*, from *ſol* to *la* the ſame as from *re* to *mi*

(H) Nothing is eaſier than to find in this ſcale the value or proportions of each ſound with relation to the ſound *ut*, which we call 1; for the two ſounds *ſol* and *fa* in the baſs are $\frac{3}{2}$ and $\frac{2}{3}$; from whence it follows,

1. That *ut* in the ſcale is the octave of *ut* in the baſs; that is to ſay, 2.
2. That *ſi* is the third major of *ſol*; that is to ſay $\frac{5}{4}$ of $\frac{3}{2}$ (note C), and of conſequence $\frac{15}{8}$.
3. That *re* is the fifth of *ſol*; that is to ſay $\frac{3}{2}$ of $\frac{3}{2}$, and of conſequence $\frac{9}{4}$.
4. That *mi* is the third major of the octave of *ut*, and of conſequence the double of $\frac{5}{4}$; that is to ſay, $\frac{5}{2}$.
5. That *fa* is the double octave of *fa* of the baſs, and conſequently $\frac{8}{3}$.
6. That *ſol* of the ſcale is the octave of *ſol* of the baſs, and conſequently 3.
7. In ſhort, that *fa* in the ſcale is the third major of *fa* of the ſcale; that is to ſay, $\frac{5}{4}$ of $\frac{8}{3}$, or $\frac{10}{3}$.

Hence then will reſult the following table, in which each ſound has its numerical value above or below it.

Diatonic Scale.	$\frac{15}{8}$	2	$\frac{9}{4}$	$\frac{5}{2}$	$\frac{8}{3}$	3	$\frac{10}{3}$
	ſi,	*ut*,	*re*,	*mi*,	*fa*,	*ſol*,	*la*.
Fundamental Baſs.	*ſol*,	*ut*,	*ſol*,	*ut*,	*fa*,	*ut*,	*fa*.
	$\frac{3}{2}$	1	$\frac{3}{2}$	1	$\frac{2}{3}$	1	$\frac{2}{3}$

And if, for the conveniency of calculation, we chooſe to call the ſound *ut*, of the ſcale 1; in this caſe there is nothing to do but to divide each of the numbers by 2, which repreſent the diatonic ſcale, and we ſhall have

$\frac{15}{16}$	1	$\frac{9}{8}$	$\frac{5}{4}$	$\frac{4}{3}$	$\frac{3}{2}$	$\frac{5}{3}$
ſi,	*ut*,	*re*,	*mi*,	*fa*,	*ſol*,	*la*.

(I) In order to compare *re* with *fa*, we need only compare $\frac{9}{8}$ with $\frac{4}{3}$; the relation between theſe fractions will be (Note C) that of 9 times 3 to 8 times 4; that is to ſay, of 27 to 32: the third minor, then, from *re* to *fa*, is not true; becauſe the proportion of 27 to 32 is not the ſame with that of 5 to 6, theſe two proportions being between themſelves as 27 times 6 is to 32 times 5, that is to ſay, as 162 to 160, or as the halves of theſe two numbers, that is to ſay, as 81 to 80.

M. Rameau, when he publiſhed, in 1726, his *New theoretical amd practical Syſtem of Muſic*, had not as yet found the true reaſon of the alteration in the conſonance which is between *re* and *fa*, and of the little attention which the ear pays to it. For he pretends, in the work now quoted, that there are two thirds minor, one in the proportion of 5 to 6, the other in the proportion of 27 to 32. But the opinion which he has afterwards adopted, ſeems much preferable. In reality, the genuine third minor, is that which is produced by nature between *mi* and *ſol*, in the continued tone of thoſe ſonorous bodies of which *mi* and *ſol* are the two harmonics; and that third minor, which is in the proportion of 5 to 6, is likewiſe that which takes place in the minor mode, and not that third minor which is falſe and different, being in the proportion of 27 to 32.

mi (L); this is the reason why the Greeks distinguished these two tetrachords; yet they joined them by the note *mi*, which is common to both, and which gave them the name of *conjunctive tetrachords*.

137 Intervals in both tetrachords equal.

51. Moreover, the intervals between any two sounds, taken in each tetrachord in particular, are precisely true: thus, in the first tetrachord, the intervals of *ut mi*, and *si, re*, are thirds, the one major and the other minor, exactly true, as well as the fourth *si mi* (M); it is the same thing with the tetrachord *mi, fa, sol, la*, since this tetrachord is exactly like the former

138 Intervals between the notes of different tetrachords dissimilar.

52. But the case is not the same when we compare two sounds taken each from a different tetrachord; for we have already seen, that the note *re* in the first tetrachord forms with the note *fa* in the second a third minor, which is not true. In like manner it will be found, that the fifth from *re* to *la* is not exactly true, which is evident; for the third major from *fa* to *la* is true, and the third minor from *re* to *fa* is not so: now, in order to form a true fifth, a third major and a third minor, which are both exactly true, are necessary.

139 Another reason for distinguishing the scale into two tetrachords.

53. From thence it follows, that every consonance is absolutely perfect in each tetrachord taken by itself; but that there is some alteration in passing from one tetrachord to the other. This is a new reason for distinguishing the scale into these two tetrachords.

140 The source of tones major and minor investigated.

54. It may be ascertained by calculation, that in the tetrachord *si, ut, re, mi*, the interval, or the tone from *re* to *mi*, is a little less than the interval or tone from *ut* to *re* (N). In the same manner, in the second tetrachord *mi, fa, sol, la*, which is, as we have proved, perfectly similar to the first, the note from *sol* to *la* is a little less than the note from *fa* to *sol*. It is for this reason that they distinguish two kinds of tones; the greater tone*, as from *ut* to *re*, from *fa* to *sol*, &c.; and the lesser†, as from *re* to *mi*, from *sol* to *la*, &c.

* Greater tone. See Interval.
† Lesser tone. See Interval.

Chap. VI. *The formation of the Diatonic Scale among the Moderns, or the ordinary Gammut.*

141 The modern scale, how formed.

55. We have just shown in the preceding chapter, how the scale of the Greeks is formed, *si, ut, re, mi, fa, sol, la*, by means of a fundamental bass composed of three sounds only, *fa, ut, sol*: but to form the scale *ut, re, mi, fa, sol, la, si, UT*, which we use at present, we must necessarily add to the fundamental bass the note *re*, and form, with these four sounds *fa, ut, sol, re*, the following fundamental bass:

ut, sol, ut, fa, ut, sol, re, sol, ut; See fig. E.

from whence we deduce the modulation or scale See Scale.

ut, re, mi, fa, sol, la, si, UT.

In effect (O), *ut* in the scale belongs to the harmony of *ut* which corresponds with it in the bass; *re*, which is the second note in the gammut, is included in the harmony of *sol*, the second note of the bass; *mi*, the third note of the gammut, is a natural harmonic of *ut*, which is the third sound in the bass, &c.

142 The Greek diatonic scale simpler than ours, and why.

56. From thence it follows, that the diatonic scale of the Greeks is, at least in some respects, more simple than ours; since the scale of the Greeks (chap. v.) may be formed alone from the mode proper to *ut*; whereas ours is originally and primitively formed, not only from the mode of *ut* (*fa, ut, sol*), but likewise from the mode of *sol*, (*ut, sol, re*).

It will likewise appear, that this last scale consists of two parts; of which the one, *ut, re, mi, fa, sol*, is in the

3 T 2

(L) The proportion of *si* to *ut* is as $\frac{15}{16}$ to 1, that is to say as 15 to 16; that betwen *mi* and *fa* is as $\frac{5}{4}$ to $\frac{4}{3}$, that is to say (note c), as 5 times 3 to 4 times 4, or as 15 to 16: these two proportions then are equal. In the same manner, the proportion of *ut* to *re* is as 1 to $\frac{9}{8}$, or as 8 to 9; that between *fa* and *sol* is as $\frac{4}{3}$ to $\frac{3}{2}$; that is to say (note c), as 8 to 9. The proportion of *mi* to *ut* is as $\frac{5}{4}$ to 1, or as 5 to 4; that between *fa* and *la* is as $\frac{5}{3}$ to $\frac{4}{3}$, or as 5 to 4: the proportions here then are likewise equal.

(M) The proportion of *mi* to *ut* is as $\frac{5}{4}$ to 1, or as 5 to 4, which is a true third major; that from *re* to *si* is as $\frac{9}{8}$ to $\frac{15}{16}$, that is to say, as 9 times 16 to 15 times 8, or as 9 times 2 to 15, or as 6 to 5. In like manner, we shall find, that the proportion of *mi* to *si* is as $\frac{5}{4}$ to $\frac{15}{16}$; that is to say, as 5 times 16 to 15 times 4, or as 4 to 3, which is a true fourth.

(N) The proportion of *re* to *ut* is as $\frac{9}{8}$ to 1, or as 9 to 8; that of *mi* to *re* is as $\frac{5}{4}$ to $\frac{9}{8}$, that is to say, as 40 to 36, or as 10 to 9: now $\frac{10}{9}$ is less removed from unity than $\frac{9}{8}$; the interval then from *re* to *mi* is a little less than that from *ut* to *re*.

If any one would wish to know the proportion which $\frac{10}{9}$ bear to $\frac{9}{8}$, he will find (note c) that it is as 8 times 10 to 9 times 9, that is to say, as 80 to 81. Thus the proportion of a lesser to a greater tone is as 80 to 81; this difference between the greater and lesser tone is what the Greeks called a *comma*.

We may remark, that this difference of a comma is found between the third minor when true and harmonical, and the same chord when it suffers alteration *re fa*, of which we have taken notice in the scale (note I); for we have seen, that this third minor thus altered is in the proportion of 80 to 81 with the true third minor.

(O) The values or estimates of the notes shall be the same in this as in the former scale, excepting only the tone *la*; for *re* being represented by $\frac{9}{8}$, its fifth will be expressed by $\frac{27}{16}$; so that the scale will be numerically signified thus:

1	$\frac{9}{8}$	$\frac{5}{4}$	$\frac{4}{3}$	$\frac{3}{2}$	$\frac{27}{16}$	$\frac{15}{8}$	2
ut,	*re,*	*mi,*	*fa,*	*sol,*	*la,*	*si,*	*UT.*

Where you may see, that the note *la* of this scale is different from that in the scale of the Greeks; and that the *la* in the modern series stands in proportion to that of the Greeks as $\frac{27}{16}$ to $\frac{5}{3}$, that is to say, as 81 to 80; these two *la's* then likewise differ by a *comma*.

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the mode of *ut;* and the other *ſol, la, ſi, ut,* in that of *ſol.*

143 The note ſol twice repeated in the diatonic ſcale from its harmonic relations to the fundamental baſs.

57. It is for this reaſon that the note *ſol* is found to be twice repeated in immediate ſucceſſion in this ſcale; once as the fifth of *ut,* which correſponds with it in the fundamental baſs; and again, as the octave of *ſol,* which immediately follows *ut* in the ſame baſs. As to what remains, theſe two conſecutive *ſol's* are otherwiſe in perfect uniſon. It is for this reaſon that we are ſatisfied with ſinging only one of them when one modulates the ſcale *ut, re, mi, fa, ſol, la, ſi, UT*: but this does not prevent us from employing a pauſe or repoſe, expreſſed or underſtood, after the ſound *fa.* There is no perſon who does not perceive this whilſt he himſelf ſings the ſcale.

144 The modern ſcale compoſed of two disjunctive tetrachords of different modes.

58. The ſcale of the moderns, then, may be conſidered as conſiſting of two tetrachords, disjunctive indeed, but perfectly ſimilar one to the other, *ut, re, mi, fa,* and *ſol, la, ſi, ut,* one in the mode of *ut,* the other in that of *ſol.* For what remains, we ſhall ſee in the ſequel by what artifice one may cauſe the ſcale *ut, re, mi, fa, ſol, la, ſi, UT,* to be regarded as belonging to the mode of *ut* alone. For this purpoſe it is neceſſary to make ſome changes in the fundamental baſs, which we have already aſſigned: but this ſhall be explained at large in chap. xiii.

145 The mode of ſol introduced in the fundamental baſs productive of conveniences.

59. The introduction of the mode proper to *ſol* in the fundamental baſs has this happy effect, that the notes *fa, ſol, la, ſi,* may immediately ſucceed each other in aſcending the ſcale, which cannot take place (art. 48.) in the diatonic ſeries of the Greeks, becauſe that ſeries is formed from the mode of *ut* alone. From whence it follows:

1. That we change the mode at every time when we modulate three notes in ſucceſſion.

2. That if theſe three notes are ſung in ſucceſſion in the ſcale *ut, re, mi, fa, ſol, la, ſi, UT,* this cannot be done but by the aſſiſtance of a pauſe expreſſed or underſtood after the note *fa;* inſomuch, that the three tones *fa, ſol, la, ſi,* (three only becauſe the note *ſol* which is repeated is not enumerated) are ſuppoſed to belong to two different tetrachords.

2

Theory of Harmony.

146 Change of mode the cauſe of the difficulty in ſinging three conſecutive tones aſcending.

60. It ought not then any longer to ſurpriſe us, that we feel ſome difficulty whilſt we aſcend the ſcale in ſinging three tones in ſucceſſion, becauſe this is impracticable without changing the mode; and if one pauſes in the ſame mode, the fourth ſound above the firſt note will never be higher than a ſemitone above that which immediately precedes it; as may be ſeen by *ut, re, mi, fa,* and by *ſol, la, ſi, ut,* where there is no more than a ſemitone between *mi* and *fa,* and between *ſi* and *ut.*

147 Intervals, though altered in themſelves, form true conſonances with the fundamental baſs.

61. We may likewiſe obſerve in the ſcale *ut, re, mi, fa,* that the third minor from *re* to *fa* is not true, for the reaſons which have been already given (art. 49.). It is the ſame caſe with the third minor from *la* to *ut,* and with the third major from *fa* to *la*: but each of theſe ſounds form otherwiſe conſonances perfectly true, with their correſpondent ſounds in the fundamental baſs.

62. The thirds *la ut, fa la,* which were true in the former ſcale, are falſe in this; becauſe in the former ſcale *la* was the third of *fa,* and here it is the fifth of *re,* which correſponds with it in the fundamental baſs.

148 Fewer altered conſonances in the Greek ſcale than in ours.

63. Thus it appears, that the ſcale of the Greeks contains fewer conſonances that are altered than ours (P); and this likewiſe happens from the introduction of the mode of *ſol* into the fundamental baſs (Q).

We ſee likewiſe that the value of *la* in the diatonic ſcale, a value which authors have been divided in aſcertaining, ſolely depends upon the fundamental baſs, and that it muſt be different according as the note *la* has *fa* or *re* for its baſs. See the note (O).

CHAP. VII. *Of Temperament.*

149 Temperament, why neceſſary.

64. The alterations which we have obſerved in the intervals between particular ſounds of the diatonic ſcale, naturally lead us to ſpeak of temperament. To give a clear idea of this, and to render the neceſſity of it palpable, let us ſuppoſe that we have before us an inſtrument with keys, a harpſichord, for inſtance, conſiſting of ſeveral octaves or ſcales, of which each includes its twelve ſemitones.

Let

(P) In the ſcale of the Greeks, the note *la* being a third from *fa,* there is an altered fifth between *la* and *re*: but in ours, *la* being a fifth to *re,* produces two altered thirds, *fa la,* and *la ut;* and likewiſe a fifth altered, *la mi,* as we ſhall ſee in the following chapter. Thus there are in our ſcale two intervals more than in the ſcale of the Greeks which ſuffer alteration.

(Q) But here it may be with ſome colour objected: The ſcale of the Greeks, it may be ſaid, has a fundamental baſs more ſimple than ours; and beſides, in it there are fewer chords which will not be found exactly true: why then, notwithſtanding this, does ours appear more eaſy to be ſung than that of the Greeks? The Grecian ſcale begins with a ſemitone, whereas the intonation prompted by nature ſeems to impel us to riſe by a full tone at once. This objection may be thus anſwered. The ſcale of the Greeks is indeed better diſpoſed than ours for the ſimplicity of the baſs, but the arrangement of ours is more ſuitable to natural intonation. Our ſcale commences by the fundamental ſound *ut,* and it is in reality from that ſound that we ought to begin; it is from this that all the others naturally ariſe, and opon this that they depend; nay, if I may ſpeak ſo, in this they are included: on the contrary, neither the ſcale of the Greeks, nor its fundamental baſs, commences with *ut;* but it is from this *ut* that we muſt depart, in order to regulate our intonation, whether in riſing or deſcending: now, in aſcending from *ut,* the intonation, even of the Greek ſcale, gives the ſeries *ut, re, mi, fa, ſol, la:* and ſo true is it that the fundamental ſound *ut* is here the genuine guide of the ear, that if, before we modulate the ſound *ut,* we ſhould attempt to riſe to it by that note in the ſcale which is moſt immediately contiguous, we cannot reach it but by the note *ſi,* and by the ſemitone from *ſi* to *ut.* Now to make a tranſition from *ſi* to *ut,* by this ſemitone, the ear muſt of neceſſity be prediſpoſed for that modulation, and conſequently preoccupied with the mode of *ut:* if this were not the caſe, we ſhould naturally riſe from *ſi* to *ut*※, and by this operation paſs into another mode.

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See fig. F.

Let us chooſe in that harpſichord one of the ſtrings which will ſound the note UT, and let us tune the ſtring SOL to a perfect fifth with UT in aſcending; let us afterwards tune to a perfect fifth with this SOL the RE which is above it; we ſhall evidently perceive that this RE will be in the ſcale above that from which we ſet out: but it is alſo evident that this RE muſt have in the ſcale a *re* which correſponds with it, and which muſt be tuned a true octave below RE; and between this and SOL there ſhould be the interval of a fifth; ſo that the *re* in the firſt ſcale will be a true fourth below the SOL of the ſame ſcale. We may afterwards tune the note LA of the firſt ſcale to a juſt fifth with this laſt *re*; then the note MI in the higheſt ſcale to a true fifth with this new LA, and of conſequence the *mi* in the firſt ſcale to a true fourth beneath this ſame LA: Having finiſhed this operation, it will be found that the laſt *mi*, thus tuned, will by no means form a juſt third major from the ſound UT (R): that is to ſay, that it is impoſſible for *mi* to conſtitute at the ſame time the third major of UT and the true fifth of LA; or, what is the ſame thing, the true fourth of LA in deſcending.

65. What is ſtill more, if, after having ſucceſſively and alternately tuned the ſtrings UT, SOL, *re*, LA, *mi*, in perfect fifths and fourths one from the other, we continue to tune ſucceſſively by true fifths and fourths the ſtrings *mi*, *ſi*, *fa*※, *ut*※, *ſol*※, *re*※, *mi*※, *ſi*※; we ſhall find, that, though *ſi*※, being a ſemitone higher than the natural note, ſhould be equivalent to UT natural, it will by no means form a juſt octave to the firſt *ut* in the ſcale, but be conſiderably higher (S); yet this *ſi*※ upon the harpſichord ought not to be different from the octave above UT; for every *ſi*※ and every UT is the ſame ſound, ſince the octave or the ſcale only conſiſts of twelve ſemitones.

150 Reaſons and rules for temperament.

66. From thence it neceſſarily follows, 1. That it is impoſſible that all the octaves and all the fifths ſhould be juſt at the ſame time, particularly in inſtruments which have keys, where no intervals leſs than a ſemitone are admitted. 2. That, of conſequence, if the fifths are juſtly tuned, ſome alteration muſt be made in the octaves; now the ſympathy or ſound which ſubſiſts between any note and its octave, does not permit us to make ſuch an alteration: this perfect coaleſcence of ſound is the cauſe why the octave

T* ſhould

(R) The LA conſidered as the fifth of *re* is $\frac{27}{16}$, and the fourth beneath this LA will conſtitute $\frac{3}{4}$ of $\frac{27}{16}$, that is to ſay, $\frac{81}{64}$; $\frac{81}{64}$ then ſhall be the value of *mi*, conſidered as a true fourth from LA in deſcending: now *mi*, conſidered as the third major of the ſound UT, is $\frac{5}{4}$, or $\frac{80}{64}$: theſe two *mi*'s then are between themſelves in the proportion of 81 to 80; thus it is impoſſible that *mi* ſhould be at the ſame time a perfect third major from UT, and a true fourth beneath LA.

(S) In effect, if you thus alternately tune the fifth above, and the fourth below, in the ſame octave, you may here ſee what will be the proceſs of your operation.

UT, SOL, a fifth; *re* a fourth; LA a fifth; *mi* a fourth; *ſi* a fifth; *fa*※ a fourth; *ut*※ a fifth; *ſol*※ a fourth; RE※ a fifth; *la*※ a fourth; MI※ or FA a fifth; ※ a fourth: now it will be found, by a very eaſy computation, that the firſt UT being repreſented by 1, SOL ſhall be $\frac{3}{2}$, *re* $\frac{9}{8}$, LA $\frac{27}{16}$, *mi* $\frac{81}{64}$, &c. and ſo of the reſt till you arrive at *ſi*※, which will be found $\frac{531441}{262144}$. This fraction is evidently greater than the number 2, which expreſſes the perfect octave *ut* to its correſpondent UT; and the octave below *ſi*※ would be one half of the ſame fraction, that is to ſay $\frac{531441}{524288}$, which is evidently greater than UT repreſented by unity. This laſt fraction $\frac{531441}{524288}$ is compoſed of two numbers; the numerator of the fraction is nothing elſe but the number 3 multiplied 11 times in ſucceſſion by itſelf, and the denominator is the number 2 multiplied 18 times in ſucceſſion by itſelf. Now it is evident, that this fraction, which expreſſes the value of *ſi*※, is not equal to the unity which expreſſes the value of the ſound UT: though, upon the harpſichord, *ſi*※ and UT are identical. This fraction riſes above unity by $\frac{7153}{524288}$, that is to ſay, by about $\frac{1}{73}$; and this difference was called the *comma of Pythagoras*. It is palpable that this comma is much more conſiderable than that which we have already mentioned (note N), and which is only $\frac{1}{81}$.

We have already proved that the ſeries of fifths produces an *ut* different from *ſi*※, the ſeries of thirds major gives another ſtill more different. For, let us ſuppoſe this ſeries of thirds, *ut*, *mi*, *ſol*※, *ſi*※, we ſhall have *mi* equal to $\frac{5}{4}$, *ſol*※ to $\frac{25}{16}$, and *ſi*※ to $\frac{125}{64}$, whoſe octave below is $\frac{125}{128}$; from whence it appears, that this laſt *ſi* is leſs than unity (that is to ſay, than *ut*), by $\frac{3}{128}$, or by $\frac{1}{42}$, or near it: A new comma, much greater than the preceding, and which the Greeks have called *apotome major*.

It may be obſerved, that this *ſi*※, deduced from the ſeries of thirds, is to the *ſi*※ deduced from the ſeries of fifths, as $\frac{125}{128}$ is to $\frac{531441}{524288}$; that is to ſay, in multiplying by 524288, as 125 multiplied by 4096 is to 531441, or as 51200 to 531441, that is to ſay, nearly as 26 is to 27: from whence it may be ſeen, that theſe two *ſi*'s※ are very conſiderably different one from the other, and even ſufficiently different to make the ear ſenſible of it; becauſe the difference conſiſts almoſt of a minor ſemitone, whoſe value, as will afterwards be ſeen (art. 139.) is $\frac{25}{24}$.

Moreover, if, after having found the *ſol*※ equal to $\frac{25}{16}$, we then tune by fifths and by fourths, *ſol*※, *re*※, *la*※, *mi*※, *ſi*※, as we have done with reſpect to the firſt ſeries of fifths, we find that the *ſi*※ muſt be $\frac{2025}{2048}$; its difference, then, from unity, or, in other words, from UT, is $\frac{23}{2048}$, that is to ſay, about $\frac{1}{89}$; a comma ſtill leſs than any of the preceding, and which the Greeks have called *apotome minor*.

In a word, if, after having found *mi* equal to $\frac{5}{4}$ in the progreſſion of thirds, we then tune by fifths and fourths *mi*, *ſi*, *fa*※, *ut*※, &c. we ſhall arrive at a new *ſi*※, which ſhall be $\frac{32805}{32768}$, and which will not differ from unity but by about $\frac{1}{885}$, which is the laſt and ſmalleſt of all the commas; but it muſt be obſerved, that, in this caſe, the thirds major from *mi* to *ſol*※, from *ſol*※ to *ſi*※ or *ut*, &c. are extremely falſe, and greatly altered.

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should serve as limits to the other intervals, and that all the notes which rise above or fall below the ordinary scale, are no more than replications, *i. e.* repetitions, of all that have gone before them. For this reason, if the octave were altered, there could be no longer any fixed point either in harmony or melody. It is then absolutely necessary to tune the *ut* or *si*※ in a just octave with the first; from whence it follows, that, in the progression of fifths, or what is the same thing, in the alternate series of fifths and fourths, UT, SOL, *re*, LA, *mi*, *si*, *fa*※, *ut*※, *sol*※, *re*※, *la*※, *mi*※, *si*※, it is necessary that all the fifths should be altered, or at least some of them. Now, since there is no reason why one should rather be altered than another, it follows, that we ought to alter them all equally. By these means, as the alteration is made to influence all the fifths, it will be in each of them almost imperceptible; and thus the fifth, which, after the octave, is the most perfect of all consonances, and which we are under the necessity of altering, must only be altered in the least degree possible.

67. It is true, that the thirds will be a little harsh: but as the interval of sounds which constitutes the third, produces a less perfect coalescence than that of the fifth, it is necessary, says M. Rameau, to sacrifice the justice of that chord to the perfection of the fifth; for the more perfect a chord is in its own nature, the more displeasing to the ear is any alteration which can be made in it. In the octave the least alteration is insupportable.

151 Its definition.

68. This change in the intervals of instruments which have, or even which have not, keys, is that which we call *temperament*.

152 Principle whence its theory may be deduced.

69. It results then from all that we have now said, that the theory of temperament may be reduced to this question.—The alternate succession of fifths and fourths having been given, UT, SOL, *re*, LA, *mi*, *si*, *fa*※, *ut*※, *sol*※, *re*※, *la*※, *mi*※, *si*※, in which *si*※ or *ut* is not the true octave of the first UT, it is proposed to alter all the fifths equally, in such a manner that the two *ut's* may be in a perfect octave the one to the other

153 Practical directions for temperament.

70. For a solution of this question, we must begin with tuning the two *ut's* in a perfect octave the one to the other; in consequence of which, we will render all the semitones which compose the octave as equal as possible. By this means (T) the alteration made in each fifth will be very considerable, but equal in all of them.

154 Rameau's method of temperament proposed.

71. In this, then, the theory of temperament consists: but as it would be difficult in practice to tune a harpsichord or organ by thus rendering all the semitones equal, M. Rameau, in his *Generation Harmonique*, has furnished us with the following method, to alter all the fifths as equally as possible.

72. Take any key of the harpsichord which you please; but let it be towards the middle of the instrument; for instance, UT: then tune the note SOL a fifth above it, at first with as much accuracy as possible; this you may imperceptibly diminish: tune afterwards the fifth to this with equal accuracy, and diminish it in the same manner; and thus proceed from one fifth to another

(T) All the semitones being equal in the temperament proposed by M. Rameau, it follows, that the twelve semitones *ut*, *ut*※, *re*, *re*※, *mi*, *mi*※, &c. shall form a continued geometrical progression; that is to say, a series in which *ut*, shall be to *ut*※ in the same proportion as *ut*※ to *re*, as *re* to *re*※, &c. and so of the rest.

These twelve semitones are formed by a series of thirteen sounds, of which *UT* and its octave *ut* are the first and last. Thus to find by computation the value of each sound in the temperament, which is the present object of our speculations, our scrutiny is limited to the investigation of eleven other numbers between 1 and 2 which may form with the 1 and the 2 a continued geometrical progression.

However little any one is practised in calculation, he will easily find each of these numbers, or at least a number approaching to its value. These are the characters by which they may be expressed, which mathematicians will easily understand, and which others may neglect.

UT	*ut*※	*re*	*re*※	*mi*	*fa*	*fa*※	*sol*	*sol*※
1	$\sqrt[12]{2}$	$\sqrt[12]{2^2}$	$\sqrt[12]{2^3}$	$\sqrt[12]{2^4}$	$\sqrt[12]{2^5}$	$\sqrt[12]{2^6}$	$\sqrt[12]{2^7}$	$\sqrt[12]{2^8}$
	la	*la*※	*si*	*ut*				
	$\sqrt[12]{2^9}$	$\sqrt[12]{2^{10}}$	$\sqrt[12]{^{11}}$	$\sqrt[12]{^{12}}$				

It is obvious, that in this temperament all the fifths are equally altered. One may likewise prove, that the alteration of each in particular is very inconsiderable; for it will be found, for instance, that the fifth from *ut* to *sol*, which should be $\frac{3}{2}$, ought to be diminished by about $\frac{1}{12}$ of $\frac{1}{73}$; that is to say, by $\frac{1}{876}$, a quantity almost inconceivably small.

It is true, that the thirds major will be a little more altered; for the third major from *ut* to *mi*, for instance, shall be increased in its interval by about $\frac{1}{100}$: but it is better, according to M. Rameau, that the alteration should fall upon the third than upon the fifth, which after the octave is the most perfect chord, and from the perfection of which we ought never to degenerate but as little as possible.

Besides, it has appeared from the series of thirds major *ut*, *mi*, *sol*※, *si*※, that this last *si*※ is very different from *ut* (note s); from whence it follows, that if we would tune this *si*※ in unison with the octave of *ut*, and alter at the same time each of the thirds major by a degree as small as possible, they must all be equally altered. This is what occurred in the temperament which we propose; and if in it the third be more altered than the fifth, it is a consequence of the difference which we find between the degrees of perfection in these intervals; a difference with which, if we may speak so, the temperament proposed conforms itself. Thus this diversity of alteration is rather advantageous than inconvenient.

another in ascent; and as the ear does not appreciate so exactly sounds that are extremely sharp, it is necessary, when by fifths you have risen to notes extremely high, that you should tune in the most perfect manner the octave below the last fifth which you had immediately formed; then you may continue always in the same manner; till in this process you arrive at the last fifth from *mi*※ to *fi*※, which should of themselves be in tune; that is to say, they ought to be in such a state, that *fi*※, the highest note of the two which compose the fifth, may be identical with the sound UT, with which you began, or at least the octave of that sound perfectly just: it will be necessary then to try if this UT, or its octave, forms a just fifth with the last sound *mi*※ or *fa* which has been already tuned. If this be the case, we may be certain that the harpsichord is properly tuned. But if this last fifth be not true, in this case it will be too sharp, and it is an indication that the other fifths have been too much diminished, or at least some of them; or it will be too flat, and consequently discover that they have not been sufficiently diminished. We must then begin and proceed as formerly, till we find the last fifth in tune of itself, and without our immediate interposition (υ).

By

(υ) All that remains, is to acknowledge, with M. Rameau, that this temperament is far remote from that which is now in practice: you may here see in what this last temperament consists as applied to the organ or harpsichord. They begin with *UT* in the middle of the keys, and they flatten the four first fifths *sol, re, la, mi,* till they form a true third major from *mi* to *ut;* afterwards, setting out from this *mi*, they tune the fifths *si, fa*※, *ut*※, *sol*※, but flattening them still less than the former, so that *sol*※ may almost form a true third major with *mi.* When they have arrived at *sol*※, they stop; they resume the first *ut*, and tune to it the fifth *fa* in descending, then the fifth *si*♭, &c. and they heighten a little all the fifths till they have arrived at *la*♭, which ought to be the same with the *sol*※ already tuned.

If, in the temperament commonly practised, some thirds are found to be less altered than in that prescribed by M. Rameau, in return, the fifths in the first temperament are much more false, and many thirds are likewise so; insomuch, that upon a harpsichord tuned according to the temperament in common use, there are five or six modes which the ear cannot endure, and in which it is impossible to execute any thing. On the contrary, in the temperament suggested by M. Rameau, all the modes are equally perfect; which is a new argument in its favour, since the temperament is peculiarly necessary in passing from one mode to another, without shocking the ear; for instance, from the mode of *ut* to that of *sol,* from the mode of *sol* to that of *re,* &c. It is true, that this uniformity of modulation will to the greatest number of musicians appear a defect: for they imagine, that, by tuning the semitones of the scale unequal, they give each of the modes a peculiar character; so that, according to them, the scale of *ut,*

ut, re, mi, fa, sol, la, si, UT,

is not perfectly similar to the gammut or diatonic scale of the mode of *mi*

mi, fa※, *sol*※, *la*※, *si, ut*※, *re*※, *mi,*

which, in their judgment, renders the modes of *ut* and *mi* proper for different manners of expression. But after all that we have said in this treatise on the formation of diatonic intervals, every one should be convinced, that, according to the intention of nature, the diatonic scale ought to be perfectly the same in all its modes: The contrary opinion, says M. Rameau, is a mere prejudice of musicians. The character of an air arises chiefly from the intermixture of the modes; from the greater or lesser degrees of vivacity in the movement; from the tones, more or less grave, or more or less acute, which are assigned to the generator of the mode; and from the chords more or less beautiful, as they are more or less deep, more or less flat, more or less sharp, which are found in it.

In short, the last advantage of this temperament is, that it will be found conformed, or at least very little different from that which they practice upon instruments without keys; as the bass-viol, the violin, in which true fifths and fourths are preferred to thirds and sixths tuned with equal accuracy; a temperament which appears incompatible with that commonly used in tuning the harpsichord.

Yet we must not suffer our readers to be ignorant, that M. Rameau, in his *New System of Music,* printed in 1726, had adopted the ordinary temperament. In that work, (as may be seen CHAP. XXIV.), he pretends that the alteration of the fifths is much more supportable than that of the thirds major; and that this last interval can hardly suffer a greater alteration than the octave, which, as we know, cannot suffer the slightest alteration. He says, that if three strings are tuned, one by an octave, the other by a fifth, and the next by a third major to a fourth string, and if a sound be produced from the last, the strings tuned by a fifth will vibrate, though a little less true than it ought to have been; but that the octave and the third major, if altered in the least degree, will not vibrate: and he adds, that the temperament which is now practised, is founded upon that principle. M. Rameau goes still farther; and as, in the ordinary temperament, there is a necessity for altering the last thirds major, and to make them a little more sharp, that they may naturally return to the octave of the principal sound, he pretends that this alteration is tolerable, not only because it is almost insensible, but because it is found in modulations not much in use, unless the composer should choose it on purpose to render the expression stronger. "For it is proper to remark (says he), that we receive different impressions from the intervals in proportion to their different alterations: for instance, the third major, which naturally elevates us to joy, in proportion as we feel it, heightens our feelings even to a kind of fury, when it is tuned too sharp; and the third minor, which naturally inspires us with tenderness and serenity, depresses us to melancholy when it is too flat." All this strain, as you may see, is immensely different from that which this celebrated musician afterwards

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By this method all the twelve founds which compofe one of the fcales fhall be tuned: nothing is neceffary but to tune with the greateft poffible exactnefs their octaves in the other fcale, and the harpfichord fhall be well tuned.

155 Alterations by either method hardly difagreeable.

We have given this rule for temperament from M. Rameau; and it belongs only to difinterefted artifts to judge of it. However this queftion be determined, and whatever kind of temperament may be received, the alterations which it produces in harmony will be but very fmall, or not perceptible to the ear, whofe attention is entirely engroffed in attuning itfelf with the fundamental bafs, and which fuffers, without uneafinefs, thefe alterations, or rather takes no notice of them, becaufe it fupplies from itfelf what may be wanting to the truth and perfection of the intervals.

Simple and daily experiments confirm what we now advance. Liften to a voice which is accompanied, in finging, by different inftruments; though the temperament of the voice, and the temperament of each of the inftruments, are all different one from another, yet you will not be in the leaft affected with the kind of cacophony which ought to refult from thefe diverfities, becaufe the ear fuppofes thefe intervals true of which it does not appreciate differences.

We may give another experiment. Strike upon an organ the three keys *mi*, *fol*, *fi*, you will hear nothing but the minor perfect chord; though *mi*, by the conftruction of that inftrument, muft caufe *fol*※ likewife to be heard; though *fol* fhould have the fame effect upon *re*, and *fi* upon *fa*※; infomuch, that the ear is at once affected with all thefe founds, *re*, *mi*, *fa*※, *fol*, *fol*※, *fi*: how many diffonances perceived at the fame time, and what a jarring multitude of difcordant fenfations, would refult from thence to the ear, if the perfect chord with which it is pre-occupied had not power entirely to abftract its attention from fuch founds as might offend!

Chap. VIII. *Of Repofes or Cadences* (†).

156 Cadences perfect and imperfect, what and why.

73. In a fundamental bafs whofe procedure is by fifths, there always is, or always may be, a *repofe*, or crifis, in which the mind acquiefces in its tranfition from one found to another: but a repofe may be more or lefs diftinctly fignified, and of confequence more or lefs perfect. If one fhould rife by fifths; if, for inftance, we pafs from *ut* to *fol*; it is the generator which paffes to one of thefe fifths, and this fifth was already pre-exiftent in its generator: but the generator exifts no longer in this fifth; and the ear, as this generator is the principle of all harmony and of all melody, feels a defire to return to it. Thus the tranfition from a found to its fifth in afcent, is termed an *imperfect repofe*, or *imperfect cadence*; but the tranfition from any found to its fifth in defcent, is denominated a *perfect cadence*, or an *abfolute repofe*: it is the offspring which returns to its generator, and as it were recovers its exiftence once more in that generator itfelf, with which when founding it refounds (chap. i.)

See Repofe or Cadence.

157 Perfect cadences more or lefs perfect, and why.

74. Amongft abfolute repofes, there are fome, if we may be allowed the expreffion, more abfolute, that is to fay, more perfect, than others. Thus in the fundamental bafs

ut, *fol*, *ut*, *fa*, *ut*, *fol*, *re*, *fol*, *ut*,

which forms, as we have feen, the diatonic fcale of the moderns, there is an abfolute repofe from *re* to *fol*, as from *fol* to *ut*: yet this laft abfolute repofe is more perfect than the preceding, becaufe the ear, prepoffeffed with the mode of *ut* by the multiplied impreffion of the found *ut* which it has already heard thrice before, feels a defire to return to the generator *ut*; and it accordingly does fo by the abfolute repofe *fol*, *ut*.

158 Cadence in melody different from what it is in harmony.

75. We may ftill add, that what is commonly called *cadence* in melody, ought not to be confounded with what we name *cadence* in harmony.

In the firft cafe, this word only fignifies an agreeable and rapid alteration between two contiguous founds, called likewife a *trill* or *fhake*; in the fecond, it fignifies a repofe or clofe. It is however true, that this fhake implies, or at leaft frequently enough prefages, a repofe, either prefent or impending, in the fundamental bafs (x).

159 Cadences in the fundamental bafs neceffary in the diatonic fcale, and which the moft perfect.

76. Since there is a repofe in paffing from one found to another in the fundamental bafs, there is alfo a repofe in paffing from one note to another in the diatonic fcale, which is formed from it, and which this bafs reprefents: and as the abfolute repofe *fol ut*, is of

terwards exhibited in his *Generation Harmonique*, and in the performances which followed it. From this we can only conclude, that the reafons which, after him, we have urged for the new temperament, muft without doubt have appeared to him very ftrong, becaufe in his mind they had fuperfeded thofe which he had formerly adduced in favour of the ordinary temperament.

We do not pretend to give any decifion for either the one or the other of thefe methods of temperament, each of which appears to us to have its particular advantages. We fhall only remark, that the choice of the one or the other muft be left abfolutely to the tafte and inclination of the reader; without, however, admitting this choice to have any influence upon the principles of the fyftem of mufic, which we have followed even till this period, and which muft always fubfift, whatever temperament we adopt.

(†) That the reader may have a clear idea of the term before he enters upon the fubject of this chapter, it may be neceffary to caution him againft a miftake into which he may be too eafily led by the ordinary fignification of the word *repofe*. In mufic, therefore, it is far from being fynonymous with the word *reft*. It is, on the contrary, the termination of a mufical *phrafe* which ends in a cadence more or lefs emphatic, as the fentiment implied in the phrafe is more or lefs complete. Thus a repofe in mufic anfwers the fame purpofe as punctuation in language. See Repos in Rouffeau's Mufical Dictionary.

(x) M. Rouffeau, in his letter on French mufic, has called this alternate undulation of different founds a *trill*, from the Italian word *trillo*, which fignifies the fame thing; and fome French muficians already appear to have adopted this expreffion.

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of all others the most perfect in the fundamental bass, the repose from *si* to *ut*, which answers to it in the scale, and which is likewise terminated by the generator, is for that reason the most perfect of all others in the diatonic scale ascending.

160 Definition and use of a sensible note.

77. It is then a law dictated by nature itself, that if you would ascend diatonically to the generator of a mode, you can only do this by means of the third major from the fifth of that very generator. This third major, which with the generator forms a semitone, has for that reason been called the *sensible note*, as introducing the generator, and preparing us for the most perfect repose.

See Sensible note.

We have already proved, that the fundamental bass is the principle of melody. We shall besides make it appear in the sequel, that the effect of a repose in melody arises solely from the fundamental bass.

CHAP. IX. *Of the Minor Mode and its Diatonic Series.*

161 The diatonic series of the minor mode ascertained by different examples.

78. In the second chapter, we have explained (art. 29. 30. 31. and 32.) by what means, and upon what principle, the minor chord *ut*, *mi*♭, *sol*, *ut*, may be formed, which is the characteristical chord of the minor mode. Now what we have there said, taking *ut* for the principal and fundamental sound, we might likewise have said of any other note in the scale, assumed in the same manner as the principal and fundamental sound: but as in the minor chord *ut*, *mi*♭, *sol*, *ut*, there occurs a *mi*♭ which is not found in the ordinary diatonic scale, we shall immediately substitute, for greater ease and conveniency, another chord, which is likewise minor and exactly similar to the former, of which all the notes are found in the scale.

79. The scale affords us three chords of this kind, viz. *re*, *fa*, *la*, *re*; *la*, *ut*, *mi*, *la*; and *mi*, *sol*, *si*, *mi*. Amongst these three we shall choose *la*, *ut*, *mi*, *la*; because this chord, without including any sharp or flat, has two sounds in common with the major chord *ut*, *mi*, *sol*, *ut*; and besides, one of these two sounds is the very same *ut*: so that this chord appears to have the most immediate, and at the same time the most simple, relation with the chord *ut*, *mi*, *sol*, *ut*. Concerning this we need only add, that this preference of the chord *la*, *ut*, *mi*, *la*, to every other minor chord, is by no means in itself necessary for what we have to say in this chapter upon the diatonic scale of the minor mode. We might in the same manner have chosen any other minor chord; and it is only, as we have said, for greater ease and conveniency that we fix upon this.

162 Tonic or key in harmony, what. See Principal. See Tonic.

80. Let us now remark, that in every mode, whether major or minor, the *principal* sound which implies the perfect chord, whether major or minor, may be called the *tonic note* or *key*; thus *ut* is the key in its proper mode, *la* in the mode of *la*, &c. Having laid down this principle.

163 The formation of the scale pursued. See fig. D.

81. We have shown how the three sounds *fa*, *ut*, *sol*, which constitute (art. 38.) the mode of *ut*, of which the first *fa* and the last *sol* are the two-fifths of *ut*, one descending, the other rising, produce the scale *si*, *ut*, *re*, *mi*, *fa*, *sol*, *la*, of the major mode, by means of the fundamental bass *sol*, *ut*, *sol*, *ut*, *fa*, *ut*, *fa*: let us in the same manner take the three sounds *re*, *la*, *mi*, which constitute the mode of *la*, for the same reason that the sounds *fa*, *ut*, *sol*, constitute the mode of *ut*; and of them let us form this fundamental bass, perfectly like the preceding, *mi*, *la*, *mi*, *la*, *re*, *la*, *re*: let us afterwards place below each of these sounds one of their harmonics, as we have done (chap. v.) for the first scale of the major mode; with this difference, that we must suppose *re* and *la* as implying their thirds minor in the fundamental bass to characterise the minor mode; and we shall have the diatonic scale of that mode,

See fig. G.

sol※, *la*, *si*, *ut*, *re*, *mi*, *fa*.

82. The *sol*※, which corresponds with *mi* in the fundamental bass, forms a third major with that *mi*, though the mode be minor; for the same reason that a third from the fifth of the fundamental sound ought to be major (art. 77.) when that third rises to the fundamental sound *la*.

83. It is true, that, in causing *mi* to imply its third major *sol*, one might also rise to *la* by a diatonic progress. But that manner of rising to *la* would be less perfect than the preceding; for this reason (art. 76.), that the absolute repose or perfect cadence, *mi*, *la*, which is found in the fundamental bass, ought to be represented in the most perfect manner in the two notes of the diatonic scale which answer to it, especially when one of these two notes is *la*, the key itself upon which the repose is made. From whence it follows, that the preceding note *sol* ought rather to be sharp than natural; because *sol*※, being included in *mi* (art. 19.), much more perfectly represents the note *mi* in the bass, than the natural *sol* could do, which is not included in *mi*.

See Imply or Carry.

164 Diversities in the scales of the major and minor mode.

84. We may remark this first difference between the scale

sol※, *la*, *si*, *ut*, *re*, *mi*, *fa*,

and the scale which corresponds with it in the major mode

si, *ut*, *re*, *mi*, *fa*, *sol*, *la*,

that from *mi* to *fa*, which are the two last notes of the former scale, there is only a semitone; whereas from *sol*, to *la*, which are the two last sounds of the latter series, there is the interval of a complete tone: but this is not the only discrimination which may be found between the scales of the two modes.

165 Investigation of these differences and their reasons. See fig. E.

85. To investigate these differences, and to discover the reason for which they happen, we shall begin by forming a new diatonic scale of the minor mode, similar to the second scale of the major mode,

ut, *re*, *mi*, *fa*, *sol*, *sol*, *la*, *si*, *ut*.

That last series, as we have seen, was formed by means of the fundamental bass *fa*, *ut*, *sol*, *re*, disposed in this manner,

ut, *sol*, *ut*, *fa*, *ut*, *sol*, *re*, *sol*, *ut*.

Let us take in the same manner the fundamental bass *re la mi si*, and arrange it in the following order,

la, *mi*, *la*, *re*, *la*, *mi*, *si*, *mi*, *la*,

See fig. H.

and it will produce the scale immediately subjoined,

la, *si*, *ut*, *re*, *mi*, *mi*, *fa*※, *sol*※, *la*,

in which *ut* forms a third minor with *la*, which in the fundamental bass corresponds with it, which denominates the minor mode; and, on the contrary, *sol*※ forms a third major with *mi* in the fundamental bass, because *sol*※ rises towards *la*, (art. 82. and 83.)

86. We ſee beſides a *fa*※, which does not occur in the former,

ſol※; *la*, *ſi*, *ut*, *re*, *mi*, *fa*,

where *fa* is natural. It is becauſe, in the firſt ſcale, *fa* is a third minor from *re* in the baſs; and in the ſecond, *fa*※ is the fifth from *ſi* in the baſs.

166
Difference between the two ſcales of the minor mode greater than between thoſe of the major.

87. Thus the two ſcales of the minor mode are ſtill in this reſpect more different one from the other than the two ſcales of the major mode; for we do not remark this difference of a ſemitone between the two ſcales of the major mode. We have only obſerved (art. 63.) ſome difference in the value of *la* as it ſtands in each of theſe ſcales, but this amounts to much leſs than a ſemitone.

167
Fa and ſol ſharp in the minor mode, and why.

88. From thence it may be ſeen why *fa* and *ſol* are ſharp when aſcending in the minor mode; nay, beſides, the *fa* is only natural in the firſt ſcale *ſol*※, *la*, *ſi*, *ut*, *re*, *mi*, *fa*, becauſe this *fa* cannot riſe to *ſol*※, (art. 48.)

168
The caſe different in deſcending, and why.

89. It is not the ſame caſe in deſcending. For *mi*, the fifth of the generator, ought not to imply the third major *ſol*※, but in the caſe when that *mi* deſcends to the generator *la* to form a perfect repoſe (art. 77. and 83.); and in this caſe the third major *ſol*※ riſes to the generator *la*: but the fundamental baſs *la mi* may, in deſcending, give the ſcale *la ſol* natural, provided *ſol* does not riſe towards *la*.

169
Explication of the deſcending ſcale in the minor mode from a fundamental baſs difficult.

90. It is much more difficult to explain how the *fa*, which ought to follow this *ſol* in deſcending, is natural and not ſharp; for the fundamental baſs

la, *mi*, *ſi*, *mi*, *la*, *re*, *la*, *mi*, *la*,

produces in deſcending,

la, *ſol*, *fa*※, *mi*, *mi*, *re*, *ut*, *ſi*, *la*.

And it is plain that the *fa* cannot be otherwiſe than ſharp, ſince *fa*※ is the fifth of the note *ſi* of the fundamental baſs. In the mean time, experience evinces that the *fa* is natural in deſcending in the diatonic ſcale of the major mode of *la*, eſpecially when the preceding *ſol* is natural: and it muſt be acknowledged, that here the fundamental baſs appears in ſome meaſure defective.

170
Rameau's ſolution, though the only one, yet unſatisfactory.

M. Rameau has invented the following means for obtaining a ſolution of this difficulty. According to him, in the diatonic ſcale of the minor mode in deſcending, *la*, *ſol*, *fa*, *mi*, *re*, *ut*, *ſi*, *la*, *ſol*, may be regarded ſimply as a note of paſſage, merely added to give ſweetneſs to the modulation, and as a diatonic gradation by which we may deſcend to *fa* natural. It is eaſily perceived, according to M. Rameau, by this fundamental baſs,

la, *re*, *la*, *re*, *la*, *mi*, *la*,

which produces

la, *fa*, *mi*, *re*, *ut*, *ſi*, *la*;

which may be regarded, as he ſays, as the real ſcale of the minor mode in deſcending; to which is added *ſol* natural between *la* and *fa*, to preſerve the diatonic order.

This anſwer appears the only one which can be given to the difficulty above propoſed: but I know not whether it will fully ſatisfy the reader; whether he will not ſee with regret, that the fundamental baſs does not produce, to ſpeak properly, the diatonic ſcale of the minor mode in deſcent, when at the ſame time this ſame baſs ſo happily produces the diatonic ſcale of that identical mode in aſcending, and the diatonic ſcale of the major mode whether in riſing or deſcending (Y).

Chap. X. *Of Relative Modes.*

171
Modes relative, what. See Mode.

91. Two modes which are of ſuch a nature that we can paſs from the one to the other, are called *relative modes*. Thus we have already ſeen, that the major mode of *ut* is relative to the major mode of *fa* and to that of *ſol*. It may likewiſe appear from what goes before, how many intimate connections there are between the *ſpecies* (†) or major mode of *ut*, and the *ſpecies* or minor mode of *la*. For, 1. The perfect chords, one major *ut mi ſol ut*, the other minor *la ut mi la*, which characteriſe each of thoſe two kinds of modulation* or harmony, have two ſounds in common, *ut* or *mi*. 2. The diatonic ſcale of the minor mode of *la* in deſcent, abſolutely contains the ſame ſounds with the gammut or diatonic ſcale of the major mode of *ut*.

* See Modulation.

It is for this reaſon that the tranſition is ſo natural and eaſy from the major mode of *ut* to the minor mode of *la*, or from the minor mode of *la* to the major mode of *ut*, as experience proves.

92. In the minor mode of *mi*, the minor perfect chord *mi ſol ſi mi*, which characteriſes it, has likewiſe two ſounds, *mi*, *ſol*, in common with the perfect chord major *ut mi ſol ut*, which characteriſes the major mode of *ut*. But the minor mode of *mi* is not ſo cloſely related nor allied to the major mode of *ut* as to the minor mode of *la*; becauſe the diatonic ſcale of the minor mode of *mi* in deſcent, has not, like the ſeries of the

(Y) For what remains when *ſol* is ſaid to be natural in deſcending the diatonic ſcale of the minor mode of *la*, this only ſignifies, that this *ſol* is not neceſſarily ſharp in deſcending as it is in riſing; for this *ſol*, beſides, may be ſharp in deſcending to the minor mode of *la*, as may be proved by numberleſs examples, of which all muſical compoſitions are full. It is true, that when the ſound *ſol* is found ſharp in deſcending to the minor mode of *la*, ſtill we are not ſure that the mode is minor till the *fa* or *ut* natural is found; both of which impreſs a peculiar character on the minor mode, viz. *ut* natural, in riſing and deſcending, and the *fa* natural in deſcending.

(†) *Species* was the only word which occurred to the tranſlator in Engliſh by which he could render the French word *genre*. It is, according to Rouſſeau, intended to expreſs the different diviſions and diſpoſitions of the intervals which formed the two tetrachords in the ancient diatonic ſcale; and as the gammut of the moderns conſiſts likewiſe of two tetrachords, though diverſified from the former, as our author has ſhown at large, the *genre* or *ſpecies*, as the tranſlator has been obliged to expreſs it, muſt conſiſt in the various diſpoſitions and diviſions of the different intervals between the notes or ſemitones which compoſe the modern ſcale.

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the minor mode of *la*, all theſe ſounds in common with the ſcale of *ut*. In reality, this ſcale is *mi re ut ſi la ſol fa* ✕ *mi*, where there occurs a *fa* ſharp which is not in the ſcale of *ut*. We may add, that though the minor mode of *mi* is leſs relative to the major mode of *ut* than that of *la*; yet the artiſt does not heſitate ſometimes to paſs immediately from the one to the other.

Of this may be ſeen one inſtance (among many others) in the prologue *des Amours, des Dieux*, at this paſſage *Ovide eſt l'objet de la fete*, which is in the minor mode of *mi*, though what immediately precedes it is in the major mode of *ut*.

We may ſee beſides, that when we paſs from one mode to another by the interval of a third, whether in deſcending or riſing, as from *ut* to *la*, or from *la* to *ut*, from *ut* to *mi*, or from *mi* to *ut*, the major mode becomes minor, or the minor mode becomes major.

93. There is ſtill another minor mode, into which an immediate tranſition may be made in iſſuing from the major mode of *ut*. It is the minor mode of *ut* itſelf in which the perfect minor chord *ut mi* ♭ *ſol ut* has two ſounds, *ut* and *ſol*, in common with the perfect major chord *ut mi ſol ut*. Nor is there any thing more common than a tranſition from the major mode of *ut* to the minor mode, or from the minor to the major (z.)

Chap. IX. *Of Diſſonance.*

172 Caſes in which the mode is uncertain.

94. We have already obſerved, that the mode of *ut* (*fa, ut, ſol*), has two ſounds in common with the mode of *ſol* (*ut, ſol, re*); and two ſounds in common with the mode of *fa* (*ſi* ♭ *fa ut*); of conſequence, this procedure of the baſs *ut ſol* may belong to the mode of *ut*, or to the mode of *ſol*, as the procedure of the baſs *fa ut*, or *ut fa*, may belong to the mode of *ut* or the mode of *fa*. When any one therefore paſſes from *ut* to *fa* or to *ſol* in a fundamental baſs, he is ſtill ignorant even to that criſis what mode he is in. It would be, however, advantageous to know it, and to be able by ſome means to diſtinguiſh the generator from its fifths.

173 How we may inveſtigate the generator and its fifths, and by that means determine the mode.

95. This advantage may be obtained by uniting at the ſame time the ſounds *ſol* and *fa* in the ſame harmony, that is to ſay by joining to the harmony *ſol ſi re* of the fifth *ſol*, the other fifth *fa* in this manner, *ſol, ſi, re, fa*; this *fa* which is added, forms a diſſonance with *ſol* (art. 18.) It is for that reaſon that the chord *ſol ſi re fa*, is called a *diſſonant* chord, or a chord of the ſeventh. It ſerves to diſtinguiſh the fifth *ſol* from the generator *ut*, which always implies, without mixture or alteration, the perfect chord *ut, mi, ſol, ut*, reſulting from nature itſelf (art. 32.) By this we may ſee, that when we paſs from *ut* to *ſol*, one paſſes at the ſame time from *ut* to *fa*, becauſe *fa* is found to be comprehended in the chord of *ſol*; and the mode of *ut* by theſe means plainly appears to be determined, becauſe there is none but that mode to which the ſounds *fa* and *ſol* at once belong.

174 Manner of treating diſſonances continued.

96. Let us now ſee what may be added to the harmony *fa, la, ut*, of the fifth *fa* below the generator, to diſtinguiſh this harmony from that of the generator. It ſeems probable at firſt, that we ſhould add to it the other fifth *ſol*, ſo that the generator *ut*, in paſſing to *fa*, may at the ſame time paſs to *ſol*, and that by this the mode ſhould be determined: but this introduction of *ſol*, in the chord *fa, la, ut*, would produce two ſeconds in ſucceſſion *fa, ſol, ſol, la*, that is to ſay, two diſſonances whoſe union would prove extremely harſh to the ear; an inconvenience which ought carefully to be avoided. For if, to diſtinguiſh the mode, we ſhould alter the harmony of the fifth *fa* in the fundamental baſs, it muſt only be altered in the leaſt degree poſſible

175 Chord of the great ſixth.

97. For this reaſon, inſtead of *ſol*, we ſhall take its fifth *re*, which is the ſound that approaches it the neareſt; and we ſhall have, inſtead of the fifth *fa*, the chord *fa, la, ut, re*, which is called a *chord of the great ſixth*.

One may here remark the analogy there is obſerved between the harmony of the fifth *ſol* and that of the fifth *fa*.

176 The ſubject of diſſonances continued.

98. The fifth *ſol*, in riſing above the generator, gives a chord entirely conſiſting of thirds aſcending from *ſol*, *ſol, ſi, re, fa*; now the fifth *fa* being below the generator *ut* in deſcending, we ſhall find, as we go lower by thirds from *ut* towards *fa*, the ſame ſounds *ut, la, fa, re*, which form the chord *fa, la, ut, re*, given to the fifth *fa*.

99. It appears beſides, that the alteration of the harmony in the two fifths conſiſts only in the third minor *re, fa*, which was reciprocally added to the harmony of theſe two fifths.

Chap. XII. *Of the Double Uſe or Employment of Diſſonance.*

177 Account of the double employment.

100. It is evident by the reſemblance of ſounds to their octaves, that the chord *fa, la, ut, re*, is in effect the ſame as the chord *re, fa, la, ut*, taken inverſely*, that the inverſe of the chord *ut, la, fa, re*, has been found

* See Inverted.

(z) There are likewiſe other minor modes, into which we may paſs in our egreſs from the mode major of *ut*; as that of *fa* minor, in which the perfect minor chord *fa, la* ♭, *ut*, includes the ſound *ut*, and whoſe ſcale in aſcent *fa, ſol, la* ♭, *ſi* ♭, *ut, re, mi, fa*, only includes the two ſounds *la* ♭, *ſi* ♭, which do not occur in the ſcale of *ut*. We find an example of this tranſition from the mode major of *ut* to that of *fa* minor, in the opera of *Pygmalion* by M. Rameau, where the *ſarabando* is in the minor mode of *fa*, and the *rigadoon* in the mode major of *ut*. This kind of tranſition, however, is not frequent.

The minor mode of *re* has only in its ſcale aſcending *re, mi, fa, ſol, la, ſi, ut* ✕, *re*, one *ut* ſharp which is not found in the ſcale of *ut*. For this reaſon a tranſition may likewiſe be made, without grating the ear, from the mode of *ut* major to the mode of *re* minor; but this paſſage is leſs immediate than the former, becauſe the chords *ut, mi, ſol, ut, re, fa, la, re*, not having a ſingle ſound in common, one cannot (art. 37.) paſs immediately from the one to the other.

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found (art. 98.) in descending by thirds from the generator *ut* (AA).

178 Difference between dominant and tonic dominant.

101. The chord *re, fa, la, ut*, is a chord of the seventh like the chord *sol, si, re, fa*: with this only difference, that in this the third *sol, si*, is major: whereas in the second, the third *re, fa*, is minor. If the *fa* were sharp, the chord *re, fa*※, *la, ut*, would be a genuine chord of the dominant, like the chord *sol, si, re, fa*; and as the dominant *sol* may descend to *ut* in the fundamental bass, the dominant *re* implying or carrying with it the third major *fa* ※ might in the same manner descend to *sol*.

102. Now I say that if the *fa* ※ should be changed into *fa* natural, *re*, the fundamental tone of this chord *re, fa, la, ut*, might still descend to *sol*; for the change from *fa*※ to *fa* natural, will have no other effect, than to preserve the impression of the mode of *ut*, instead of that of the mode of *sol*, which the *fa* ※ would have here introduced. For what remains, the note *re* will always preserve its character as the dominant, on account of the mode of *ut*, which forms a seventh. Thus in the chord of which we treat, *re, fa, la, ut, re*, may be considered as an *imperfect dominant*: I call it *imperfect*, because it carries with it the third minor *fa*, instead of the third major *fa*※. It is for this reason that in the sequel I shall call it simply the *dominant*, to distinguish it from the dominant *sol*, which shall be named the *tonic dominant* †.

† See Dominant.

103. Thus the sounds *fa* and *sol*, which cannot succeed each other (art. 37.) in a diatonic bass, when they only carry with them the perfect chords *fa, la, ut, sol, si, re*, may succeed one another if you join *re* to the harmony of the first, and *fa* to the harmony of the second; and if you invert the first chord, that is to say, if you give to the two chords this form *re, fa, la, ut, sol, si, re, fa*.

179 Seeming contradictions reconciled.

104. Besides, the chord *fa, la, ut, re*, being allowed to succeed the perfect chord *ut, mi, sol, ut*, it follows for the same reasons, that the chord *ut, mi, sol, ut*, may be succeeded by *re, fa, la, ut*; which is not contradictory to what we have above said (art. 37.), that the sounds *ut* and *re* cannot succeed one another in the fundamental bass: for in the passage quoted, we had supposed that both *ut* and *re* carried with them a perfect chord major; whereas, in the present case, *re* carries the third minor *fa*, and likewise the sound *ut*, by which the chord *re fa la ut* is connected with that which precedes it *ut mi sol ut*; and in which the sound *ut* is found. Besides, this chord, *re fa la ut*, is properly nothing else but the chord *fa la ut re* inverted, and if we may speak so, disguised.

180 Double employment, what, and why so called.

105. This manner of presenting the chord of the sub-dominant under two different forms, and of employing it under these two different forms, has been called by M. Rameau its *double office* or *employment* †. This is the source of one of the finest varieties in harmony; and we shall see in the following chapter the advantages which result from it.

† See Double employment.

We may add, that as this double employment is a kind of licence, it ought not to be practised without some precaution. We have lately seen that the chord *re fa la ut*, considered as the inverse of *fa la ut re*, may succeed to *ut mi sol ut*, but this liberty is not reciprocal: and though the chord *fa la ut re* may be followed by the chord *ut mi sol ut*, we have no right to conclude from thence that the chord *re fa la ut*, considered as the inverse of *fa la ut re*, may be followed by the chord *ut mi sol ut*. For this the reason shall be given Chap. XVI.

Chap. XIII. *Concerning the Use of this Double Employment, aud its Rules.*

181 By the double use of the abovementioned chord, the impression of the mode may be preserved.

106. We have shown (chap. vi.) how the diatonic scale, or ordinary gammut, may be formed from the fundamental bass *fa, ut, sol, re*, by twice repeating the word *sol* in that series; so that this gammut is primitively and originally composed of two similar tetrachords, one in the mode of *ut*, the other in that of *sol*. Now it is possible, by means of this double employment, to preserve the impression of the mode of *ut* through the whole extent of the scale, without twice repeating the note *sol*, or even without supposing this repetition. For this effect we have nothing to do but form the following fundamental bass,

ut, sol, ut, fa, ut, re, sol, ut:

in which *ut* is understood to carry with it the perfect chord *ut mi sol ut*; *sol*, the chord *sol si re fa*; *fa*, the chord

(AA) "M. Rameau, in several passages of his works (for instance, in p. 110, 111, 112, and 113, of the *Generation Harmonique)*, appears to consider the chord *re, fa, la, ut*, as the primary chord and generator of the chord *fa, la, ut, re*, which is nothing but that chord itself reversed; in other passages (particularly in p. 116. of the same performance), he seems to consider the first of these chords as nothing else but the reverse of the second. It would seem that this great artist has neither expressed himself upon this subject with so much uniformity nor with so much precision as is required. For my own part, I think there is some foundation for considering the chord *fa, la, ut, re*, as primitive: 1. Because in this chord, the fundamental and principal note is the sub-dominant *fa*, which ought in effect to be the fundamental and principal sound in the chord of the sub-dominant. 2. Because that without having recourse, with M. Rameau, to harmonical and arithmetical progressions, of which the consideration appears to us quite foreign to the question, we have found a probable and even a satisfactory reason for adding the note *re* to the harmony of the fifth *fa* (art. 96. and 97.) The origin thus assigned for the chord of the sub-dominant appears to us the most natural, though M. Rameau does not appear to have felt its full value; for scarcely has it been slightly insinuated by him."

Thus far our author. We do not enter with him into the controversy concerning the origin of the chord in question; but only propose to add to his definition of the sub-dominant Rousseau's idea of the same note. It is a name, says he, given by M. Rameau to the fourth note in any modulation relative to a given key, which of consequence is in the same interval from the key in descending as the dominant in rising; from which circumstance it takes its name.

chord *fa la ut re;* and *re*, the chord *re fa la ut.* It is plain from what has been said in the preceding chapter, that in this case *ut* may ascend to *re* in the fundamental bass, and *re* descend to *sol*, and that the impression of the mode of *ut* is preserved by the *fa* natural, which forms the third minor *re fa*, instead of the third major which *re* ought naturally to imply.

107. This fundamental bass will give, as it is evident, the ordinary diatonic scale,

ut, re, mi, fa, sol, la, si, UT,

which of consequence will be in the mode of *ut* alone; and if one should choose to have the second tetrachord in the mode of *sol*, it will be necessary to substitute *fa*♯ instead of *fa* natural in the harmony of *re* (BB).

108. Thus the generator *ut* may be followed according to pleasure in ascending diatonically either by a tonic dominant (*re fa*♯ *la ut*), or by a simple dominant (*re fa la ut*).

109. In the minor mode of *la*, the tonic dominant *mi* ought always to imply its third major *mi sol*♯, when this dominant *mi* descends to the generator *la* (art. 83.); and the chord of this dominant shall be *mi sol*♯ *si re*, entirely similar to *sol si re fa*. With respect to the sub-dominant *re*, it will immediately imply the third minor *fa*, to denominate the minor mode; and we may add *si* above its chord *re fa la*, in this manner *re fa la si*, a chord similar to that of *fa la ut re;* and as we have deduced from the chord *fa la ut re* that of *re fa la ut*, we may in the same manner deduce from the chord *re fa la si* a new chord of the seventh *si re fa la*, which will exhibit the *double employment of dissonances* in the minor mode.

110. One may employ this chord *si re fa la*, to preserve the impression of the mode of *la* in the diatonic scale of the minor mode, and to prevent the necessity of twice repeating the sound *mi;* but in this case, the *fa* must be rendered sharp, and change this chord to *si re fa*♯ *la*, the fifth of *si* is *fa*♯, as we have seen above; this chord is then the inverse of *re fa*♯ *la si*, where the subdominant implies the third major, which ought not to surprise us. For in the minor mode of *la*, the second tetrachord *mi fa*♯ *sol*♯ *la* is exactly the same as it would be in the major mode of *la;* now, in the major mode of *la*, the sub-dominant *re* ought to imply the third major *fa*♯.

182 Diversities in the minor mode more numerous than in the major.

111. From thence we may see that the minor mode is susceptible of a much greater number of varieties than the major: likewise the major mode is the product of nature alone; whereas the minor is, in some measure, the product of art. But in return, the major mode has received from nature, to which it owes its immediate formation, a force and energy which the minor cannot boast.

Chap. XIV. *Of the Different Kinds of Chords of the Seventh.*

183 Investigation whether art, in consequence of some successful advances, may not be carried farther.

112. The dissonance added to the chord of the dominant and of the sub-dominant, though in some measure insinuated by nature (chap. xi.), is nevertheless a work of art; but as it produces great beauties in harmony by the variety which it introduces into it, let us discover whether in consequence of this first advance, art may not still be carried farther.

184 Different chords of the seventh.

113. We have already three different kinds of chords of the seventh, *viz.*

1. The chord *sol si re fa*, composed of a third major followed by two thirds minor.

2. The chord *re fa la ut*, or *si re fa*♯ *la*, composed of a third major between two minors.

3. The chord *si re fa la*, composed of two thirds minor followed by a major.

114. There are still two other kinds of chords of the seventh which are employed in harmony; one is composed of a third minor between two thirds major, *ut mi sol si*, or *fa la ut mi;* the other is wholly composed of thirds minor *sol*♯ *si re fa*. These two chords, which at first appear as if they ought not to enter into harmony if we rigorously keep to the preceding rules, are nevertheless frequently practised with success in the fundamental bass. The reason is this:

185 The chords last described admissible, and why.

115. According to what has been said above, if we would add a seventh to the chord *ut mi sol*, to make a dominant of *ut*, one can add nothing but *si*♭; and in this case *ut mi sol si*♭ would be the chord of the tonic dominant in the mode of *fa*, as *sol si re fa* is the chord of the tonic dominant in the mode of *ut;* but if you would preserve the impression of the mode of *ut* in the harmony, you then change this *si*♭ into *si* natural, and the chord *ut mi sol si*♭ becomes *ut mi sol si*. It is the same case with the chord *fa la ut mi*, which is nothing else but the chord *fa la ut mi*♭; in which one may substitute for *mi*♭, *mi* natural, to preserve the impression of the mode of *ut*, or of that of *fa*.

Besides, in such chords as *ut mi sol si, fa la ut mi*, the sounds *si* and *mi*, though they form a dissonance

(BB) We need only add, that it is easy to see, that this fundamental bass *ut sol, ut fa, ut re, sol ut*, which formed the ascending scale *ut, re, mi, fa, sol, la, si, UT*, cannot by inverting it, and taking it inversely in this manner *si, ut, sol, re, ut, fa, ut, sol, UT*, form the diatonic scale *UT, si, la, sol, fa, mi, re, ut*, in descent. In reality, from the chord *sol, si, re, fa*, we cannot pass to the chord *re, fa, la, ut*, nor from thence to *ut, mi, sol, ut*. It is for this reason that in order to have the fundamental bass of the scale, *UT, si, la, sol, fa, mi, re, ut*, in descent, we must either determine to invert the fundamental bass mentioned in art. 55. in this manner, *ut, sol, re, sol, ut, fa, ut, sol, ut*, in which the second *sol* and the second *ut* answer to the *sol* alone in the scale; or otherwise we must form the fundamental bass *ut, sol, re, sol, ut, sol, ut*, in which all the notes imply perfect chords major, except the second *sol*, which implies the chord of the seventh *sol, si, re, fa*, and which answers to the two notes of the scale *sol, fa*, both comprehended in the chord *sol si, re, fa*.

Which ever of these two basses we shall choose, it is obvious that neither the one nor the other shall be wholly in the mode of *ut*, but in the mode of *ut* and in that of *sol*. From whence it follows, that the double employment which gives to the scale a fundamental bass all in the same mode when ascending, cannot do the same in descending; and that the fundamental bass of the scale in descending will be necessarily in two different modes.

with *ut* in the first case, and with *fa* in the second, are nevertheless supportable to the ear, because these sounds *si* and *mi* (art. 19.) are already contained and understood, the first in the note *mi* of the chord *ut mi sol si*, as likewise in the note *sol* of the same chord; the second in the note *la* of the chord *fa la ut mi*, as likewise in the note *ut* of the same chord. All together then seem to allow the artist to introduce the note *si* and *mi* into these two chords (CC).

186 Chords of the seventh continued and explained.

116. With respect to the chord of the seventh *sol※ si re fa*, wholly composed of thirds minor, it may be regarded as formed from the union of the two chords of the dominant and of the sub-dominant in the minor mode. In effect, in the minor mode of *la*, for instance, these two chords are *mi sol※ si re*, and *re fa la si*, whose union produces *mi*, *sol※*, *si*, *re*, *fa*, *la*. Now, if we should suffer this chord to remain thus, it would be disagreeable to the ear, by its multiplicity of dissonances, *re mi*, *mi*, *la*, *la sol※*, *la si*, *re sol※*, (art. 18.); so that, to avoid this inconveniency, the generator *la* is immediately expunged, which (art. 19.) is as it were understood in *re*, and the fifth or dominant *mi* whose place the sensible note *sol※* is supposed to hold: thus there remains no more than the chord *sol※ si re fa*, wholly composed of thirds minor, and in which the dominant *mi* is considered as understood; in such a manner that the chord *sol※ si re fa* represents the chord of the tonic dominant *mi sol※ si re*, to which we have joined the chord of the sub-dominant *re fa la si*, but in which the dominant *mi* is always reckoned the principal note (DD).

117. Since, then, from the chord *mi sol※ si re*, we may pass to the perfect *la ut mi la*, and *vice versa*, we may in like manner pass from the chord *sol※ si re fa* to the chord *la ut mi la*, and from this last to the chord *sol※ si re fa*: this remark will be very useful to us in the sequel.

Chap XV. *Of the Preparation of Discords.*

187 Dissonance what.

118. In every chord of the seventh, the highest note, that is to say, the seventh above the fundamental, is called a *dissonance* or *discord*; thus *fa* is the dissonance of the chord *sol si re fa*, *ut* in the chord *re fa la ut*, &c.

188 Manner of preparing dissonances investigated.

119. When the chord *sol si re fa* follows the chord *ut mi sol ut*, as this may happen, and in reality often happens, it is obvious that we do not find the dissonance *fa* in the preceding chord *ut mi sol ut*. Nor ought it indeed to be found in that chord; for this dissonance is nothing else but the sub-dominant added to the harmony of the dominant to determine the mode: now, the sub-dominant is not found in the harmony of the generator.

120. For the same reason, when the chord of the sub-dominant *fa la ut re* follows the chord *ut mi sol ut*, the note *re*, which forms a dissonance with *ut*, is not found in the preceding chord.

It is not so when the chord *re fa la ut* follows the chord *ut mi sol ut*; for *ut*, which forms a dissonance in the second chord, stands as a consonance in the preceding.

189 Dissonance is only tolerable to the ear when found in preceding chords.

121. In general, dissonance being the production of art (chap. xi.), especially in such chords as are not of the tonic dominant nor sub-dominant; the only means to prevent its displeasing the ear by appearing too heterogeneous to the chord, is, that it may be, if we may speak so, announced to the ear by being found in the preceding chord, and by that means serve to connect the two chords. From whence follows this rule:

190 Preparation of dissonances how performed.

122. In every chord of the seventh, which is not the chord of the tonic dominant, that is to say, (art. 102.) which is not composed of a third major followed by two thirds minor, the dissonance which this chord forms ought to stand as a consonance in the chord which precedes it.

This is what we call a *prepared dissonance*. See Preparation.

123. From thence it follows, that in order to prepare a dissonance, it is absolutely necessary that the fundamental bass should ascend by the interval of a second, as

UT mi sol ut, *RE fa la ut*;

or descend by a third, as

UT mi sol ut, *LA ut mi sol*;

or descend by a fifth, as

UT mi sol ut, *FA la ut mi*:

in every other case the dissonance cannot be prepared. This is what may be easily ascertained. If, for instance, the fundamental bass rises by a third, as *ut mi sol ut*, *mi sol si re*, the dissonance *re* is not found in the chord *ut mi sol ut*. The same might be said of *ut mi sol ut*, *sol si re fa*, and *ut mi sol ut*, *si re fa la*, in which the fundamental bass rises by a fifth or descends by a second.

124. It may only be added, that when a tonic, that is to say, a note which carries with it a perfect chord, is followed by a dominant in the interval of a fifth or third, this procedure may be regarded as a process from that same tonic to another, which has been

(CC) On the contrary, a chord such as *ut mi♭ sol si*, in which *mi* would be flat, could not be admitted in harmony, because in this chord the *si* is not included and understood in *mi♭*. It is the same case with several other chords, such as *si re fa la※*, *si re※ fa la*, &c. It is true, that in the last of these chords, *la* is included in *fa*, but it is not contained in *re※*; and this *re※* likewise forms with *fa* and with *la* a double dissonance, which, joined with the dissonance *si fa*, would necessarily render this chord not very pleasing to the ear; we shall yet, however, see in the second part, that this chord is sometimes used.

(DD) We have seen (art. 109.) that the chord *si re fa la*, in the minor mode of *la*, may be regarded as the inverse of the chord *re fa la si*; it would likewise seem, that, in certain cases, this chord *si re fa la* may be considered as composed of the two chords *sol si re fa*, *fa la ut re*, of the dominant and of the sub-dominant of the major mode of *ut*; which chords may be joined together, after having excluded from them, 1. The dominant *sol*, represented by its third major *si*, which is presumed to retain its place. 2. The note *ut* which is understood in *fa*, which will form this chord *si re fa la*. The chord *si re fa la*, considered in this point of view, may be understood as belonging to the major mode of *ut* upon certain occasions.

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been rendered a dominant by the addition of the diſſonance.

Moreover, we have ſeen (art. 119. and 120.) that a diſſonance does not ſtand in need of preparation in the chords of the tonic dominant and of the ſub-dominant: from whence it follows, that every tonic carrying with it a perfect chord, may be changed into a tonic dominant (if the perfect chord be major), or into a ſub-dominant (whether the chord be major or minor) by adding the diſſonance all at once.

Chap. XVI. *Of the Rules for reſolving Diſſonances.*

191 Diſſonances to be reſolved, muſt be diſguiſed and made to appear in the character of harmonics.

125. We have ſeen (chap. v. and vi.) how the diatonic ſcale, ſo natural to the voice, is formed by the harmonies of fundamental ſounds; from whence it follows, that the moſt natural ſucceſſion of harmonical ſounds is to be diatonic. To give a diſſonance then, in ſome meaſure, as much the character of an harmonic ſound as may be poſſible, it is neceſſary that this diſſonance, in that part of the modulation where it is found, ſhould deſcend or riſe diatonically upon another note, which may be one of the conſonances of the ſubſequent chord.

192 In the chord of the tonic dominant, the diſſonance ſhould rather riſe than deſcend, and why.

126. Now in the chord of the tonic dominant it ought rather to deſcend than to riſe; for this reaſon. Let us take, for inſtance, the chord *ſol ſi re fa* followed by the chord *ut mi ſol ut;* the part which formed the diſſonance *fa* ought to deſcend to *mi* rather than riſe to *ſol*, though both the ſounds *mi* and *ſol* are found in the ſubſequent chord *ut mi ſol ut;* becauſe it is more natural and more conformed to the connection which ought to be found in every part of the muſic, that *ſol* ſhould be found in the ſame part where *ſol* has already been ſounded, whilſt the other part was ſounding *fa*, as may be here ſeen (parts firſt and fourth.)

Firſt part, - - - - -	*fa mi,*
Second, - - - -	*ſi ut,*
Third, - - - -	*re ut,*
Fourth, - - -	*ſol ſol,*
Fundamental baſs, - -	*ſol ut,*

193 Conſequences of the former rule.

127. For the ſame reaſon, in the chord of the ſimple dominant *re fa la ut*, followed by *ſol ſi re fa*, the diſſonance *ut* ought rather to deſcend to *ſi* than riſe to *re*.

194 Another conſonance.

128. In ſhort, for the ſame reaſon, we ſhall find, that in the chord of the ſub-dominant *fa la ut re*, the diſſonance *re* ought to riſe to *mi* of the following chord *ut mi ſol ut*, rather than deſcend to *ut;* whence may be deduced the following rules.

195 But is deduced from the former propoſitions.

129. 1°. In every chord of the dominant, whether tonic or ſimple, the note which conſtitutes the ſeventh, that is to ſay, the diſſonance, ought diatonically to deſcend upon one of the notes which form a conſonance in the ſubſequent chord.

2°. In every chord of the ſubdominant, the diſſonance ought to riſe diatonically upon the third of the ſubſequent chord.

196 Diſſonance reſolved, what. See Reſolution.

130. A diſſonance which deſcends or riſes diatonically according to theſe two rules, is called a *diſſonance reſolved.*

From theſe rules it is a neceſſary reſult, that the chord of the ſeventh *re fa la ut*, though one ſhould even conſider it as the inverſe of *fa la ut re*, cannot be ſucceeded by the chord *ut mi ſol ut*, ſince there is not in this laſt chord of *ſi* any note upon which the diſſonance *ut* of the chord *re fa la ut* can deſcend.

One may beſides find another reaſon for this rule, in examining the nature of the double employment of diſſonances. In effect, in order to paſs from *re fa la ut*, to *ut mi ſol ut*, it is neceſſary that *re fa la ut* ſhould in this caſe be underſtood as the inverſe of *fa la ut re.* Now the chord *re fa la ut* can only be conceived as the inverſe of *fa la ut re*, when this chord *re fa la ut* precedes or immediately follows the *ut mi ſol ut;* in every other caſe the chord *re fa la ut* is a primitive chord, formed from the perfect minor chord *re fa la*, to which the diſſonance *ut* was added, to take from *re* the character of a tonic. Thus the chord *re fa la ut*, could not be followed by the chord *ut mi ſol ut*, but after having been preceded by the ſame chord. Now, in this caſe, the *double employment* would be entirely a futile expedient, without producing any agreeable effect; becauſe, inſtead of this ſucceſſion of chords *ut mi ſol ut, re fa la ut, ut mi ſol ut*, it would be much more eaſy and natural to ſubſtitute this other, which furniſhes this natural proceſs, *ut mi ſol ut, fa la ut re, ut mi ſol ut.* The proper uſe of the double employment is, that, by means of inverting the chord of the ſub-dominant, it may be able to paſs from that chord thus inverted to any other chord except that of the tonic, to which it naturally leads.

Chap. XVII. *Of the Broken or Interrupted Cadence.*

197 The teſt of perfection in cadences to be found in the fundamental baſs.

131. In a fundamental baſs which moves by fifths, there is always, as we have formerly obſerved, (chap. viii.), a repoſe more or leſs perfect from one ſound to another; and of conſequence there muſt likewiſe be a repoſe more or leſs perfect from one ſound to another in the diatonic ſcale, which reſults from that baſs. It may be demonſtrated by a very ſimple experiment, that the cauſe of a repoſe in melody is ſolely in the fundamental baſs expreſſed or underſtood. Let any perſon ſing theſe three notes *ut re ut*, performing on the *re* a ſhake, which is commonly called a *cadence;* the modulation will appear to him to be finiſhed after the ſecond *ut*, in ſuch a manner that the ear will neither expect nor wiſh any thing to follow. The caſe will be the ſame if we accompany this modulation with its natural fundamental baſs *ut ſol ut:* but if, inſtead of this baſs, we ſhould give it the following *ut ſol la;* in this caſe the modulation *ut re ut* would not appear to be finiſhed, and the ear would ſtill expect and deſire ſomething more. This experiment may eaſily be made.

198 Broken cadence what, and why. See Cadence.

132. This paſſage *ſol la*, when the dominant *ſol* diatonically aſcends upon the note *la*, inſtead of deſcending by a fifth upon the generator *ut*, as it ought naturally to do, is called a *broken cadence;* becauſe the perfect cadence *ſol ut*, which the ear expected after the dominant *ſol*, is, if we may ſpeak ſo, broken and ſuſpended by the tranſition from *ſol* to *la*.

133. From thence it follows, that if the modulation *ut re ut* appeared finiſhed when we ſuppoſed no baſs to it at all, it is becauſe its natural fundamental baſs *ut ſol ut* is ſuppoſed to be implied; becauſe the ear deſires ſomething to follow this modulation, as ſoon as it is reduced to the neceſſity of hearing another baſs.

134. The

199 Origin of interrupted cadence in the double employment of dissonances.

134. The interrupted cadence may, as it seems to me, be considered as having its origin in the *double employment of dissonances;* since this cadence, like the double employment, only consists in a diatonic procedure of the bass ascending (chap. xii.). In effect, nothing hinders us to descend from the chord *sol si re fa* to the chord *ut mi sol la,* by converting the tonic *ut* into a sub-dominant, that is to say, by passing all at once from the mode of *ut* to the mode of *sol:* now to descend from *sol si re fa* to *ut mi sol la* is the same thing as to rise from the chord *sol si re fa* to the chord *la ut mi sol,* in changing the chord of the sub-dominant *ut mi sol la* for the imperfect chord of the dominant, according to the laws of the double employment.

200 Manner of performing this cadence.

135. In this kind of cadence, the dissonance of the first chord is resolved by descending diatonically upon the fifth of the subsequent chord. For instance, in the broken cadence *sol si re fa, la ut mi sol,* the dissonance *fa* is resolved by descending diatonically upon the fifth *mi.*

201 Interrupted cadence, what. See Cadence.

136. There is still another kind of cadence called an *interrupted cadence,* where the dominant descends by a third to another dominant, instead of descending by a fifth upon the tonic, as in this process of the bass, *sol si re fa, mi sol si re;* in the case of an interrupted cadence, the dissonance of the former chord is resolved by descending diatonically upon the octave of the fundamental note of the subsequent chord, as may be here seen, where *fa* is resolved upon the octave of *mi.*

202 Origin of this kind of cadence, likewise in the double employment.

137. This kind of interrupted cadence, as it seems to me, has likewise its origin in the double employment of dissonances. For let us suppose these two chords in succession, *sol si re fa, sol si re mi,* where the note *sol* is successively a tonic dominant and sub-dominant; that is to say, in which we pass from the mode of *ut* to the mode of *re;* if we should change the second of these chords into the chord of the dominant, according to the laws of the double employment, we shall have the interrupted cadence *sol si re fa, mi sol si re.*

Chap. XVIII. *Of the Chromatic Species.*

203 Fundamental bass may be formed by thirds major.

138. The series or fundamental bass by fifths produces the diatonic species in common use (chap. vi.): now the third major being one of the harmonics of a fundamental sound as well as the fifth, it follows, that we may form fundamental basses by thirds major, as we have already formed fundamental basses by fifths.

204 A chromatic interval or minor semitone, how found. See fig. K.

139. If then we should form this bass *ut, mi, sol*♯, the two first sounds carrying each along with it their thirds major and fifths, it is evident that *ut* will give *sol,* and that *mi* will give *sol*♯: now the semitone which is between this *sol* and this *sol*♯ is an interval much less than the semitone which is found in the diatonic scale between *mi* and *fa,* or between *si* and *ut.* This may be ascertained by calculation (EE): it is for this reason that the semitone from *mi* to *fa* is called *major,* and the other *minor* (FF).

140. If the fundamental bass should proceed by thirds minor in this manner, *ut, mi*♭, a succession which is allowed when we have investigated the origin of the minor mode (chap. ix.), we shall find this modulation *sol, sol*♭, which would likewise give a minor semitone (GG.)

205 An intonation minor semitone difficult to be hit, and why.

141. The minor semitone is hit by young practitioners in intonation with more difficulty than the semitone major. For which this reason may be assigned: The semitone major which is found in the diatonic scale, as from *mi* to *fa,* results from a fundamental bass by fifths *ut fa,* that is to say, by a succession which is most natural, and for this reason the easiest to the ear. On the contrary, the minor semitone arises from a succession by thirds, which is still less natural than the former. Hence, that scholars may truly hit the minor semitone, the following artifice is employed. Let us suppose, for instance, that they intend to rise from *sol* to *sol*♯; they rise at first from *sol* to *la,* then descend from *la* to *sol*♯ by the interval of a semitone major; for this *sol* sharp, which is a semitone major below *la,* proves a semitone minor above *sol.* [See the notes (EE) and (FF).]

206 Minor semitone to be found in every procedure of the fundamental bass by thirds.

142. Every procedure of the fundamental bass by thirds, whether major or minor, rising or descending, gives the minor semitone. This we have already seen from the succession of thirds in ascending. The series of thirds minor in descending, *ut, la,* gives *ut, ut*♯ (HH;)

(EE) In reality, *ut* being supposed 1, as we have always supposed it, *mi* is $\frac{4}{5}$, and *sol*♯ $\frac{25}{16}$: now *sol* being $\frac{3}{2}$, *sol*♯ then shall be to *sol* as $\frac{25}{16}$ to $\frac{3}{2}$; that is to say, as 25 times 2 to 3 times 16: the proportion then of *sol*♯ to *sol* is as 25 to 24, an interval much less than that of 16 to 15, which constitutes the semitone from *ut* to *si,* or from *fa* to *mi* (note L.)

(FF) It may be observed, that a minor joined to a major semitone will form a minor tone; that is to say, if one rises, for instance, from *mi* to *fa,* by the interval of a semitone major, and afterwards from *fa* to *fa*♯ by the interval of a minor semitone, the interval from *mi* to *fa*♯ will be a minor tone. For let us suppose *mi* to be 1, *fa* will be $\frac{16}{15}$, and *fa*♯ will be $\frac{25}{24}$ of $\frac{16}{15}$; that is to say, 25 times 16 divided by 24 times 15, or $\frac{10}{9}$; *mi* then is to *fa*♯ as 1 is to $\frac{10}{9}$, the interval which constitutes the minor tone (note N.).

With respect to the tone major, it cannot be exactly formed by two semitones; for, 1. Two major semitones in immediate succession would produce more than a tone major. In effect, $\frac{16}{15}$ multiplied by $\frac{16}{15}$ gives $\frac{256}{225}$, which is greater than $\frac{9}{8}$, the interval which constitutes (note N) the major tone. A semitone minor and a semitone major would give less than a major tone, since they amount only to a true minor. 3. And, *à fortiori,* two minor semitones would give still less.

(GG) In effect, *mi*♭ being $\frac{6}{5}$, *sol*♭ will be $\frac{6}{5}$ of $\frac{6}{5}$; that is to say, (note C) $\frac{36}{25}$: now the proportion of $\frac{3}{2}$ to $\frac{36}{25}$ (note C) is that of 3 times 25 to 2 times 36; that is to say, as 25 to 24.

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(HH); and the series of thirds major in descending, *ut, la*♭, gives *ut, ut*♭, (II).

207 The minor semitone when prevalent, constitutes chromatic music.

143. The minor semitone constitutes the species called *chromatic;* and with the species which moves by diatonic intervals, resulting from the succession of fifths (chap. v. and vi.), it comprehends the whole of melody.

CHAP. XIX. *Of the Enharmonic Species.*

208 Diësis or enharmonic interval, what, and how formed.

* See Fourth of a Tone.

144. THE two extremes, or highest and lowest notes, *ut sol*※, of the fundamental bass by thirds major, *ut mi sol*※, give this modulation *ut si*※; and these two sounds *ut, si*※, differ between themselves by a small interval which is called the *diësis*, or *enharmonic fourth** *of a tone* (LL), which is the difference between a semitone major and a semitone minor (MM). This quarter tone is inappretiable by the ear, and impracticable upon several of our instruments. Yet have means been found to put it in practice in the following manner, or rather to perform what will have the same effect upon the ear.

209 Manner of seemingly introducing this interval upon instruments of fixed scales.

145. We have explained (art. 116.) in what manner the chord *sol*※ *si re fa* may be introduced into the minor mode, entirely consisting of thirds minor perfectly true, or at least supposed such. This chord supplying the place of the chord of the dominant (art. 116.) from thence we may pass to that of the tonic or generator *la* (art. 117.). But we must remark,

1. That this chord *sol*※ *si re fa*, entirely consisting of thirds minor, may be inverted or modified according to the three following arrangements, *si re fa sol*※, *re fa sol*※ *si fa sol*※ *si re;* and that in all these three different states, it will still remain composed of thirds minor; or at least there will only be wanting the enharmonic fourth of a tone to render the third minor between *fa* and *sol*※ entirely just; for a true third minor, as that from *mi* to *sol* in the diatonic scale, is composed of a semitone and a tone both major. Now from *fa* to *sol* there is a tone major, and from *sol* to *sol*※ there is only a minor semitone. There is then awanting (art. 144.) the enharmonic fourth of a tone, to render the third *fa sol*※ exactly true.

2. But as this division of a tone cannot be found in the gradations of any scale practicable upon most of our instruments, nor be appretiated by the ear, the ear takes the different chords,

si re fa sol※
re fa sol※ *si*,
fa sol※ *si re*,

which are absolutely the same, for chords composed every one of thirds minor exactly just.

Now the chord *sol*※ *si re fa*, belonging to the minor mode of *la*, where *sol*※ is the sensible note; the chord *si re fa sol*※, or *si re fa la*♭, will, for the same reason, belong to the minor mode of *ut*, where *si* is the sensible note. In like manner, the chord *re fa sol*※ *si*, or *si re fa la*♭ *ut*♭, will belong to the minor mode of *mi*♭, and the chord *fa sol*※ *si re*, or *fa la*♭ *ut*♭ *mi*♭♭, to the minor mode of *sol*♭.

After having passed then by the mode of *la* to the chord *sol*※ *si re fa* (art. 117.), one may by means of this last chord, and by merely satisfying ourselves to invert it, afterwards pass all at once to the modes of *ut* minor, of *mi*♭ minor, or of *sol*♭ minor; that is to say, into the modes which have nothing, or almost

 nothing,

(HH) *La* being $\frac{5}{6}$, *ut*※ is $\frac{5}{4}$ of $\frac{5}{6}$; that is to say $\frac{25}{24}$, and *ut* is 1: the proportion then between *ut* and *ut*※ is that of 1 to $\frac{25}{24}$, or of 24 to 25.

(II) *La*♭ being the third major below *ut*, will be $\frac{4}{5}$ (note C): *ut*♭, then, is $\frac{7}{5}$ of $\frac{4}{5}$; that is to say $\frac{24}{25}$. The proportion, then, between *ut* and *ut*♭, is as 25 to 24.

(LL) *Sol*※ being $\frac{25}{16}$ and *si*※ being $\frac{5}{4}$ of $\frac{25}{16}$, we shall have *si*※ equal (note C) to $\frac{125}{64}$, and its octave below shall be $\frac{125}{128}$; an interval less than unity by about $\frac{3}{128}$ or $\frac{1}{43}$. It is plain then from this fraction, that the *si*※ in question must be considerably lower than *ut*.

This interval has been called *the fourth of a tone*, and this denomination is founded on reason. In effect, we may distinguish in music four kinds of quarter tones.

1. The fourth of a tone major: now, a tone major being $\frac{9}{8}$, and its difference from unity being $\frac{1}{8}$, the difference of this quarter tone from unity will be almost the fourth of $\frac{1}{8}$; that is to say, $\frac{1}{32}$.

2. The fourth of a tone minor; and as a tone minor, which is $\frac{10}{9}$, differs from unity by $\frac{1}{9}$, the fourth of a minor tone will differ from unity about $\frac{1}{36}$.

3. One half of a tone major; and as this semitone differs from unity by $\frac{1}{15}$, one half of it will differ from unity about $\frac{1}{30}$.

4. Finally, one half of a semitone minor, which differs from unity by $\frac{1}{24}$: its half then will be $\frac{1}{48}$.

The interval, then, which forms the enharmonic fourth of a tone, as it does not differ from unity but by $\frac{1}{43}$, may justly be called the *fourth of a tone*, since it is less different from unity than the largest interval of a quarter tone, and more than the least.

We shall add, that since the enharmonic fourth of a tone is the difference between a semitone major and a semitone minor; and since the tone minor is formed (note FF) of two semitones, one major and the other minor; it follows, that two semitones major in succession form an interval larger than that of a tone by the enharmonic fourth of a tone; and that two minor semitones in succession form an interval less than a tone by the same fourth of a tone.

(MM) That is to say, that if you rise from *mi* to *fa*, for instance, by the interval of a semitone major, and afterwards, returning to *mi*, you should rise by the interval of a semitone minor to another sound which is not in the scale, and which I shall mark thus, *fa*+, the two sounds *fa*+ and *fa* will form the enharmonic fourth of a tone: for *mi* being 1, *fa* will be $\frac{16}{15}$; and *fa*+ $\frac{25}{24}$: the proportion then between *fa*+ and *fa* is that of $\frac{25}{24}$ to $\frac{16}{15}$ (note C); that is to say, as 25 times 15 to 16 times 24; or otherwise, as 25 times 5 to 16 times 8, or as 125 to 128. Now this proportion is the same which is found in the beginning of the preceding note, to express the enharmonic fourth of a tone.

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nothing, in common with the minor mode of *la*, and which are entirely foreign to it (†).

210 The alteration however, by which it is effectuated, abrupt and sensible.

146. It must, however, be acknowledged, that a transition so abrupt, and so little expected, cannot deceive nor elude the ear; it is struck with a sensation so unlooked-for without being able to account for the passage to itself. And this account has its foundation in the enharmonic fourth of a tone; which is overlooked as nothing, because it is inappretiable by the ear; but of which, though its value is not ascertained, the whole harshness is sensibly perceived. The instant of surprise, however, immediately vanishes; and that astonishment is turned into admiration, when one feels himself transported as it were all at once, and almost imperceptibly, from one mode to another, which is by no means relative to it, and to which he never could have immediately passed by the ordinary series of fundamental notes.

CHAP. XX. *Of the Diatonic Enharmonic Species.*

147. If we form a fundamental bass, which rises alternately by fifths and thirds, as *fa, ut, mi, si*, this bass will give the following modulation, *fa, mi, mi, re*※; in which the semitones from *fa* to *mi*, and from *mi* to *re*※, are equal and major (NN). See fig. M.

This species of modulation or of harmony, in which all the semitones are major, is called the *enharmonic diatonical* species. The major semitones peculiar to this species give it the name of *diatonic*, because major semitones belong to the diatonic species; and the tones which are greater than major by the excess of a fourth, resulting from a succession of major semitones, give it the name of *enharmonic* (note LL). See Enharmonic.

CHAP. XXI. *Of the Chromatic Enharmonic Species.*

211 Chromatic enharmonic intervals, how formed. See fig. N.

148. If we pass alternately from a third minor in descending to a third major in rising, as *ut, ut, la, ut*※, *ut*※, we shall form this modulation *mi* ♭, *mi, mi, mi, mi*※, in which all the semitones are minor (OO).

This species is called the *chromatic enharmonical* species: the minor semitones peculiar to this kind give it the name of *chromatic*, because minor semitones belong to the chromatic species; and the semitones which are lesser by the diminution of a fourth resulting from a succession of minor semitones, give it the name of *enharmonic* (note LL).

212 From this species the effects of harmony and melody appear to be in the fundamental bass.

149. These new species confirm what we have all along said, that the whole effects of harmony and melody reside in the fundamental bass.

213 Diatonic species most agreeable, and why.

150. The diatonic species is the most agreeable, because the fundamental bass which produces it is formed from a succession of fifths alone, which is the most natural of all others.

214 The chromatic next.

151. The chromatic being formed from a succession of thirds, is the most natural after the preceding.

215 Lastly, the enharmonic.

152. Finally, the enharmonic is the least agreeable of all, because the fundamental bass which gives it is not immediately indicated by nature. The fourth of a tone which constitutes this species, and which is itself inappretiable to the ear, neither produces nor can produce its effect, but in proportion as imagination suggests the fundamental bass from whence it results; a bass whose procedure is not agreeable to nature, since it is formed of two sounds which are not contiguous one to the other in the series of thirds (art. 144.)

CHAP. XXII. *Showing that Melody is the Offspring of Harmony.*

216 The effects of melody to be investigated in harmony expressed or understood.

153. All that we have hitherto said, as it seems to me, is more than sufficient to convince us, that melody has its original principle in harmony; and that it is in harmony, expressed or understood, that we ought to look for the effects of melody.

154. If this should still appear doubtful, nothing more is necessary than to pay due attention to the first experiment (art. 19.), where it may be seen that the principal sound is always the lowest, and that the sharper sounds which it generates are with relation to it what the treble of an air is to its bass.

155. Yet more, we have proved, in treating of broken cadence (chap. xvii.), that the diversification of basses

(†) As this method for obtaining or supplying enharmonic gradations cannot be practised on every occasion when the composer or practitioner would wish to find them, especially upon instruments where the scale is fixed and invariable, except by a total alteration of their œconomy, and re-tuning the strings, Dr Smith in his Harmonics has proposed an expedient for redressing or qualifying this defect, by the addition of a greater number of keys or strings, which may divide the tone or semitone into as many appretiable or sensible intervals as may be necessary. For this, as well as for the other advantageous improvements which he proposes in the structure of instruments, we cannot with too much warmth recommend the perusal of his learned and ingenious book to such of our readers as aspire to the character of genuine adepts in the the theory of music.

(NN) It is obvious, that if *fa* in the bass be supposed 1, *fa* of the scale will be 2, *ut* of the bass $\frac{3}{2}$, and *mi* of the scale $\frac{5}{4}$ of $\frac{3}{2}$, that is, $\frac{15}{8}$; the proportion of *fa* to *mi* is as 2 to $\frac{15}{8}$, or as 1 to $\frac{15}{16}$. Now *mi* of the bass being likewise $\frac{5}{4}$ of $\frac{3}{2}$, or $\frac{15}{8}$; *si* of the bass is $\frac{3}{2}$ of $\frac{15}{8}$, and its third major *re*※ $\frac{5}{4}$ of $\frac{3}{2}$ of $\frac{15}{8}$, or $\frac{15}{8}$ of $\frac{15}{8}$; this third major, approximated as much as possible to *mi* in the scale by means of octaves, will be $\frac{15}{16}$ of $\frac{15}{8}$: *mi* then of the scale will be to *re*※ which follows it, as $\frac{15}{8}$ is to $\frac{15}{16}$ of $\frac{15}{8}$, that is to say, as 1 to $\frac{15}{16}$. The semitones then from *fa* to *mi*, and from *mi* to *re*※, are both major.

(OO) It is evident that *mi*♭ is $\frac{6}{5}$ (note C), and that *mi* is $\frac{5}{4}$: these two *mi*'s, then, are between themselves as $\frac{6}{5}$ to $\frac{5}{4}$, that is to say, as 6 times 4 to 5 times 5, or as 24 to 25, the interval which constitutes the minor semitone. Moreover, the *la* of the bass is $\frac{5}{6}$, and *ut*※ $\frac{5}{4}$ of $\frac{5}{6}$, or $\frac{25}{24}$: *mi*※ then is $\frac{5}{4}$ of $\frac{25}{24}$, the *mi* in the scale is likewise to the *mi*※ which follows it, as 24 to 25. All the semitones therefore in this scale are minor.

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baſſes produces effects totally different in a modulation which, in other reſpects, remains the ſame.

156. Can it be ſtill neceſſary to adduce more convincing proofs? We have nothing to do but examine the different baſſes which may be given to this very ſimple modulation *ſol, ut;* of which it will be found ſuſceptible of a great many, and each of theſe baſſes will give a different character to the modulation *ſol ut*, though in itſelf it remains always the ſame; in ſuch a manner that we may change the whole nature and effects of a modulation, without any other alteration except that of changing its fundamental baſs.

M. Rameau has ſhown, in his *New Syſtem of Muſic*, printed at Paris 1726, p. 44. that this modulation *ſol ut*, is ſuſceptible of 20 different fundamental baſſes. Now the ſame fundamental baſs, as may be ſeen in our ſecond part, will afford ſeveral continued or thorough baſſes. How many means, of conſequence, may be practiſed to vary the expreſſion of the ſame modulation?

217 Conſequences deducible from this principle.

157. From theſe different obſervations it may be concluded, 1. That an agreeable melody, naturally implies a baſs extremely ſweet and adapted for ſinging; and that reciprocally, as muſicians expreſs it, a baſs of this kind generally prognoſticates an agreeable melody (PP).

2. That the character of a juſt harmony is only to form in ſome meaſure one ſyſtem with the modulation, ſo that from the whole taken together the ear may only receive, if we may ſpeak ſo, one ſimple and indiviſible impreſſion.

3. That the character of the ſame modulation may be diverſified, according to the character of the baſs which is joined with it.

But notwithſtanding the dependency of melody upon harmony, and the ſenſible influence which the latter may exert upon the former; we muſt not however from thence conclude, with ſome celebrated muſicians, that the effects of harmony are preferable to thoſe of melody. Experience proves the contrary. [See, on this account, what is written on the licence of muſic, printed in tom. iv. of D'Alembert's *Melanges de Literature*, p. 448.]

General Remark.

The diatonic ſcale or gammut being compoſed of twelve ſemitones, it is clear that each of theſe ſemitones taken by itſelf may be the generator of a mode; and that thus there muſt be twenty-four modes in all, twelve major and twelve minor. We have aſſumed the major mode of *ut*, to repreſent all the major modes in general, and the minor mode of *la*, to repreſent the modes minor, to avoid the difficulties ariſing from ſharps and flats, of which we muſt have encountered either a greater or leſſer number in the other modes. But the rules we have given for each mode are general, whatever note of the gammut be taken for the generator of a mode.

Part II. Principles and Rules of COMPOSITION.

218 Compoſition in harmony, what See Compoſition.

158. Composition, which is likewiſe called *counterpoint*, is not only the art of compoſing an agreeable air, but alſo that of compoſing a great many airs in ſuch a manner that when heard at the ſame time, they may unite in producing an effect agreeable and delightful to the ear; this is what we call *compoſing muſic in ſeveral parts*.

The higheſt of theſe parts is called the *treble*, the loweſt is termed the *baſs;* the other parts, when there are any, are termed *middle parts;* and each in particular is ſignified by a different name.

Chap. I. *Of the Different Names given to the ſame Interval.*

219 Particular intervals ſignified by different names, and why.

159. In the introduction (art. 9.), which is at the front of this treatiſe, we have ſeen a detail of the moſt common names which are given to the different intervals. But there are particular intervals which have obtained different names, according to particular circumſtances; which it is proper to explain.

220 Second redundant, what.

160. An interval compoſed of a tone and a ſemitone, which is commonly called a *third minor*, is likewiſe ſometimes called a *ſecond redundant;* ſuch is the interval from *ut* to *re*♯ in aſcending, or that of *la* to *ſol*♭ deſcending.

221 Why ſo called.

This interval is ſo termed, becauſe one of the ſounds which form it is always either ſharp or flat, and that, if you deduce that ſharp or that flat, the interval will be that of a ſecond.

222 Falſe fifth, what.

161. An interval compoſed of two tones and two ſemitones, as that from *ſi* to *fa*, is called a *falſe fifth*. This interval is the ſame with the *triton* (art. 9.), ſince two tones and two ſemitones are equivalent to three tones. There are, however, ſome reaſons for diſtinguiſhing them, as will appear below.

223 Fifth redundant, what.

162. As the interval from *ut* to *re*♯ in aſcending has been called a ſecond redundant, they likewiſe call the interval from *ut* to *ſol*♯ in aſcending a *fifth redundant*, or from *ſi* to *mi*♯ in deſcending, each of which intervals are compoſed of four tones.

224 Diſtinguiſhed from the fixth minor.

This interval is, in the main, the ſame with that of the ſixth minor (art. 6.): but in the fifth redundant there is always a ſharp or a flat; inſomuch, that if this ſharp or flat were deduced, the interval would become a true fifth.

225 Seventh diminiſhed, what.

163. For the ſame reaſon, an interval compoſed of three tones and three ſemitones, as from *ſol*♯ to *fa* in aſcending,

(PP) There are likewiſe ſeveral eminent muſicians, who in their compoſitions, if we can depend on what has been affirmed, begin with determining and writing the baſs. This method, however, appears in general more proper to produce a learned and harmonious muſic, than a ſtrain prompted by genius and animated by enthuſiaſm.

aſcending, is called a *ſeventh diminiſhed;* becauſe, if you deduce the ſharp from *ſol*, the interval from *ſol* to *fa* will become that of an ordinary ſeventh. The interval of a ſeventh diminiſhed is in other reſpects the ſame with that of the ſixth major (art. 9.)

226 Seventh major and redundant coincident.

164. The major ſeventh is likewiſe ſometimes called a *ſeventh redundant* (QQ.)

CHAP. II. *Compariſon of the Different Intervals.*

227 Notes in different octaves or ſcales replications each of the other.

165. If we ſing *ut ſi* in deſcending by a ſecond, and afterwards *ut ſi* in aſcending by a ſeventh, theſe two *ſi*'s ſhall be octaves one to the other; or, as we commonly expreſs it, they will be *replications* one of the other.

228 Hence to deſcend to one replication, and riſe to another, has the ſame effect.

166. On account then of the reſemblance between every ſound and its octave (art. 22.), it follows, that *to riſe by a ſeventh*, or *deſcend by a ſecond*, amount to one and the ſame thing.

167. In like manner, it is evident that the ſixth is nothing but a replication of the third, nor the fourth but a replication of the fifth.

229 Detail of replications.

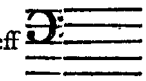
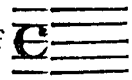
168. The following expreſſions either are or ought to be regarded as ſynonymous.

230 Examples of this.

To riſe / To deſcend	by a ſecond.	To deſcend / To riſe	by a ſeventh.
To riſe / To deſcend	by a third.	To deſcend / To riſe	by a ſixth.
To riſe / To deſcend	by a fourth.	To deſcend / To riſe	by a fifth.

169. Thus, therefore, we ſhall employ them indifferently the one for the other; ſo that when we ſay, for inſtance, *to riſe by a third*, it may be ſaid with equal propriety *to deſcend by a ſixth*, &c.

CHAP. III. *Of the different Cleffs; of the Value or Quantity; of the Rithmus; and of Syncopation.*

170. There are three cleffs* in muſic; the cleff of *fa* 𝄢:, or 𝄡 𝄞; the cleff *ut* 𝄡; and the cleff of *ſol* 𝄞. But, in Britain, the following characters are uſed: The F, or baſs-cleff ; the C, or tenor cleff ; and the G, or treble cleff .

* See Cleff.

231 Cleffs, what,

232 And how placed.

The cleff of *fa* is placed on the fourth line, or on the third; and the line upon which this cleff is placed gives the name of *fa* or *F*, to all the notes which are upon that line. See fig. O.

The cleff of *ut* is placed upon the fourth, the third, the ſecond, or the firſt line; and in theſe different poſitions all the notes upon that line where the cleff is placed take the name of *ut*, or *C*. See fig. P. See fig. Q.

Laſtly, the cleff of *ſol* is placed upon the ſecond or firſt line; and all the notes upon that line where the cleff is placed take the name of *ſol* or *G*.

233 Names of notes to be inveſtigated from the poſition of the cleffs.

171. As the notes are placed on the lines, and in the ſpaces between the lines, any one, when he ſees the cleff, may eaſily find the name of any note whatever. Thus he may ſee, that, in the firſt cleff of *fa*, the note which is placed on the loweſt line ought to be *ſol*; that the note which occupies the ſpace between the two firſt lines ſhould be *la*; and that the note which is on the ſecond line is a *ſi*, &c. (RR). See fig. O.

4

172. A

(QQ) The chief uſe of theſe different denominations is to diſtinguiſh chords: for inſtance, the chord of the redundant fifth and that of the diminiſhed ſeventh are different from the chord of the ſixth; the chord of the ſeventh redundant, from that of the ſeventh major. This will be explained in the following chapters.

(RR) It is on account of the different compaſſes of voices and inſtruments that theſe cleffs have been invented.

The maſculine voice, which is the loweſt, may at its greateſt depth, without ſtraining, deſcend to *ſol*, which is in the laſt line of the firſt cleff of *fa*; and the female voice, which is the ſharpeſt, may at its higheſt pitch riſe to a *ſol*, which is a triple octave above the former.

The loweſt of maſculine voices is adapted to a part which may be called a *mean baſs*, and its cleff is that of *fa* on the fourth line; this cleff is likewiſe that of the violoncello and of the deepeſt inſtruments. A mean baſs extremely deep is called a *baritonus* or *counter-baſs*.

The maſculine voice which is next in depth to what we have called the *mean baſs* may be termed the *concordant baſs*. Its cleff is that of *fa* on the third line.

The maſculine voice which follows the *concordant baſs* may be denominated a *tenor;* a voice of this pitch is the moſt common, yet ſeldom extremely agreeable. Its cleff is that of *ut* on the fourth line. This cleff is alſo that of the baſſoon or baſs hautboy.

The higheſt maſculine voice of all may be called *counter tenor*. Its cleff is that of *ut* on the third line. It is likewiſe the cleff of tenor violins, &c.

The deepeſt female voice immediately follows the counter tenor, and may be called *baſs in alt*. Its cleff is that of *ut* upon the firſt line. The cleff of *ut* upon the ſecond line is not in frequent uſe.

The ſharpeſt female voice is called *treble;* its cleff is that of *ſol* on the ſecond line.

This laſt cleff, as well as that of *ſol* on the firſt line, is likewiſe the cleff of the ſharpeſt inſtruments, ſuch as the violin, the flute, the trumpet, the hautboy, the flagelet, &c.

The *ut* which may be ſeen in the cleffs of *fa* and in the cleffs of *ut* is a fifth above the *fa* which is on the line of the cleff of *fa;* and the *ſol* which is on the two cleffs of *ſol* is a fifth above *ut:* inſomuch that *ſol* which is

Principles of Composition.

234 Marks and powers of sharps, flats, and naturals, what.

172. A note before which there is a sharp (marked thus ※) ought to be raised by a semitone; and if, on the contrary, there is a ♭ before it, it ought to be depressed by a semitone, (♭ being the mark of a flat.)

The natural (marked thus ♮) restores to its natural value a note which had been raised or depressed by a semitone.

173. When you place at the cleff a sharp or a flat, all the notes upon the line on which this sharp or flat is marked are sharp or flat. Thus let us take, for instance, the cleff of *ut* upon the first line, and let us place a sharp in the space between the second and third line, which is the place of *fa;* all the notes which shall be marked in that space will be *fa*※; and if you would restore them to their original value of *fa* natural, you must place a ♮ or a ♭ before them. (See fig. R.; See fig. S.)

In the same manner, if a flat be marked at the cleff, and if you would restore the note to its natural state, you must place a ♮ or a ※ before it. (See fig. X.)

235 Bars and times, what.

174. Every piece of music is divided into different equal times, which they call *measures* or *bars;* and each bar is likewise divided into different times.

There are properly two kinds of measures or modes of time (*See* T): the measure of two times, or of common time, which is marked by the figure 2 placed at the beginning of the tune; and the measure of three times, or of triple time, which is marked by the figure 3 placed in the same manner. (*See* V.) (See Time.)

The different bars are distinguished by perpendicular lines.

In a bar we distinguish between the *perfect* and *imperfect* time; the *perfect* time is that which we *beat*, the *imperfect* that in which we *lift up the hand or foot*. A bar consisting of four times ought to be regarded as compounded of two bars, each consisting of two times: thus there are in this bar two perfect and two imperfect times. In general, by the words *perfect* and *imperfect*, even the parts of the same time are distinguished: thus the first note of each time is reckoned as belonging to the *perfect* part, and the others as belonging to the *imperfect*. (See fig. Y.)

236 The value of notes in duration.

175. The longest of all notes is a semibreve. A minim is half its value; that is to say, in singing, we only employ the same duration in performing two minims which was occupied in one semibreve. A minim in the same manner is equivalent to two crotchets, the crotchet to two quavers, &c.

237 Syncopation, what.

176. A note which is divided into two parts by a time, that is to say, which begins at the end of a time, and terminates in the time following, is called (ss) a *syncopated note*. (*See* Z; where the notes *ut*, *si*, and *la*, are each of them syncopated.) (†). (See Syncopation.)

3 X* 177. A

is on the lowest line of the first cleff of *fa*, is lower by two whole octaves than the *sol* which is on the lowest line of the second cleff of *sol*.

[Thus far the translator has followed his original as accurately as possible; but this was by no means an easy task. Among all the writers on music which he has found in English, there is no such thing as different names for each particular part which is employed to constitute full or complete harmony. He was therefore under a necessity of substituting by analogy such names as appeared most expressive of his author's meaning. To facilitate this attempt, he examined in Rousseau's musical dictionary the terms by which the different parts were denominated in D'Alembert; but even Rousseau, with all his depth of thought and extent of erudition, instead of expressing himself with that precision which the subject required, frequently applies the same names indiscriminately to different parts, without assigning any reason for this promiscuous and licentious use of words. The English reader therefore will be best able to form an accurate idea of the different parts, by the nature and situation of the cleffs with which they are marked; and if he should find any impropriety in the names which are given them, he may adopt and associate others more agreeable to his ideas.]

(ss) Syncopation consists in a note which is protracted in two different times belonging partly to the one and partly to the other, or in two different bars; yet not so as entirely to occupy or fill up the two times, or the two bars. A note, for instance, which begins in the imperfect time of a bar, and which ends in the perfect time of the following, or which in the same bar begins in the imperfect part of one time and ends in the perfect of the following, is syncopated. A note which of itself occupies one or two bars, whether the measure consists of two or three times, is not considered as syncopated: this is a consequence of the preceding definition. This note is said to be *continued* or *protracted*. In the end of the example Z, the *ut* of the first bar consisting of three times is not syncopated, because it occupies two whole times. It is the same case with *mi* of the second bar, and with the *ut* of the fourth and fifth. These therefore are continued or protracted notes.

(†) *Times* and *bars* in music answer the very same end as punctuation in language. They determine the different periods of the movement, or the various degree of completion, which the sentiment, expressed by that movement, has attained. Let us suppose, for instance, a composer in music intending to express grief or joy, in all its various gradations, from its first and faintest sensation, to its acme or highest possible degree. We do not say that such a progress of any passion either has been or can be delineated in practice, yet it may serve to illustrate what we mean to explain. Upon this hypothesis, therefore, the degrees of the sentiment will pass from less to more sensible, as it rises to its most intense degree. The first of these gradations may be called a *time*, which is likewise the most convenient division of a bar or measure into its elementary or aliquot parts, and may be deemed equivalent to a comma in a sentence; a bar denotes a degree still more sensible, and may be considered as having the force of a semicolon; a strain brings the sentiment to a tolerable degree of perfection, and may be reckoned equal to a colon: the full period is the end of the imitative piece. It must have been remarked by observers of measure in melody or harmony, that the notes of which a bar or measure consists, are not diversified by their different durations alone, but likewise by greater or lesser degrees of emphasis,

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233 Value of a pointed note.

177. A note followed by a point or dot is increaſed half its value. The *ſi*, for inſtance, in the fifth bar of the example Y, followed by a point, has the value (*) or duration of a minim and of a crotchet at ſame time.

Chap. IV. *Containing a Definition of the principal Chords.*

239 Perfect chords, what.

178. The chord compoſed of a third, a fifth, and an octave, as *ut mi ſol ut*, is called a *perfect chord* (art. 32.)

If the third be major, as in *ut mi ſol ut*, the perfect chord is denominated *major:* if the third be minor, as in *la ut mi la*, the perfect chord is minor. The perfect chord major conſtitutes what we call the *major mode;* and the perfect chord minor, what we term the *minor mode* (art. 31).

240 Chord of the ſeventh, what, and how to be practiſed.

179. A chord compoſed of a third, a fifth, and a ſeventh, as *ſol ſi re fa*, or *re fa la ut*, &c. is called a *chord of the ſeventh*. It is obvious that ſuch a chord is wholly compoſed of thirds in aſcending.

All chords of the ſeventh are practiſed in harmony, ſave that which might carry the third minor and the ſeventh major, as *ut mi♭ ſol ſi;* and that which might carry a falſe fifth and a ſeventh major, as *ſi re fa la*※, (chap. xiv. Part I.)

241 Thoſe of different kinds.

180. As thirds are either major or minor, and as they may be differently arranged, it is clear that there are different kinds of chords of the ſeventh; there is even one, *ſi re fa la*, which is compoſed of a third, a falſe fifth, and a ſeventh.

242 Of the greater ſixth, what.

181. A chord compoſed of a third, a fifth, and a ſixth, as *fa la ut re*, *re fa la ſi*, is called a *chord of the greater ſixth*.

182. Every note which carries a perfect chord is called a *tonic*, and a perfect chord is marked by an 8, by a 3, or by a 5, which is written above the note; but frequently theſe numbers are ſuppreſſed. Thus in the example I. the two *ut*'s equally carry a perfect chord.

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243 Tonic, what, and its chords, how figured.

183. Every note which carries a chord of the ſeventh is called a *dominant* (art. 102); and this chord is marked by a 7 written above the note. Thus in the example II. *re* carries the chord *re fa la ut*, and *ſol* the chord *ſol ſi re fa*.

244 Dominant, what, and how figured.

It is neceſſary to remark, that among the chords of the ſeventh we do not reckon the chord of the ſeventh diminiſhed, which is only improperly called a *chord of the ſeventh;* and of which we ſhall ſay more below.

[244] Sub dominant, what, and how figured.

184. Every note which carries the chord of the great ſixth, is called a *ſubdominant*, (art. 97, and 42.) and is marked with a 6. Thus in the example III. *fa* carries the chord of *fa la ut re*. You ought to remark that the ſixth ſhould always be major, (art. 97, and 109.)

245 Fundamental note, what. See Fundamental.

185. In every chord, whether perfect, or a chord of the ſeventh, or of the great ſixth, the note which carries this chord, and which is the flatteſt or loweſt, is called the *fundamental note*. Thus *ut* in the example I. *re* and *ſol* in the example II. and *fa* in the example III. are fundamental notes.

246 Diſſonance of a chord, what.

186. In every chord of the ſeventh, and of the great ſixth, the note which forms the ſeventh or ſixth above the fundamental, that is to ſay, the higheſt note of the chord, is called a *diſſonance*. Thus in the chords of the ſeventh *ſol ſi re fa*, *re fa la ut*, *fa* and *ut* are the diſſonances, viz. *fa* with relation to *ſol* in the firſt chord, and *ut* with relation to *re* in the ſecond. In the chord of the great ſixth *fa la ut re*, *re* is the diſſonance (art. 120.); but that *re* is only, properly

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phaſis. The moſt emphatic parts of a bar are called the *accented parts;* thoſe which require leſs energy in expreſſions are called the *unaccented*. The ſame obſervation holds with regard to times as bars. The ſtroke, therefore, of the hand or foot in beating marks the accented part of the bar, the elevation or preparation for the ſtroke marks the unaccented part. Let us once more reſume our compoſition intended to expreſs the different periods in the progreſs of grief or joy. There are ſome revolutions in each of theſe ſo rapid as not to be marked by any ſenſible tranſition whether diatonic or conſonant. In this caſe, the moſt expreſſive tone may be continued from one part of a time or meaſure to another, and end before the period of that time or meaſure in which it begins. Here therefore is a natural principle upon which the practice of ſyncopation may be founded even in melody: but when muſic is compoſed in different parts to be ſimultaneouſly heard, the continuance of one note not divided by regular times and meaſures, nor beginning and ending with either of them, whilſt the other parts either aſcend or deſcend according to the regular diviſions of the movement, has not only a ſenſible effect in rendering the imitation more perfect, but even gives the happieſt opportunities of diverſifying the harmony, which of itſelf is a moſt delightful perception.

For the various diſpoſitions of accent in times and meaſures, according to the movement of any piece, ſee a Treatiſe on muſic by Alexander Malcolm.

For the opportunity of diverſifying harmony afforded by ſyncopation, ſee Rameau's Principles of Compoſition.

(*) To prevent ambiguity or confuſion of ideas, it is neceſſary to inform our readers, that we have followed M. D'Alembert in his double ſenſe of the word *value*, though we could have wiſhed he had diſtinguiſhed the different meanings by different words. A ſound may be either eſtimated by its different degrees of intenſeneſs, or by its different quantities of duration.

To ſignify both thoſe ideas the word *value* is employed by D'Alembert. The reader, therefore, will find it of importance to diſtinguiſh the value of a note in height from its value in duration. This he may eaſily do, by conſidering whether the notes are treated as parts of the diatonic ſcale, or as continued for a greater or leſſer duration.

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properly ſpeaking, a diſſonance with relation to *ut* from which it is a *ſecond*, and not with reſpect to *ſi* from which it is a *ſixth major* (art. 17, and 18).

247 Tonic and ſimple dominant, what.

187. When a chord of the ſeventh is compoſed of a third major, followed by two thirds minor, the fundamental note of this chord is called the *tonic dominant*. In every other chord of the ſeventh the fundamental is called the *ſimple dominant* (art. 102.) Thus in the chord *ſol ſi re fa*, the fundamental *ſol* is the *tonic dominant*; but in the other chords of the ſeventh, as *ut mi ſol ſi*, *re fa la ut*, &c. the fundamentals *ut* and *re* are *ſimple dominants*.

248 Major chords, how rendered minor, and vice verſa.

188. In every chord, whether perfect, or of the ſeventh, or of the ſixth, if you have a mind that the third above the fundamental note ſhould be major, though it is naturally minor, you muſt place a ſharp above the fundamental note. For example, if I would mark the perfect major chord *re fa*※ *la re*, as the third *fa* above *re* is naturally minor, I place above *re* a ſharp, as you may ſee in example IV. In the ſame manner the chord of the ſeventh *re fa*※ *la ut*, and the chord of the great ſixth *re fa*※ *la ſi*, is marked with a ※ above *re*, and above the ※ a 7 or a 6 (ſee V. and VI.)

On the contrary, when the third is naturally major, and if you ſhould incline to render it minor, you muſt place above the fundamental note a ♭. Thus the examples VII. VIII. IX. ſhow the chords *ſol ſi*♭ *re ſol*, *ſol ſi*♭ *re fa*, *ſol ſi*♭ *re mi* (TT).

Chap. V. *Of the Fundamental Baſs.*

249 Fundamental baſs, how formed.

189. Invent a modulation at your pleaſure; and under this modulation let there be ſet a baſs compoſed of different notes, of which ſome may carry a perfect chord, others that of the ſeventh, and others that of the great ſixth, in ſuch a manner that each note of the modulation which anſwers to each of the baſs, may be one of thoſe which enters into the chord of that note in the baſs; this baſs being compoſed according to the rules which ſhall be immediately given, will be the *fundamental baſs* of the modulation propoſed. See Part I. where *the nature and principles of the fundamental baſs* are explained.

See Fundamental baſs.

Thus (Exam. XVIII.) you will find that this modulation, *ut re mi fa ſol la ſi ut*, has or may admit for its fundamental baſs *ut ſol*⁷ *ut fa*⁶ *ut re*⁷ *ſol*⁷ *ut*.

In reality, the firſt note *ut* in the upper part is found in the chord of the firſt note *ut* in the baſs, which chord is *ut mi ſol ut*; the ſecond note *re* in the treble is found in the chord *ſol ſi re fa*, which is the chord of the ſecond note in the baſs, &c. and the baſs is compoſed only of notes which carry a perfect chord, or that of the ſeventh, or that of the great ſixth. Moreover, it is formed according to the rules which we are now about to give.

Chap. VI. *Rules for the Fundamental Baſs.*

250 Rules for the formation of this baſs.

190. All the notes of the fundamental baſs being only capable of carrying a perfect chord, or the chord of the ſeventh, or that of the great ſixth, are either tonics, or dominants, or ſub-dominants; and the dominants may be either ſimple or tonic.

The fundamental baſs ought always to begin with a tonic, as much as it is practicable. And now follow the rules for all the ſucceeding chords; rules which are evidently derived from the principles eſtabliſhed in the *Firſt Part* of this treatiſe. To be convinced of this, we ſhall find it only neceſſary to review the articles 34, 91, 122, 124, 126, 127.

Rule I.

191. In every chord of the tonic, or of the tonic dominant, it is neceſſary that at leaſt one of the notes which form that chord ſhould be found in the chord that precedes it.

Rule II.

192. In every chord of the ſimple dominant, it is neceſſary

(TT) We may only add, that there is no occaſion for making theſe ſharps or flats when they are originally placed at the cleff. For inſtance, if the ſharp be upon the cleff of *fa* (ſee Exam. X.), one may ſatiſfy himſelf with ſimply writing *re*, without a ſharp to mark the perfect chord major of *re*, *re fa*※ *la re*. In the ſame manner, in the Example XI. where the flat is at the cleff upon *ſi*, one may ſatiſfy himſelf with ſimply writing *ſol*, to mark the perfect chord minor of *ſol ſi*♭ *re ſol*.

But if a caſe occurs where there is a ſharp or a flat at the cleff, if any one would wiſh to render the chord minor which is major, or *vice verſa*, he muſt place above the fundamental note a ♮ or natural. Thus the Example XII. marks the minor chord *re fa la re*, and Example XIII. the major chord *ſol ſi re ſol*.—Frequently, in lieu of a natural, a flat is uſed to ſignify the minor chord, and a ſharp to ſignify the major. Thus Example XIV. marks the minor chord *re fa la re*, and Example XV. the major chord *ſol ſi re ſol*.

When in a chord of the great ſixth, the diſſonance, that is to ſay, the ſixth, ought to be ſharp, and when the ſharp is not found at the cleff, they write before or after the 6 a ※; and if this ſixth ſhould be flat according to the cleff, they write a ♮.

In the ſame manner, if in a chord of the ſeventh of the tonic dominant, the diſſonance, that is to ſay, the ſeventh, ought to be flat or natural, they write by the ſide of the ſeventh a ♭ or a ♮. Many muſicians, when a ſeventh from the ſimple dominant ought to be altered by a ſharp or a natural, have likewiſe written by the ſide of the ſeventh a ※ or a ♮; but M. Rameau ſuppreſſes theſe characters. The reaſon ſhall be given below, when we ſpeak of chords by ſuppoſition.

If there be a ſharp on the cleff of *fa*, and if I ſhould incline to mark the chord *ſol ſi re fa*, or the chord *la ut mi fa*, I would place before the ſeventh or the ſixth a ♮ or a ♭.

In the ſame manner, if there be a flat on the cleff at *ſi*, and if I ſhould incline to mark the chord *ut mi ſol ſi*, I would place before the ſeventh a ※ or a ♮; and ſo of the reſt.

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necessary that the note which constitutes the seventh, or dissonance, should likewise be found in the preceding chord.

RULE III.

193. In every chord of the sub-dominant, at least one of its consonances must be found in the preceding chord. Thus, in the chord of the sub-dominant *fa la ut re*, it is necessary that *fa*, *la*, or *ut*, which are the consonances of the chord, should be found in the chord preceding. The dissonance *re* may either be found in it or not.

RULE IV.

194. Every simple or tonic dominant ought to descend by a fifth. In the first case, that is to say, when the dominant is simple, the note which follows can only be a dominant; in the second it may be any one you choose; or, in other words, it may either be a tonic, a tonic dominant, a simple dominant, or a sub-dominant. It is necessary, however, that the conditions prescribed in the second rule should be observed, if it be a simple dominant.

This last reflection is necessary, as you will presently see. For let us assume the succession of the two chords *la ut※ mi sol*, *re fa la ut* (see Exam. XIX.), this succession is by no means legitimate, though in it the first dominant descends by a fifth; because the *ut* which forms the dissonance in the second chord, and which belongs to a simple dominant, is not in the preceding chord. But the succession will be admissible, if, without meddling with the second chord, one should take away the sharp carried by the *ut* in the first; or if, without meddling with the first chord, one should render *ut* or *fa* sharp in the second (UU); or in short, if one should simply render the *re* of the second chord a tonic dominant, in causing it to carry *fa※* instead of *fa* natural (119. & 122.).

It is likewise by the same rule that we ought to reject the succession of the two following chords,

re fa la ut, *sol si re fa※*;

(see Exam. XX.).

RULE V.

195. Every sub-dominant ought to rise by a fifth; and the note which follows it may, at your pleasure, be either a tonic, a tonic dominant, or a sub-dominant.

REMARK.

251 Other rules substituted.

Of the five fundamental rules which have now been given, instead of the three first, one may substitute the three following, which are nothing but consequences from them, and which you may pass unnoticed if you think it proper.

RULE I.

If a note of the fundamental bass be a tonic, and rise by a fifth or a third to another note, that second note may be either a *tonic* (34. & 91.), see Examples XXI. and XXII. (XX); a *tonic dominant* (124.), see XXIII. and XXIV.; or a *sub-dominant* (124.), see XXV. and XXVI.; or, to express the rule more simply, that second note may be any one you please, except a *simple dominant*.

RULE II.

If a note of the fundamental bass be a tonic, and descend by a fifth or a third upon another note, this second note may be either a tonic (34. & 91.), see Exam. XXVII. and XXVIII.; or a tonic dominant, or a simple dominant, yet in such a manner that the rule of art. 192. may be observed (124.), see XXIX. XXX. XXXI. XXXII.; or a sub-dominant (124.), see XXXIII. and XXXIV.

The procedure of the bass *ut mi♭ sol ut*, *fa la ut mi*, from the tonic *ut* to the dominant *fa* (Ex. XXXV.), is excluded by art. 192.

RULE III.

If a note in the fundamental bass be a tonic, and rise by a second to another note, that note ought to be a tonic dominant, or a simple dominant (101. & 102.). See XXXVI. and XXXVII. (YY.)

We must here advertise our readers, that the examples XXXVIII. XXXIX. XL. XLI. belong to the fourth rule above, art. 194; and the examples XLII. XLIII. XLIV. to the fifth rule above, art. 195. See the articles 34, 35, 121, 123, 124.

REMARK I.

196. The transition from a tonic dominant to a tonic is called an *absolute repose*, or a *perfect cadence* (73.); and the transition from a sub-dominant to a tonic is called an *imperfect* or *irregular cadence* (73.); the cadences are formed at the distance of four bars one from another, whilst the tonic then falls within the first time of the bar. See XLV. and XLVI. 252 Perfect and imperfect cadences, what, and how employed.

REMARK II.

197. We must avoid, as much as we can, syncopations in the fundamental bass; that, within the first time of which a bar is constituted, the ear may be entertained with a harmony different from that which it had 253 Syncopation only admissible in the fundamental bass by licence.

2

(UU) In this chord it is necessary that the *ut* and *fa* should be sharp at the same time; for the chord *re fa la ut※*, in which *ut* would be sharp without the *fa*, is excluded by art. 179.

(XX) When the bass rises or descends from one tonic to another by the interval of a third, the mode is commonly changed; that is to say, from a major it becomes a minor. For instance, if I ascend from the tonic *ut* to the tonic *mi*, the major mode of *ut*, *ut mi sol ut*, will be changed into the minor mode of *mi*, *mi sol si mi*. For what remains, we must never ascend from one tonic to another, when there is no sound common to both their modes: for example, you cannot rise to the mode of *ut*, *ut mi sol ut*, from the minor mode of *mi*♭, *mi*♭ *sol*♭ *si*♭ *mi*♭ (91.)

(YY) By this we may see, that all the intervals, viz. the third, the fifth, and second, may be admitted in the fundamental bass, except that of a second in descending. For what remains, it is very proper to remark, that the rules immediately given for the fundamental bass are not without exception, as approved compositions in music will certainly discover; but these exceptions being in reality licences, and for the most part in opposition to the great principle of connection, which prescribes that there should be at least one note in common between a preceding and a subsequent chord, it does not seem necessary to entertain initiates with a minute detail of these licences in an elementary work, where the first and most essential rules of the art alone ought to be expected.

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had before perceived in the last time of the preceding bar. Nevertheless, syncopation may be sometimes admitted in the fundamental bass, but it is by a licence (zz).

Chap. VII. *Of the Rules which ought to be observed in the Treble with relation to the Fundamental Bass.*

254
Definition of treble.

198. The treble is nothing else but a modulation above the fundamental bass, and whose notes are found in the chords of that bass which corresponds with it (189.). Thus in Ex. XVIII. the scale *ut re mi fa sol la si ut*, is a treble with respect to the fundamental bass *ut sol ut fa ut re sol ut*.

255
One note in the treble or bass may answer to several of its correspondent parts, and why.

199. We are just about to give the rules for the treble; but first we think it necessary to make the two following remarks.

1. It is obvious, that many notes of the treble may answer to one and the same note in the fundamental bass, when these notes belong to the chord of the same note in the fundamental bass. For example, this modulation *ut mi sol mi ut*, may have for its fundamental bass the note *ut* alone, because the chord of that note comprehends the sounds *ut*, *mi*, *sol*, which are found in the treble.

2. In like manner, a single note in the treble may, for the same reason, answer to several notes in the bass. For instance, *sol* alone may answer to these three notes in the bass, *ut sol ut* (AAA).

Rule I. *for the Treble.*

200. If the note which forms the seventh in a chord of the *simple dominant* is found in the treble, the note which precedes it must be the very same. This is what we call a *discord prepared* (122). For instance, let us suppose that the note of the fundamental bass shall be *re*, bearing the chord of the simple dominant *re fa la ut*; and that this *ut*, which (art. 18. and 118.) is the dissonance, should be found in the treble; it is necessary that the note which goes before it in the treble should likewise be an *ut*.

201. And it is requisite to observe, that, according to the rules which we have given for the fundamental bass, *ut* will always be found in the chord of that note in the fundamental bass which precedes the simple dominant *re*. See XLVIII. XLIX. L. In the first example the dissonance is *ut*, in the second *sol*, and in the third *mi*; and these notes are already in the preceding chord (BBB).

Rule II.

202. If a note of the fundamental bass be a tonic dominant, or a simple dominant, and if the dissonance be found in the treble, this dissonance in the same treble ought to descend diatonically. But if the note of

(zz) There are notes which may be found several times in the fundamental bass in succession with a different harmony. For instance, the tonic *ut*, after having carried the chord *ut mi sol ut*, may be followed by another *ut* which carries the chord of the seventh, provided that this chord be the chord of the tonic dominant *ut mi sol si*♭. See LXXII. In the same manner, the tonic *ut* may be followed by the same tonic *ut*, which may be rendered a *sub-dominant*, by causing it to carry the chord *ut mi sol la*. See LXXIII.

A dominant, whether tonic or simple, sometimes descends or rises upon one another by the interval of a tritone or false fifth. For example, the dominant *fa*, carrying the chord *fa la ut mi*, may be followed by another dominant *si*, carrying the chord *si re fa la*. This is a licence in which the musician indulges himself, that he may not be obliged to depart from the scale in which he is; for instance, from the scale of *ut* to which *fa* and *si* belong. If one should descend from *fa* to *si*♭ by the interval of a just fifth, he would then depart from that scale, because *si*♭ is no part of it.

(AAA) There are often in the treble several notes which may, if we choose, carry no chord, and be regarded merely as notes of passage, serving only to connect between themselves the notes that do carry chords, and to form a more agreeable modulation. These notes of passage are commonly quavers. See Exam. XLVII. in which this modulation *ut re mi fa sol*, may be regarded as equivalent to this other, *ut mi sol*, as *re* and *fa* are no more than notes of passage. So that the bass of this modulation may be simply *ut sol*.

When the notes are of equal duration, and arranged in a diatonic order, the notes which occupy the perfect part of each time, or those which are accented, ought each of them to carry chords. Those which occupy the imperfect part, or which are unaccented, are no more than mere notes of passage. Sometimes, however, the note which occupies the imperfect part may be made to carry harmony; but the value of this note is then commonly increased by a point which is placed after it, which proportionably diminishes the continuance of the note that occupies the perfect time, and make it pass more swiftly.

When the notes do not move diatonically, they ought generally all of them to enter into the chord which is placed in the lower part correspondent with these notes.

(BBB) There is, however, one case in which the seventh of a simple dominant may be found in a modulation without being prepared. It is when, having already employed that dominant in the fundamental bass, its seventh is afterwards heard in the modulation, as long as this dominant may be retained. For instance, let us imagine this modulation,

	ut |	*re*	*ut*	*si*	*ut* |	*re*;
and this fundamental bass,	*ut* |		$\overset{7}{re}$	$\overset{7}{sol}$	*ut* |	$\overset{7}{sol}$

(see Example LI.); the $\overset{7}{re}$ of the fundamental bass answers to the two notes *re ut* of the treble. The dissonance *ut* has no need of preparation, because the note $\overset{7}{re}$ of the fundamental bass having already been employed for the *re* which precedes *ut*, the dissonance *ut* is afterwards presented, below which the chord *re* may be preserved, or *re fa la ut*.

of the bass be a sub-dominant, it ought to rise diatonically. This dissonance, which rises or descends diatonically, is what we have called a *dissonance saved* or *resolved* (129, 130.). See LII. LIII. LIV.

203. One may likewise observe here, that, according to the rules for the fundamental bass which we have given, the note upon which the dissonance ought to descend or rise will always be found in the subsequent chord (ccc).

Chap. VIII. *Of the Continued Bass, and its Rules.*

* See Continued bass.

256 Thorough-bass, what.

257 Chords inverted, how.

204. A continued* or thorough bass, is nothing else but a fundamental bass whose chords are *inverted.* We invert a chord when we change the order of the notes which compose it. For example, if instead of the chord *sol si re fa*, I should say *si re fa sol* or *re fa sol si*, &c. the chord is inverted. Let us see then, in the first place, all the possible ways in which a chord may be inverted.

The ways in which a Perfect Chord may be Inverted.

205. The perfect chord *ut mi sol ut* may be inverted in two different ways.

1. *Mi sol ut mi*, which we call a chord of the *sixth*, composed of a third, a sixth, and an octave, and in this case the note *mi* is marked with a 6. (See LVI.)

2. *Sol ut mi sol*, which we call a *chord of the sixth and fourth*, composed of a fourth, a sixth, and an octave; and it is marked with a $^{6}_{4}$. (See LVII.)

The perfect minor chord is inverted in the same manner.

The ways in which the Chord of the Seventh may be Inverted.

206. In the chord of the tonic dominant, as *sol si re fa*, the third major *si* above the fundamental note *sol* is called a *sensible note* (77.); and the inverted chord *si re fa sol*, composed of a third, a false fifth, and sixth, is called the *chord of the false fifth*, and is marked with an 8 or a ♭5 (see LVIII. and LIX.)

The chord *re fa sol si*, composed of a third, a fourth, and a sixth, is called the *chord of the sensible sixth*, and marked with a 6 or a ※6. In this chord thus figured, the third is minor, and the sixth major, as it is easy to be perceived. (See LX.)

The chord *fa sol si re*, composed of a second, a tritone, and a sixth, is called the *chord of the tritone*, and is marked thus 4+, thus ×4, or thus ※4. (See LXI.)

207. In the chord of the simple dominant *re fa la ut*, we find,

1. *Fa la ut re*, a chord of the great sixth, which is composed of a third, a fifth, and a sixth, and which is figured with a $^{6}_{5}$. See LXIII. (ddd).

2. *La ut re fa*, a chord of the lesser sixth, which is figured with a 6. See LXIV. (eee).

3. *Ut re fa la*, a chord of the second, composed of a second, a fourth, and a sixth, and which is marked with a 2. See LXII. (fff).

The ways in which the Chord of the sub-Dominant may be inverted.

208. The chord of the sub-dominant, as *fa la ut re*, may be inverted in three different manners; but the method of inverting it which is most in practice is the chord of the lesser sixth *la ut re fa*, which is marked with a 6, and the chord of the seventh *re fa la ut*. See LXIV.

Rules for the Continued Bass.

209. The continued bass is a fundamental bass, whose chords are only inverted in order to render it more in the taste of singing, and suitable to the voice. See LXV. in which the fundamental bass which in itself is monotonic and little suited for singing, *ut sol ut sol ut sol ut*, produces, by inverting its chords, this continued

(ccc) When the treble syncopates in descending diatonically, it is common enough to make the second part of the syncope carry a discord, and the first a concord. See *Example* LV. where the first part of the syncopated note *sol* is in concord with the notes *ut mi sol ut*, which answer to it in the fundamental bass, and where the second part is a dissonance in the subsequent chord *la ut mi sol*. In the same manner, the first part of the syncopated note *fa* is in concord with the notes *re fa la ut*, which answer to it; and the second part is a dissonance in the subsequent chord *sol si re fa*, which answer to it, &c.

(ddd) We are obliged to mark likewise, in the continued bass, the chord of the sub-dominant with a $^{6}_{5}$, which in the fundamental bass is figured with a 6 alone; and this to distinguish it from the chords of the sixth and of the lesser sixth. (See Examples LVI. and LXIV.) For what remains, the chord of the great sixth in the fundamental bass carries always the sixth major, whereas in the continued bass it may carry the sixth minor. For instance, the chord of the seventh *ut mi sol si*, gives the chord of the great sixth *mi sol si ut*, thus improperly called, since the sixth from *mi* to *ut* is minor.

(eee) M. Rameau has justly observed, that we ought rather to figure this lesser sixth with a $^{3}_{4}$, to distinguish it from the sensible sixth which arises from the chord of the tonic dominant, and from the sixth which arises from the perfect chord. In the mean time he figures in his works with a 6 alone, the lesser sixths which do not arise from the tonic dominant; that is to say, he figures them as those which arise from the perfect chord; and we have followed him in that, though we thought with him, that it would be better to mark this chord by a particular figure.

(fff) The chord of the seventh *si re fa la* gives, when inverted, the chord *fa la si re*, composed of a third, a tritone, and a sixth. This chord is commonly marked with a 6, as if the tritone were a just fourth. It is his business who performs the accompaniment, to know whether the fourth above *fa* be a tritone or a fourth redundant. One may, as to what remains, figure this chord thus $^{6}_{4}$*.

tinued bass highly proper to be sung, *ut si ut re mi fa mi*, &c. (GGG)

The continued bass then is properly nothing else but a treble with respect to the fundamental bass. Its rules immediately follow, which are properly no other than those already given for the treble.

RULE I.

210. Every note which carries the chord of the false fifth, and which of consequence must be what we have called a *sensible note*, ought (77) to rise diatonically upon the note which follows it. Thus in example LXV. the note *si*, carrying the chord of the false fifth marked with an 8, rises diatonically upon *ut* (HHH).

RULE II.

211. Every note carrying the chord of the tritone should descend diatonically upon the subsequent note. Thus in the same example LXV. *fa*, which carries the chord of the tritone figured with a 4+, descends diatonically upon *mi*. (Art. 202.)

RULE III.

212. The chord of the second is commonly put in practice upon notes which are syncopated in descending, because these notes are dissonances which ought to be prepared and resolved (200, 202.) See the example LXVI. where the second *ut*, which is syncopated, and which descends afterwards upon *si*, carries the chord of the second (III).

CHAP.

(GGG) The continued bass is proportionably better adapted to singing, as the sounds which form it more scrupulously observe the diatonic order, because this order is the most agreeable of all. We must therefore endeavour to preserve it as much as possible. It is for this reason that the continued bass in Example LXV. is much more in the taste of singing, and more agreeable, than the fundamental bass which answers to it.

(HHH) The continued bass being a kind of treble with relation to the fundamental bass, it ought to observe the same rules with respect to that bass as the treble. Thus a note, for instance *re*, carrying a chord of the seventh *re fa la ut*, to which the chord of the sub-dominant *fa la ut re* corresponds in the fundamental bass, ought to rise diatonically upon *mi*, (art. 129, n° 2. and art. 202.)

(III) When there is a *repose* in the treble, the note of the continued bass ought to be the same with that of the fundamental bass, (see example LXVII.) In the closes which are found in the treble at *si* and *ut* (bars third and fourth), the notes in the fundamental and continued bass are the same, viz. *sol* for the first cadence, and *ut* for the second. This rule ought above all to be observed in final cadences which terminate a piece or a modulation.

It is necessary, as much as possible, to prevent coincidences of the same notes in the treble and continued bass, unless the motion of the continued bass should be contrary to that of the treble. For example, in the second note of the second bar in example LXVII. *mi* is found at the same time in the continued bass and in the treble; but the treble descends from *fa* to *mi*, whilst the bass rises from *re* to *mi*.

Two octaves, or two fifths, in succession, must likewise be shunned. For instance, in the treble sounds *sol mi*, the bass must be prevented from sounding *sol mi*, *ut la*, or *re si*, because in the first case there are two octaves in succession, *sol* against *sol*, and *mi* against *mi*; and because in the second case there are two fifths in succession, *ut* against *sol*, and *la* against *mi*, or *re* against *sol*, and *si* against *mi*. This rule, as well as the preceding, is founded upon this principle, that the continued bass ought not to be a copy of the treble, but to form a different melody.

Every time that several notes of the continued bass answer to one note alone of the fundamental, the composer satisfies himself with figuring the first of them. Nay he does not even figure it if it be a tonic; and he draws above the others a line, continued from the note upon which the chord is formed. See example LXVIII. where the fundamental bass *ut* gives the continued bass *ut mi sol mi*; the two *mi*'s ought in this bass to carry the chord 6, and *sol* the chord $\frac{6}{4}$: but as these chords are comprehended in the perfect chord *ut mi sol ut*, which is the first of the continued bass, we place nothing above *ut*, only we draw a line over *ut mi sol mi*.

In like manner, in the second bar of the same example, the notes *fa* and *re* of the continued bass, rising from the note *sol* alone of the fundamental bass which carries the chord *sol si re fa*, we think it sufficient to figure *fa* with the number of the tritone 4×, and to draw a line above *fa* and *re*.

It should be remarked, that this *fa* ought naturally to descend to *mi*; but this note is considered as subsisting so long as the chord subsists; and when the chord changes, we ought necessarily to find the *mi*, as may be seen by that example.

In general, whilst the same chord subsists in passing through different notes, the chord is reckoned the same as if the first note of the chord had subsisted; in such a manner, that, if the first note of the chord is, for instance, the sensible note, we ought to find the tonic when the chord changes. See example LXIX. or this continued bass, *ut si sol si re ut*, is reckoned the same with this *ut si ut*. (Example LXX.)

If a single note of the continued bass answers to several notes of the fundamental bass, it is figured with the different chords which agree to it. For example, the note *sol* in a continued bass may answer to this fundamental bass *ut sol ut*, (see example LXXI.); in this case, we may regard the note *sol* as divided into three parts, of which the first carries the chord $\frac{6}{4}$, the second the chord 7, and the third the chord $\frac{6}{4}$.

We shall repeat here, with respect to the rules of the continued bass, what we have formerly said concerning the rules of the fundamental bass in the note upon the third rule, art. 193. The rules of the continued bass have exceptions, which practice and the perusal of good authors will teach. There are likewise several other rules which might require a considerable detail, and which will be found in the *Treatise of Harmony* by M. Rameau, and elsewhere. These rules, which are proper for a complete dissertation, did not appear to me indispensably necessary in an *elementary essay upon music*, such as the present. The books which we have quoted at the end of our *preliminary discourse* will more particularly instruct the reader concerning this practical detail.

Principles of Composition.

Chap. IX. *Of some Licences assumed in the Fundamental Bass.*

§ 1. *Of* Broken *and* Interrupted Cadences.

258 Broken cadence, how executed.

213. The broken cadence is executed by means of a dominant which rises diatonically upon another, or upon a tonic by a licence. See, in the example LXXIV. *sol la*, (132, and 134).

259 Interrupted cadence, how formed.

214. The interrupted cadence is formed by a dominant which descends by a third upon another (136). See, in the example LXXV. *sol mi* (LLL).

These cadences ought to be permitted but rarely and with precaution.

§ 2. *Of* Supposition.

260 Chord by supposition, what. See Supposition.

215. When a dominant is preceded by a tonic in the fundamental bass, we add sometimes, in the continued bass to the chord of that dominant, a new note which is a third or fifth below; and the chord which results from it in this continued bass is called *a chord by supposition*.

For example, let us suppose, that in the fundamental bass we have a dominant *sol* carrying the chord of the seventh *sol si re fa;* let us add to this chord the note *ut*, which is a fifth below this dominant, and we shall have the total chord *ut sol si re fa*, or *ut re fa sol si*. which is called *a chord by supposition* (MMM.)

Of the different kinds of chords by supposition.

216. It is easy to perceive, that chords by supposition are of different kinds. For instance, the chord of the tonic *sol si re fa* gives,

261 These different chords what and how figured.

1. By adding the fifth *ut*, the chord *ut sol si re fa*, called a *chord of the seventh redundant*, and composed of a fifth, seventh, ninth, and eleventh. It is figured with a ※7; see LXXVI. (NNN). This chord is not practised but upon the tonic. They sometimes leave out the sensible note, for reasons which we shall give in the note QQQ, upon the art. 219; it is then reduced to *ut fa sol re*, and marked with $\frac{5}{4}$ or $\frac{5}{2}$.

2. By adding the third *mi*, we shall have the chord *mi sol si re fa*, called a *chord of the ninth*, and composed of a third, fifth, seventh, and ninth. It is figured with a 9. This third may be added to every third of the dominant. See LXXVII. (OOO).

3. If to a chord of the simple dominant, as *re fa la ut*, we should add the fifth *sol*, we would have the chord *sol re fa la ut*, called a *chord of the eleventh*, and which is figured with a $\frac{9}{4}$ or $\frac{4}{9}$. (See LXXVIII.)

Observe.

262 Occasions when retrenchments of chords are proper.

217. When the dominant is not a tonic dominant, they often take away some notes from the chord. For example, let us suppose that there is in the fundamental bass this simple dominant *mi*, carrying the chord *mi sol si re:* if there should be added the third *ut* beneath, we shall have this chord of the continued bass *ut mi sol si re*, but they suppress the seventh *si*, for reasons which shall be explained in the note QQQ upon art.

(LLL) One may sometimes, but very rarely cause several tonics in succession to follow one another in ascending or descending diatonically, as *ut mi sol ut, re fa la re, si*♭ *re fa si*♭; but, besides that this succession is harsh, it is necessary, in order to render it practicable, that the fifth below the first tonic should be found in the chord of the tonic following, as here *fa*, a fifth below the first tonic *ut*, is found in the chord *re fa la re*, and in the chord *si*♭ *re fa si*♭ (37 and note G.)

(MMM) Though supposition be a kind of licence, yet it is in some measure founded on the experiment related in the note (F), where you may see that every principal or fundamental sound causes its twelfth and seventeenth major in descending to vibrate, whilst the twelfth and the seventeenth major ascending resound: which seems to authorize us in certain cases to join with the fundamental harmony this twelfth and seventeenth in descending; or, which is the same thing, the fifth or the third beneath the fundamental sound.

Even without having recourse to this experiment, we may remark, that the note added beneath the fundamental sound, causes that very fundamental sound to be heard. For instance, *ut* added beneath *sol*, causes *sol* to resound. Thus *sol* is found in some measure to be implied in *ut*.

If the third added beneath the fundamental sound be minor, for example, if to the chord *sol si re fa*, we add the third *mi*, the supposition is then no longer founded on the experiment, which only gives the seventeenth major, or, what is the same thing, the third major beneath the fundamental sound. In this case the addition of the third minor must be considered as an extension of the rule, which in reality has no foundation in the chords emitted by a sonorous body, but is authorized by the sanction of the ear and by practical experiment.

(NNN) Many musicians figure this chord with a ※ $\frac{7}{2}$; M. Rameau suppresses this 2, and merely marks it to be the seventh redundant by a 7※ or ※7. But it may be said, how shall we distinguish this chord from the seventh major, which, as it would seem, ought to be marked with a 7※? M. Rameau answers, that there is no danger of mistake, because in the seventh major, as the seventh ought to be prepared, it is found in the preceding chord; and thus the sharp subsisting already in the preceding chord, it would be useless to repeat it.

7
※
Thus *re sol*, according to M. Rameau, would indicate *re fa*※ *la ut, sol si re fa*※. If we would change *fa*※
7
※ 7♮
of the second chord into *fa*, it would then be necessary to write *re sol.* In notes such as *ut*, whose natural seventh is major, the figure 7 preceded or followed by a sharp will sufficiently serve to distinguish the chord of the seventh redundant *ut sol si re fa*, from the simple chord of the seventh *ut mi sol si*, which is marked with a 7 alone. All this appears just and well founded.

(OOO) Supposition introduces into a chord dissonances which were not in it before. For instance, if to the chord *mi sol si re*, we should add the note of supposition *ut* descending by a third, it is plain that, besides the dissonance art. 219. In this ſtate the chord is ſimply compoſed of a third, fifth, and ninth, and is marked with a 9. See LXXIX. (PPP)

218. What is more, in the chord of the ſimple dominat, as *re fa la ut*, when the fifth *ſol* is added, they frequently obliterate the ſounds *fa* and *la*, that too great a number of diſſonances may be avoided, which reduces the chord to *ſol ut re*. This laſt is compoſed only of the fourth and the fifth. It is called a *chord of the fourth*, and it is figured with a 4. (See LXXX.)

219. Sometimes they only remove the note *la*, and then the chord ought to be figured with $^{7}_{4}$ or $^{4}_{7}$ (QQQ).

263 Chord of the fifth redundant what, and how figured.

220. Finally, in the minor mode, for example, in that of *la*, where the chord of the tonic dominant (109,) is *mi ſol*※ *ſi re*; if we add to this chord the third *ut* below, we ſhall have *ut mi ſol*※ *ſi re*, called the *chord of the fifth redundant*, and compoſed of a third, a fifth redundant, a ſeventh, and a ninth. It is figured with a ※5 or a +5. See LXXXI. (RRR.)

§ 3. *Of the* Chord *of the* Diminished Seventh.

264 Chord of the flat ſeventh what, and how figured.

221. In the minor mode, for inſtance, in that of *la mi* a fifth from *la* is the tonic dominant (109), and carries the chord *mi ſol*※ *ſi re*, in which *ſol* is the ſenſible note. For this chord they ſometimes ſubſtitute that other *ſol*※ *ſi re fa* (116), all compoſed of minor thirds; and which has for its fundamental ſound the ſenſible note *ſol*※. This chord is called a *chord of the flat, or diminiſhed ſeventh*, and is figured with a 7 in the fundamental baſs, (ſee LXXXII.): but it is always conſidered as repreſenting the chord of the tonic dominant.

265 Chords produced in the continued baſs by this what, and how figured.

222. This chord in the fundamental baſs produces in the continued baſs the following chords:

1. The chord *ſi re fa ſol*※, compoſed of a third, falſe fifth, and ſixth major. They call it the *chord of the ſixth ſenſible and falſe fifth*; and it is figured thus ※ $^{6}_{5}$, or + $^{6}_{5}$. (See LXXXIII).

2. The chord *re fa ſol*※ *ſi*, compoſed of a third, a tritone, and a ſixth, they call it the *chord of the tritone and third minor*; and they mark it thus ※ $\overset{4}{b}$. (See LXXXIV.)

3. The chord *fa ſol*※ *ſi re*, compoſed of a ſecond redundant, a tritone, and a ſixth. They call it the *chord of the ſecond redundant*, and they figure it thus ※2, or +2. See LXXXV. (SSS).

266 Alterations by ſuppoſition, chords which they produce what, and how figured.

223. Beſides, ſince the chord *ſol*※ *ſi re fa* repreſents the chord *mi ſol*※ *ſi re*, it follows, that if we operate by ſuppoſition upon the firſt of theſe chords, it muſt be performed as one would perform it upon *mi*

diſſonance between *mi* and *re* which was in the original chord, we have two new diſſonances, *ut ſi*, and *ut re*; that is to ſay, the ſeventh and the ninth. Theſe diſſonances, like the others, ought to be prepared and reſolved. They are prepared by being ſyncopated, and reſolved by deſcending diatonically upon one of the conſonances of the ſubſequent chord. The ſenſible note alone can be reſolved in aſcending; but it is even neceſſary that this ſenſible note ſhould be in the chord of the tonic dominant. As to the diſſonances which are found in the primitive chord, they ſhould always follow the common rules. (See art. 202.)

(PPP) Several muſicians call this laſt chord the *chord of the ninth*; and that which, with M. Rameau, we have ſimply called a *chord of the ninth*, they term a *chord of the ninth and ſeventh*. This laſt chord they mark with a $^{9}_{7}$; but the denomination and figure uſed by M. Rameau are more ſimple, and can lead to no error; becauſe the chord of the ninth always includes the ſeventh, except in caſes of which we have already ſpoken.

(QQQ) They often remove ſome diſſonances from chords of ſuppoſition, either to ſoften the harſhneſs of the chord, or to remove diſcords which can neither be prepared nor reſolved. For inſtance, let us ſuppoſe, that in the continued baſs the note *ut* is preceded by the ſenſible note *ſi*, carrying the chord of the falſe fifth, and that we ſhould chooſe to form upon this note *ut* the chord *ut mi ſol ſi re*, we muſt obliterate the ſeventh *ſi*, becauſe in retaining it we ſhould deſtroy the effect of the ſenſible note *ſi*, which ought to riſe to *ut*.

In the ſame manner, if to the harmony of a tonic dominant *ſol ſi re fa*, one ſhould add the note by ſuppoſition *ut*, it is uſual to retrench from this chord the ſenſible note *ſi*; becauſe, as the *re* ought to deſcend diatonically to *ut*, and the *ſi* to riſe to it, the effect of the one would deſtroy that of the other. This above all takes place in the *ſuſpence*, concerning which we ſhall preſently treat.

(RRR). *Suppoſition* produces what we call *ſuſpence*; and which is almoſt the ſame thing. Suſpenſion conſiſts in retaining as many as poſſible of the ſounds in a preceding chord, that they may be heard in the chord which ſucceeds. For inſtance, if this fundamental baſs be given *ut* $\overset{7}{\textit{ſol}}$ *ut*, and this continued baſs above it *ut* $\overset{※7}{\textit{ut}}$ *ut*, it is a ſuppoſition; but if we have this fundamental baſs *ut* $\overset{7}{\textit{ſol}}$ $\overset{7}{\textit{ſol}}$ *ut*, and this continued baſs above it *ut* $\overset{7}{\textit{ſol}}$ $\overset{※7}{\textit{ut}}$ *ut*, it is a ſuſpence; becauſe the perfect chord of *ut*, which we naturally expect after *ſol* in the continued baſs, is *ſuſpended* and *retarded* by the chord $\overset{※7}{\textit{ut}}$, which is formed by retaining the ſounds *ſol ſi re fa* of the preceding chord to join them to the note *ut* in this manner, *ut ſol ſi re fa*; but this chord $\overset{※7}{\textit{ut}}$ does nothing in this caſe but *ſuſpend* for a moment the perfect chord *ut mi ſol ut*, which ought to follow it.

(SSS) The chord of the diminiſhed ſeventh, ſuch as *ſol*※ *ſi re fa*, and the three derived from it, are termed *chords of ſubſtitution*. They are in general harſh, and proper for imitating melancholy objects.

mi ſol※ ſi re; that is to ſay, that it will be neceſſary to add to the chord *ſol※ ſi re fa*, the notes *ut* or *la*, which are the third or fifth below *mi*, and which will produce,

1. By adding *ut*, the chord *ut ſol※ ſi re fa*, compoſed of a fifth redundant, a ſeventh, a ninth, and eleventh, which is the octave of the fourth. It is called a *chord of the fifth redundant and fourth*, and thus marked $+^5_4$, or ※$^5_4$. (See LXXXVI.)

2. By adding *la*, we ſhall have the chord *la ſol※ ſi re fa*, compoſed of a ſeventh redundant, a ninth, an eleventh, and a thirteenth minor, which is the octave of the ſixth minor. It is called the *chord of the ſeventh redundant and ſixth minor*, and marked $\flat\overset{7}{6}$, or $※\overset{7}{\flat}$. (See LXXXVII.) It is of all chords the moſt harſh, and the moſt rarely practiſed (TTT).

In the *Treatiſe of Harmony* by M. Rameau, and elſewhere, may be ſeen a much longer detail of the chords by ſuppoſition: But here we delineate the elements alone.

Chap. X. *Of ſome Licences uſed in the Treble and Continued Baſs.*

267 Licence 1ſt.

224. Sometimes in a treble, the diſſonance which ought to have been reſolved by deſcending diatonically upon the ſucceeding note, inſtead of deſcending, on the contrary riſes diatonically: but in that caſe, the note upon which it ought to have deſcended muſt be found in ſome of the other parts. This licence ought to be rarely practiſed.

In like manner, in a continued baſs, the diſſonance in a chord of the ſub-dominant inverted, as *la* in the chord *la ut mi ſol*, inverted from *ut mi ſol la*, may ſometimes deſcend diatonically inſtead of riſing as it ought to do, art. 129. n° 2.; but in that caſe the note ought to be repeated in another part, that the diſſonance may be there reſolved in aſcending.

268 Licence 2d.

225. Sometimes likewiſe, to render a continued baſs more agreeable by cauſing it to proceed diatonically, they place between two ſounds of that baſs a note which belongs to the chord of neither. See example XCIV, in which the fundamental baſs *ſol ut* produces the continued baſs *ſol la ſi ſol ut*, where *la* is added on account of the diatonic modulation. This *la* has a line drawn above it to ſhow its reſolution by paſſing under the chord *ſol ſi re fa*.

In the ſame manner, (ſee XCV), this fundamental baſs *ut fa* may produce the continued baſs *ut re mi ut fa*, where the note *re* which is added paſſes under the chord *ut mi ſol ut*.

Chap. XI. *Containing the Method of finding the Fundamental Baſs when the Continued Baſs is figured.*

269 How to find the fundamental baſs when the continued is figured.

226. To exerciſe yourſelf with greater eaſe in finding the fundamental baſs, and to render it more familiar to you, it is neceſſary to obſerve how eminent maſters, and above all how M. Rameau has put the rules in practice. Now, as they never place any thing but the continued baſs in their works, it becomes then neceſſary to know how to find the fundamental baſs when the continued baſs is figured. This problem may be eaſily ſolved by the following rules.

227. 1. Every note which has no figure in the continued baſs, ought to be the ſame, and without a figure in the fundamental baſs; it either is a tonic, or reckoned ſuch, (UUU).

2. Every note which in the continued baſs carries a 6, ought in the fundamental baſs to give its third below not figured,* or its fifth below marked with a 7. We ſhall diſtinguiſh theſe two caſes below. (See LVI. and LXIV, and the note ZZZ). * See Figured.

3. Every note carrying $\frac{6}{4}$ gives in the fundamental baſs its fifth below not figured. (See LVII.)

4. Every note figured with a 7 or a $\not{7}$, is the ſame in both baſſes, and with the ſame figure (XXX).

5. Every note figured with a 2 gives in the fundamental baſs the diatonic note above figured with a 7. See LXII. (YYY).

6. Every note marked with a 4 gives in the fundamental

(TTT) As the chord of the diminiſhed ſeventh *ſol※ ſi re fa*, and the chord of the tonic dominant *mi ſol※ ſi re*, only differ one from the other by the notes *mi* and *fa*; one may form a diatonic modulation of theſe two notes, and then the fundamental baſs does nothing but paſs from the tonic dominant to the ſenſible note, and from that note to the tonic dominant, till it arrives at the tonic. (See XCII.)

For the ſame reaſon, as the chord of the diminiſhed ſeventh *ſol※ ſi re fa*, and the chord *ſi re fa la*, which carries the fifth *ſi* of the tonic dominant *mi*, only differs by the ſenſible note *ſol※*, and the tonic *la*; one may ſometimes, while the treble modulates *ſol※ la ſol※ la ſol※ la*, aſcend in the fundamental baſs, from the baſs note to the third above, provided one deſcend at laſt from thence to the tonic dominant, and from thence to the tonic; (ſee XCIII.) As to what remains, this and the preceding examples are licences.

(UUU) I ſay a tonic, or *reckoned ſuch*, becauſe it may perhaps be a dominant from which the diſſonance has been removed. But in that caſe one may know that it is a real dominant by the note which precedes it. For inſtance, if the note *ſol*, carrying a perfect chord, is preceded by *re* a ſimple dominant, carrying the chord *re fa la ut*, that note *ſol* is not a real tonic; becauſe, in order to this, it would have been neceſſary that *re* ſhould have been a tonic dominant, and ſhould have carried the chord *re fa※ la ut*; and that a ſimple dominant, as *re*, carrying the chord *re fa la ut*, ſhould only naturally deſcend to a dominant, (art. 194.)

(XXX) Sometimes a note which carries a 7 in the continued baſs, gives in the fundamental baſs its third above, figured with a 6. For example, this continued baſs $\overset{7}{la}\ \overset{8}{ſi}\ ut$ gives this fundamental baſs $\overset{6}{ut}\ \overset{7}{ſol}\ ut$; but in this caſe it is neceſſary that the note figured with a 6 ſhould riſe by a fifth, as we ſee here *ut* riſe to *ſol*.

(YYY) A note figured with a 2, gives likewiſe ſometimes in the fundamental baſs its fourth above, figured with

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mental bafs the diatonic note above, figured with a 7. (See LXI.)

7. Every note figured with an 8 gives its third below figured with a 7. (See LVIII.)

8. Every note marked with a 6 gives the fifth below marked with a 7; (fee LX.) and it is plain by art. 187, that in the chord of the feventh, of which we treat in thefe three laft articles, the third ought to be major, and the feventh minor, this chord of the feventh being the chord of the tonic dominant. (See art. 102.)

9. Every note marked with a 9 gives its third above figured with a 7. (See LXXVII and LXXIX.)

10. Every note marked with a $\genfrac{}{}{0pt}{}{9}{4}$ gives the fifth above figured with a 7. (See LXXVIII.)

11. Every note marked with a ※5, or with a +5, gives the third above figured with a $\overset{7}{※}$. (See LXXXI.)

12. Every note marked with a ※7 gives a fifth above figured with a 7, or with a $\overset{7}{※}$. (See LXXVI.) It is the fame cafe with the notes marked $\genfrac{}{}{0pt}{}{7}{4}$, $\genfrac{}{}{0pt}{}{5}{\genfrac{}{}{0pt}{}{4}{2}}$, or $\genfrac{}{}{0pt}{}{5}{2}$: which fhows a retrenchment, either in the complete chord of the eleventh, or in that of the feventh redundant.

13. Every note marked with a 4 gives a fifth above figured with a 7, or a $\overset{7}{※}$. (See LXXX.)

14. Every note marked with a ※$\genfrac{}{}{0pt}{}{6}{8}$ gives the third minor below, figured with a $\dot{7}$. (See LXXXIII.)

15. Every note marked with a ※$\overset{4}{b}$ gives the tritone above figured with a $\dot{7}$. (See LXXXIV.)

16. Every note marked with a +2 gives the fecond redundant above, figured with a $\dot{7}$. (See LXXXV.)

17. Every note marked with a ※$\genfrac{}{}{0pt}{}{5}{4}$ gives the fifth redundant above, figured with a $\dot{7}$. (See LXXXVI.)

18. Every note marked with a $\genfrac{}{}{0pt}{}{※7}{b6}$ gives the feventh redundant above, figured with a $\dot{7}$. See LXXXVII. (zzz).

Remark.

228. We have omitted two cafes, which may caufe fome uncertainty. 270 A difficulty in finding the fundamental bafs.

The firft is that where the note of the continued bafs is figured with a 6. We now prefent the reafon of the difficulty.

Suppofe we fhould have the dominant $\overset{7}{re}$ in the fundamental bafs, the note which anfwers to it in the continued bafs may be *la* carrying the figure 6 (fee LXIV.); that is to fay, the chord *la ut re fa*: now if we fhould have the fub-dominant $\overset{6}{fa}$ in the fundamental

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with a 6; but it is neceffary in that cafe that the note figured with a 6, may even here rife to a fifth. (See note xxx).

Thefe variations in the fundamental bafs, as well in the chord concerning which we now treat, as in the chord figured with a 7, and in two others which fhall afterwards be mentioned (art. 228 and 229), are caufed by a deficiency in the figns proper for the chord of the fub-dominant, and for the different arrangements by which it is inverted.

M. l'Abbe Rouffier, to redrefs this deficiency, had invented a new manner of figuring the continued bafs. His method is moft fimple for thofe who know the fundamental bafs. It confifts in expreffing each chord by only fignifying the fundamental found with that letter of the fcale by which it is denominated, to which is joined a 7 or $\dot{7}$, or a 6, in order to mark all the difcords. Thus the fundamental chord of the feventh *re fa la ut* is expreffed by a $\overset{7}{D}$; and the fame chord, when it is inverted from that of the fub-dominant *fa la ut re*, is characterized by $\overset{6}{F}$; the chord of the fecond *ut re fa la*, inverted from the dominant *re fa la ut*, is likewife reprefented by $\overset{7}{D}$; and the fame chord *ut re fa la* inverted from that of the fub-dominant *fa la ut re* is fignified by F; the cafe is the fame when the chords are differently inverted. By this means it would be impoffible to miftake either with refpect to the fundamental bafs of a chord, or with refpect to the note which forms its diffonance, or with refpect to the nature and fpecies of that difcord.

(zzz) We may only add, that here and in the preceding articles, we fuppofe, that the continued bafs is figured in the manner of M. Rameau. For it is proper to obferve, that there are not, perhaps, two muficians who characterife their chords with the fame figures; which produces a great inconveniency to the perfon who plays the accompaniments: but here we do not treat of accompaniments. For every reafon, then, we fhould advife initiates to prefer the continued baffes of M. Rameau to all the others, as by them they will moft fuccefsfully ftudy the fundamental bafs.

It is even neceffary to advertife the reader, and I have already done it (note EEE), that M. Rameau only marks the leffer fixth by a 6 without a line, when this leffer fixth does not refult from the chord of the tonic dominant; in fuch a manner that the 6 renders it uncertain whether in the fundamental bafs we ought to choofe the third or the fifth below: but it will be eafy to fee whether the third or the fifth is fignified by that figure. This may be diftinguifhed, 1. In obferving which of the two notes is excluded by the rules of the fundamental bafs. 2. If the two notes may with equal propriety be placed in the fundamental bafs, the preference muft be determined by the tone or mode of the treble in that particular paffage. In the following chapter we fhall give rules for determining the mode.

There is a chord of which we have not fpoken in this enumeration, and which is called the *chord of the fixth redundant*. The chord is compofed of a note, of its third major, of its redundant fourth or tritone, and its redundant fixth, as *fa la fi re*※. It is marked with a 6※. It appears difficult to find a fundamental bafs for this chord; nor is it indeed much in ufe amongft us. (See the note upon the art. 115.)

mental bass, this sub-dominant might produce in the continued bass the same note *la* figured with a 6. When therefore one finds in the continued bass a note marked with a 6, it appears at first uncertain whether we should place in the fundamental bass the fifth below marked with a 7, or the third below marked with a 6.

271 Another.

229. The second case is that in which the continued bass is figured with a $^{6}_{5}$. For instance, if there should be found $\overset{6}{\underset{5}{fa}}$ in the continued bass, one may be ignorant whether he ought to insert in the fundamental bass *fa* marked with a 6, or *re* figured with a 7.

272 Solution.

230. You may easily extricate yourself from this little difficulty, in leaving for an instant this uncertain note in suspence, and in examining what is the succeeding note of the fundamental bass; for if that note be in the present case a fifth above *fa*, that is to say, if it is *ut*, in this case, and in this alone, he may place $\overset{6}{fa}$ in the fundamental bass. It is a consequence of this rule, that in the fundamental bass every sub-dominant ought to rise by a fifth (195).

Chap. XII. *What is meant by being in a Mode or Tone.*

273 Method of determining the mode in which we are.

231. In the first part of this treatise (chap. vi.), we have explained, how by the means of the note *ut*, and of its two fifths *sol* and *fa*, one in ascending, which is called a *tonic dominant*, the other in descending, which is called a *sub-dominant*, the scale *ut re mi fa sol la si ut* may be found: the different sounds which form this scale compose what we call the *major mode* of *ut*, because the third *mi* above *ut* is major. If therefore we would have a modulation in the major mode of *ut*, no other sounds must enter into it than those which compose this scale; in such a manner that if, for instance, I should find *fa*※ in this modulation, this *fa*※ discovers to me that I am not in the mode of *ut*, or at least that, if I have been in it, I am no longer so.

232. In the same manner, if I form this scale in ascending *la si ut*※ *re mi fa*※ *sol*※ *la*, which is exactly similar to the scale *ut re mi fa sol la si ut* of the major mode of *ut*, this scale, in which the third form *la* to *ut*※ is major, shall be in the major mode of *la*; and if I incline to be in the minor mode of *la*, I have nothing to do but to substitute for *ut* sharp *ut* natural; so that the major third *la ut*※ may become minor *la ut*; I shall have then

la si ut re mi fa※ *sol*※ *la*,

which is (85) the scale of the minor mode of *la* in ascending; and the scale of the minor mode of *la* in descending shall be (90)

la sol fa mi ut re si la,

in which the *sol* and *fa* are no longer sharp. For it is a singularity peculiar to the minor mode, that its scale is not the same in rising as in descending (89).

274 Hence it appears what sharps and flats should be placed at the cleff in the major mode of la, and why they are omitted in the minor mode in descending.

233. This is the reason why, when we wish to begin a piece in the major mode of *la*, we place three sharps at the cleff upon *fa*, *ut*, and *sol*; and on the contrary, in the minor mode of *la*, we place none, because the minor mode of *la*, in descending, has neither sharps nor flats.

275 Modes 24 in the whole.

234. As the scale contains twelve sounds, each distant from the other by the interval of a semitone, it is obvious that each of these sounds can produce both a major and a minor mode, which constitute 24 modes upon the whole. Of these we shall immediately give a table, which may be very useful to discover the mode in which we are.

A TABLE of the Different Modes.

Major Modes.

Maj. Mode.	
of *ut*	*ut re mi fa sol la si ut.*
of *sol*	*sol la si ut re mi fa*※ *sol.*
of *re*	*re mi fa*※ *sol la si ut*※ *re.*
of *la*	*la si ut*※ *re mi fa*※ *sol*※ *la.*
of *mi*	*mi fa*※ *sol*※ *la si ut*※ *re*※ *mi.*
of *si*	*si ut*※ *re*※ *mi fa*※ *sol*※ *la*※ *si.*
of *fa*※	*fa*※ *sol*※ *si ut*※ *re*※ *mi*※ *fa*※ (AAAA).
of *ut*※ or *re*♭	*re*♭ *mi*♭ *fa sol*♭ *la*♭ *si*♭ *ut re*♭.
of *sol*※ or *la*♭	*la*♭ *si*♭ *ut re*♭ *mi*♭ *fa sol la*♭.
of *re*※ or *mi*♭	*mi*♭ *fa sol la*♭ *si*♭ *ut re mi*♭.

(AAAA) The major mode of *fa*※, of *ut*♭ or *re*※, and of *sol*※ or *la*♭, are not much practised. In the opera of *Pyramus* and *Thisbe*, p. 267, there is a passage in the scene, of which one part is the major mode of *fa*※, and the other in the major mode of *ut*※, and there are six sharps at the cleff.

When a piece begins upon *ut*※, there ought to be seven sharps placed at the cleff: but it is more convenient only to place five flats, and to suppose the key *re*♭, which is almost the same thing with *ut*※. It is for this reason that we substitute here the mode of *re*♭ for that of *ut*※.

It is still much more necessary to substitute the mode of *la*♭ for that of *sol*※; for the scale of the major mode of *sol* is *sol*※, *la*※, *si*※, *ut*※, *re*※, *mi*※, *sol*, *sol*※,
in which you may see that there are at the same time both a *sol* natural and a *sol*※: it would then be necessary, even at the same time, that upon *sol* there should and should not be a sharp at the cleff; which is shocking and inconsistent. It is true that this inconvenience may be avoided by placing a sharp upon *sol* at the cleff, and by marking the note *sol* with a natural through the course of the music wherever it ought to be natural; but this would become troublesome, above all if there should be occasion to transpose. In the article 236, we shall give an account of transposition. One might likewise in this series, instead of *sol* natural, which is the note immediately before the last, substitute *fa*※※, that is to say, *fa* twice sharp: which, however, is not absolutely the same sound with *sol* natural, especially upon instruments whose scales are fixed, or whose intervals are invariable. But in that case two sharps may be placed at the cleff upon *fa*, which would produce another inconvenience. But by substituting *la*♭ for *sol*※, the trouble is eluded.

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of *la*※ } or *si*♭ } *si*♭ *ut re mi*♭ *fa sol la si.*
of *mi*※ } or *fa*♭ } *fa sol la si*♭ *ut re mi fa.*
of *si*※ } or *ut*♭ } *ut re mi fa sol la si ut.*

Minor Modes.

Of *la.*
In descending. *la sol fa mi re ut si la.*
In rising. *la si ut re mi fa*※ *sol*※ *la.*

Of *mi.*
In descending. *mi re ut si la sol fa*※ *mi.*
In rising. *mi fa*※ *sol la si ut*※ *re*※ *mi.*

Of *si.*
In descending. *si la sol fa*※ *mi re ut*※ *si.*
In rising. *si ut*※ *re mi fa*※ *sol*※ *la*※ *si.*

Of *fa*※.
In descending. *fa*※ *mi re ut*※ *si la sol*※ *fa.*
In rising. *fa*※ *sol*※ *la si ut*※ *re*※ *mi*※ *fa*※.

Of *ut*※.
In descending. *ut si la sol*※ *fa*※ *mi re*※ *ut*※.
In rising. *ut*※ *re*※ *mi fa*※ *sol*※ *la*※ *si*※ *ut*※.

Of *sol*※ or *la*♭.
In descending. *sol*※ *fa*※ *mi ut*※ *si la*※ *sol*※.
In rising. *la*♭ *si*♭ *ut*♭ *re*♭ *mi*♭ *fa sol la*♭.

Of *re*※ or *mi*♭.
In descending. *mi*♭ *re*♭ *ut*♭ *si*♭ *la*♭ *sol*♭ *fa mi*♭.
In rising. *mi*♭ *fa sol*♭ *la*♭ *si*♭ *ut re mi*♭.

Of *la*※ or *si*♭.
In descending. *si*♭ *la* , *sol*♭ *fa mi*♭ *re*♭ *ut si*♭.
In rising. *si*♭ *ut re*♭ *mi*♭ *fa sol la si*♭.

Of *mi*※ or *fa*♭.
In descending. *fa mi*♭ *re*♭ *ut si*♭ *la*♭ *sol fa.*
In rising. *fa sol la*♭ *si*♭ *ut re mi fa.*

Of *ut*
In descending. *ut si*♭ *la*♭ *sol fa mi*♭ *re ut.*
In rising. *ut re mi*♭ *fa sol la si ut.*

Of *sol.*
In descending. *sol fa mi*♭ *re ut si*♭ *la sol.*
In rising. *sol la si*♭ *ut re mi fa*※ *sol.*

Of *re.*
In descending. *re ut si*♭ *la sol fa mi re.*
In rising. *re mi fa sol la si ut*※ *re* (BBBB.)

276 Modes crowded with sharps and flats little practised.

235. These then are all the modes, as well major as minor. Those which are crowded with sharps and flats are little practised, as being extremely difficult in execution.

277 Results.

236. From thence it follows,

1. That when there are neither sharps nor flats at the cleff, it is a token that the piece begins in the major mode of *ut*, or in the minor mode of *la*.

2. That when there is one single sharp, it will always be placed upon *fa*, and that the piece begins in the major mode of *sol*, or the minor of *mi*, in such a manner that it may be sung as if there were no sharp, by singing *si* instead of *fa*※, and in singing the tune as if it had been in another cleff. For instance, let there be a sharp upon *fa* in the cleff of *sol* upon the first line; one may then sing the tune as if there were no sharp: And instead of the cleff of *sol* upon the first line, let there be the cleff of *ut*; for the *fa*※, when changed into *si*, will require that the cleff of *sol* should be changed to the cleff of *ut*, as may be easily seen. This it what we call *transposition* (‡).

See Transposition.

278 All the modes reducible to the major of ut and the minor of la.

237. It is evident, that when *fa*※ is changed into *si*, *sol* must be changed into *ut*, and *mi* into *la*. Thus by transposition, the air has the same melody as if it were in the major mode of *ut*, or in the minor mode of

(BBBB) We have already seen, that in each mode, the principal note is called a *tonic;* that the fifth above that note is called a *tonic dominant*, or the *dominant of the mode*, or simply a *dominant;* that the fifth beneath the tonic, or, what is the same thing, the fourth above that tonic, is called a *sub-dominant;* and in short, that the note which forms a semitone beneath the tonic, and which is a third major from the dominant, is called a *sensible note.* The other notes have likewise in every mode particular names which it is advantageous to know. Thus a note which is a tone immediately above the tonic, as *re* in the mode of *ut*, and *si* in that of *la*, is termed a *sub-tonic;* the following note, which is a third major or minor from the tonic, according as the chord is major or minor, such as *mi* in the major mode of *ut*, and *ut* in the minor mode of *la*, is called a *mediant;* in short, the note which is a tone above the dominant, such as *la* in the mode of *ut*, and *fa*※ in that of *la*, is called a *sub dominant.*

‡ Though our author's account of this delicate operation in music will be found extremely just and compendious; though it proceeds upon simple principles, and comprehends every possible contingency; yet as the manner of thinking upon which it depends may be less familiar to English readers, if not profoundly skilled in music, it has been thought proper to give a more familiar, though less comprehensive, explanation of the manner in which *transposition* may be executed.

It will easily occur to every reader, that if each of the intervals through the whole diatonic series were equal, in a mathematical sense, it would be absolutely indifferent upon what note any air were begun, if within the compass of the gammut; because the same equal intervals must always have the same effects. But since, besides the natural semitones, there is another distinction of diatonic intervals into *greater* and *lesser tones;* and since these vary their positions in the series of an octave, according as the note from whence you begin is placed, that note is consequently the best key for any tune whose natural series is most exactly correspondent with the intervals which that melody or harmony requires. But in instruments whose scales are fixed, notwithstanding the temperament and other expedients of the same kind, such a series is far from being easily found, and is indeed in common practice almost totally neglected. All that can frequently be done is, to take care that the ear may not be sensibly shocked. This, however, would be the case, if, in transposing any tune, the situation of the semitones, whether natural or artificial, were not exactly correspondent in the series to which your air must be transposed, with their positions in the scale from which you transpose it. Suppose for

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of *la*. The major mode then of *ſol*, and the minor of *mi*, are by tranſpoſition reduced to thoſe of *ut* major, and of *la* minor. It is the ſame caſe with all the other modes, as any one may eaſily be convinced (cccc).

CHAP. XIII. *To find the Fundamental Baſs of a given Modulation.*

238. As we have reduced to a very ſmall number the rules of the fundamental baſs, and thoſe which in the treble ought to be obſerved with relation to this baſs, it ſhould no longer be difficult to find the fundamental baſs of a given modulation, nay, frequently to find ſeveral; for every fundamental baſs will be legitimate, when it is formed according to the rules which we have given (Chap. VI.); and that, beſides this, the diſſonances which the modulation may form with this

Principles of Compoſition.

279 Method of finding a fundamental baſs to a given air not difficult, and why.

for inſtance, your air ſhould begin upon *ut* or C, requiring the natural diatonic ſeries through the whole gammut, in which the diſtance between *mi* and *fa*, or E and F, as alſo that between *ſi* and *ut*, or B and C, is only a ſemitone. Again, ſuppoſe it neceſſary for your voice, or the inſtrument on which you play, that the ſame air ſhould be tranſpoſed to *ſol* or G, a fifth above its former key; then becauſe in the firſt ſeries the intervals between the third and the fourth, ſeventh and eighth notes, are no more than ſemitones, the ſame intervals muſt take the ſame place in the octave to which you tranſpoſe. Now, from *ſol* or G, the note with which you propoſe to begin, the three tones immediately ſucceeding are full; but the fourth, *ut* or C, is only a ſemitone; it may therefore be kept in its place. But from *fa* or F, the ſeventh note above, to *ſol* or G, the eighth, the interval is a full tone, which muſt conſequently be redreſſed by raiſing your *fa* a ſemitone higher. Thus the ſituations of the ſemitonic intervals in both octaves will be correſpondent; and thus, by conforming the poſitions of the ſemitones in the octave to which you tranſpoſe, with thoſe in the octave in which the original key of the tune is contained, you will perform your operation with as much ſucceſs as the nature of fixed ſcales can admit: But the order in which you muſt proceed, and the intervals required in every mode are minutely and ingeniouſly delineated by our author.

(cccc) Two ſharps, *fa*※ and *ut*※, indicate the major mode of *re*, or the minor of *ſi*; and then, by tranſpoſition, the *ut*※ is changed into *ſi*, and of conſequence, *re* into *ut* and *ſi* into *la*.

Three ſharps, *fa*※ *ut*※ *ſol*※ indicate the major mode of *la*, or the minor of *fa*※; and it is then *ſol*※, which muſt be changed into *ſi*, and of conſequence *la* into *ut*, and *fa*※ into *la*.

Four ſharps, *fa*※ *ut*※ *ſol*※ *re*※, indicate the major mode of *mi*, or the minor of *ut*※; then the *re*※ is changed into *ſi*, and of conſequence *mi* into *ut*, and *ut*※ into *la*.

Five ſharps, *fa*※ *ut*※ *ſol*※ *re*※ *la*※, indicate the major mode of *ſi*, or the minor of *ſol*※; *la* then is changed into *ſi*, and of conſequence *ſi* into *ut*, and *ſol*※ into *la*.

Six ſharps, *fa*※ *ut*※ *ſol*※ *re*※ *la*※ *mi*※, indicate the major mode of *fa*※; *mi*※ then is changed into *ſi*, and of conſequence *fa*※ into *ut*.

Six flats, *ſi*♭ *mi*♭ *la*♭ *re*♭ *ſol*♭ *ut*♭, indicate the minor mode of *mi*♭; *ut* is changed into *fa*, and of conſequence *mi*♭ into *la*.

Five flats, *ſi*♭ *mi*♭ *la*♭ *re*♭ *ſol*♭, indicate the major mode of *re*♭, or the minor mode of *ſi*♭; then the *ſi*♭ is changed into *fa*, and of conſequence the *re*♭ into *ut*, and the *ſi*♭ into *la*.

Four flats, *ſi*♭ *mi*♭ *la*♭ *re*♭, indicate the major mode of *la*♭, or the minor mode of *fa*; *re*♭ then is changed into *fa*, and of conſequence *la*♭ into *ut*, and *fa* into *la*.

Three flats, *ſi*♭ *mi*♭ *la*♭, indicate the major mode of *mi*♭, or the minor of *ut*; the *la*♭ then is changed into *fa*, and of conſequence *mi*♭ into *ut*, and the *ſol* into *la*.

Two flats, *ſi*♭ *mi*♭, indicate the major mode of *ſi*♭, or the minor of *ſol*; *mi*♭ then is changed into *fa*, and of conſequence *ſi*♭ into *ut*, and the *fa* into *la*.

One flat, *ſi*♭, indicates the major mode of *fa*, or the minor mode of *re*, and *ſi*♭ is changed into *fa*; of conſequence the *fa* is changed into *ut*, and the *re* into *la*.

All the major modes then may be reduced to that of *ut*, and the modes minor to that of *la* minor.

It only remains to remark, that many muſicians, and amongſt others the ancient muſicians of France, as Lulli, Campra, &c. place one flat leſs in the minor mode: ſo that in the minor mode of *re*, they place neither ſharp nor flat at the cleff; in the minor mode of *ſol*, one flat only; in the minor mode of *ut*, two flats, &c.

This practice in itſelf is ſufficiently indifferent, and ſcarcely merits the trouble of a diſpute. Yet the method which we have here deſcribed, according to M. Rameau, has the advantage of reducing all the modes to two; and beſides it is founded upon this ſimple and very general rule, That in the major mode, we muſt place as many ſharps or flats at the cleff, as are contained in the diatonic ſcale of that mode in aſcending; and in the minor mode, as many as are contained in that ſame ſcale in deſcending.

However this be, I here preſent you with a rule for tranſpoſition, which appears to me more ſimple than the rule in common uſe.

For the Sharps.

Suppoſe *ſol*, *re*, *la*, *mi*, *ſi*, *fa*, and change *ſol* into *ut* if there is one ſharp at the cleff, *re* into *ut* if there are two ſharps, *la* into *ut* if there are three, &c.

For the Flats.

Suppoſe *fa*, *ſi*, *mi*, *la*, *re*, *ſol*, and change *fa* into *ut* if there is only one flat at the cleff, *ſi* into *ut* if there are two flats, *mi* into *ut* if there are three, &c.

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this bafs, will both be prepared, if it is neceffary that they fhould be fo, and always refolved (DDDD).

280 Difficulty of afsigning general rules for afcertaining the mode of a melody whofe fundamental bafs is fought.

239. It is of the greateft utility in fearching for the fundamental bafs, to know what is the tone or mode of the melody to which that bafs fhould correfpond. —But it is difficult in this matter to affign general rules, and fuch as are abfolutely without exception, in which nothing may be left that appears indifferent or difcretionary; becaufe fometimes we feem to have the free choice of referring a particular melody either to one mode or another. For example, this melody *fol ut* may belong to all the modes, as well major as minor, in which *fol* and *ut* are found together; and each of thefe two founds may even be confidered as belonging to a different mode.

281 Reafons why one may proceed without the knowledge of the mode, and how he may be preferved from deviating in compofition.

240. For what remains, one may fometimes, as it fhould feem, operate without the knowledge of the mode, for two reafons: 1. Becaufe, fince the fame founds belong to feveral different modes, the mode is fometimes confiderably undetermined; above all, in the middle of a piece, and during the time of one or two bars. 2. Without giving ourfelves much trouble about the mode, it is often fufficient to preferve us from deviating in compofition, if we obferve in the fimpleft manner the rules above prefcribed (ch. VI.) for the procedure of the fundamental bafs.

282 Knowledge of the mode in beginning a piece indifpenfable, and why.

241. In the mean time, it is above all things neceffary to know in what mode we operate at the beginning of the piece, becaufe it is indifpenfable that the fundamental bafs fhould begin in the fame mode, and that the treble and bafs fhould likewife end in it; nay, that they fhould even terminate in its fundamental note, which in the mode of *ut* is *ut*, and *la* in that of *la*, &c. Befides, in thofe paffages of the modulation where there is a cadence, it is generally neceffary that the mode of the fundamental bafs fhould be the fame with that of the part to which it correfponds.

283 Inveftigation of the mode continued.

242. To know upon what mode or in what key a piece commences, our inquiry may be entirely reduced to diftinguifh the major mode of *ut* from the minor of *la*. For we have already feen (art. 236. and 237.), that all the modes may be reduced to thefe two, at leaft in the beginning of the piece. We fhall now therefere give a detail of the different means by which thefe two modes may be diftinguifhed.

284 Means by which the modes may be determined.

1. From the principal and characteriftical founds of the mode, which are *ut mi fol* in the one, and *la ut mi* in the other; fo that if a piece fhould, for inftance, begin thus, *la ut mi la*, it may be almoft conftantly concluded, that the tone or mode is in *la* minor, although the notes *la ut mi* belong to the mode of *ut*.

2. From the fenfible note, which is *fi* in the one, and *fol*※ in the other; fo that if *fol*※ appears in the firft bars of a piece, one may be certain that he is in the mode of *la*.

3. From the adjuncts of the mode, that is to fay, the modes of its two fifths, which for *ut* are *fa* and *fol*, and *re* and *mi* for *la*. For example, if after having begun

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(DDDD) We often fay, *that we are upon a particular key*, inftead of faying *that we are in a particular mode*. The following expreffions therefore are fynonymous; *fuch a piece is in* ut *major*, or *in the mode of* ut *major*, or *in the key of* ut *major*.

We have feen that the diatonic fcale or gammut of the Greeks was *la fi ut re mi fa fol la* (art. 49.) A method has likewife been invented of reprefenting each of the founds in this fcale by a letter of the alphabet; *la* by A, *fi* by B, *ut* by C, &c. It is from hence that thefe forms of fpeaking proceed: Such a piece is upon A *with* mi, la, *and its third minor;* or, fimply, it is upon A, *with* mi, la, *and its minor;* fuch another piece upon C, *with* fol, ut, *and its third major;* or, fimply, upon C, *with* fol, ut, *and its major;* to fignify that the one is the mode of *la minor*, or that the other is in that of *ut major*; this laft manner of fpeaking is more concife, and on this account it begins to become general.

They likewife call the cleff of *ut fa*F, the cleff of *re fol*G, &c. to denominate the cleff of *fa*, the cleff of *fol*, &c,

They fay likewife to take the A *mi la*, to give the A *mi la*; that is to fay, to take the unifon of a certain note called *la* in the harpfichord, which *la* is the fame that occupies the fifth line, or the higheft line in the firft cleff of *fa*. This *la* divides in the middle the two octaves which fubfift (note RR) between the *fol* which occupies the firft line in the cleff of *fol* upon that fame line, and that *fol* which occupies the firft line in the cleff of *fa* upon the fourth; and as it poffeffes (if we may fpeak fo) the middle ftation between the fharpeft and loweft founds, it has been chofen to be the found with relation to which all the voices and inftruments ought to be tuned in a concert (§).

(§) Thus far our author: and though the note is no more than an illuftration of the technical phrafeology in his native language, we did not think it confiftent with the fidelity of a tranflation to omit it. We have little reafon to envy, and ftill lefs to follow, the French in their abbreviations of fpeech; the native energy of our tongue fuperfedes this neceffity in a manner fo effectual, that, in proportion as we endeavour to become fuccinct, our ftyle, without the fmalleft facrifice of perfpicuity, becomes more agreeable to the genius of our language; whereas, in French, laconic diction is equally ambiguous and difagreeable. Of this we cannot give a more flagrant inftance than the note upon which thefe obfervations are made, in its original. We muft, however, follow the author's example, in reciting a few technical phrafes upon the fame fubject, which occur in our language, and which, if we are not miftaken, will be found equally concife, at the fame time that they are more natural and intelligible. When we mean to exprefs the fundamental note of that feries within the diatonic octave which any piece of mufic demands, we call that note the *key*. When we intend to fignify its mode, whether major or minor, we denominate the harmony *fharp* or *flat*. When in a concert we mean to try how inftruments are in tune by that note upon which, according to the genius of each particular inftrument, they may beft agree in unifon, we defire the muficians who join us to found A.

gun a melody by some of the notes which are common to the modes of *ut* and of *la* (as *mi re mi fa mi re ut si ut*), I should afterwards find the mode of *sol*, which I ascertain by the *fa*♯, or that of *fa* which I ascertain by the *si*♭ or *ut*♮, I may conclude that I have begun in the mode of *ut;* but if I find the mode of *re*, or that of *mi*, which I ascertain by *si*♭, *ut*♯, or *re*♯, &c. I conclude from thence that I have begun in the mode of *la*.

4. A mode is not for ordinary deserted, especially in the beginning of a piece, but that we may pass into one or other of these modes which are most relative to it, which are the mode of its fifth above, and that of its third below, if the original mode be major, or of its third above if it be minor. Thus, for instance, the modes which are most intimately relative to the major mode of *ut*, are the major mode of *sol*, and that of *la* minor. From the mode of *ut* we commonly pass either into the one or the other of these modes; so that we may sometimes judge of the principal mode in which we are, by the relative mode which follows it, or which goes before it, when these relative modes are decisively marked. For what remains, besides these two relative modes, there are likewise two others into which the principal mode may pass, but less frequently, viz. the mode of its fifth below, and that of its third above, as *fa* and *mi* for the mode of *ut* (EEEE).

5. The modes may still be likewise distinguished by the cadences of the melody. These cadences ought to occur at the end of every two, or at most of every four bars, as in the fundamental bass: now the note of the fundamental bass which is most suitable to these closes*, is always easy to be found. For the sounds which occur in the treble may be consulted M. Rameau, p. 54. of his *Nouveau Systeme de Musique theorique et pratique* (FFFF).

* See Cadence.

285 Having ascertained the mode, the fundamental bass not difficult.

When a person is once able to ascertain the mode, and can render himself sure of it by the different means which we have pointed out, the fundamental bass will cost little pains. For in each mode there are three fundamental sounds.

1. The tonic of the mode, or its principal sound, which carries always the perfect chord major or minor, according as the mode itself is major or minor.

Major mode of UT. *ut mi sol ut.*

Minor mode of LA. *la ut mi la.*

2. The tonic dominant, which is a fifth above the tonic, and which, whether in the major or minor mode, always carries a chord of the seventh, composed of a third major followed by two thirds minor.

Tonic dominant.

Major mode of UT. *sol si re fa.*

Tonic dominant.

Minor mode of LA. *mi sol*♯ *si re.*

3. The sub-dominant, which is a fifth below the tonic, and which carries a chord composed of a third, fifth, and sixth major, the third being either greater or lesser, according as the mode is major or minor.

Sub-dominant.

Major mode of UT. *fa la ut re.*

Minor mode of LA. *re fa la si.*

These three sounds, the tonic, the tonic dominant, and the sub-dominant, contain in their chords all the notes which enter into the scale of the mode; so that when a melody is given, it may almost always be found which of these three sounds should be placed in the fundamental bass, under any particular note of the upper part. Yet it sometimes happens that not one of these notes can be used. For example, let it be supposed that we are in the mode of *ut*, and that we find in the melody these two notes *la si* in succession; if we confine ourselves to place in the fundamental bass one of the three sounds *ut sol fa*, we shall find nothing for the sounds *la* and *si* but this fundamental bass $\overset{6}{\textit{fa}}$ $\overset{7}{\textit{sol}}$; now such a succession as $\overset{6}{\textit{fa}}$ to $\overset{7}{\textit{sol}}$ is prohibited by the fifth rule for the fundamental bass, according to which every sub-dominant, as *fa*, should rise by a fifth; so that $\overset{6}{\textit{fa}}$ can only be followed by *ut* in the fundamental bass, and not by $\overset{7}{\textit{sol}}$.

To remedy this, the chord of the sub-dominant *fa la ut re* must be inverted into a fundamental chord of the seventh, in this manner, *re fa la ut*, which has been called the *double employment* (art. 105.) because it is a secondary manner of employing the chord of the sub-

(EEEE) It is certain that the minor mode of *mi* has an extremely natural connection with the mode of *ut*, as has been proven (art. 92.) both by arguments and by examples. It has likewise appeared in the note upon the art. 93. that the minor mode of *re* may be joined to the major mode of *ut:* and thus in a particular sense, this mode may be considered as relative to the mode of *ut*, but it is still less so than the major modes of *sol* and *fa*, or than those of *la* and *mi* minor; because we cannot immediately, and without licence, pass in a fundamental bass from the perfect minor chord of *ut* to the perfect minor chord of *re;* and if you pass immediately from the major mode of *ut* to the minor mode of *re* in a fundamental bass, it is by passing, for instance, from the tonic *ut*, or from *mi sol ut*, to the tonic dominant of *re*, carrying the chord *la ut*♯ *mi sol*, in which there are two sounds, *mi sol*, which are found in the preceding chord; or otherwise from *ut mi sol ut* to *sol si*♭ *re mi*, a chord of the sub-dominant in the minor mode of *re*, which chord has likewise two sounds, *sol* and *mi*, in common with that which went immediately before it.

(FFFF) All these different manners of distinguishing the modes ought, if we may speak so, to give mutual light and assistance one to the other. But it often happens, that one of these signs alone is not sufficient to determine the mode, and may even lead to error. For example, if a piece of music begins with these three notes, *ut mi sol*, we must not with too much precipitation conclude from thence that we are in the major mode of *ut*, although these three sounds, *mi ut sol*, be the principal and characteristical sounds in the major mode of *ut:* we may be in the minor mode of *mi*, especially if the note *mi* should be long. You may see an example in the fourth act of *Zoroaster*, where the first air sung by the priests of Arimanes begins thus with two times *sol mi*♭ *si*♭, each of these notes being a crotchet. The air is in the minor mode of *sol*, and not in the major mode of *mi*♭, as one would at first be tempted to believe it. Now we may be sensible that it is in *sol* minor, by the relative modes which follow, and by the notes where the cadences fall.

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sub-dominant. By these means we give to the modulation *la si*, this fundamental bass $\overset{7}{re}$ $\overset{7}{sol}$, which procedure is agreeable to rules.

Here then are four chords, *ut mi sol ut*, *sol si re fa*, *fa la ut re*, *re fa la ut*, which may be employed in the major mode of *ut*. We shall find in like manner, for the minor mode of *la*, four chords,

la ut mi la, *mi sol※ si re*,
re fa la si, *si re fa la*.

And in this mode we sometimes change the last of these chords into *si re fa※ la*, substituting the *fa※* for *fa*♮. For instance, if we have this melody in the minor mode of *la mi fa※ sol ※la*, we would cause the first note *mi* to carry the perfect chord *la ut mi la*, the second note *fa ※* to carry the chord of the seventh *si re fa※ la*; the third note *sol※* the chord of the tonic dominant *mi sol※ si re*, and in short, the last the perfect chord *la ut mi la*.

On the contrary, if this melody is given always in the minor mode *la la sol※ la*, the second *la* being syncopated, it might have the same bass as the modulation *mi fa※ sol※ la*, with this difference alone, that *fa*♮ might be substituted for *fa※* in the chord *si re fa※ la*, the better to mark out the minor mode.

Besides these chords which we have just mentioned, and which may be regarded as the principal chords of the mode, there are still a great many others; for example, the series of dominants,

    7   7   7   7   7   7   7   7   7   7
ut la re sol ut fa si mi la re sol ut

which are terminated equally in the tonic *ut*, either entirely belong, or at least may be reckoned as belonging (GGGG) to the mode of *ut*; because none of these dominants are tonic dominants, except *sol*, which is the tonic dominant of the mode of *ut*; and besides, because the chord of each of these dominants forms no other sounds than such as belong to the scale of *ut*.

But if I were to form this fundamental bass,

    7 7 7 7♭
ut la re sol ut,

considering the last *ut* as a tonic dominant in this manner *ut mi sol si*♭; the mode would then be changed at the second *ut*, and we should enter into the mode of *fa*, because the chord *ut mi sol si*♭ indicates the tonic dominant of the mode of *fa*; besides, it is evident that the mode is changed, because *si*♭ does not belong to the scale of *ut*.

In the same manner, were I to form this fundamental bass

    7 7 7 6
ut la re sol ut,

considering the last *ut* as a tonic dominant in this manner, *ut mi sol la*; this last *ut* would indicate the mode of *sol*, of which *ut* is the *sub-dominant*.

In like manner, still, if in the first series of dominants, I caused the first *re* to carry the third major, in this manner *re fa※ la ut*; this *re* having become a tonic dominant, would signify to me the major mode of *sol*, and the $\overset{7}{sol}$ which should follow it, carrying the chord $\overset{7}{si}$ *re fa*, would relapse into the mode of *ut*, from whence we had departed.

Finally, in the same manner, if in this series of dominants, one should cause *si* to carry *fa※* in this manner, *si re fa※ la*, this *fa* would show that we had departed from the mode *ut*, to enter into that of *sol*.

From hence it is easy to form this rule for discovering the changes of mode in the fundamental bass. 286

A rule for discovering the changes of mode.

1. When we find a tonic in the fundamental bass, we are in the mode of that tonic; and the mode is major or minor, according as the perfect chord is major or minor.

2. When we find a sub-dominant, we are in the mode of the fifth above that sub-dominant; and the mode is major or minor, according as the third in the chord of the sub-dominant is major or minor.

3. When we find a tonic dominant, we are in the mode of the fifth below that tonic dominant. As the tonic dominant carries always the third major, one cannot be secure by the assistance of this dominant alone, whether the mode be major or minor: but it is only necessary for the composer to cast his eye upon the following note, which must be the tonic of the mode in which he is; by the third of this tonic he will discover whether the mode be major or minor.

243. Every change of the mode supposes a cadence; and when the mode changes in the fundamental bass, it is almost always either after the tonic of the mode in which we have been, or after the tonic dominant of that mode, considered then as a tonic by favour of a close which ought necessarily to be found in that place: Whence it happens that cadences in a melody for the most part presage a change of mode which ought to follow them.

244. All these rules, joined with the table of modes which we have given (art. 234.), will serve to discover in what mode we are in the middle of a piece, especially in the most essential passages, as cadences (HHHH).

I here subjoin the soliloquy of Armida, with the continued and fundamental basses. The changes of the mode will be easily distinguished in the fundamental bass,

(GGGG) I have said, *that they may be reckoned as belonging to this mode*, for two reasons: 1. Because, properly speaking, there are only three chords which essentially and primitively belong to the mode of *ut*, viz. *ut* carrying the perfect chord, *fa* carrying that of the sub-dominant, and *sol* that of the tonic dominant, to which we may join the chord of the seventh, *re fa la ut* (art. 105.): but we here regard *as extended* the series of dominants in question, as belonging to the mode of *ut*, because it preserves in the ear the impression of that mode. 2. In a series of dominants, there are a great many of them which likewise belong to other modes; for instance, the simple dominant *la* belongs naturally to the mode of *sol*, the simple dominant *si* to that of *la*, &c. Thus it is only improperly, and by way of extension, as I have already said, that we regard here these dominants as belonging to the mode of *ut*.

(HHHH) Two modes are so much more intimately relative as they contain a greater number of sounds common to both; for example, the minor mode of *ut* and the major of *sol*, or the major mode of *ut* and the minor of bass, by the rules which we have just given at the end of the article 242. This soliloquy will serve for a lesson to beginners. M. Rameau quotes it in his New System of Music, as an example of modulation highly just and extremely simple. (See Plate VI. and the following (IIII).

Chap. XIV. *Of the Chromatic and Enharmonic.*

287 Chromatic, what.

245. We call that melody *chromatic* which is composed of several notes in succession, whether rising or descending by semitones. (See LXXXVIII. and LXXXIX.)

288 To an air descending by chromatic intervals, fundamental bass, what.

246. When an air is chromatic in descending, the most natural and ordinary fundamental bass is a concatenated series of tonic dominants; all of which follow one another in descending by a fifth, or which is the same thing, in rising by a fourth. See LXXXVIII (LLLL).

289 Ascending, what.

247. When the air is chromatic in ascending, one may form a fundamental bass by a series of tonics and of tonic dominants, which succeed one another alternately by the interval of a third in descending, and of a fourth in ascending, (see LXXXIX. There are many other ways of forming a chromatic air, whether in rising or descending; but these details in an elementary essay are by no means necessary.

290 Enharmonic little practised.

248. With respect to the enharmonic, it is very rarely put in practice; and we have explained its formation in the first book, to which we refer our readers. We shall content ourselves with saying, that, in the beautiful soliloquy of the fourth act of Dardanus, at the words *lieux funestes*, &c. "fatal places, &c." we find an example of the enharmonic; an example of the diatonic enharmonic in the trio of the Fatal Sisters, in Hippolitus and Aricia, at the words, *Ou cours-tu malheureux*, "Whither, unhappy, dost thou run;" and that there are no examples of the chromatic enharmonic, at least in our French operas. M. Rameau had imitated an earthquake by this species of music, in the second act of the Gallant Indians; but he informs us, that in 1735 he could not cause it to be executed by the band. The trio of the Fatal Sisters in Hippolitus has never been sung in the opera as it is composed. But M. Rameau asserts, (and we have heard it elsewhere by people of taste, before whom the piece was performed), and the trial had succeeded when made by able hands that were not mercenary, and that its effect was astonishing.

Chap. XV. *Of Design, Imitation, and Fugue.*

See Design.

291 Design, what.

249. In music, the name of *design*, or *subject*, is generally given to a particular air or melody, which the composer intends should prevail through the piece; whether it is intended to express the meaning of words to which it may be set, or merely inspired by the impulse of taste and fancy. In this last case, design is distinguished into *imitation* and *fugue*.

See Imitation.

292 Imitation, what.

250. *Imitation* consists in causing to be repeated the melody of one or of several bars in one single part, or in the whole harmony, and in any of the various modes that

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of *la*: on the contrary, two modes are less intimately relative as the number of sounds which they contain as common to both is smaller; for instance, the major mode of *ut* and the minor of *si*, &c.

When you find yourself led away by the current of the modulation, that is to say, by the manner in which the fundamental bass is constituted, into a mode remote from that in which the piece was begun, you must continue in it but for a short time, because the ear is always impatient to return to the former mode.

(IIII) It is extremely proper to remark, that we have given the fundamental, the continued bass, and in general the modulation of this soliloquy, merely as a lesson in composition extremely suitable to *beginners*; not that we recommend the soliloquy in itself as a model of expression. Upon this last object what we have said may be seen in what we have written concerning the liberties to be taken in music, Vol. IV. p. 435, of our Literary Miscellany. It is precisely because this soliloquy is a proper lesson for initiates, that it would be a bad one for the mature and ingenious artist. The novice should learn tenaciously to observe his rules; the man of art and genius ought to know on what occasions and in what manner they may be violated when this expedient becomes necessary.

(LLLL) We may likewise give to a chromatic melody in descending, a fundamental bass, into which may enter chords of the seventh and of the diminished seventh, which may succeed one another by the intervals of a false fifth and a fifth redundant: thus in the Example XC. where the continued bass descends chromatically, it may easily be seen that the fundamental bass carries successively the chords of the seventh and of the seventh diminished, and that in this bass there is a false fifth from *re* to *sol*※, and a fifth redundant from *sol*※ to *ut*.

The reason of this licence is, as it appears to me, because the chord of the diminished seventh may be considered as representing (art. 221.) the chord of the tonic dominant; in such a manner that this fundamental bass

7 7 7 7 7 ※7
la re sol※ *ut fa*※ *si mi la*

(see Example XCI.) may be considered as representing (art. 116.) that which is written below,

7 ※7 7 7 7 ※7
la re mi ut fa※ *si mi la*

Now this last fundamental bass is formed according to the common rules, unless that there is a broken cadence from *re* to *mi*※7, and an interrupted cadence from *mi* to *ut*, which are licenses (art. 213 and 214.)

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that may be chosen. When all the parts absolutely repeat the same air* or melody, and beginning one after the other, this is called a *canon*. *Fugue* consists in alternately repeating that air in the treble, and in the bass, or even in all the parts, if there are more than two.

* See Air, Canon, Fugue.

293 Principal rules for composing in several parts.

251. Imitation and fugue are sometimes conducted by rules merely deducible from taste, which may be seen in the 332d and following pages of M. Rameau's *Treatise on Harmony*; where will likewise be found a detail of the rules for composition in several parts. The chief rules for composition in several parts are, that the discords should be found, as much as possible, prepared and resolved in the same part; that a discord should not be heard at the same time in several parts, because its harshness would disgust the ear; and that in no particular part there should be found two octaves or two fifths in succession (MMMM) with respect to the bass. Musicians, however, do not hesitate sometimes to violate this precept, when taste or occasion require. In music, as in all the other fine arts, it is the business of the artist to assign and to observe rules; the province of men who are adorned with taste and genius is to find the exceptions.

Chap. XVI. *Definitions of the Different Airs.*

252. We shall finish this treatise by giving in a few words the characteristic distinctions of the different airs to which names have been given, as *chacoon*, *minuet*, *rigadoon*, &c.

The *chacoon* is a long piece of music, containing three times in each bar, of which the movement is regular, and the bars sensibly distinguished. It consists of several couplets, which are varied as much as possible. Formerly the bass of the chacoon was a *constrained bass*, or regulated by a rythmus terminating in 4 bars, and proceeding again by the same number; at present composers of this species no longer confine themselves to that practice. The chacoon begins, for the most part, not with the perfect time, which is struck by the hand or foot, but with the imperfect, which passes while the hand or foot is elevated

The *villanelle* is a chacoon a little more lively, with its movement somewhat more brisk than the ordinary chacoon.

The *passacaille* only differs from a chacoon as it is more slow, more tender, and beginning for ordinary with a perfect time.

The *minuet* is an air in triple time, whose movement is regular, and neither extremely brisk nor slow, consisting of two parts or strains, which are each of them repeated; and for which reason they are called by the French *reprises*: each strain of the minuet begins with a time which is struck, and ought to consist of 4, of 8, or of 12 bars; so that the cadences may be easily distinguished, and recur at the end of each 4 bars.

The *sarabando* is properly a slow minuet; and the *courant* a very slow sarabando: this last is no longer in use. The *passepied* is properly a very brisk minuet, which does not begin like the common minuet, with a stroke of the foot or hand; but in which each strain begins in the last of the three times of which the bar consists.

The *loure* is an air whose movement is slow, whose time is marked with $\frac{6}{4}$, and where two of the times in which the bar consists are beaten; it generally begins with that in which the foot is raised. For ordinary the note in the middle of each time is shortened, and the first note of the same time pointed.

The *jig* is properly nothing else but a loure very brisk, and whose movement is extremely quick.

The *forlana* is a moderate movement, and in a mediocrity between the loure and the jig.

The *rigadoon* has two times in a bar, is composed of two strains, each to be repeated, and each consisting of 4, of 8, or of 12 bars: its movement is lively; each strain begins, not with a stroke of the foot, but at the last note of the second time.

The *bourée* is almost the same thing with the rigadoon.

The *gavotte* has two times in each bar, is composed of two strains, each to be repeated, and each consisting of 4, of 8, or of 12 bars: the movement is sometimes slow, sometimes brisk; but never extremely quick, nor very slow.

The *tambourin* has two strains, each to be repeated, and each consisting of 4, of 8, or of 12 bars, &c. Two of the times that make up each bar are beaten, and are very lively; and each strain generally begins in the second time.

The *musette* consists of two or three times in each bar; its movement is neither very quick nor very slow; and for its bass it has often no more than a single note, which may be continued through the whole piece.

APPENDIX.

THE treatise of D'Alembert, of which we have given a translation, is well entitled to the merit of accuracy; but perhaps a person who has not particularly studied the subject, may find difficulty in following the scientific deductions of that author.—We subjoin, therefore, a few general observations on the philosophy of musical sound, commonly called *harmonics*, which may perhaps convey the full portion of knowledge of the theory of music, with which one in search only of general information, and not a professed student of this particular science, would choose to rest satisfied.

The theory of musical sound, which only in the beginning of the present century was ultimately established by mathematical demonstration, is no other than that which distinguished the ancient musical sect who

(MMMM) Yet there may be two fifths in succession, provided the parts move in contrary directions, or, in other words, if the progress of one part be ascending, and the other descending; but in this case they are not properly two fifths, they are a fifth and a twelfth; for example, if one of the parts in descending should sound *fa re*, and the other *ut la* in rising, *ut* is the fifth of *fa*, and *la* the twelfth of *re*.

General observations on Harmonics

who followed the opinions of Pythagoras on that subject.

No part of natural philosophy has been more fruitful of hypothesis than that of which musical sound is the object. The musical speculators of Greece arranged themselves into a great number of different sects, the chief of whom were the Pythagoreans and the Aristoxenians.

Pythagoras supposed the air to be the *vehicle* of sound; and the agitation of that element, occasioned by a similar agitation in the parts of the sounding body, to be the *cause* of it. The vibrations of a string or other sonorous body, being communicated to the air, affected the auditory nerves with the sensation of sound; and this sound, he argued, was acute or grave in proportion as the vibrations were quick or slow.—He discovered by experiment, that of two strings equal in every thing but length, the shorter made the quicker vibrations, and emitted the acuter sound:—in other words, that the number of vibrations made in the same time, by two strings of different lengths, was inversely as those lengths; that is, the greater the length the smaller the number of vibrations in any given time. Thus sound, considered in the vibrations that cause it, and the dimensions of the vibrating body, came to be reduced to quantity, and as such was the subject of calculation, and expressible by numbers.—For instance, the two sounds that form an octave could be expressed by the numbers 1 and, 2, which would represent either the number of vibrations in a given time, or the length of the strings; and would mean, that the acuter sound vibrates twice, while the graver vibrates once; or that the string producing the lower sound is twice the length of that which gives the higher. If the vibrations were considered, the higher sound was as 2, the lower as 1; the reverse, if the length was alluded to. In the same manner, in the same sense, the 5th would be expressed by the ratio of 2 to 3, and the 4th by that of 3 to 4.

Aristoxenus, in opposition to the calculations of Pythagoras, held the ear to be the sole standard of musical proportions. That sense he accounted sufficiently accurate for musical, though not for mathematical, purposes; and it was in his opinion absurd to aim at an artificial accuracy in gratifying the ear beyond its own power of distinction. He, therefore, rejected the velocities, vibrations, and proportions of Pythagoras as foreign to the subject, in so far as they substituted *abstract causes* in the room of *experience*, and made music the object of *intellect* rather than of *sense*.

Of late, however, as has been already mentioned, the opinions of Pythagoras have been confirmed by absolute demonstration; and the following propositions, in relation to musical sound, have passed from conjecture to certainty.

Sound is generated by the vibrations of elastic bodies, which communicate the like vibrations to the air, and these again the like to our organs of hearing. This is evident, because sounding bodies communicate tremors to other bodies at a distance from them. The vibrating motion, for instance, of a musical string, excites motion in others, whose tension and quantity of matter dispose their vibrations to keep time with the undulations of air propagated from it (the string first set in motion.)

If the vibrations be isochronous, and the sound musical, continuing at the same pitch, it is said to be acuter, sharper, or higher, than any other sound whose vibrations are slower; and graver, flatter, or lower, than any other whose vibrations are quicker.—For while a musical string vibrates, its vibrations become quicker by increasing its tension or diminishing its length; its sound at the same time will be more acute: and, on the contrary, by diminishing its tension or increasing its length, the vibrations will become slower and the sound graver. The like alteration of the pitch of the sound will follow, by applying, by means of a weight, an equal degree of tension to a thicker or heavier and to a smaller or lighter string, both of the same length, as in the smaller string the mass of matter to be moved by the same force is less.

If several strings, however, different in length, density, and tension, vibrate altogether in equal times, their sounds will have all one and the same pitch, however they may differ in loudness or other qualities.—They are called *unisons*. The vibrations of unisons are isochronous.

The vibrations of a musical string, whether wider or narrower, are nearly isochronous. Otherwise, while the vibrations decrease in breadth till they cease, the pitch of the sound could not continue the same (which we perceive by experience it does), unless where the first vibrations are made very violently; in which case, the sound is a little acuter at the beginning than afterwards.

Lastly, the word *vibration* is understood to mean the time which passes between the departure of the vibrating body from any assigned place and its return to the same.

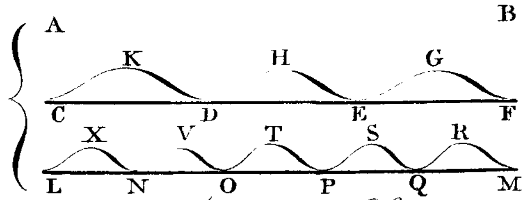
Glass-Music. See Harmonica.

MUSIMON, in natural history, the name of an animal esteemed a species of sheep, described by the ancients as common in Corsica, Sardinia, Barbary, and the north-east parts of Asia. It has been doubted whether the animal described under this name is now any where to be found in the world; and whether it was not, probably, a spurious breed between two animals of different species, perhaps the sheep and goat, which, like the mule, not being able to propagate its species, the production of them may have been discontinued.

Buffon supposes it to be the sheep in a wild state; and it is described as such by Mr Pennant. These animals live in the mountains, and run with great swiftness among the rocks. Those of Kamtschatka are so strong, that 10 men can scarce hold one; and the horns are so large as sometimes to weigh 30 pounds, and

A
Tone tone semitone tone tone tone semitone
ut re mi fa sol la si ut

B
ut re mi fa sol la si VT RE MI FA SOL &c
Scale first. Scale Second.

C


The Chromatic Species.

D
The diatonic Scale of the Greeks.
Si Ut Re Mi Fa Sol La
Sol Ut Sol Ut Fa Ut Fa
The Fundamental bass.

K
Scale.
Sol Sol &c.
Ut Mi Sol ※
The Fundamental bass.

E
Ut Re Mi Fa Sol Sol La Si Ut
Ut Sol Ut Fa Ut Sol Re Sol Ut
The Fundamental bass.

L
Scale.
Ut Mi Si ※
Ut Mi Sol ※
The Fundamental bass.

F
VT, VT ※, re, re ※, mi, mi ※, fa ※, SOL, sol ※, LA, la ※, si, si ※, ut, ut ※, RE, RE ※, MI, MI ※,
Scale first. Scale Second.

G
The first Scale of the minor mode.
Sol La Si Ut Re Mi Fa
Third minor. Third minor. Third minor.
Mi La Mi La Re La Re
The Fundamental bass.

N
Scale.
Mi♭ Mi Mi Mi Mi※
Ut Ut La Ut Ut
The Fundamental bass.

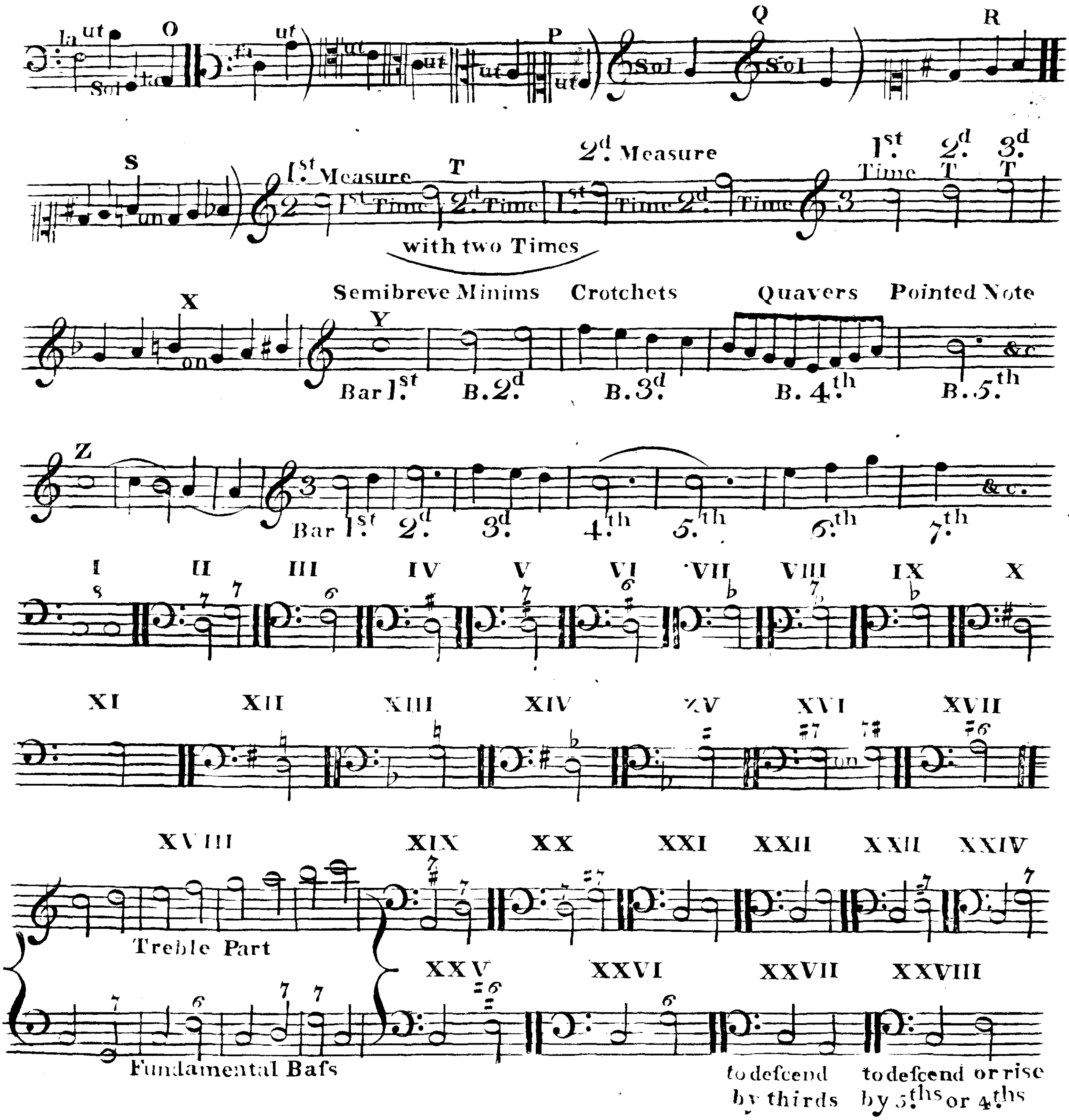
H
The second Scale of the minor mode
La Si Ut Re Mi mi fa※ Sol※ La
La Mi La Re La Mi Si Mi La
The Fundamental bass.

M
Scale
Fa Mi Mi Re
Fa Ut Mi Si
The Fundamental bass.

I
Scale.
Ut Re Mi Fa Sol La Si Ut
Ut Sol Ut Fa Ut Re Sol Ut

T. & L. sc.

MUSIC


la ut Sol la O
fa ut ut ut ut P ut
Q Sol Sol R
S on
1st Measure T 2d Measure
1st Time 2d Time 1st Time 2d Time
with two Times
1st Time 2d T 3d T
X on
Semibreve Minims Crotchets Quavers Pointed Note
Y &c
Bar 1st B. 2d B. 3d B. 4th B. 5th
Z
Bar 1st 2d 3d 4th 5th 6th 7th &c.
I II III IV V VI VII VIII IX X
XI XII XIII XIV XV XVI XVII on
XVIII XIX XX XXI XXII XXII XXIV
Treble Part
XXV XXVI XXVII XXVIII
Fundamental Bafs
to defcend by thirds
to defcend or rise by 5ths or 4ths

MUSIC


XXIX XXX XXXI XXXII XXXIII XXXIV XXXV XXXVI XXXVII
XXXVIII XXXIX XL XLI XLII XLIII XLIV XLV XLVI
Perfect Cadence
unperfectCad
XLVII XLVIII
difsonance prepared.
XLIX dis.pre.
L dis.pre.
LI
Treble part
Treble
Treble
Treble
Fundamental Bafs
Fund.Bafs
Fund.Bafs
LII dissonance resolved
LIII difs. res
LIV difs. res
LV LVI LVII LVIII
Treble
Treble
Treble
Fund.B
Fund.B
Fund.B
Fund.B
F.B.
F.B.
LIX LX LXI LXII LXIII LXIV LXV LXVI
Th.B. T.B. T.B. T.B. T.B. T.B.
Thorough Bafs
T.B.
F.B. F.B. F.B. F.B. F.B. F.B.
Fundamental Bafs
F.B.

MUSIC

LXVII
Treble
Thorough Bafs
Fundamental Bafs
LXVIII
Treble
Th^o. B.
Fund. B.
LXIX
LXX
LXXI
The Key
T. B. or tonic
The sensible Note.
Key.
T. B.
Sen. N.
Key
Th. B.
Fund. B.
Fund. B.
LXXII
LXXIII
LXXIV
LXXV
F.B.
F.B.
F.B. Broken Cadence
F.B. Interupted Cadence
LXXVI.
LXXXV.
T.B.
T.B.
T.B.
T.B.
T.B.
T.B.
T.B.
T.B.
T.B.
T.B.
Fund. B
F.B.
F.B.
F.B.
F.B.
F.B.
F.B.
F.B.
F.B.


LXXXVI. LXXXVII.
LXXXVIII. Cromatic modulation defcen.g
LXXXIX. Cromatic modulation afcending.
T.B. T.B. The treble
The Treble
F.B. FB. Fund. B.
Fund. B.
XC
Treble
T.B.
F.B.
XCI
Tho. B.
Fund. B.
XCII
Treble
Fund. B.
XCIII
Treble
XCIV
Th B.
Fund. B.
XCV
Th B.
Fund. B.


En fin, il eft en ma puif_fance, Ce fatal en ne_ _ _ mi Ce fu=per=be vain_ _ _
Th.B.
F.B
_ _ queur, Le charme du fom meil le livre à ma ven=geance, Je vais per_ _ _
Th.B.
F.B.
_ _ cer fon in vin ci ble cœur; Par luy, tous mes Captifs font fortis d efcla_ _
Th.B.
F.B.

MUSIC


vage; Qu'il eprouve toute ma rage Quel trouble me faifit! Qui me fait hefi_ _
Th. B.
F. B.
_ _ter. Queftce quen fa fa_ _ _veur la pilie me veut di re Frapons, Ciel! qui peut marrê
Th. B.
F. B.
ter Achevons je fremis! Vengeons nous je foû pire! Eft ce ainfi que je
Th. B.
F. B.

MUSIC


dois me venger anjour d'huy! Ma co_le_re_se' teint Quand j'aproche de luy
Th.B.
F.B.
Plus je le vois! plus ma vengeance est vaine; Mon bras tremblant fe re=
Th.B.
F.B.
fufe a' ma haine: Ah! quelle cruau te de luy ra vir le jour! A ce jeune He
Th.B.
F.B.

MUSIC


ros, tout ce de fur la terre: Qui croiroit qu'il fût ne feulement pour la guerre, Il
Th.B.
F.B.
femble être fait pour l'Amour Ne puis je me ven ger à moins qu'il ne pe
Th.B.
F.B.
riffe. Hé! ne fuffi_t_il pas que l'Amour le pu niffe. Puifqu'il n'a pu trou
Th.B.
F.B.

MUSIC.

Tranſlation. Intended to give ſuch Readers as do not underſtand French, an idea of the Song.

At length the victim in my power I ſee,
This fatal year reſigns him to my rage;
Subdued by ſleep he lies, and leaves me free,
With chaſtening hand my fury to aſſwage.
That mighty heart invincible and fierce,
Which all my captives free'd from ſervile chains;
That mighty heart, my vengeful hand ſhall pierce;
My rage inventive wanton in his pains.
Ha! in my ſoul what perturbation reigns!
What? would compaſſion in his favour plead!
Strike, hand. O heaven! what charm thy force reſtrains?
Obey my wrath. I ſigh; yet let it bleed.
And is it thus my juſt revenge improves
The fair occaſion to chaſtize my foe?
As I approach, a ſofter paſſion moves,
And all my boaſting fury melts in wo.
Trembling, relax'd, and faithleſs to my hate,
The dreadful taſk this coward arm declines.
How cruel thus to urge his inſtant fate,
Depriv'd of life amid his great deſigns!
In youth how blooming! what a heavenly grace,
Thro' all his form, reſiſtleſs power diſplays!
How ſweet the ſmile that dwells upon his face,
Relentleſs rage diſarming whilſt I gaze!
Tho' to the proweſs of his conquering arms
Earth ſtood with all her hoſts oppoſed in vain;
Yet is he form'd to ſpread more mild alarms,
And bind all nature in a ſofter chain.
Can then his blood, his precious blood alone
Extinguiſh all the vengeance in my heart?
Tho' ſtill ſurviving, might he not atone.
For all the wrongs, I feel, by gentler ſmart?
Since all my charms, unfeeling, he defies,
Let Magic force his ſtubborn ſoul ſubdue;
Whilſt I, inflexible to tears and ſighs,
With hate (if I can hate) his peace purſue.

and so capacious, that young foxes often shelter themselves in the hollow of such as by accident fall off in the deserts. See OVIS.

MUSIS (Agostino de), a noted engraver, better known by the name of *Agostino Veneziano*, or in England by that of "Augustin the Venetian;" but *Musis* was his proper family name. He was a native of Venice, and scholar of Marc Antonio Raimondi. It is not certain at what period he began his studies under that celebrated master; but the first dated print by Agostino appeared A. D. 1509, at which time, it is probable, his tutor still resided at Venice. After the death of Raphael, which happened in 1520, Agostino de Musis, and Marc de Ravenna, his fellow-disciple, who had conjointly assisted each other, separated, and worked entirely upon their own account. It is uncertain at what time Agostino died; but his prints are not dated latter than 1536. So that it may be reasonably supposed that he did not long survive that period. Agostino de Musis imitated the style of his master with great attention, and was, upon the whole, the most successful of all his scholars. In neatness and mechanical execution with the graver, he has often equalled if not sometimes exceeded him; but in point of taste, and in the purity and correctness of outline, he certainly fell greatly short of him. Agostino's drawing had more of manner and stiffness; the heads of his figures are not so accurately marked; nor the other extremities expressed with equal truth.

MUSIVUM AURUM. See CHEMISTRY, n° 1224.

MUSK, a very strong-scented substance found under the belly of an East Indian animal. See MOSCHUS.

According to Tavernier, the best and greatest quantities of musk come from the kingdom of Boutan, from whence it is carried for sale to Patna, the chief town of Bengal. After killing the animal, the peasants cut off the bag, which is about the size of an egg, and is situated nearer the organs of generation than the navel They next take out the musk, which has then the appearance of clotted blood. When they want to adulterate it, they put a mash of the animal's blood and liver into the place of the musk they had extracted. In two or three years this mixture produces certain small animals which eat the good musk; so that, when opened, a great consumption is perceived. Others, after extracting a portion of the musk, put in small pieces of lead to augment the weight. The merchants who transport the musk to foreign countries are less averse to this trick than the former; because in this case none of the animals abovementioned are produced. But the deceit is still worse to discover, when, of the skin taken from the belly of a young animal, they make little bags, which they sew so dexterously with threads of the same skin, that they resemble genuine bags. Those they fill with what they take out of the genuine bags, and some fraudulent mixture, which it is extremely difficult for the merchants to detect. When the bags are sewed immediately on their being cut, without allowing any part of the odour to dissipate in the air, after they have abstracted as much of the musk as they think proper, if a person applies one of these bags to his nose, blood will be drawn by the mere force of the odour, which must necessarily be weakened or diluted in order to render it agreeable without injuring the brain. Our author brought one of the animals with him to Paris, the odour of which was so strong, that it was impossible for him to keep it in his chamber. It made every head in the house giddy; and he was obliged to put it in a barn, where the servants at last cut away the bag: the skin, notwithstanding, always retained a portion of the odour. The largest musk-bag seldom exceeds the size of a hen's egg, and cannot furnish above half an ounce of musk; three or four of them are sometimes necessary to afford a single ounce. In one of his voyages to Patna, Tavernier purchased 1663 bags, which weighed 1557 ounces and a half; and the musk, when taken out of the bags, weighed 452 ounces.

Musk affords the strongest of all known odours. A small bit of it perfumes a large quantity of matter. The odour of a small particle extends through a considerable space. It is likewise so fixed and permanent, that at the end of several years it seems to have lost no part of its activity. When it comes to us, it is dry, with a kind of unctuosity, of a dark reddish brown or rusty blackish colour, in small round grains, with very few hard black clots, and perfectly free from any sandy or other visible foreign matter. If chewed, and rubbed with a knife on paper, it looks smooth, bright, yellowish, and free from bitterness. Laid on a red hot iron, it catches flame, and burns almost entirely away, leaving only an exceeding small quantity of light greyish ashes: if any earthy substances have been mixed with the musk, the quantity of the residuum will readily discover them.

Musk has a bitterish subacrid taste; a fragrant smell, agreeable at a distance, but when smelt near to, so strong as to be disagreeable unless weakened by the admixture of other substances. If a small quantity be infused in spirit of wine in the cold for a few days, it imparts a deep, but not red tincture: this, though it discovers no great smell of the musk, is nevertheless strongly impregnated with its virtues; a single drop of it communicates to a whole quart of wine a rich musky flavour. The degree of flavour which a tincture drawn from a known quantity of musk communicates to vinous liquors, is perhaps one of the best criteria for judging of the goodness of this commodity. Neumann informs us, that spirit of wine dissolves 10 parts out of 30 of musk, and that water takes up 12; that water elevates its smell in distillation, whilst pure spirit brings over nothing.

Musk is a medicine of great esteem in the eastern countries; among us, it has been for some time pretty much out of use, even as a perfume, on a supposition of its occasioning vapours, &c. in weak females and persons of a sedentary life. It appears, however, from late experience, to be, when properly managed, a remedy of good service even against those disorders which it has been supposed to produce. Dr Wall has communicated (in the Philosoph. Transac. n° 474.) an account of some extraordinary effects of musk in convulsive and other diseases, which have too often baffled the force of medicine. The doctor observes, that the smell of perfumes is often of disservice, where the substance, taken inwardly and in considerable quantity produces the happiest effects; that two persons, labouring under a *subsultus tendinum*, extreme anxiety, and want of sleep, from the bite of a mad dog,

dog, by taking two doses of musk, each of which was 16 grains, were perfectly relieved from their complaints. He likewise observes, that convulsive hiccups, attended with the worst symptoms, were removed by a dose or two of 10 grains; and that in some cases, where this medicine could not, on account of strong convulsions, be administered to the patient by the mouth, it proved of service when injected as a glyster. He likewise adds, that under the quantity of six grains, he never found much effect from it; but that, taken to 10 grains and upwards, it never fails to produce a mild diaphoresis, without at all heating or giving any uneasiness: that, on the contrary, it eases pain, raises the spirits; and that, after the sweat breaks out, the patient usually falls into a refreshing sleep: that he never met with any hysterical person, how averse soever to perfumes, but could take it, in the form of a bolus, without inconvenience. To this paper is annexed an account of some farther extraordinary effects of musk, observed by another gentleman. Repeated experience has since confirmed its efficacy in these disorders. The dose has sometimes been increased, particularly in convulsive disorders, to the quantity of a scruple or half a dram every three or four hours, with two or three spoonfuls of musk julep between. The julep is the only officinal preparation of it. It is combined with opium in tetanus, and with mercury in rabies canina.

Musk-Animal. See Moschus.

Musk-Ox. See Bos.

Musk-Rat, in zoology. See Castor.

MUSKET, or Musquet, properly a fire-arm borne on the shoulder, and used in war; to be fired by the application of a lighted match.

The length of the barrel is fixed to three feet eight inches from the muzzle to the touch-pan, and its bore is to be such as may receive a bullet of 14 in a pound, and its diameter differs not above one 50th part from that of the bullet.

Muskets were anciently borne in the field by the infantry, and were used in England so lately as the beginning of the civil wars. At present they are little used except in the defence of places, fusees or firelocks having taken their place and name.

MUSKETOON, a kind of short thick musket, whose bore is the 38th part of its length: it carries five ounces of iron, or seven and a half of lead, with an equal quantity of powder. This is the shortest kind of blunderbusses.

MUSLIN, a fine sort of cotton cloth, which bears a downy knot on its surface. There are several sorts of muslins brought from the East Indies, and more particularly from Bengal; such as doreas, betelles, mulmuls, tanjecbs, &c. Muslin is now manufactured in Britain, and brought to very great perfection.

MUSONIUS, (Caius Rufus), a Stoic philosopher of the second century, was banished into the island of Gyare, under the reign of Nero, for criticising the manners of that prince; but was recalled by the emperor Vespasian. He was the friend of Apollonius Tyaneus, and the letters that passed between them are still extant.

MUSQUETOE. See Culex.

MUSSULMAN, or Musylman, a title by which the Mahometans distinguish themselves; signifying, in the Turkish language, "true believer, or orthodox." See Mahometanism.

In Arabic, the word is written *Moslem*, *Mosleman*, or *Mosolman*. The appellation was first given to the Saracens, as is observed by Leunclavius.—There are two kinds of Mussulmans, very averse to each other; the one called *Sonnites*, and the other *Shiites*.—The Sonnites follow the interpretation of the Alcoran given by Omar; the Shiites are the followers of Ali. The subjects of the king of Persia are Shiites; and those of the grand signior, Sonnites. See Sonna, and Alcoran.

Some authors will have it, that the word Mussulman signifies *saved*, that is, predestinated; and that the Mahometans give themselves the appellation, as believing they are all predestinated to salvation—Martininius is more particular as to the origin of the name; which he derives from the Arabic מסלם, *musalem*, "saved, snatched out of danger:" the Mahometans, he observes, establishing their religion by fire and sword, massacred all those who would not embrace it, and granted life to all that did, calling them *Mussulmans*, q. d. *erepti è periculo*; whence the word, in course of time, became the distinguishing title of all those of that sect, who have affixed to it the signification of *true believers*.

MUST, Mustum, sweet wine newly pressed from the grape; or the new liquor pressed from the fruit before it has worked or fermented. See Wine.

Must of Rhenish wine. This is a liquor that, tho' drank by some, is found extremely to affect the brain; for not having passed the natural effervescence which it would have been subject to, in the making of wine, its salts are locked up till the heat of the stomach setting them to work, they raise their effervescence there, and send up abundance of subtle vapours to the brain. The Rhenish must is of two kinds, being made either with or without boiling. That made without boiling is only put up so close in the vessel that it cannot work; this is called *stumm-wine*. That by boiling is thus prepared: they take strong vessels not quite filled, and putting them into a cellar, they make a fire mild at first, but increased by degrees, and afterwards they gradually lessen it again, that the boiling may cease of itself. This operation is finished in 36 or 40 hours, according to the size of the vessel; and the wine-boilers, instead of common candles, which would melt by the heat, use thin pieces of split beech-wood. These also serve for a double purpose; not only lighting them, but giving them notice of the boiling being enough; before that time, the quantity of vapours thrown up make them burn dim; but as soon as it is finished, the vapours ascend in less quantity, and the lights burn brisk and clear. About seven or eight days after this boiling, the must begins to work, and after this working it is called *wine*. They have also another kind of Rhenish must which is thus prepared: they boil the liquor to half the quantity, and put into it the medicinal ingredients they are most fond of; such as orange-peel, elecampane-root, and juniper-berries, or the like; being thus medicated, the whole works much more slowly than it otherwise would.—If the boiled must, by too violent an effervescence, cast out its lees, it will on this become vapid and dead, unless this separation is stopped by some fatty substance,

stance, such as fresh butter or the like: they put this in upon a vine leaf, or else apply hard to the mouth of the vessel.

A must for artificial wine may be thus made: Take 20 pounds of fine sugar, five gallons of water, four ounces of white tarter finely pulverized, or cream of tartar, and boil them in a large vessel over a gentle fire.

MUSTARD. See SINAPI.

Mustard-Seed, is one of the strongest of the pungent, stimulating, diuretic medicines, that operate without exciting much heat. It is sometimes, taken unbruised, to the quantity of a spoonful at a time, in paralytic, cachectic, and serous disorders. It is applied also as an external stimulant, to benumbed and paralytic limbs: to parts affected with fixed rheumatic pains: and to the soles of the feet, in the low state of acute diseases, for raising the pulse; in this intention, a mixture of equal parts of the powdered seeds and crumbs of bread, with the addition sometimes of a little bruised garlic, are made into a cataplasm with a sufficient quantity of vinegar. See SINAPISM.

Mustard-seed yields upon expression, a considerable quantity of oil, which is by some recommended externally against rheumatisms and palsies, though it has nothing of that quality by which the seeds themselves prove useful in those disorders; the oil being mild and insipid as that of olives, and the pungency of the seed remaining entire in the cake left after expression; nor is any considerable part of the pungent matter extracted by rectified spirit. The bruised seeds give out readily to water nearly the whole of their active matter: added to boiling milk they curdle it, and communicate their pungency to the whey. The powder of mustard-seed may be made into the consistence of a loch with warm water, in which a little sea salt has been dissolved. Of this a common-spoonful, sometimes two, diluted with tepid water, are given on an empty stomach: it operates as well as an emetic, and proves an excellent remedy in most nervous disorders, according to Dr Monro, in Med. Ess. Edinb. vol. ii. art. 19. p. 303. note.

MUSTELA, the OTTER and WEASEL; a genus of quadrupeds of the order of feræ. There are six cutting teeth in each jaw; those of the upper jaw, erect, sharp-pointed, and distinct: of the lower jaw, blunter, huddled together, and two placed within the line of the rest: The tongue is smooth.

Plate CCCXXXIII. 1. The lutris, or sea-otter, having hairy feet and a hairy tail. The length from nose to tail is about three feet long, and the tail is about 13 inches; the body and the limbs are black, except the fore-part of the head, which is white or grey; the largest individual weighs from 70 to 80 pounds; the fur is very thick, long, black, and glossy, sometimes varying to silvery, with a soft down beneath. The sea-otter inhabits the coasts of North-west America and Eastern Asia, and the intermediate islands. It lives mostly in the sea, and swims with great facility: frequenting shallows which abound in sea-weeds, and feeding on lobsters, fish, *sepiæ* or cuttle-fish, and shell-fish. It is a harmless animal; very affectionate to its young, insomuch that it will pine to death at the loss of them, and die on the very spot where they have been taken from it. Before the young can swim, the dams carry them in their paws, lying in the water on their backs; they swim often on their back, their sides, and even in a perpendicular posture; are very sportive: embrace, and kiss each other; they breed but once a-year, and have but one young at a time, suckle it for a year, and bring it on shore. They are dull-sighted, but quick-scented: and run very swiftly on land. They are hunted for their skins, which are of great value; being sold to the Chinese for 70 or 80 rubles a-piece: each skin weighs $3\frac{1}{2}$ lib. The young are reckoned very delicate meat, scarce to be distinguished from a sucking lamb. The cry of this creature is nearly similar to a young dog; and it is sometimes interrupted by another cry similar to that of the saki or fox-tailed monkey. It may be nourished with the flour of manioc diluted in water.

2. The lutra, or common otter, has naked feet, and the tail is about half the length of the body. It is in general about two feet long, from the tip of the nose to the base of the tail. The fur is of a deep brown colour, with two small white spots on each side of the nose, and one beneath the chin. This animal inhabits Europe, North America, and Asia as far south as Persia. It frequents fresh water rivers, lakes, and fish-ponds; and preys on fish, frogs, and fresh-water crustaceous animals, being exceedingly destructive to fish-ponds. The otter procreates in February, and the female brings forth three or four young ones in May: the male calls the female by a soft murmuring noise. The otter shows great sagacity in forming its habitation; it burrows under ground on the banks of some river or lake: it always makes the entrance of its hole under water; working upwards to the surface of the earth and forming, before it reaches the top, several holes or lodges, that in case of high floods, it may have a retreat; for no animal affects lying drier at top: it makes a minute orifice for the admission of air. It is further observed, that this animal, the more effectually to conceal its retreat, contrives to make even this little air-hole in the middle of some thick bush. Our author also informs us, that the otter is capable of being tamed; that he will follow his master like a dog and even fish for him, and return with his prey. Though the otter does not cast his hair, his skin is browner, and sells dearer in winter than in summer; and makes a very fine fur. His flesh has a disagreeable fishy taste. His retreats exhale a noxious odour from the remains of putrid fishes: and his own body has a bad smell. The dogs chace the otter spontaneously, and easily apprehend him when at a distance from water or from his hole. But, when seized, he defends himself, bites the dogs most cruelly, and sometimes with such force as to break their leg-bones, and never quits his hold but with life. The beaver, however, who is not a very strong animal, pursues the otters, and will not allow them to live on the same banks with himself.

3. The lutreola, or small otter, has very broad hairy feet, and a white mouth: and seldom exceeds a foot in length. The body is of a tawny and dusky colour mixed together; the fur having two series of hairs, the shorter of which are yellowish and the long black. This animal inhabits Poland, Finland, Russia, and Siberia: frequenting marshy places, and preying

Mustella. on fish and frogs. It is caught with dogs and traps, and is excessively fetid; but its fur is very valuable, being esteemed next in beauty to that of the sable.

Plate CCCXXXIII. 4. The canadensis, or Canadian otter, is of a black colour, and the fur is smooth. It has a long taper tail: and inhabits Canada and other parts of North America.

5. The guianensis, or small Guiana otter, with the hind-feet webbed, the toes of the fore-feet unconnected, and a long taper naked tail inhabits Cayenne. and probably other parts of South America. It is only about seven inches long from the nose to the rump; the tail is near seven; the upper parts of the head and body are marked with large brownish black spots, exactly corresponding on both sides, and the intervals are of a yellowish grey colour; all the under parts of the body and head, and the fore-parts of the fore-legs are white, and there is a white spot over each eye: the ears are large and round; and the mouth is garnished with long whiskers. Buffon informs us that there are three species of otters in Cayenne: 1st, Black, which weighs from 40 to 50 French pounds. 2d, Yellowish, weighing 20 or 25 pounds. 3d, The small greyish kind above described; which only weighs three or four pounds. The other two are not described; but they are said to appear in numerous troops, to be very fierce and dangerous, and to defend themselves against dogs, biting very cruelly: they litter in holes which they dig on the banks of rivers; are often tamed and brought up in houses.

The otters, of which there are several more species described by authors, are distinguished from the following tribe, the *weasels*, by having their feet palmated or webbed; whereas the latter have their toes separate, or unconnected by any web or membrane.

1. The galera, tayra, or Guinea weasel, is of an uniform dusky colour, the fur very rough. It is about the size of a rabbit, and is shaped like a rat. It inhabits Guinea; where it burrows in the ground by means of its fore feet, which are strong and formed for digging. It is very common about the negro villages, and is exceedingly fierce and destructive to poultry.

2. The foina, or common martin, is of a blackish chesnut colour, with the throat and breast white: the head and body measure 18 inches in length, the tail 10. The martin inhabits Britain, Germany, France, and most parts of the south of Europe, and even the warmer parts of Russia. He lives in woods, and goes about during the night in quest of prey, He is a most elegant lively animal. His movements are all exceedingly nimble; he rather bounds and leaps than walks. He climbs rough walls with ease and alacrity; enters the pigeon or hen houses, eats the eggs, pigeons, fowls, &c. and the female often kills great numbers, and transports them to her young. He likewise seizes mice, rats, moles, and birds, in their nests. M. Buffon kept one of these animals for a considerable time. He tamed to a certain degree, but never formed any attachment, and continued always so wild, that it was necessary to chain him. He made war against the rats, and attacked the poultry whenever they came in his way. He often got loose, though chained by the middle of the body. At first he went to no great distance, and returned in a few hours; but without discovering any symptoms of joy or affection to any particular person. He, however, called for victuals like a cat or dog. Afterwards he made longer excursions; and at last he thought proper never to return. He was then about a year and a half old, seemingly the age at which nature assumes her full ascendency. He eat every thing presented to him, except sallad and herbs; was fond of honey, and preferred hemp-seed to every other grain. It was remarked that he drank very often; that he sometimes slept two days successively, and at other times would sleep none for two or three days; that before sleeping, he folded himself in a round form, and covered his head with his tail; and that, while awake, his motions were so violent, so perpetual, and so incommodious, that though he had not disturbed the fowls, it was necessary to chain him, to prevent him from breaking every thing. The same author informs, that he has had in his possession several martins of a more advanced age, which had been taken in nets: but they continued to be totally savage, bit all who attempted to touch them, and would eat nothing but raw flesh. The character of this animal is somewhat differently given by Mr Pennant: who says "it is very *good-natured*, sportive, and capable of being *tamed*." The younger females bring three or four at a birth; when older, they produce six or seven. They breed in hollows of trees; and are often, in winter, found in magpies nests. The skin and excrements have a musky smell.

3. The martes, or pine-martin, has the body of a dark or blackish chesnut colour, the breast and throat yellow. It inhabits the north of Europe, Asia, and America; and is more rarely found in Britain, France, Germany, and Hungary; and as far as Tonquin and China. They live in large woods or forests, keeping in the day-time in the hollows of trees, occupying squirrels nests, especially for their young, and go about only by night. They prey on squirrels, mice, rats, and small birds; eat likewise berries, ripe fruit, and honey; and, in winter, go in quest of pigeons, and poultry. They procreate in February; and the female is said, after nine months, to bring forth seven or eight young ones. The head of this species is shorter, and the legs are somewhat longer, than in the common martin. The fur is far superior in fineness to that of the common kind, and is a prodigious article in commerce: Those about Mount Caucasus, with an orange throat, are more esteemed by furriers than the rest.

4. The Guiana or South American martin, is of a dark brown colour, with a white forehead, and a long narrow stripe along the side of the neck. The body and head are near two feet long, and the tail is only about five inches. It inhabits Guiana,

5. The laniger, woolly weasel, or small Guiana martin, is covered with white woolly hair, and has a long taper tail: the body and head are near 16 inches long, and the tail near 9. It inhabits Cayenne.

6. The zibellina, or sable, has a great resemblance to the martin; from which it differs in having a longer head; longer ears, surrounded by a yellow margin: longer and more elegant fur; the feet more thickly clothed with hair; and the tail shorter than the hind-legs when extended, while that of the martin is much longer. The colour of the hair is cinerous at the bottom, and black at the tips; the chin is cinerous, sometimes white, yellowish, or spotted; the mouth is garnished with long whiskers; and the feet are large, with white claws. It inhabits the northern parts of Asia

Mustella. Asia and America, Siberia, Kamtschatka, and the Kurile islands, and formerly in Lapland; being found in Asia as low as 58°, and in America even to 40° of latitude. The sables frequent the banks of rivers and the thickest parts of the woods: avoiding the rays of the sun, which are said in a short time to change the colour of their hair. They live in holes of the earth, or beneath the roots of trees: sometimes they will form nests in the trees, and skip with great agility from one to the other: they are very lively, and much in motion during the night. Gmelin tells us, that after eating, they generally sleep half an hour or an hour, when they may be pushed, shaken, and even pricked, without awaking. During the night they are excessively active and restless. A tame one kept by Gmelin was accustomed to rise upon its hind-legs on sight of a cat, in order to prepare for the combat: In the woods they are much infested by wild cats. During summer the sables prey on ermines, weasels, and squirrels, but especially on hares; in winter, on birds; in autumn, on whortleberries, cranberries, and the berries of the service-tree; but during this last season their skins are at the worst; that diet causing their skins to itch, and to rub off their fur against the trees. They bring forth at the end of March or beginning of April; and have from three to five at a time, which they suckle for four or five weeks. In spring, after shedding the coat, the fur is sometimes of a tawny cast, and sometimes varies to snowy whiteness. The blackest are reputed the best; and sometimes sell even in Siberia, from one to ten pounds Sterling each. See the article Sable.

Plate CCCXXXIII. 7. The putorius, or pole-cat, is of a dirty yellow colour, with white muzzle and ears. He inhabits most parts of Europe, and in the temperate climates of Asiatic Russia; and has a great resemblance to the martin in temperament, manners, disposition, and figure. Like the latter, he approaches our habitations, mounts on the roofs, takes up his abode in hay-lofts, barns, and unfrequented places, from which he issues during the night only in quest of prey. He burrows under ground, forming a shallow retreat about two yards in length, generally terminating unde the roots of some large tree. He makes greater havock among the poultry than the martin, cutting of the head of all the fowls, and then carrying them off one by one to his magazine. If, as frequently happens, he cannot carry them off entire, on account of the smallness of the entry to his hole, he eats the brains, and takes only the heads along with him. He is likewise very fond of honey, attacks the hives in winter, and forces the bees to abandon them. The females come in season in the spring; and bring forth three, four, or five at a time. In the desarts of Asiatic Russia, pole-cats are sometimes found, especially in winter, of a white colour; they are likewise found beyond lake Baikal with white or yellowish rumps, bounded with black. It is exceedingly fetid, like several other species of this genus, especially the martin and sable, giving out from the anus a most offensive vapour when frightened. The male is mostly of a yellowish tinge, having a whitish muzzle, while the muzzle of the female is commonly of a yellowish dirty white.

8. The furo, or ferret, has red and fiery eyes; the colour of the whole body is of a very pale yellow; the length from nose to tail is about 14 inches, the tail five. In its wild state it inhabits Africa: from thence it was brought into Spain, in order to free that county from multitudes of rabbits with which it was over-run; and from Spain the rest of Europe has been supplied. This creature is incapable of bearing the cold, and cannot subsist even in France unless in a domestic state. The ferret is not in our climates endowed with the same capacity of finding his subsistence as other wild animals, but must be carefully nourished within doors, and cannot exist in the fields; for those who are lost in the burrows of rabits never multiply, but probably perish during the winter. Like other domestic animals, he varies in colour. The female ferret is less than the male; and when in season, we are assured, she is so extremely ardent, that she dies if her desires are not gratified. Ferrets are brought up in casks or boxes, where they are furnished with beds of hemp or flax. They sleep almost continually. Whenever they awake they search eagerly for food; and bran, bread, milk, &c. are commonly given them. They produce twice every year; and the female goes six weeks with young. Some of them devour their young as soon as they are brought forth, instantly come again in season, and have three litters, which generally consist of five or six, and sometimes of seven, eight, or nine. They are employed for hunting rabbits; and as in this country they are apt to degenerate, warreners are in use to cross the breed, procuring an intercourse between a female ferret and a male pole, by leaving the former, when in season, near the haunts of the latter: The produce is of a much darker colour than the ferret, having a great resemblance to the pole-cat. This animal is by nature a mortal enemy to the rabbit. Whenever a dead rabbit is for the first time presented to a young ferret, he flies upon it, and bites it with fury; but if it be alive, he seizes it by the throat or the nose, and sucks its blood. When let into the burrows of rabbits, he is muzzled, that he may not kill them in their holes, but only oblige them to come out, in order to be caught in the nets. If the ferret is let in without a muzzle, he is in danger of being lost: for, after sucking the blood of the rabbit, he falls asleep; and even smoking the hole is not acertain method of recalling him; because the holes have often several entries which communicate with each other, and the ferret retires into one of those when incommoded with the smoke. Boys likewise use the ferret for catching birds in the holes of walls, or of old trees. The ferret, though easily tamed, and rendered docile, is extremely irascible; his odour is always disagreeable; but when he is irritated, it becomes much more offensive. His eyes are lively, and his aspect is inflammatory; all his movements are nimble; and he is at the same time so vigorous, that he can easily master a rabit, though at least four times larger than himself.

9. The sarmatica, or Sarmatian weasel, is of a brownish black colour, spotted and striped irregulary with obscure yellow, and is about 14 inches in length, exclusive of the tail, which is six inches in length. It resembles the pole cat, but has a narrower head, a more lengthened body, a long tail, and shorter hair, except on the feet and tail; inhabits Poland, especially Volhynia, in the deserts of Russia between the Volga and Tanais, the mountains of Caucasus, Georgia, and Bucharia,

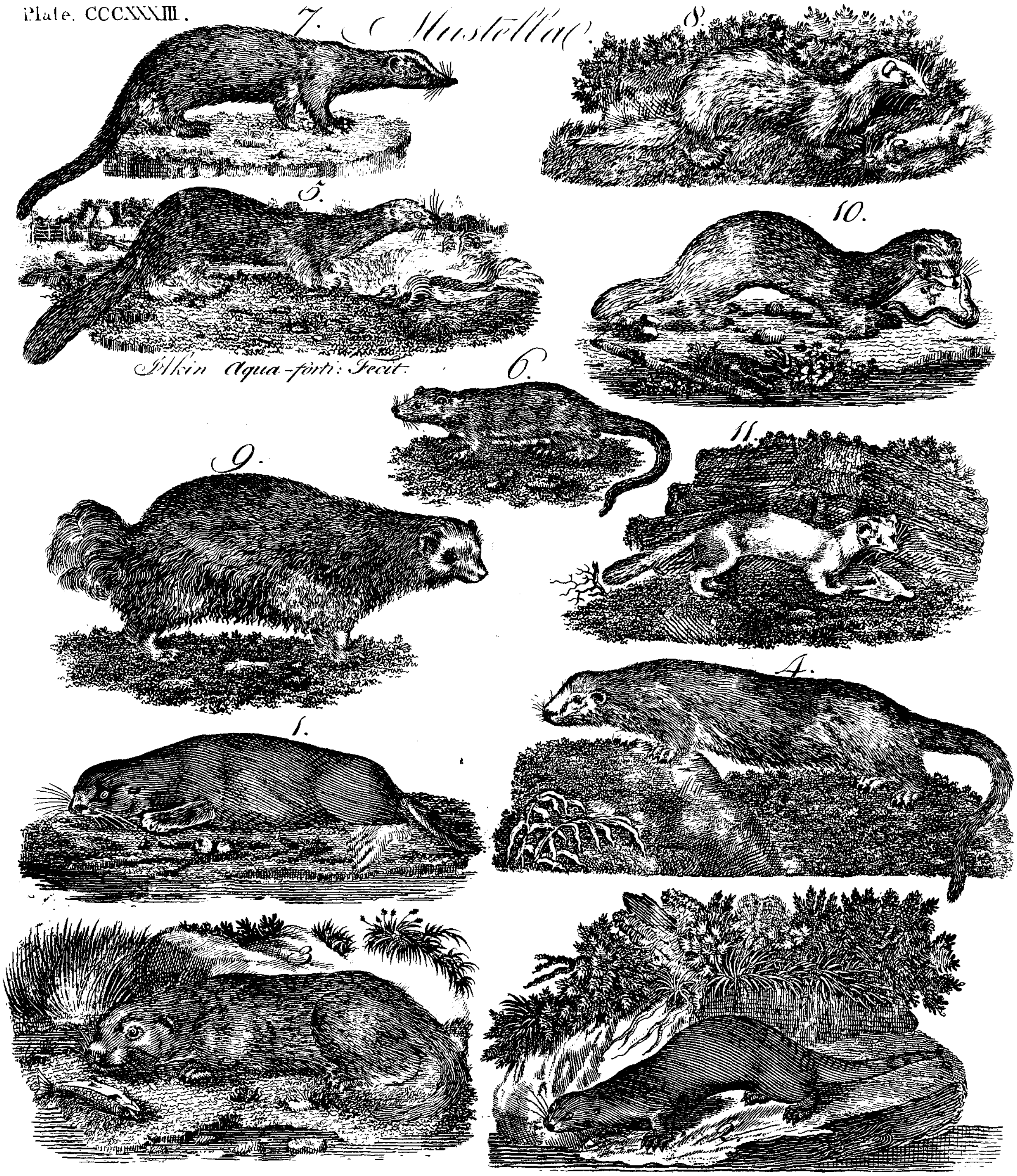
Mustella. charia. This is a most voracious animal, which feeds on marmots, rats, mice, jerboas, birds, and other small animals. It procreates in spring, and after eight weeks the female which has eight teats, brings forth from four to eight young ones. It lives in holes, sometimes of its own burrowing, but mostly in those which have been made by other animals, and is exceedingly fetid.

Plate CCCXXXIII. 10. The vulgaris, or common weasel, foumart, or whitret, has the upper parts of the body of a pale reddish brown; the lower parts white. It inhabits the temperate and northern parts of Europe, Asia, and America, and as far to the southward as the northern provinces of Persia, and is said to be found even in Barbary. In the more northern parts of Russia and Sweden, particularly in Westbothnia, it becomes white in winter like the ermine; but even in this state it is easily distinguishable from the latter, being a great deal smaller; the body and head not exceeding seven inches long, and the tail two inches and a half. It is very destructive to young birds, poultry, and young rabbits: and is besides a great devourer of eggs. It does not eat its prey on the place; but after killing it by one bite near the head, carries it off to its young, or to its retreat. It preys also on moles, as appears by its being sometimes caught in the mole-traps. It is a remarkably active animal: and will run up the sides of walls with such ease, that scarce any place is secure from it; and the body is so small that there is scarce any hole but what is pervious to it.—This species is much more domestic than any of the rest, and frequents out-houses, barns, and granaries. It clears its haunt in a short time from mice and rats, being a much greater enemy to them than the cat itself. In summer, however, they retire farther from houses, especially into low grounds, about mills, along rivulets, concealing themselves among brush wood, in order to surprise birds; and often take up their abode in old willows, where the female brings forth her young. She prepares for them a bed of straw, leaves, and other herbage, and litters in the spring, bringing from six to eight or more at a time. The young are born blind; but soon acquire sight and strength sufficient to follow their mothers. Their motion consists of unequal and precipitant leaps; and when they want to mount a tree, they make a sudden bound, by which they are at once elevated several feet high. They leap in the same manner when they attempt to seize a bird. These creatures as well as the pole-cat and ferret, have a disagreeable odour, which is stronger in summer than in winter; and when pursued or irritated, their smell is felt at a considerble distance. They move always with caution and silence, and never cry but when they are hurt. Their cry is sharp, rough and very expressive of resentment. As their own odour is offensive, they seem not to be sensible of a bad smell in other bodies. M. Buffon informs us, that a peasant in his neighbonrhood took three new-littered weasels out of the carcase of a wolf that had been hung up on a tree by the hind-feet. The wolf was almost entirely putrified, and the female weasel had made a nest of leaves and herbage for her young in the thorax of this putrid carcase. The weasel may be perfectly tamed, and rendered as caressing and frolicksome as a dog or squirrel. The method of taming them is to stroke them often and gently over the back; and to threaten, and even to beat them when they bite. In the domestic state their odour is never offensive but when irritated. They are fed with milk, boiled flesh, and water.

11. The erminea, or ermine, has the tail tipt with black, and has been distinguished by authors into two varieties, the *stoat* and the *white ermine*, though the difference seems chiefly to depend on climate and the season of the year; the stoat of a pale tawny brown or reddish yellow colour in summer, becoming the white ermine of winter in cold countries. They inhabit the north of Europe, Asia, and America, and as far as the northern parts of Persia and China; living in heaps of stones on the banks of rivers, in the hollows of trees, and particularly in forests, especially those of beech, preying on squirrels and lemmings. In manners and food this animal resembles the common weasel, but does not frequent houses, haunting chiefly in woods and hedges, especially such as border on brooks or rivulets. In general appearance it comes very near to the martin, but is shorter in the body, being scarcely ten inches long from nose to rump, and the tail about five and a half; the hair is likewise shorter and less shining than in that animal. In the northern regions, the fur of the ermine becomes entirely white during winter, except the outer half of the tail, which remains black. The skin is reckoned valuable, and sells in Siberia from two to three pounds Sterling a-hundred; but in ancient times it was in much greater request than now. In summer, the upper part of the body is of a pale tawny brown colour; the edges of the ears, and ends of the toes, are yellowish white; the throat, breast, and belly are white; in winter in the more temperate regions, it is sometimes mottled with brown and white; but in more severe winters becomes entirely white; the farther north and the more rigorous the climate, the white is the purer; those of Britain generally retain a yellowish tinge. In Persia and other more southern parts, it is brown the whole year. In Siberia they burrow in the fields, and are taken in traps baited with flesh. In Norway they are either shot with blunt arrows, or taken in traps made of two flat stones, one being propped up with a stick, to which is fastened a baited string, which when the animals nibble, the stone falls down and crushes them to death. The Laplanders take them in the same manner, only instead of stones make use of two logs of wood.

There are about 12 other species of the weasel tribe described by authors.—A Beautiful species of *weasel*, as it is called by some authors and universally considered by the Arabians, is described by Mr Bruce in his appendix under the name of *El Fennec*. It is about ten inches long from the snout to the tail; the tail near five inches and a quarter, and about half an inch of it black at the tip. From the point of the fore-shoulder to the point of the fore-toe it is two inches and seven eighths; from the occupit to the point of the nose, two inches and a half; and the ears are three inches and three eighths in length; and about an inch and a half in breadth, with the cavities very large. They are doubled and have a plait on the outside; the border of the inside is thick and covered with white soft hair, the middle part being bare and of a rose or pink colour. The pupil of the

eye


Mustellae.
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eye is large and black, surrounded with a deep blue iris; the mustachoes are thick and strong; the tip of the nose is very sharp, black, and polished. There are four grinders on each side of the mouth, six fore-teeth in each jaw, and the upper jaw projected beyond the lower one. The canine teeth are large, long, and very sharp pointed; the legs small and the feet broad, with four toes armed with short, black, sharp retractile claws; those on the fore-feet being sharper than those behind. The whole body of the animal is of a dirty white, approaching to cream-colour; the hair of the belly rather whiter, longer, and softer than the rest, with a number of paps upon it.

Mr Bruce obtained one of these animals for two sequins, by means of a janisary, who had it from a Turkish foot-soldier just returned from Biscara, a southern district of Mauritania Cæsariensis, now called the *Province of Constantina*. According to his account, they are not uncommon in this district, though more frequently to be met with in the neighbouring date-territories of Beni Mezab and Werglab, the residence of the ancient Melano-Gætuli. In the Werglab the animals are hunted for their skins, which are sold at Mecca, and afterwards exported to India. Mr Bruce kept this one for several months at his country-house near Algiers, that he might learn its manners. Its favourite food he tells us was dates or other sweet fruit, yet it is also very fond of eggs. It devoured those of pigeons and small birds with great avidity when first brought to him; but did not seem to know how to manage hen's eggs, though when they were broken to him he ate the contents with as great avidity as the others. When hungry, he would eat bread, especially with honey or sugar. His attention was greatly engrossed by the sight of any bird flying across the room where he was, or confined in a cage near him, and could not be diverted from viewing it by placing biscuit before him; so that it seems probable, that he preys upon them in his wild state. He was extremely impatient of having his ears touched; so that it was with much difficulty that they could be measured; and, on account of this impatience, it was found impossible to count the protuberances or paps on his belly. He seemed very much frightened at the sight of a cat; and endeavoured to hide himself, though he did not appear to meditate any defence. On this occasion also he lowered his ears, which at other times he kept erect. Notwithstanding his impatience, he would suffer himself, though with difficulty, to be handled in the day-time; but in the night he was extremely restless, always endeavouring to make his escape; and though he did not attempt the wire, yet with his sharp teeth he would soon have made his way through a wooden one, as two others which they attempted to bring along with him actually did. These animals are very swift of foot. They build their nests in trees, particularly the palms, of which they eat the fruit; feeding also on locusts and other insects, and perhaps sometimes preying upon small birds. Mr Bruce has a long criticism on Dr Sparmann for pretending that one Mr Brander was the discoverer of this animal, whereas he says that he himself gave it to Mr Brander. This is the same animal with that formerly described as a species of Canis* under the name of *zerda*, and of which a figure is given in Plate CXX. Its exact place in the zoological system has not yet been ascertained.

*See Canis, n° xiv.

MUSTER, in a military sense, a review of troops under arms, to see if they be complete and in good order; to take an account of their numbers, the condition they are in, viewing their arms and accoutrements, &c.

Muster-Master-general, or *Commissary-general of the Musters;* one who takes account of every regiment, their number, horses, arms, &c. reviews them, sees the horses be well mounted, and all the men well armed and accoutred, &c.

Muster-Rolls, lists of soldiers in each company, troop, or regiment, by which they are paid, and the strength of the army is known.

MUTABILITY is opposed to immutability. See Immutability.

MUTATION, the act of changing, or sometimes the change itself.

Mutation, in the ancient music, is applied to the changes or alterations that happen in the order of the sounds which compose the melody.

MUTATIONES, among the Romans, post-stages, or places where the public couriers were supplied with fresh horses.—The *mutationes* were wholly designed for the use of these couriers, or messengers of state; in which respect they differ from *mansiones*.

MUTCHKIN, a liquid measure used in Scotland; it contains four gills, and is the fourth part of a Scotch pint.

MUTE, in a general sense, signifies a person that cannot speak, or has not the use of speech.

Mute, in law, a person that stands dum or speechless, when he ought to answer, or to plead. See Arraignment.

Mute, in grammar, a letter which yields no sound without the addition of a vowel. The simple consonants are ordinarily distinguished into mutes and liquids, or semi-vowels. See the articles Consonant, Liquid, &c.

The mutes in the Greek alphabet are nine, three of which, viz. π, κ, τ, are termed *tenues;* three β, γ, δ, termed *mediæ;* and three ϕ, χ, θ, termed *aspirates*. See the article Aspirate, &c.

The mutes of the Latin alphabet are also nine, viz. B, C, D, G, I, K, P, Q, T.

MUTILATION, the retrenching or cutting away any member of the body.

This word is also extended to statues and buildings, where any part is wanting, or the projecture of any member, as a cornice or an impost, is broken off. It is sometimes also used in a more immediate manner for castration: (See Castration and Eunuch). The practice of this sort of mutilation is of various kinds: The Hottentots are said to cut away one testicle from their children, upon supposition that they are thereby made lighter and more active for running. In other countries poor people completely mutilate their boys, to prevent the misery and want which would attend their offspring. Those who have nothing in view but the improvement of a vain talent, or the formation of a voice which disfigures nature, as was the case formerly in Italy, are contented with cutting away the testicles. But in some countries of Asia, especially among the Turks and in part of Africa, those whom jealousy

jealousy inspires with distrust, would not think their wives safe in the custody of such eunuchs: They employ no slaves in their seraglios who have not been deprived of all the external parts of generation.

Amputation is not the only means of accomplishing this end. Formerly, the growth of the testicles was prevented, and their organization destroyed, by simple rubbing, while the child was put into a warm bath made of a decoction of plants. Some pretend that by this species of castration the life is in no danger. Amputation of the testicles is not attended with much danger; but complete amputation of the external parts of generation is often fatal. This operation can only be performed on children from seven to ten years of age. Eunuchs of this kind, owing to the danger attending the operation, cost in Turkey five or six times more than others. *Chardin* relates, that this operation is so painful and dangerous after 15 years of age, that hardly a fourth part of those by whom it is undergone escape with life. *Pietro della Valle*, on the contrary, informs us, that in Persia those who suffer this cruel and dangerous operation as a punishment for rapes and other crimes of this kind, are easily cured though far advanced in life; and that nothing but ashes is applied to the wound.

There are eunuchs at Constantinople, throughout all Turkey, and in Persia, of a grey complexion: they come for the most part from the kingdom of Golconda, the peninsula on this side the Ganges, the kingdoms of Assau, Aracan, Pegu, and Malabar. Those from the gulph of Bengal are of an olive colour. There are some white eunuchs who come from Georgia and Circassia, but their number is small. The black eunuchs come from Africa, and especially from Ethiopia. These, in proportion to their horrible appearance, are the more esteemed and cost dearer. It appears that a very considerable trade is carried on in this species of men; for Tavernier informs us, that when he was in the kingdom of Golconda, in the year 1657, 22,000 eunuchs were made in it. In that country they are sold at the fairs.

Eunuchs who have been deprived only of their testicles, continue to feel a titillation in what remains, and to have the external sign even more frequently than other men. But the part which remains is very small, and continues almost in the same state in which it was when the operation was performed during childhood.

If the different kinds of Eunuchs are examined with attention, it will be found almost universally, that castration and its consequences have produced greater or less changes in their shape and appearance, independent of its physical effects.

Eunuchs, says Mr Withof, are timid, irresolute, fearful, suspicious, and unsteady: And this seems to hold generally, though not universally, or without exceptions; see the article EUNUCH). The reason is, that their blood has not received all the necessary preparation in passing through the spermatic vessels. Thus being deprived of the properties of males, they participate of the dispositions of females, and their very soul is of an intermediate sex. They are not, however, without advantages: They become larger and fatter than other men; but they sometimes grow to a disgusting size. Though oily substances are more abundant in eunuchs, they are likewise less subject to gout and to madness than men who have a greater quantity of blood and of splenetic humours. The abundant circulation of oily liquor prevents roughness or inequalities in the trachea or palate. This, joined to the flexibility of the epiglottis and of the other organs of the voice, makes it so sonorous and extensive, and at the same time so sweet, that it is almost impossible for eunuchs to pronounce distinctly the letter R. Is this factitious advantage a sufficient consolation to these unhappy men for the barbarity of those who have dared to sacrifice nature at the shrine of avarice? It is impossible to reflect on all the motives for making eunuchs without a sigh of pity and regret: and yet it most not be supposed that this abominable cruelty is always infallibly attended with that advantage which is sometimes expected from it. Of 2000 victims to the luxury and extravagant caprices of the art, hardly three are found who unite good talents with good organs. The other languishing and inactive wretches, are outcasts from both sexes, paralytic members in the community, an useless burden upon the earth, by which they are supported and nourished. But let us pay the tribute which is due to that virtuous pontiff Pope Clement VIII. who, listenng to the voice of modesty and humanity, proscribed and abolished this detestable and infamous practice. Mutilation he declared was the most abominable and disgraceful of crimes.

MUTILLA, in zoology, a genus of animals belonging to the order of insecta hymenoptera. There are 10 species; the most remarkable of which is the occidentalis, or velvet ant, an inhabitant of North America. It has six legs, with short crooked antennæ; the abdomen large, with a black list crossing the lower part of it, and another black spot at the joining of the thorax; excepting which, the whole body and head resembles crimson-velvet. The trunk or shell of the body is of such a strong and hard contexture, that though trod upon by men and cattle they receive no harm. They have a long sting in their tails, which causes inflammation and great pain for half an hour to those who are stung by them; which usually happens to negroes and others that go barefooted. They are mostly seen running very nimbly on sandy roads in the hottest summer-weather; and always single. What they feed on, in what manner they breed, and where they secure themselves in winter, is unknown.

MUTINA (anc. geog.) a noble city of the Cispadana, made a Roman colony in the same year with Parma, situated between the rivers Gabellus and Scultenna, on the Via Æmilia. Here D. Brutus, being besieged by Antony, was relieved by the consuls Hirtius and Pansa. The Greeks called it *Mutine;* except Polybius, in whom it is *Motine;* and in Ptolemy *Mutina*, after the Roman manner.—Now *Modena*, a city of Lombardy, and capital of a cognominal duchy. E. Long. 11. 20. N. Lat. 44. 45.

MUTINY, in a military sense, to rise against authority.—Any officer or soldier who shall presume to use traiterous or disrespectful words against the State or Executive power.

"Any officer or soldier who shall behave himself with

with contempt or disrespect towards the general or other commander in chief of the forces, or shall speak words tending to their hurt or dishonour, is guilty of mutiny.

"Any officer or soldier who shall begin, excite, cause, or join in, any mutiny or sedition, in the troop, company, or regiment, to which he belongs, or in any other troop or company in the service, or on any party, post, detachment, or guard, on any pretence whatsoever, is guilty of mutiny.

"Any officer or soldier who, being present at any mutiny or sedition, does not use his utmost endeavours to suppress the same, or coming to the knowledge of any mutiny, or intended mutiny, does not without delay give information to his commanding officer, is guilty of mutiny.

"Any officer or soldier who shall strike his superior officer, or draw, or offer to draw, or shall lift up any weapon, or offer any violence against him, being in the execution of his office, on any pretence whatsoever, or shall disobey any lawful command of his superior officer, is guilty of mutiny."

Mutiny-Act. See *Military-State*.

MUTIUS (Caius), surnamed *Godrus*, and afterwards *Scævola*, was one of the illustrious Roman family of the Mutians, and rendered his name famous in the war between Porsenna king of Tuscany and the Romans. That prince resolving to restore the family of Tarquin the Proud, went to besiege Rome 507 B. C. Mutius resolved to sacrifice himself for the safety of his country; and boldly entering the enemy's camp, killed Porsenna's secretary, whom he took for Porsenna himself. Being seized and brought before Porsenna, he told him boldly, that 300 young men like himself had sworn to murder him; *but since this hand has missed thee*, continued he, *it must be punished*; then putting his right hand on the burning coals, he let it burn with such a constancy as astonished the beholders. The king, amazed at the intrepidity of this young Roman, ordered that he should have his freedom and return to Rome, and soon after concluded a peace with the Romans. From this action Mutius obtained the surname of *Scævola*, "or left-handed," which was enjoyed by his family.

Mutius Scævola (Q.), surnamed the *Augur*, was an excellent civilian, and instructed Cicero in the laws. He was made prætor in Asia; was afterwards consul, and performed very important services for the republic.

He ought not to be confounded with *Quintus Mutius Scævola*, another excellent civilian, who was prætor in Asia, tribune of the people, and at length consul, 95 B. C. He governed Asia with such prudence and equity, that his example was proposed to the governors who were sent into the provinces. Cicero says, "that he was the most eloquent orator of all the civilians, and the most able civilian of all the orators." He was assassinated in the temple of Vesta, during the wars of Marius and Sylla, 82 B. C.

MUTTON, the common name of the flesh of a sheep after the animal has been killed. Mutton has been commonly preferred to all the fleshes of quadrupeds. And indeed, besides its being more perfect, it has the advantage over them of being more generally suited to different climates; whereas beef, *e. g.* requires a very nice intermediate state, which it seems to enjoy in temperate climates; for although northern countries supply what are reckoned the best cattle, it is in the rich southern pastures that they are brought to perfection. Now the sheep can be brought almost to the same perfection in the bleak northern regions as in the southern countries.

MUTUAL, a relative term, denoting something that is reciprocal between two or more persons.

Thus we say, *mutual assistance, mutual aversion*, &c. There are mutual or reciprocal duties, offices, &c. between superiors and inferiors; as the State and its Citizens the master and his servants, &c.

Vaugelas makes a distinction between *mutual* and *reciprocal: mutual*, according to him, is understood of what is between two only; and *reciprocal*, of what is between more than two: but this distinction is little regarded in common use.

MUTULE, in architecture, a kind of square modillion set under the cornice of the Doric order.

MUTUNUS, or MUTINUS (fab. hist.), a deity among the Romans, much the same as the Priapus of the Greeks. The Roman matrons, and particularly newly married women, disgraced themselves by the obscene ceremonies which custom obliged them to observe before the statue of this impure deity.

MUZZLE *of a* GUN *or* MORTAR, the extremity at which the powder and ball is put in; and hence the muzzle-ring is the metalline circle or moulding that surrounds the mouth of the piece.

MYA, the GAPER, in zoology; a genus belonging to the order of vermes testacea, the characters of which are these. It has a bivalve shell gaping at one end; the hinge, for the most part, furnished with a thick, strong, and broad tooth, not inserted into the opposite valve. Its animal is an ASCIDIA. The most remarkable species are.

1. The declivis, or sloping mya, has a brittle half-transparent shell, with a hinge slightly prominent near the open, and sloping downwards. It inhabits the rivers of Europe. It is frequent about the Hebrides; the fish eaten there by the gentry. Plate CCCXXXV. fig. 1.

2. The mya pictorum has an oval brittle shell, with a single longitudinal tooth like a lamina in one shell, and two in the other; the breadth is a little above two inches, the length one. It inhabits rivers. The shells are used to put water-colours in, whence the name. Otters feed on this and the other fresh-water shells. Fig. 2.

3. The margaritifera, or pearl mya, has a very thick, coarse, opaque shell; often much decorticated; oblong, bending inward on one side, or arcuated; black on the outside; usual breadth from five to six inches, length two and a quarter. It inhabits great rivers, especially those which water the mountainous parts of Great Britain.—This shell is noted for producing quantities of pearl. There have been regular fisheries for the sake of this precious article in several English rivers. Sixteen have been found within one shell. They are the disease of the fish, analogous to the stone in the human body. On being squeezed, they will eject the pearl, and often cast it spontaneously in the sand of the stream. The river Conway was noted for them in the days of Cambden. A notion also prevails, that Sir Richard Wynne of Gwydir chamberlain to Catharine Fig. 3. & 4.

rine queen to Charles II. presented her majesty with a pearl (taken in this river) which is to this day honoured with a place in the regal crown. They are called by the Welch *cregen diluw*, or "deluge shells," as if left there by the flood. The Irt in Cumberland was also productive of them. The famous circumnavigator, Sir John Hawkins, had a patent for fishing in that river. He had observed pearls plentiful in the Straits of Magellan, and flattered himself with being enriched by procuring them within his own island. In the last century, several of great size were got in the rivers of the counties of Tyrone and Donegal in Ireland. One that weighed 36 carets was valued at 40 l. but being foul, lost much of its worth. Other single pearls were sold for 4 l. 10 s. and even for 10 l. The last was sold a second time to Lady Glenlealy, who put it into a necklace, and refused 80 l. for it from the duchess of Ormond. Suetonius reports, that Cæsar was induced to undertake his British expedition for the sake of their pearls; and that they were so large that it was necessary to use the hand to try the weight of a single one. Mr Pennant supposes that Cæsar only heard this by report; and that the crystalline balls called *mineral pearl*, were mistaken for them. We believe that Cæsar was disappointed of his hope: yet we are told that he brought home a buckler made with British pearl, which he dedicated to, and hung up in, the temple of Venus Genetrix: a proper offering to the goddess of beauty, who sprung from the sea. It may not be improper to mention, that notwithstanding the classics honour English pearl with their notice, yet they report them to have been small and ill-coloured, an imputation that in general they are still liable to. Pliny says, that a red small kind was found about the Thracian Bosphorus, in a shell called *mya;* but does not give it any mark to ascertain the species.

Linnæus made a remarkable discovery relating to the generation of pearls in this fish.---It is a fish that will bear removal remarkably well; and it is said, that in some places they form reservoirs for the purpose of keeping it, and taking out the pearl, which, in a certain period of time, will be again renewed. From observations on the growth of their shells, and the number of their annular laminæ or scales, it is supposed the fish will attain a very great age; 50 or 60 years are imagined to be a moderate computation. The discovery turned on a method which Linnæns found, of putting these shell-fish into a state of producing pearls at his pleasure; though the final effect did not take place for several years: He says, that in five or six years after the operation, the pearl would have acquired the size of a vetch. We are unacquainted with the means by which he accomplished this extraordinary operation; but it was probably published at the time, and considered as important, since it is certain that the author was rewarded with a munificent premium from the states of the kingdom on this account. We regret that we cannot speak more fully on this head; but may observe, that it is probable, from a paper published many years afterwards in the Berlin Acts, that the method consisted in injuring the shell externally, perhaps by a perforation; as it has been observed, that these concretions in shell-fish are found on the inside, exactly opposite to perforations and injuries made from without by serpulæ and other animals.

MYAGRUM, Gold of Pleasure, in botany: A genus of the siliculosa order, belonging to the tetradynamia class of plants; and in the natural method ranking under the 39th order, *Siliquosæ*. The silicula is terminated by an oblong style; the cell generally monospermous. There are five species; but the only remarkable one is the sativum, which grows naturally in corn-fields in the south of France and Italy, and also in some parts of Britain. It is an annual plant, with an upright stalk, a foot and a half high, sending out two or four side-branches, which grow erect; the flowers grow in loose spikes at the end of the branches, standing upon short footstalks an inch long; they are composed of four small yellowish petals, placed in form of a cross; these are succeeded by oval capsules, which are bordered and crowned at the top with the style of the flower, having two cells filled with red seeds---This is cultivated in Germany for the sake of the expressed oil of the seeds, which the inhabitants use for medicinal, culinary, and œconomical purposes. The seeds are a favourite food with geese. Horses, goats, sheep, and cows, eat the plant.

MYCALE, a city and mountain of Caria; also a promontory of Asia opposite Samos, celebrated for a battle which was fought there between the Greeks and Persians about the year of Rome 275. The Persians were about 100,000 men, who had just returned from the unsuccessful expedition of Xerxes in Greece.---They had drawn their ships to the shore, and fortified themselves strongly, as if determined to support a siege. They suffered the Greeks to disembark from their fleet without the least molestation, and were soon obliged to give way before the cool and resolute intrepidity of an inferior number of men. The Greeks obtained a complete victory, slaughtered some thousands of the enemy, burned their camp, and sailed back to Samos with an immense booty, in which were 70 chests of money.

MYCENÆ (anc. geog.) a town of Argolus, in Peloponnesus. The kingdom of the Argives was divided into two portions by Acrisius and his brother Prœtus. Argos and Mycenæ were their capitals.---These, as belonging to the same family, and distant only about 50 stadia or six miles and a quarter from each other, had one tutelary deity, Juno, and were jointly proprietors of her temple, the Heræum, which was near Mycenæ. It was here that Agamemnon reigned. He enlarged his dominions by his valour and good fortune, and possessed, besides Mycenæ, the region about Corinth and Sicyon, and that called afterwards Achæa. On his return from Troy, he was slain with his companions at a banquet. Mycenæ then declined; and under the Heraclidæ was made subject to Argos. (See Argos and Argeia.) The Mycenæans sending 80 men, partook with the Lacedæmonians in the glory acquired at Thermopylæ. The jealousy of the Argives produced the destruction of their city, which was abandoned after a siege, and laid waste in the first year of the 78th Olympiad, or 466 years before Christ. Some part of the wall remained in the second century, with a gate, on which were lions, a fountain, the subterraneous edifices where Atreus and his sons had deposited their treasures, and, among other sepulchral monuments, one of Agamemnon, and one of his fellow-soldiers and sufferers.

MYCETITES Discoides, in natural history, a name

name given by Dr Woodward to thoſe kinds of foſſile coralloide bodies which the generality of writers had called, after Dr Plott, *porpitæ*. Theſe are uſually ſmall, and of a roundiſh, but flatted figure; they are hollowed on one ſide with a ſort of umbilicus, and ſtriated on the other, they are found on the ploughed lands in Oxfordſhire, and ſome other of the midland counties, and in other places, buried in the ſolid ſtrata of ſtone; they are ſometimes yellowiſh, ſometimes browniſh, and are from the breath of an inch to a fourth part or leſs of that ſize; when broken, they are uſually found to conſiſt of a kind of ſpar, not unlike that of which the ſhelly coats of the echinitæ, or the lapides indici, and other ſpines of echini conſiſt in their foſſile ſtate; and in ſome of them the ridges and ſtriæ are thick ſet with little knobs and tubercles. The baſis in ſome of theſe is flat, as it is in others riſing in form of a circular elevation from the umbilicus, and others have a circular cavity in the ſame place.

MYCONE, an iſland on the Archipelago, ſituated in E. Long. 25. 51. N. Lat. 37. 28. It is about 36 miles in circuit, and has a town of the ſame name, containing about 3000 inhabitants. The people of this iſland are ſaid to be the beſt ſailors in the Archipelago, and have about 150 veſſels of different ſizes. The iſland yields a ſufficient quantity of barley for the inhabitants, and produces abundance of figs, and ſome olives; but there is a ſcarcity of water, eſpecially in ſummer, there being but one well on the iſland.—There are a great number of churches and chapels, with ſome monaſteries. The dreſs of the women in this iſland is very remarkable, and as different from that of the other iſlands as that of thoſe iſlanders is different from the dreſs of the other European ladies. Their heads are adorned with lively coloured turbans; their garments are a ſhort white ſhift plaited before and behind, which reaches to their knees; they have white linen-drawers; and red, green, yellow, or blue ſtockings, with various coloured ſlippers. An ordinary ſuit for the better ſort will coſt 200 crowns.

MYCONUS (anc. geog.) one of the iſlands called Cyclades, near Delos, under which the laſt of the Centaurs ſlain by Hercules are feigned to lie buried. Hence the proverb, *Omnia ſub unam Myconum congerere*, applied to an injudicious or unnatural farrago. Myconii, people noted for baldneſs. Hence Myconius, a bald perſon. According to Strabo, the inhabitants became bald at the age of 20 or 25; and Pliny ſays that the children were always born without hair. The iſland was poor, and the inhabitants very avaricious; whence Archilochus reproached a certain Pericles, that he came to a feaſt like a Myconian, that is, without previous invitation. Now called *Mycone*, an iſland in the Archipelago. E. Long. 25° 6′. Lat. 37°.

Plate dccxxxv.

MYCTERIA, the JABIRU, in ornithology; a genus of birds belonging to the order of grallæ. The bill is long, bending upwards, and acute; the noſtrils are ſmall and linear; there is no tongue; and the feet have four toes. There are two ſpecies: 1. The Americana, or American jabiru, is about the ſize of a turky. The bill is long, ſtout, and of a black colour; the whole plumage is white, except the head, and about two thirds of the neck, which are bare of feathers and of a blackiſh colour; the remainder is alſo bare, and of a fine red; on the hind-head are a few greyiſh feathers; the legs are ſtrong, of a great length, and covered with black ſcales; wings and tail even at the end. This bird is found in all the Savannas of Cayenne, Guiana, and other parts of South America. It is migratory and gregarious. It makes its neſt in great trees, which grow on the borders; lays two eggs, and brings up the young in the neſt till they can deſcend to the ground. The colour of the young birds is grey: the ſecond year it changes to roſe-colour, and the third to pure white. They are very wild and voracious, and their food is fiſh, which they devour in great quantities. The fleſh of the young birds is ſaid to be good eating, but that of the old is hard and oily.

2. The Aſiatica, or Indian jabiru, is of a large ſize. The bill is duſky, almoſt ſtraight above, and gibbous near the fore head; the under mandible ſwelled beneath; and from the baſe of the bill there paſſes through and beyond the eye a black ſtreak. The general colour of the plumage is white; the lower half of the back, the prime quills, and the tail, are black; the legs a pale red. This ſpecies inhabits the Eaſt Indies, and feeds on ſnails.

MYGDONIA (anc. geog.), a diſtrict of Macedonia, to the north of the Sinus Thermaicus, and eaſt of the river Axius, which ſeparates it from Bottiæis, and weſt of the river Strymon, (Pliny.) Alſo a diſtrict of Meſopotamia, which took its name from that of Macedonia, running along the Euphrates, from Zeugma down to Thapſacus, extending a great way eaſt, becauſe Niſibis was reckoned to it.

MYGINDA, in botany: A genus of the tetragynia order, belonging to the tetrandria claſs of plants; and in the natural method ranking with thoſe of which the order is doubtful. The calyx is quadripartite; the petals four; the fruit a globoſe plum.

MYIAGRUS DEUS, in the heathen mythology, a name given ſometimes to Jupiter, and ſometimes to Hercules, on occaſion of their being ſacrificed to for the driving away the vaſt numbers of flies which infeſted the ſacrifices on certain public occaſions. The word is uſually ſpelt *Myagrus;* but this muſt be an error, as this word does not expreſs the *fly-deſtroyer*, but the *mouſe-deſtroyer:* and we have it ſufficiently teſtified by the ancients, that flies were the only creatures againſt whom this deity was invoked. Pliny calls this deity alſo *Myoides*, and tells us that the flies which uſed to peſter the Olympic rites went away in whole clouds on the ſacrificing a bull to this god. We find in Athenæus alſo, that this ſacrificing to the god of flies at the Olympic games was a conſtant cuſtom. Some diſtinguiſh theſe two deities, and tell us that the latter, or Myoides, uſed to viſit the nations in vengeance, with a vaſt multitude of flies; and that, on paying him the due honours of a ſacrifice, they all went away again; and this ſeems to agree with what Pliny tells us in ſome places.

At the time of the Olympic games, Jupiter was worſhipped under the name of the *Apomyios or Myiagrus Deus*, to ſupplicate the deſtruction of thoſe troubleſome creatures. This happened only once in many years, when the ſacrifices were performed there; but the Elians worſhipped him continually under this name, to deprecate the vengeance of heaven, which uſually ſent, as they expreſſed it, an army of flies and other inſects, toward the latter end of the summer, that infested the whole country with sickness and pestilence.

MYOIDES DEUS, in the heathen mythology, a name sometimes given to Hercules, but more frequently to Jupiter, to whom a bull was sacrificed, in order to make him propitious in driving away the flies that infested the Olympic games.

MALAE (anc. geog.) a Greek city situated on an isthmus of a cognominal peninsula, on the north-east side of the island. *Mylaei*, or *Mylenses*, the people. A town built by those of Zancle (Strabo,) Mylaeus, the epithet, as Mylæus Campus mentioned by Polybius. Now called *Milazzo* a port town of Sicily, in the Val di Demona. E. Long. 15° 5'. Lat. 38. 36'.

MULASY, or MYLASSA, (anc. geog.), a noble city of Caria in Asia Minor, situated at the distance of about three leagues from the *Sinus Ceramicus*. It was the capital of Hecatomnus king of Caria, and father of Mausolus. Pliny speaks of Menander king of Caria, and says that the Rhodians preserved with the greatest care his portrait painted by Appelles: but it was not in honour of this Menander that a Corinthian pillar was erected at Mylasa, which still exists, and on which is to be seen the following inscription: "The people erected this pillar in honour of Menander, the son of Uliades, and grandson of Euthydemus, the benefactor of his country, and whose ancestors rendered it great services also." Euthydemus, the grandfather of this Menander, lived in the time of Julius Cæsar and Augustus. Caria was taken by Mithridates, and afterwards by Labienus, whose father had been one of Cæsar's generals. Hybrias, whose eloquence and valour deservedly intitled him to a distinguished rank among his countrymen, in vain encouraged them to make a most obstinate defence while it was besieged by the latter. He himself was obliged to yield to necessity, and to take refuge at Rhodes: but scarely had the conqueror quitted the city, when Hybrias returned and restored liberty to his country. —Not content with rendering it this service, he also destroyed the power of a dangerous citizen, whose riches and talents rendered him a necessary evil. Euthydemus, often banished, and as often recalled, always too powerful in a state the independence of which he threatened, saw his ambition checked by the zeal and activity of Hybrias. The Romans left to Mylasa that liberty of which it rendered itself so worthy, by the great efforts it made to preserve it. Pliny calls it *Mylasa libera*. Strabo informs us, that it was one of the most magnificent cities of antiquity, and one of those the temples, porticoes, and other public monuments of which were highly admired. A quarry of white marble in the neighbourhood furnished it with abundance of materials for erecting these edifices.— The Mylasians had two temples dedicated to Jupiter, one situated in the city, which was named *Osogo*, and another built on a mountain, at the distance of 60 leagues. The latter was dedicated to *Jupiter Stratius*, Jupiter the Warrior. His statue, which was very ancient, inspired great veneration; people came from all quarters to implore his protection; and for the greater accommodation of his votaries a paved way was constructed, which reached from Mylasa to this venerable fabric. This city is now called *Melasso*, and, according to Dr Chandler, is still a large place.— The houses are numerous, but chiefly of plaster, and mean, with trees interspersed. The air is accounted bad; and scorpions abound as anciently, entering often at the doors and windows, and lurking in the rooms. The plain is surrounded by lofty mountains, and cultivated. Round the town are ranges of broken columns, the remnants of porticoes, now with rubbish bounding the vineyards. A large portion of the plain is covered with scattered fragments, and with piers of ordinary aqueducts; besides inscriptions, mostly ruined and illegible. Some altars dedicated to Hecatomnus have been discovered. Of all the ancient temples which formerly ornamented this city, one only escaped the power of time, the blind zeal of the early Christians, and the barbarous superstition of the Mahometans. This monument was dedicated to Augustus and the divinity of Rome. When Pococke visited Melasso, it was perfect and entire; but at present no traces of it remain, except a few fragments, which have been employed to construct a Turkish mosque.

MYLOGLOSSUM, in anatomy. See ANATOMY, *Table of the Muscles*.

MYLOHYOIDÆUS. *Ibid.*

MYNSICHT (Hadrian), physician to the duke of Mecklenburgh and several other German princes, was distinguished for his knowledge of chemistry, at the beginning of the 17th century. He published a work entitled *Armentarium Medico-Chymicum*, which has undergone various editions. In this work he gives a description of several medicines, about the virtues of which he is not always to be depended upon. To him we are indebted for a knowledge of the salt *de duobus* or the *Arcanum*, which is still in use.

MYOLOGY, formed of μυς, μυος, "a muscle," and λογος, "discourse"), in anatomy, a description of the muscles; or the knowledge of what relates to the muscles of the human body. See ANATOMY, *Table of the Muscles*.

MYOMANCY, a kind of divination, or method of foretelling future events by means of mice.

Some authors hold myomancy to be one of the most ancient kinds of divination; and think it is on this account that Isai. lxvi. 17. reckons mice among the abominable things of the idolators. But, beside that it is not certain that the Hebrew word עכבר used by the prophet signifies *a mouse*, it is evident it is not the divination by that animal, be it what it will, that is spoken of, but the eating it.

MYOPIA, SHORT-SIGHTEDNESS: a species of vision wherein objects are seen only at small distances. See MEDICINE, nº 361.

MYOSOTIS, SCORPION-GRASS: 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 corolla is salver-shaped, quinquefid, and emarginated; the throat shut up by small arches. There are four species; of which the most remarkable is the scorpioides, or mouse ear. This is a native of Britain, growing naturally in dry fields, and on the margins of springs aud rills. It hath naked seeds, and the points of the leaves callous. It varies considerably in different situations. In dry places the plant and flowers are smaller; in moist ones both are larger, and sometimes hairy. The blossoms vary from a full blue to a very pale one, and sometimes a yellow; and appear in a long spirally twisted spike. When it grows in the water, and its taste and smell is thereby rendered less observable, sheep will sometimes eat it, but it is generally fatal to them. Cows, horses, swine, and goats refuse it.

MYOSURUS, in botany: A genus of the polygynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 26th order *Multisiliquæ*. The calyx is pentaphyllous, the leaves cohering at the base; there are five subulated nectaria resembling petals: the seeds are numerous.

Plate CCCXVIII fig 12. MYOXUS, the DORMOUSE, in zoology; a genus of quadrupeds belonging to the order of glires. There are two fore-teeth in each jaw; the upper ones cuneated, the under compressed; the whiskers are long, the tail is hairy and round, growing thicker towards the extremity; the fore and hind legs are of equal length, and the fore-feet have four toes.

1. The glis, or hoary dormouse, is of a pale ash-colour on the upper parts of the body, and whitish on the under; and is about the size of the common squirrel, but thicker in the body. It inhabits France and the south of Europe, and the south-west of Russia about the Volga of Samara. This animal, which is the ελειος of Aristotle, μυοξος of Oppian, and *glis* of, Pliny, was held in great esteem among the Romans as a luxurious delicacy: they were, fed in places called *gliriaria*, constructed for the purpose, and they are still eaten by the modern Italians. It forms a nest in the hollow of some tree, in which it sleeps all day; feeds in the night on nuts, walnuts, the seeds of apples, &c. and grows very fat in autumn. About the month of October, they gather in troops; and retiring into subterranean burrows, remain torpid till near the end of May. The female has ten teats, six of which are situated on the breast, and four on the belly: and she brings from nine to twelve young ones at a litter.

Fig. 14. 2. The nitella, or garden dormouse, is of a tawny colour on the upper parts of the body, and whitish ash, tinged with yellow on the under; has a black circle round each eye, and a black spot behind each ear; and is five inches long, besides the tail, which measures four. It inhabits the south parts of Europe and Russia, where it lives chiefly in gardens, though it sometimes is found in houses. They are very destructive to fruit, particularly peaches, which they seem to prefer to every other kind. They also eat pease, apricots, and plums; and when soft fruits are not to be had, they will eat almonds, filberts, nuts, and even leguminous plants. Of these they carry off great quantities into their retreats which they dig in the earth, and particularly in well cultivated gardens; for in old orchards they are often found in hollow trees, where they make beds of herbs, moss, and leaves. Eight or ten of them are frequently found in the same place, all benumbed, and rolled up in the midst of their provision of fruits and nuts. They copulate in spring, and bring forth in summer. The litter consists of five or six young, who grow very quickly, but are not fertile till the next year. Their flesh is not eatable but has the same disagreeable odour with the domestic rat.

Fig. 3. 3. The muscardinus, or common dormouse, is about the size of the domestic mouse, but of a plumper appearance; the nose is more blunt; the head, sides, belly, and tail, are of a tawny red colour, the throat white. Dormice inhabit woods, or very thick hedges; forming their nests in the hollow of some low tree, or near the bottom of a close shrub; they form little magazines of nuts, and eat in an upright posture like the squirrel. The consumption of their hoard, however, during the rigour of the season is but small; for they sleep most of the time, retiring into their holes; at the approach of winter they roll themselves up, and become torpid. Sometimes they experience a short revival in a warm sunny day, when they take a little food, and relapse into their former state. These animals seldom appear far from their retreats, or in any open place; for which reason they seem less common in Britain than they really are. They make their nests of moss, grass, and dead leaves; and bring usually three or four young at a time.

MYREPSUS (Nicolas), was a physician of Alexandria, to whom we are under great obligations for the pains he took to collect, into a kind of pharmacopœia, all the compound medicines which lie scattered in the works of the Greeks and Arabian writers. His work was accomplished before the beginning of the 14th century; and though written in barbarous Greek, continued for a long time to be the rule of pharmaceutical preparations in Europe. A translation of it into Latin by Leonard Fusch is entitled *Opus Medicamentorum, in Sectiones quadriginta octo digestum.* There are a great many editions of this work; the best is that of Hartman Beverus; Nuremberg, 1658, 8vo.

MYRIAD, a term sometimes used to denote ten thousand.

MYRICA, GALE, or SWEAT-WILLOW, in botany: A genus of the tetrandria order, belonging to the diœcia class of plants; and in the natural method ranking under the fifth order, *Amentaceæ*. The scale of the male catkin is in the form of a crescent, without any corolla. The scale of the female catkin the same: there is no corolla; but two styles, and a monospermous berry.

1. The gale, Dutch myrtle, or sweet-willow, grows naturally upon bogs in many places both of Scotland and England. It rises about four feet high, with many shrubby stalks, which divide into several slender branches, garnished with stiff spear-shaped leaves of a light yellowish green, smooth and a little sawed at their points. The female flowers or catkins are produced from the sides of the branches, growing upon separate plants from the female, which are succeeded by clusters of small berries, each having a single seed. It flowers in July, and ripens in autumn. When transplanted into shruberries, the moistest parts must be assigned to it.

The leaves, flowers, and seeds of this plant, have a strong fragrant smell, and a bitter taste. They are said to be used among the common people for destroying moths and cutaneous insects, being accounted an enemy to insects of every kind; internally, in infusions, as a stomachic and vermifuge; and as a substitute to hops for preserving malt liquors, which they render more inebriating, and of consequence less salubrious: it is said that this quality is destroyed by boiling.

The

Myrica.

2. The cerifera, wax-bearing myrica, or candleberry myrtle, is a native of North America. It is a ſmall tree about ten or twelve feet high, with crooked ſtems branching forth near the ground irregularly. The leaves grow irregularly on them all round; ſometimes by pairs, ſometimes alternately but generally at unequal diſtances. They are of a lanceolated figure: and ſome are ſerrated at the top, whilſt others have their edges wholly entire. They ſtand on very ſhort footſtalks; having their upper ſurface ſmooth, and of a ſhining green colour, whilſt their under is of a more duſky hue. The branches of the old plants ſhed their leaves in the autumn; but the young plants raiſed from ſeeds retain them the greateſt part of the winter ſo as during that ſeaſon to have the appearance of an evergreen. But this beauty will not be laſting, for they ſhed their leaves proportionally earlier as the plants get older. There are both male and female trees of this ſort; The flowers are ſmall, of a whitiſh colour, and make no figure; neither does the fruit that ſucceeds the female, which is a ſmall, dry, blue berry, though produced in cluſters, make any ſhow. So that it is from the leaves this trees receives its beauty and value; for theſe being bruiſed, as well as the bark of the young ſhoots emit the moſt refreſhing and delightful fragrance, that is exceeded by no myrtle, or any other aromatic ſhrub.

There is a variety of this ſpecies of lower growth, with ſhorter but broader leaves, and of equal fragrance. This grows commonly in Carolina; where the inhabitants collect from its berries a wax of which they make candles, and which occaſions its being called the *candleberry tree.* It delights in a moiſtiſh ſoil. —The wax is procured in the followed manner: In November and December, when the berries are ripe, a man with his family will remove from home to ſome iſland or ſand-bank near the ſea, where theſe trees moſt abound, taking with them kettles to boil the berries in. He builds a hut with palmetto leaves for the ſhelter of himſelf and family during his reſidence there which is commonly four or five weeks. The man cuts down the trees, while the children ſtrip off the berries into a porridge-pot; and having put water to them, they boil them till the oil floats, which is then ſkimmed off into another veſſel. This is repeated till no more oil appears. When cold, this hardens to the conſiſtence of wax, and is of a dirty green colour. Then they boil it again, and clarify it in braſs kettles; which gives it a tranſparent greenneſs. Theſe candles burn a long time, and yield a grateful ſmell. They uſually add a fourth part of tallow, which makes them burn clearer. Both the above ſorts may be propagated by ſeeds or layers. 1. The ſeeds of the candleberry myrtle received from abroad: thoſe of the ſweet-gale from the bogs. where they grow in England or Scotland. The beſt way is to ſow them in boxes of earth from a rich paſture, well broken and fine. They ſhould be ſown about half an inch deep: and when the hot weather comes on, ſhould be ſet in the ſhade, They will often remain the ſecond year before they come up, eſpecially thoſe ſeeds that come from abroad. If the boxes are ſet in the ſhade, and the plants come up, they will require no other trouble the firſt ſummer than keeping clean from weeds; in winter they ſhould be removed to a warm edge or wall, where they may enjoy the benefit of the ſun. In the following ſpring they will come up in plenty. In the beginning of May they ſhould reſume their ſhady ſituation; and this ſummer they will require no other trouble than weeding and watering in dry weather. In the winter they ſhould be removed into a well-ſheltered place; and this may be repeated two years; when in the ſpring they ſhould be taken out of the boxes, and planted in the nurſery at about a foot aſunder. 2. Theſe ſorts may be alſo eaſily propagated by layers; for this operation being performed on the young wood in the autumn, will occaſion them to ſhoot good roots by the autumn following; many of which will be good plants, fit for any place. 3. Theſe plants may likewiſe be increaſed by ſuckers, for many of them often throw them out in vaſt plenty; ſo that theſe being taken out, the ſtrongeſt and beſt rooted may be finally ſet out; whilſt the weaker, and thoſe with leſs root, may be planted in the nurſery.

Myrica ‖ Myriſtica.

There are five other ſpecies, *viz*, the *nagi*, or Japan myrica, with lanceolate entire veinleſs leaves, and berries about the ſize of a cherry: the *ethiopica*, or willow-leaved myrica, with the leaves ſlightly ſerated; a native of Ethiopia; the *quercifolia*, with oblong leaves, ſinuated or notched on the ſides, like the leaves of the oak; of which there are two varieties, the ſmooth and the hairy, natives of the Cape of Good Hope: the trifoliata, or trifoliate myrica, with ternate leaves toothed on the edges; and the cordifolia, or heart-leaved myrica, with ſubcordated, ſawed, ſeſſile leaves; both alſo natives of the Cape. Theſe are all tender plants, kept as curioſities in the green-houſe, and difficult of propagation.

MYRIOPHILLUM, 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 tetraphyllous; there is no corolla; the ſtamina are eight in number. The female calyx is tetraphyllous; the piſtils four; there is no ſtyle; and four naked ſeeds.

MYRISTICA, the NUTMEG TREE, in botany, A genus of plants belonging to the claſs diœcia, and order ſyngeneſia, in the *New Genera Plantarum* of Linnæus by *Shreber;* and of the natural order *Lauri*, in his fourth claſs *Monocotylidones*.—The male calyx is monophyllous, ſtrong, and parted into three *lacinii* of an oval ſhape, and ending in a point, it has no corolla. In the middle of the receptacle riſes a column of the height of the calyx: to the upper part of which the antheræ are attached. They vary in number from three to twelve or thirteen—The female calyx and corolla as in the male, on a diſtinct tree. The germen of an oval ſhape; the ſtyle ſhort, with a bifid ſtigma; the lacinii of which are oval and ſpreading—The fruit is of that ſort called *drupa*. It is fleſhy, roundiſh, ſometimes uniloculer, ſometimes bivalved, aud burſts when ripe at the ſide. The ſeed is enveloped with a fleſhy and fatty membraneous ſubſtance, which divides into filaments (this, in one of the ſpecies is the mace of the ſhops). The ſeed or nutmeg is round or oval ſhaped, unilocular, and contains a ſmall kernel. variegated on the ſurface by the fibres running in the form of a ſcrew.

Species. There are five ſpecies of this genus according

Myristica. cording to some authors; but several of these being only varieties, may be reduced to three, viz.

1. Myristica fatua, or wild nutmeg: this grows in Tobago, and rises to the height of an apple-tree; has oblong, lanceolated, downy leaves, and hairy fruit:—the nutmeg of which is aromatic, but when given inwardly is narcotic, and occasions drunkenness, delirium, and madness, for a time. See a figure in *Gaerner de Sem* and *Fruct*. T. 41. f. 3. 4.

2. The myristica, sebifera, (*Virola Sibifera Aublet*, page 904. Tab. 345.) A tree frequent in Guiana, rising to 40 or even to 60 feet high; on wounding the trunk of which, a thick, acrid, red juice runs out. Aublet says nothing of the nutmegs being aromatic; he only observes, that a yellow fat is obtained from them, which serves many œconomical and medical purposes, and that the natives make candles of it.

3. The myristica moschata, or nutmeg, attains the height of 30 feet, producing numerous branches which rise together in stories, and covered with bark, which of the trunk is a reddish brown, but that of the young branches is of a bright green colour: the leaves are nearly elliptical, pointed, undulated, obliquely nerved, on the upper side of a bright green, on the under whitish, and stand alternately upon footstalks: the flowers are small, and hang upon slender peduncles, proceeding from the axillæ of the leaves: they are both male and female upon separate trees.

M. Schwartz, who has carefully examined this as well as the two first species, preserved in spirits, places them amongst the monodelphia.

The nutmeg has been supposed to be the *Comacum* of Theophrastus, but there seems little foundation for this opinion; nor can it with more probability be thought to be the *Chrysobalanos* of Galen. Our first knowledge of it was evidently derived from the Arabians; by Avicenna it was called *jiausiban*, or *jausiband*, which signifies nut of banda. Rumphius both figured and described this tree; but the figure given by him is so imperfect, and the description so confused, that Linnæus, who gave it the generic name *myristica*, was unable to assign its proper characters.—Sonnerat's account of the *muscadier* is still more erroneous; and the younger Linnæus was unfortunately misled by this author, placing the myristica in the class *Polyandria*, and describing the corolla as consisting of five petals. Thunberg who examined the flower of the nutmeg, places it in the class *Monœcia;* and according to this description, the male flower has but one filament, surrounded at the upper part by the antheræ; and as the filaments are short and slender, and the antheræ united, this mistake might easily arise. M. De La Marck informs us, that he received several branches of the Myristica, both in flower and fruit, from the Isle of France, where a nutmeg-tree, which was introduced by Monsieur Poivre in 1770, is now very large, and continually producing flowers and fruit. From these branches, which were sent from Monf. Cere, director of the king's garden in that island, Monf. De La Marck has been enabled to describe and figure this and other species of the myristica with tolerable accuracy: and that we have profited by his labours, will appear from the annexed plate, of which the following is an explanation:

Plate CCCXXXIV. Fig. *a*. A sprig with fructification. The drupa of the natural size, and bursting open. Fig. *b*. The full-grown fruit cut lengthways. Fig. *c*. Another section of the same. Fig. *d*. The nutmeg enveloped with its covering the mace. Fig. *e*. The fatty membrane or mace spread out. Fig. *f*. The nutmeg of its natural size. Fig. *g*. The same with its external tegument removed at one end. Fig. *h*. The same with its outer tegument entirely removed. Fig. *i*. A transverse section of the nutmeg. Fig. 1. and 2. Sprigs of the *Myristica moschata* in flower, with a leaf of the natural size, and a representation of the calyx and column in the flower. Plate CCCXXXV.

The seeds or kernels called *nutmegs* are well known, as they have been long used both for culinary and medical purposes. Distilled with water, they yield a large quantity of essential oil, resembling in flavour the spice itself; after the distillation, an insipid sebaceous matter is found swimming on the water; the decoction inspissated, gives an extract of an unctous, very lightly bitterish taste, and with little or no astringency. Rectified spirit extracts the whole virtue of nutmegs by infusion, and elevates very little of it in distillation; hence the spirituous extract possesses the flavour of the spice in an eminent degree.

Nutmegs, when heated, yield to the press a considerable quantity of limpid yellow oil, which on cooling concretes into a sebaceous consistence. In the shops we meet with three sorts of unctuous substances, called *oil of mace*, though really expressed from the nutmeg. The best is brought from the East Indies in stone jars; this is of a thick consistence, of the colour of mace, and has an agreeable fragrant smell; the second sort, which is paler coloured, and much inferior in quality, comes from Holland in solid masses, generally flat, and of a square figure: the third, which is the worst of all, and usually called *common oil of mace*, is an artificial composition of sevum, palm oil, and the like, flavoured with a little genuine oil of nutmeg.

Method of gathering and preparing Nutmeg. When the fruit is ripe, the natives ascend the trees, and gather it by pulling the branches to them with long hooks. Some are employed in opening them immediately, and in taking off the green shell or first-rhind, which is laid together in a heap in the woods, where in time it putrefies. As soon as the putrefaction has taken place, there spring up a kind of mushrooms, called *boleti moschatyni*, of a blackish colour, and much valued by the natives, who consider them as delicate eating. When the nuts are stripped of their first rhind they are carried home, and the mace is carefully taken off with a small knife. The mace, which is of a beautiful red, but afterwards assumes a darkish or reddish colour, is laid to dry in the sun for the space of a day, and is then removed to a place less exposed to his rays, where it remains for eight days, that it may soften a little. They afterwards moisten it with sea-water, to prevent it from drying too much, or from losing its oil. They are careful, however, not to employ too much water, lest it should become putrid, and be devoured by the worms. It is last of all put into small bags, and squeezed very close. Mace must not be confounded with *macer*. See the word Macer.

The nuts, which are still covered with their ligneous shell, are for three days exposed to the sun, and afterwards

afterwards dried before a fire till they emit a ſound when they are ſhaken; they then beat them with ſmall ſticks in order to remove their ſhell, which flies off in pieces. Theſe nuts are diſtributed into three parcels; the firſt of which contains the largeſt and moſt beautiful, which are deſtined to be brought to Europe; the ſecond contains ſuch as are reſerved for the uſe of the inhabitants; and the third contains the ſmalleſt, which are irregular or unripe. Theſe are burnt; and part of the reſt is employed for procuring oil by preſſure. A pound of them commonly gives three ounces of oil, which has the conſiſtence of tallow, and has entirely the taſte of nutmeg. Both the nut and mace, when diſtilled, afford an eſſential, tranſparent, and volatile oil, of an excellent flavour.

The nutmegs which have been thus ſelected would ſoon corrupt if they were not watered, or rather pickled, with lime-water made from calcined ſhell-fiſh, which they dilute with ſalt-water till it attain the conſiſtence of fluid pap. Into this mixture they plunge the nutmegs, contained in ſmall baſkets, two or three times, till they are completely covered over with the liquor. They are afterwards laid in a heap, where they heat, and loſe their ſuperfluous moiſture by evaporation. When they have ſweated ſufficiently, they are then properly prepared, and fit for a ſea-voyage.

In the iſland of Banda, the fruit of the nutmeg-tree is preſerved entire in the following manner: When it is almoſt ripe, but previous to its opening, it is boiled in water and pierced with a needle. They next lay it in water to ſoak for ten days, till it has loſt its ſour and ſharp taſte. They then boil it gently in a ſyrup of ſugar, to which, if they wiſh it to be hard, a little lime is added. This operation is repeated for eight days, and each time the ſyrup is renewed. The fruit when thus preſerved is put for the laſt time into a pretty thick ſyrup, and is kept in earthen pots cloſely ſhut.

Theſe nuts are likewiſe pickled with brine or with vinegar; and when they intend to eat them, they firſt ſteep them in freſh water, and afterwards boil them in ſyrup of ſugar, &c.

Uſes. Nutmegs preſerved entire are preſented as deſerts, and the inhabitants of India ſometimes eat them when they drink tea. Some of them uſe nothing but the pulp; others likewiſe chew the mace; but they generally throw away the kernel, which is really the nutmeg. Many who perform ſea-voyages to the north chew this fruit every morning.

The medicinal qualities of nutmeg are ſuppoſed to be aromatic, anodyne, ſtomachic, and reſtringent; and with a view to the laſt mentioned effects, it has been much uſed in diarrhœas and dyſenteries. To many people the aromatic flavour of nutmeg is very agreeable; they however ſhould be cautious not to uſe it in too large quantities, as it is apt to affect the head, and even to manifeſt an hypnotic power in ſuch a degree as to prove extremely dangerous. Bontius ſpeaks of this as a frequent occurrence in India; and Dr Cullen relates a remarkable inſtance of this ſoporific effect of the nutmeg, which fell under his own obſervation, and hence concludes, that in apoplectic and paralytic caſes this ſpice may be very improper. He obſerves, that a perſon by miſtake took two drachms or a little more of powdered nutmeg: he felt it warm in his ſtomach, without any uneaſineſs; but in about an hour after he had taken it he was ſeized with a drowſineſs, which gradually increaſed to a complete ſtupor and inſenſibility; and not long after he was found fallen from his chair, lying on the floor of his chamber in the ſtate mentioned. Being laid a-bed he fell aſleep; but waking a little from time to time, he was quite delirious; and he thus continued alternately ſleeping and delirious for ſeveral hours. By degrees, however, both theſe ſymptoms diminiſhed; ſo that in about ſix hours from the time of taking the nutmeg he was pretty well recovered from both. Although he ſtill complained of head-ach, and ſome drowſineſs, he ſlept naturally and quietly the following night, and next day was quite in his ordinary health.

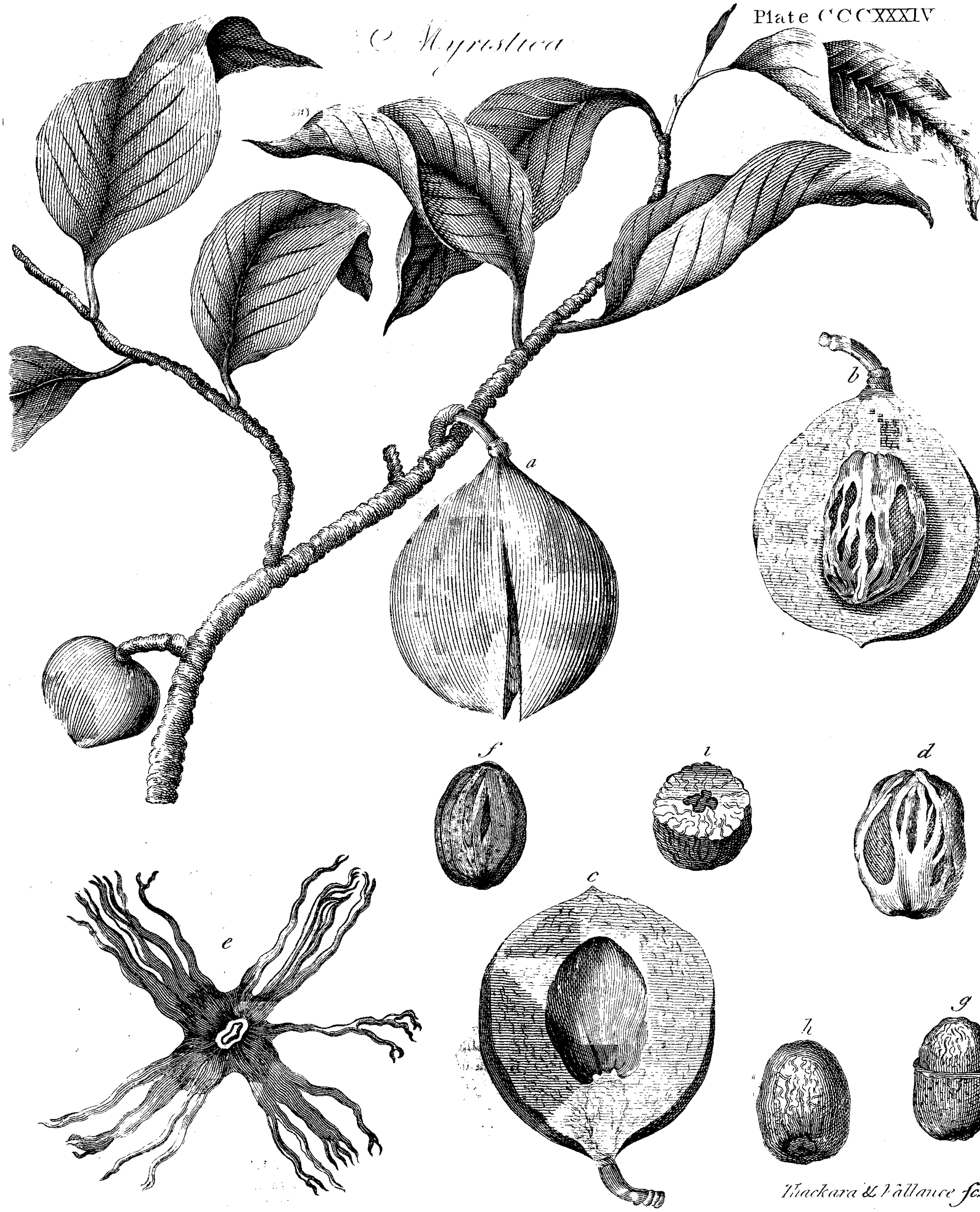
The officinal preparations of nutmeg are a ſpirit and eſſential oil, and the nutmeg in ſubſtance roaſted, to render it more aſtringent. Both the ſpice itſelf and its eſſential oil enter ſeveral compoſitions, as the confectio aromatica ſpiritus amonæ com. &c. Mace poſſeſſes qualities ſimilar to thoſe of the nutmeg, but is leſs aſtringent, and its oil is ſuppoſed to be more volatile and acrid.

Remarks on the Trade of Nutmegs. Nutmeg-trees grow in ſeveral iſlands in the eaſtern ocean. The wood-pigeon of the Moluccas is unintentionally a great planter of theſe trees, and diſſeminates them in places where a nation, powerful by its commerce, thinks it for its intereſt that they ſhould be rooted out and deſtroyed. The Dutch, whoſe unwearied patience can ſurmount the greateſt obſtacles, have appropriated to themſelves the crop of nutmeg, as well as that of cloves and cinnamon, growing in the iſlands of Ternate, Ceylon, &c. either by right of conqueſt or by paying ſubſidies to the iſlanders, who find theſe much more profitable than the former produce of their trees. It is nevertheleſs true, that they have prevailed upon or compelled the inhabitants of the Moluccas to cut down and root out all the clove-trees, which they have preſerved only in the iſlands of Amboyna and Ternate, which are in a great meaſure ſubject to them. We know for certain, that the Dutch pay 18,000 rix dollars yearly to the king of Ternate, by way of tribute or gift, in order to recompence him for the loſs of his clove-trees in the other Molucca iſlands; and that they are moreover bound by treaty to take at 3¼d. a pound, all the cloves brought by the natives of Amboyna to their magazines. They have likewiſe ſucceeded to deſtroy the cinnamon every where except in the iſland of Ceylon, which is in their poſſeſſion. The ſame is the caſe with white pepper, &c. ſo that the trade of the whole of Europe, and of great part of Aſia in this ſpecies of commodity, paſſes through their hands.

The Dutch have immenſe and very rich magazines of theſe precious aromatics, both in India and Europe. They have actually by them the produce of 16 years, and never ſupply their neighbours with the laſt, but always with the oldeſt crop: in 1760 they ſold what was laid up in 1744. It is commonly ſaid, that when the Dutch have too great a quantity of cloves, nutmeg, &c. in their magazines, they throw them into the ſea; but the fact is, that they get rid of their ſuperfluous aromatics by burning them. On the

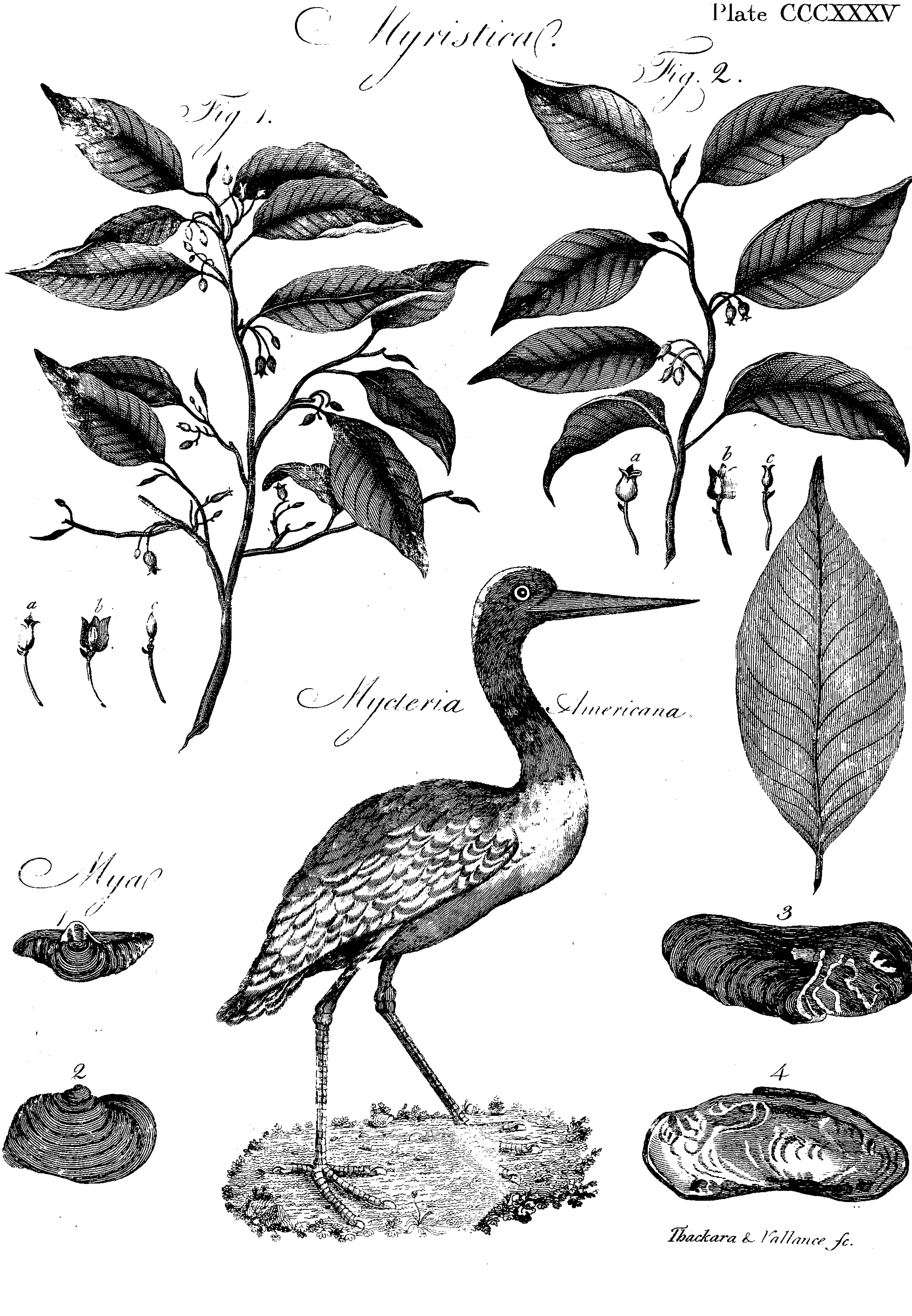
Plate CCCXXXIV

Myristica



Thackara & Vallance sc.

Plate CCCXXXV



the 10th of June 1760, M. Beaumare ſaw at Amſterdam, near the Admiralty, a fire, the fuel of which was valued at 8,000,000 of livres; and as much was to be burned on the day following. The feet of the ſpectators were bathed in the eſſential oil of theſe ſubſtances; but no perſon was allowed to gather any of it, much leſs to take any of the ſpices which were in the fire. Some years before, upon a ſimilar occaſion, and at the ſame place, a poor man who had taken up ſome nutmegs which had rolled out of the fire, was, as M. Beaumare was informed, ſeized and condemned to immediate execution. We will only add, that notwithſtanding the jealouſy of the Dutch, and the pains they take to preſerve the ſale of cloves wholly to themſelves, they have never been able to prevent their own officers in ſeveral parts of India from embezzling and ſelling conſiderable quantities of them. M. de Jaucourt informs us, that in order to defraud the company, they ſell them to the veſſels of other nations which they meet at ſea, and moiſten the remainder with water, that they may ſtill have the number of quintals of which their cargo conſiſted. The quantity ſold may amount to 10 quintals in 100 before it can be perceived by the clerks of the magazines at Batavia, where they are received.

We are informed by M. Romé de Liſle, who has lately arrived from India, that the Engliſh draw a great deal of cinnamon, pepper, and cloves, from the iſland of Sumatra. The ſtaple for this commodity, which gives great offence to the Dutch, is at the factory of Bencoolen. We have likewiſe ſeen a ſpecimen of pretty good cinnamon raiſed at Martinico.—The French, to prevent the exportation of ſpecie for theſe aromatic and exotic productions, have attempted to introduce the culture of them into ſome of their colonies. A great many plants of the clove and nutmeg-tree have been procured, and planted in the Iſle of France, the iſland of Bourbon, and alſo at Cayenne, where they have a very promiſing appearance.

Plate CCCXXXVI. MYRMECOPHAGA, or Ant-bear, in zoology; a genus of quadrupeds, belonging to the order of bruta: There are no teeth in the mouth; the tongue is long and cylindrical; the head terminates in a long ſnout or muzzle; and the body is covered with pretty long hair. There are five ſpecies, viz.

1. The didactyla, or little ant bear, hath a conic noſe bending a little down; ears ſmall, and hid in the fur; two hooked claws on the fore-feet, the exterior being much the largeſt; four on the hind-feet; the head, body, limbs, and upper part and ſides of the tail, covered with long ſoft ſilky hair, or rather wool, of a yellowiſh brown colour: from the noſe to the tail it meaſures ſeven inches and an half; the tail eight and an half, the laſt four inches of which on the under ſide are naked. It is thick at the baſe, and tapers to a point. It inhabits Guinea, climbs trees in queſt of a ſpecies of ants which build their neſts among the branches: has a prehenſible power with its tail.

2. The tridactyla, tamandua-guaca, or tamanoir, has three toes on the fore-feet, five on the hind feet, and long hair on the tail. This animal is about four feet long, and the head and ſnout about 15 inches: it is a native of the Eaſt Indies, and feeds on ants, &c. in the ſame manner as the former.

3. The jubata, or great ant-bear, has a long ſlender noſe, ſmall black eyes; ſhort round ears; a ſlender tongue two feet and an half long, which lies double in the mouth; the legs ſlender; four toes on the fore-feet, five on the hind feet; the two middle claws on the fore-feet very large, ſtrong, and hooked; the hair on the upper part of the body is half a foot long, black mixed with grey; the fore-legs are whitiſh, marked above the feet with a black ſpot; the tail is clothed with very coarſe black hair a foot long: the length from the noſe to the tail about four feet; the tail two feet and an half. This animal inhabits South America, and the kingdom of Congo in Africa. It covers itſelf with its tail when aſleep and to guard againſt rain. Its fleſh is eaten by the natives of America.

4. The tetradactyla, or middle ant-bear, has four toes on the fore-feet, and five on the hind, with a tail naked at the extremity; the length from the noſe to the tail is one foot ſeven inches, and the tail ten inches. It inhabits South America.

5. The Capenſis, or Cape ant-bear, has four claws on the fore-paws; a long ſnout; large pendent ears; and a tail which is ſhorter than the body, and taper at the point. It inhabits the country at the Cape of Good Hope.—This animal is much larger than the other ſpecies of the genus, ſo that Kolben compares it to the ſize of a hog, and aſſerts that it weighs 100 pounds. It burrows in the ground, ſleeps during the day, and only goes abroad at night.

Theſe animals have many properties in common with each other, both in their ſtructure and manners. They all feed upon ants, and plunge their tongues into honey and other liquid or viſcid ſubſtances. They readily pick up crumbs of bread or ſmall morſels of fleſh. They are eaſily tamed, and can ſubſiſt for a long time without food. They never ſwallow all the liquor which they take for drink; for a part of it falls back through their noſtrils. They run ſo ſlowly, that a man may eaſily overtake them in an open field.—Their fleſh, though its taſte be very diſagreeable, is eaten by the ſavages. At a diſtance the great ant-eater has the appearance of a fox; and for this reaſon ſome travellers have given him the name of the *American fox*. He has ſtrength ſufficient to defend himſelf from a large dog, or even from the jaguar or Braſilian cat. When attacked, he at firſt fights on end, and like the bear, annoys his enemy with the claws of his fore-feet, which are very terrible weapons.—He then lies down on his back, and uſes all the four feet, in which ſituation he is almoſt invincible; and continues the combat to the laſt extremity. Even when he kills his enemy, he quits him not for a long time after. He is enabled to reſiſt better than moſt other animals, becauſe he is covered with long buſhy hair; his ſkin is remarkably thick; his fleſh has little ſenſation; and his principle of life is very tenacious.

MYRMELION, or Ant-lion, in zoology; a genus of inſects of the nemopteca order. There are 15 ſpecies of which the moſt remarkable is the formicarius, or ant-eater. The perfect inſect is oblong, and of a brown colour. Its head is broad, with two large eyes on the ſides, and two antennæ beneath. The neck is rather long, cylindrical, and narrower than the head. The thorax ſeems compoſed of two parts, one anterior,

rior, whence arise the upper wings; and the other posterior, which, which gives birth to the under ones. The abdomen is of an oblong form, and consists of eight segments; the wings are diaphanous, adorned with a net-work of black fibres, charged with several blackish brown spots. The larva of this insect is very fond of ants, which it hunts after, whence its name. The larvæ proceed from the egg which the perfect insect had deposited in very fine dry sand, in a place sheltered from rain, either within a cleft of a wall or of the ground, or at the foot of a wall generally exposed to the south sun. There they are hatched, and make their usual abode. Their colour is grey, and their body, which is covered with small protuberances, is of an oval form. Its posterior extremity terminates in a point, and is of use to sink itself down into the sand; for it only walks retrogressively, though furnished with six feet. Before the head is placed a dentated forceps, sharp and hollow within, with which the creature catches and sucks flies and other insects, but especially ants. This forceps serves as a mouth or rostrum, as well as as for an offensive weapon. The animal's retrograde march not allowing it to run after the insects on which it is to feed, it uses a stratagem. It dives down into the sand, and turning about in a circle, hollows out concentric furrows, gradually deeper and deeper, casting at a distance with its horns the sand it takes from that place. At length it manages to dig a hole in shape like a funnel, at the bottom of which it takes its station, concealed in the sand, nothing but the open extended forceps appearing above it. Mischief overtakes every insect that happens to fall into that hole. The myrmelio who is apprized of it by the grains of sand rolling down to the bottom, overwhelms him with a shower of dust, which it ejects with its horns, then drags the insect to the bottom of the hole, where it seizes him with its forceps and sucks its vitals. It does not even spare other myrmelions who in their motions to and fro chance to fall into it. When the larva is come to its full growth, it digs no more holes; it moves backwards and forwards tracing irregular furrows on the sand, and at length spins itself a cod, shaped like a ball, the outward part of which is formed of the sand in which it lived, and the inward is lined with fine white silk. Within this cod it turns to a chrysalis, which is curved into a semicircle, and wherein may be distinguished all the parts of the perfect insect that is to issue from it. It is more oblong than the larva, but much shorter than the perfect insect. After a certain period the chrysalis casts off its slough, turns to a winged insect, and breaks through the cod in order to take its flight. The perfect insect is very scarce, but is sometimes met with in sandy places, and near rivulets.

Barbut's Genera of Insects, p. 223.

MYRMIDONS (Myrmidones), in antiquity; a people on the southern borders of Thessaly, who accompanied Achilles to the Trojan war. They received their name from Myrmidon, a son of Jupiter and Eurymedusa, who married one of the daughters of Æolus son of Helen. His son Actor married Ægina the daughter of Asopus. He gave his name to his subjects, who dwelt near the river Peneus in Thessaly. According to some, the Myrmidons received their name from their having arisen from ants or pismires, upon a prayer put up for that purpose by king Æacus to Jupiter, after his kingdom had been dispeopled by a severe pestilence. According to Strabo, they received it from their industry, because they imitated the diligence of the ants, and like them were indefatigable, and were continually employed in cultivating the earth.

MYRMILLONES, were gladiators of a certain kind at Rome, who fought against the Retiarii. Their arms were a sword, head-piece and shield. On the top of the head-piece they wore a fish embossed, called Μορμυρος, whence their name is by some supposed to be derived. The Retiarii, in their engagements, made use of a net, in which they endeavoured to entangle their adversaries, and sung during the fight, "*Non te peto, piscem peto; quid me fugis, Galle?*" I aim not at thee, but I aim at thy fish; why dost thou shun me, O Gaul?" The myrmillones were called Galli, because they wore Gallic armour. They were also named *Secutores*. This kind of gladiators was suppressed by Caligula. See Gladiators, Retiarii, &c.

MYROBALANS, a kind of medicinal fruit brought from the Indies, of which there are five kinds. 1. The citrine, of a yellowish red colour, hard, oblong, and the size of an olive. 2. The black, or Indian myrobalan, of the bigness of an acorn, wrinkled, and without a stone. 3. Chebulic myrobalans, which are of the size of a date, pointed at the end, and of a yellowish brown. 4. Emblic, which are round, rough, the size of a gall, and of a dark brown. 5. Belleric, which are hard, round, of the size of an ordinary prune, less angular than the rest, and yellow. They are all slightly purgative and astringent. The word comes from the Greek μυρον, "ointment," and βαλανος, "acorn, as being in the form of acorns, and used in medicine.

MYRON, an excellent Grecian statuary, flourished 442 B. C. The cow he represented in brass was an admirable piece of workmanship, and was the occasion of many fine epigrams in Greek.

MYROXYLON, in botany: a genus of the monogynia order, belonging to the decandria class of plants. The calyx is campanulated; the superior petal larger than the rest; the germ is longer than the corolla; the legumen monospermous. There is but one species, the peruiferum, a native of Peru and the warmer parts of America. It is this shrub that yields the balsam of Peru, which is said to be extracted from it by coction in water. This balsam, as brought to us is nearly of the consistence of thin honey, of a reddish brown colour inclining to black, an agreeable aromatic smell, and a very hot biting taste. Distilled with water, it yields a small quantity of a fragrant essential oil of a reddish colour, and in a strong fire, without addition, a yellowish red oil. Balsam of Peru is a very warm aromatic medicine, considerably hotter and more acrid than copaiva. Its principal effects are to warm the habit, to strengthen the nervous system, and attenuate viscid humours. Hence its use in some kinds of asthmas, gonorrhœas, dysenteries, suppressions of the uterine discharges, and other disorders proceeding from a debility of the solids or a sluggishness and inactivity of the juices. It is also employed externally, for cleansing and healing wounds and ulcers, and sometimes against palsies and rheumatic pains.—There is another sort of balsam of Peru of a white colour, Myrrh.

colour, and considerably more fragrant than the former. This is very rarely brought to us. It is said to be the produce of the same plant which yields the common or black balsam, and to exsude from incisions made in the trunk, while the former is obtained by boiling. There is also a third kind, commonly called the red or dry. This is supposed to obtain a different state from the white, merely in consequence of the treatment to which it is subjected after it is got from the tree. It is almost as fragrant as the balsam of Gilead, held in so high esteem among the eastern nations. It is very rarely in use in Britain, and almost never to be met with in the shops.

MYRRH, a gummy-resinous concrete juice, obtained from an oriental tree of which we have as yet no certain account. It comes over to us in globes or drops, of various colours and magnitudes. The best sort is somewhat transparent, friable, in some degree unctuous to the touch, of an uniform brownish or reddish-yellow colour, often streaked internally with whitish semicircular or irregular veins; of a moderately strong, not disagreeable smell; and a lightly pungent, very bitter taste, accompanied with aromatic flavour, but not sufficient to prevent its being nauseous to the palate. There are sometimes found among it hard shining pieces, of a pale yellowish colour, resembling gum-arabic, of no taste or smell: sometimes masses of bdellium, darker coloured, more opaque, internally softer than the myrrh, and differing from it both in smell and taste: sometimes an unctuous gummy resin, of a moderately strong somewhat ungrateful smell, and a bitterish very durable taste, obviously different both from those of bdellium and myrrh: sometimes likewise, as Cartheuser observes, hard compact dark coloured tears, less unctuous than myrrh, of an offensive smell; and a most ungrateful bitterness, so as, when kept for some time in the mouth, to provoke reaching, though so resinous, that little of them is dissolved by the saliva. Great care is therefore requisite in the choice of this drug.

We have, as already observed, no certain information concerning the tree from which this substance flows; we are only told that the myrrh-tree, or plant, is a native of Abexim in Ethiopia, and is named *beduins* by the Arabs. It is affirmed by some that the myrrh we have at present is not equal in quality to that of the ancients, and has not that exquisite smell which all authors ascribe to the latter. They aromatized their most delicious wines with it; and it was presented as a very valuable perfume to our Lord while he lay in the manger (A). But to this it may be easily answered, that there is no disputing about perfumes any more than about tastes and colours. Men are equally changeable with regard to smells, of which we have striking examples in musk and civet (B). The ancients reckoned two kinds of myrrh: the one liquid,

(A) It was this gum also which was mingled with the wine given him to drink at his passion, to deaden his pains, and produce a stupor. (See Mark xv. 23.) The gall mentioned on the same occasion by St Matthew is probably the same with myrrh; for any thing bitter was usually distinguished by the name of gall. The Hebrews were accustomed to give those that were executed some stupefying draught. The difficulty which arises from the seeming difference betwixt the two evangelists, by some is solved by saying, that St Matthew, writing in Syriac, made use of the word *mara*, which signifies "myrrh, bitterness, or gall;" but the Greek translator has taken it for gall, and St Mark for myrrh. Others will have it, that our Saviour's drink was mingled with myrrh, as a stupefying drug; but suppose that the soldiers, out of wanton cruelty and inhumanity, infused gall; which was the reason, say they, why, when he had tasted, he refused to drink.

(B) In the *Journal de Physique*, &c. *Suppl.* tom. xiii. 1778, we find some remarks on myrrh made by Mr Bruce while in Abyssinia, of which the following is a statement: The same remarks have been since published in the Appendix to his Travels. The ancients, and particularly Dioscorides, who speak of myrrh, seem never to have seen it; or at least that which they have seen and described is altogether unknown to modern physicians and naturalists. The Arabians, however, who form the intermediate link in the chain between the Greek physicians and those of our days, among whom this substance grew, and from whom it received its name, afford an incontestible proof that the myrrh with which we are acquainted is in no respect different from that of the ancients, being produced in the same countries from which the Greeks formerly procured theirs; that is, on the eastern shores of Arabia Felix; on the coasts of the Indian ocean; and on that part of Lower Abyssinia which lies to the south east of the Red sea, nearly between the 12th and 13th degrees of north latitude, bounded on the west by a meridian running through the island of Massovia, and on the east by one which passes through cape Guardsey in the straits of Babel mandel. This region the Greeks called *Trog odytria* and must be distinguished from the country of the Troglodites, a nation different in every respect, and inhabiting the forests between Abyssinia and Nubia. The Abyssinian myrrh was always more valued than that of Arabia; and this preference it still retains to the present day. That part of Abyssinia being partly overflowed with water, and partly desert and over-run by a barbarous nation from the south, the Arabians have very little intercourse with it except by means of some Mahometan merchants, whose desperate adventures, undertaken on chance, sometimes turn out well, but oftener prove very unfortunate. The island of Massova is the common medium of exportation for the Troglodite myrrh; but so little is brought from it in comparison with what is sent from Arabia to Grand Cairo, that this is certainly the only reason which can be assigned for the inferiority of our myrrh to that of the ancients, who received it from Abyssinia. Although these barbarians employ the gum, leaves, and bark of this tree in many diseases to which they are subject, as it is the most common tree in the country, they nevertheless cut it down and burn it for domestic purposes; and as they never plant new trees to replace those which they have cut down, it is probable that in a few years the quid, which they called *ſtacté* or *ſtarti;* the other was ſolid, and went by the name of *troglodite myrrh.* The ſtacte was procured by inciſion, and was received in veſſels very cloſely ſhut. Large pieces ſometimes preſent externally, or contain a kind of oily juice to which likewiſe the moderns give the name of *Stacté.* To prevent this juice from hardening, or at leaſt in a very ſmall degree it is ſufficient to exclude it from the contract of the air immediately after its iſſuing from the tree; and by theſe means its aromatic nature will be much better preſerved (c).

The medical effects of this aromatic bitter are to warm

the true Troglodite myrrh will be entirely loſt; and the erroneous deſcriptions of the ancient Greeks will lead poſterity, as it has done us, to form many miſtaken conjectures concerning the nature of the myrrh of the ancients.

Though the Troglodite myrrh was ſuperior to every ſpecies of Arabian myrrh, the Greeks plainly perceived that it was not all of the ſame quality. Pliny and Theophraſtus affirm, that this difference was owing to the trees, ſome of which were wild, and others meliorated by culture: but this is a mere conjecture; for the truth is that none of them are cultivated. The quality of the drug formerly depended, and muſt ſtill depend, on the age and ſoundneſs of the tree, on the way of making the inciſion, and on the ſeaſon of the year, and the temperature of the air when the myrrh is gathered. To have the firſt and moſt perfect kind of myrrh, the natives ſelect a young vigorous tree, free from moſs or any other plant adhering to the bark and make a deep inciſion with a hatchet above the firſt large branches. What runs from this wound the firſt year, is myrrh of the firſt growth, and is never plentiful. This operation is performed ſome time after the rains have ceaſed, that is from April to June: and the myrrh is produced in July and Auguſt. At each return of the ſeaſon, the ſap continues to run in the courſe to which it has been accuſtomed; but the tropical rains, which are very violent, and which laſt for ſix months, convey ſo much filth and water into the inciſion, that by the ſecond year the tree begins to rot at that place; ſo that the myrrh is of a ſecondary quality, and at Cairo does not bring ſo great a price by a third as the myrrh of the firſt year. That which iſſues from inciſions near the roots and in the trunks of old trees is of the ſecond growth and quality, and ſometimes worſe; but it is reckoned good myrrh in the ſhops of Italy every where except Venice. It is of a red blackiſh colour, dirty, ſolid, and heavy. It loſes very little of its weight by being long kept, and can ſcarcely be diſtinguiſhed from that of Arabia Felix. The third and worſt kind is that which flows from old inciſions formerly made in old trees, or which not having been at firſt obſerved, has remained a whole year upon the tree. It is black, heavy, and of an earthy colour: it has little ſmell and bitterneſs, and is probably the *caucalus* of the ancients.

Myrrh newly gathered has always a ſtrong ſmell of rancid oil; and when put into water, globules of an oily ſubſtance are detached from it, which riſe and ſwim on the ſurface. This oilineſs does not ariſe from the myrrh, but from being put by the natives into goats ſkins, which they anointed with butter to make them pliant. It is kept in theſe ſkins, and thus carried to market: ſo that inſtead of being a fault, as ſome ſuppoſe, it is a proof that the myrrh is newly gathered; which is the beſt property that myrrh of the firſt kind can have. Beſides, this oily covering muſt have retained the volatile particles of the freſh myrrh, which eſcape in ſuch abundance as frequently to occaſion a conſiderable diminution in the weight.

(c) Pliny ſpeaks of the ſtarti as a recent or liquid myrrh: and Dioſcorides, chap. 67. ſays nearly the ſame thing. Mr Bruce is of opinion (but we think he is miſtaken), that the ancient Greeks and Romans, who lay at ſo great a diſtance, could never have it in that ſtate; becauſe he was aſſured by the natives, that it hardened on the tree as ſoon as it was expoſed to the air; and becauſe, though he was near the place where it grows, he never ſaw it ſofter than it is commonly found. Dioſcorides mentions likewiſe a ſpecies of myrrh, which, he ſays, is green, and has the conſiſtence of paſte. Serapio and the Arabians affirm, that ſtarti was a preparation of myrrh diſſolved in water: hence Mr Bruce conjectures, that this green unknown ſpecies was likewiſe a compoſition of myrrh and ſome other ingredient; and by no means a kind of Abyſſinian myrrh which they could never ſee either green or ſoft. The ſame author ſuppoſes, that *apocalbaſum,* or gum of Saſſa and myrrh, are one and the ſame ſubſtance; and he alleges, that Arabic myrrh may be diſtinguiſhed from myrrh of Abyſſinia in the following manner: A handful of the very ſmall pieces which are found at the bottom of the packet containing the myrrh, is thrown into a baſon with a ſufficient quantity of warm water to cover them. Here the myrrh remains for ſome time without any perceptible change, becauſe it diſſolves ſlowly; whereas the gum ſwells to five times its original ſize, and appears like ſo many white particles among the myrrh. But nothing can be inferred from this diſtinction. Does the Arabian myrrh diſſolve, and that of Abyſſinia ſwell? In that caſe the Arabian myrrh would act like pure gum Arabic, or acacia gum, and that of Abyſſinia like gum tragacanth. To us it appears, that Mr Bruce, of whoſe zeal and labours in other reſpects we entertain a high opinion, has not performed his experiments with ſufficient care; or if there was no miſtake in them, we muſt be allowed to think, that the ſuppoſed myrrhs which he employed were nothing but a mixture of Arabian gum acacia, and gum of Baſſora, or Egyptian tragacanth. We are more inclined to be of this opinion, when he ſays that the branches, leaves, and bark of the myrrh trees were brought to him by naked ſavages from the country of the Troglodites; and that he found that the leaves and bark bore a great reſemblance to the acacia vera. Among theſe leaves he obſerved ſome ſtraight prickles, about two inches in length. He likewiſe mentions, that he ſaw a ſaſſa tree which was a native of the myrrh country, and covered with beautiful crimſon-coloured flowers. We know that the ſhrub which produces the gum tragacanth is prickly, and has flowers of purple colour.

warm and strengthen the viscera: it frequently occasions a mild diaphoresis, and promotes the fluid secretions in general. Hence it proves serviceable in languid cases, diseases arising from a simple inactivity, those female disorders which proceed from a cold, mucous, sluggish indisposition of the humours, suppressions of the uterine discharges, cachectic disorders, and where the lungs and thorax are oppressed by viscid phlegm. Myrrh is likewise supposed in a peculiar manner to resist putrefaction in all parts of the body; and in this light stands recommended in malignant, putrid, and pestilential fevers, and in the small-pox; in which last it is said to accelerate the eruption.

The present practice does not seem to expect any peculiar virtue from myrrh; and it is now perhaps less employed than formerly. Some late writers, however, and particularly Dr Simmons, in his treatise on Consumptions, have bestowed very high encomiums on it, even in cases of tuberculous phthisis; and although it can by no means be represented as a remedy much to be depended on, yet there is reason to believe that it has been serviceable in some cases.

Rectified spirit extracts the fine aromatic flavour and bitterness of this drug, and does not elevate any thing of either in evaporation: the gummy substance left by this menstruum has a disagreeable taste, with scarcely any of the peculiar flavour of the myrrh: this part dissolves in water, except some impurities which remain. In distillation with water, a considerable quantity of a ponderous essential oil arises, resembling in flavour the original drug. Myrrh is the basis of an officinal tincture. It enters the pilulæ ex aloe et myrrha, the pilulæ e gummi, and pilulæ stomachicæ, and some other formulæ. But for obtaining its full effects, it must be given in doses of half a dram or upwards; and it is thought to be advantageously united with a proportion of nitre, cream of tartar, or some other refrigerant salt.

MYRRHINE, or MURRINE. See MURRINE.

MYRSINE, in botany: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 18th order, *Bicornes*. The corolla is semiquinquefid and connivent: the germen filling the corolla: the berry quinquelocular and pentaspermous.

MYRTIFORM, in anatomy, an appellation given to several parts, from their resembling myrtle-berries.

MYRTIS, a Greek woman who distinguished herself by her poetical talents. She flourished about 500 years before the Christian era, and instructed the celebrated Corinna in the several rules of versification. Pindar himself, as some report, was also one of her pupils.

MYRTLE, in botany. See MYRTUS.

MYRTOUM MARE, a part of the Ægean sea, lying between Eubœa, Peloponnesus, and Attica. It receives this name from Myrto a woman, or from Myrtos a small island in the neighbourhood, or from Myrtilus the son of Mercury who was drowned there, &c.

MYRTUS (anc. geog.), a small island near Carystus in Eubœa, which gave name to the Mare Myrtoum. Others, according to Pausanias, derive the appellation from *Myrto*, the name of a woman. Strabo extends this sea between Crete, Argia, and Attica. Pausanias beginning it at Eubœa, joins it at Helena, a desart island, with the Ægean sea. Ptolemy carries it to the Coast of Caria. Pliny says, that the Cyclades and Sporades are bounded on the west by the Myrtoan coast of Attica.

MURTUS, in botany, the *Myrtle*: A genus of the monogynia order, belonging to the icosandria class of plants; and in the natural manner ranked under the 19th order, *Hesperideæ*, The calx is quinquefid, superior; there are five petals; the berry is dispermous or trispermous. There are 14 species, of which the most remarkable are,

1. The communis, or common myrtle-tree, rises with a shrubby, upright, firm stem, branching numerously all around into a close full head, rising eight or ten feet high; very closely garnished with oval lanceolate, entire, mostly opposite leaves, from half an inch to an inch and a half long, and one broad, on short footstalks; and numerous, small, pale flowers from the axillas, singly on each footstalk, having dyaphyllous involucrums; each flower succeeded by a small oval, dark purple berry. The most material varieties are, broad-leaved Roman myrtle, with oval, shining, green leaves, an inch and an half long, and one broad; and which is remarkably floriferous. Gold-striped broad-leaved Roman myrtle. Broad leaved Dutch myrtle, with spear-shaped, sharp pointed, dark green leaves, an inch long and about three quarters of one broad. Double-flowered Dutch myrtle. Broad-leaved Jews myrtle, having the leaves placed by threes at each joint: by which particular circumstance this species is in universal estimation among the Jews in their religious ceremonies, particularly in decorating their tabernacles; and for which purpose many gardeners about London cultivate this variety with particular care, to sell to the above people, who are often obliged to purchase it at the rate of sixpence or a shilling for a small branch: for the true sort, having the leaves exactly by threes, is very scare, and is a curiosity; but by care in its propagation, taking only the perfectly ternate-leaved shoots for cuttings, it may be increased fast enough; and is worth the attention of the curious, and particularly those who raise myrtles for the London markets. Orange-leaved Spanish myrtle, with oval spear-shaped leaves, an inch and a half long or more, and one broad in clusters round the branches, and resemble the shape and colour of orange-tree leaves. Gold-striped leaved orange myrtle. Common upright Italian myrtle, with its branches and leaves growing more erect, the leaves oval, lanceolate-shaped, acute-pointed, and near in inch broad and a half one broad. Silver-striped upright Italian myrtle. White-berried upright Italian myrtle. Portugal acute leaved myrtle, with spear shaped, oval acute-pointed leaves, about an inch long. Box-leaved myrtle, with weak branches, small, oval obtuse, lucid green. closely-placed leaves. Striped box-leaved myrtle. Rosemary-leaved myrtle, hath erect branches small, narow, lanceolate, acute pointed. shining, green, very fragrant leaves. Silver-striped rosemary-leaved myrtle. Thyme-leaved myrtle, with very small closely-placed leaves. Nutmeg-myrtle, with erect branches and leaves; the leaves oval, acute-pointed, and finely scented like a nutmeg. Broad-leaved nutmeg-myrtle. Silver-striped leaved ditto. Cristated or cock's-comb myrtle, frequently called *bird's-nest-myrtle*,

Myrtus. *myrtle*, hath a narrow, sharp-pointed leaves, cristated at intervals. These are all beautiful ever-green shrubs of exceeding fragrance; exotics originally of the southern parts of Europe, and of Asia and Africa, and consequently in this country require shelter of a green house in winter: all of which, though rather of the small-leaved kind, have their foliage closely placed, and remain all the year, and are very floriferous in summer; and when there is a collection of the different sorts, they afford an agreeable source of variety with each other. They therefore claim universal esteem as principal green house plants. especially as they are all so easily raised from cuttings, and of such easy culture, as to be attainable in every garden where there is any sort of green house, or garden frames furnished with glasses for protectiong them in winter from frost: but some of the broad-leaved sorts are so hardy as to succeed in the full ground, against a south wall and other warm exposures, all the year, by only allowing them shelter of mats occasionally in severe frosty weather: so that a few of these sorts may also be exhibited in a warm situation in the shrubbery: observing, however, all the sorts are principally to be consiered as green-house plants, and a due portion of them must always remain in pots to move to that department in winter.

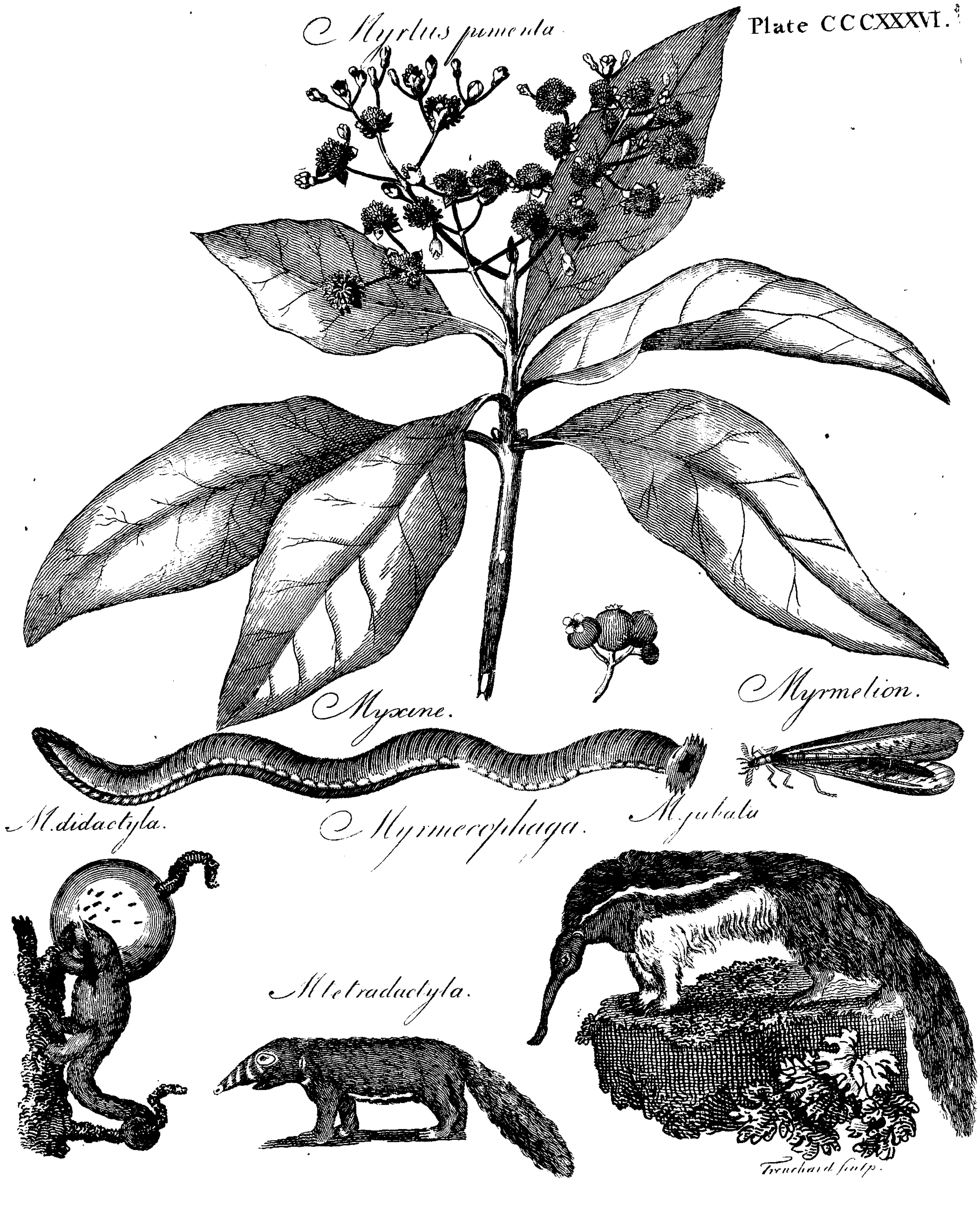
Plate CCCXXXVI. 2. The pimenta, pimento, Jamaica pepper, or all-spice tree, grows above 30 feet in height and two in circumference; the branches near the top are much divided and thickly beset with leaves, which by their continual verdure always give the tree a beautiful appearance: the bark is very smooth externally, and of a grey colour; the leaves vary in shape and in size, but are commonly about four inches long, veined, pointed, elliptical, and of a deep shining green colour: the flowers are produced in bunches or panicles, and stand upon subdividing or trichotomous stalks, which usually terminate the branches; the calyx is cut into four roundish segments; the petals are also four, white, small, reflex, oval, and placed opposite to each other between the segments of the calyx; the filaments are numerous, longer than the petals, spreading, of a greenish white colour, and rise from the calyx and upper part of the germen; the antheræ are roundish, and of a pale pellow colour; the style is smooth, simple and erect; the stigma is obtuse; the germen becomes a round succulent berry, containing two kidney-shaped flattish seeds. This tree is a native of New Spain and the West India islands. In Jamaica it grows very plentifully; and in June, July, and August, puts forth its flowers, which with every part of the tree breathes an aromatic fragrance. The berries when ripe are of a dark purple colour, and full of a sweet pulp, which the birds devour greedily, and muting the seeds, afterwards propagate these trees in all parts of the woods It is thought that the seeds passing through them, in this manner undergo some fermentation, which fits them better for vegetating than those gathered immediately from the tree.

The pimento is a most beautiful odoriferous evergreen and exhibits a fine variety in the stove at all seasons. It was first introduced and cultivated in England by Mr Philip Miller in 1739. With respect to flowering, all the varieties of the *myrtus communis* flower there in July and August, most of which are very floriferous: the broad leaved Roman kind in particular is often covered with flowers, which in some of the sorts are succeeded here by berries ripening in winter. The pimento also flowers in the stove with great beauty and luxuriance. The flowers of most of the sorts are small, but numerous; and are all formed each of five oval petals and many stamina. As all these plants require protection in this country, they must be kept always in pots, for moving to the proper places of shelter, according to their nature; the *myrtus communis* and varieties to the greenhouse in winter, the pimento and other delicate kinds to the stove, to remain all the year: therefore let all the sorts be potted in light rich earth; and as they advance in growth, shift them into larger pots, managing the myrtles as other green house shrubs, and the stove-kinds as other woody exotics of the stove. Myrtus.

Properties, &c. The leaves and flowers of *common* upright myrtle have an astringent quality, and are used for cleansing the skin, fixing the teeth when loosened by the scurvy, and strengthening the fibres. From the flowers and young tops is drawn a distilled water that is detersive, astringent, cosmetic, and used in gargles. A decoction of the flowers and leaves is applied in fomentations. The berries have a binding detersive quality; and the chemical oil obtained from them is excellent for the hair, and used in pomatums and most other external beautifiers of the face and skin. As an internal medicine, these berries have little or no merit.

In the *Dictionnaire portatif d'Histoire Naturelle*, a fact is related, which, if true, tends to show the strongly astringent quality of myrtle. "Myrtle. (says he) is likewise the base of a pommade called *pommade de la Comtesse*, and well known on account of an extraordinary historical fact. One of those gay youths who flutter about the toilets of the fair happened one day to be left alone in the storehouse of the graces. With eager curiosity he examined the purfumes, the smelling bottles, the perfumed powder, the essences, and the cosmetics. To give more of the vermillion and greater pliancy to his lips, and to remove some disagreeable eruptions, he lightly spreads with his indiscreet finger the fatal pommade, looks at himself in the glass, and contemplates his beauty with admiration. The lady enters; he wishes to speak, but his lips contracted, and he could only stammer. The lady looked at him with astonishment; at length casting her eyes on the toilet, she discovered by the open pot the cause of the mistake, and enjoyed a hearty laugh at the expence of her admirer, whose confusion announced his indiscretion."

Pimento berries are chiefly imported into Britain from Jamaica; whence the name *Jamaica pepper*. It is also called *all-spice*, from its taste and flavour being supposed to resemble those of many different spices mixed together. It is one of the staple articles of Jamaica; where the pimento walks are upon a large scale, some of them covering several acres of ground. When the berries arrive at their full growth, but before they begin to ripen, they are picked from the branches, and exposed to the sun for several days, till they are sufficiently dried; this operation is to be conducted with great care, observing that on the first and second, day's exposure


Myrtus pimenta
Myxine.
Myrmelion.
M. didactyla.
Myrmecophaga.
M. jubata
M. tetradactyla.
Trenchard sculp.

exposure they require to be turned very often, and always to be preserved from rain and the evening dews. After this process is completed, which is known by the colour and rattling of the seeds in the berries, they are put up in bags or hogsheads for the market. This spice, which was at first introduced for dietetic uses, has been long employed in the shops as a succedaneum to the more costly oriental aromatics: it is moderately warm, of an agreeable flavour, somewhat resembling that of a mixture of cloves, cinnamon and nutmegs. Distilled with water it yields an elegant essential oil, so ponderous as to sink in the water, in taste, moderately pungent, in smell and flavour approaching to oil of cloves, or rather a mixture of cloves and nutmegs. To rectified spirit it imparts, by maceration or digestion, the whole of its virtue: in distillation it gives over very little to this menstruum, nearly all its active matter remaining concentrated in the inspissated extract. Pimento can scarcely be considered as a medicine: it is, however, an agreeable aromatic, and on this account is not unfrequently employed with different drugs, requiring such a grateful adjunct. Both the pharmacopœias direct an aqueous and spirituous distillation to be made from these berries, and the Edinburgh college order also the *oleum essenciale piperis Jamaciensis*.

MYSIA, a country of Asia Minor, generally divided into Major and Minor. Mysia Minor was bounded on the north and west by the Propontis and Bithynia, and Phrygia on the southern and eastern borders. Mysia Major had Æolia on the south, Ægean on the west, and Phrygia on the north and east. Its chief cities were Cyzicum, Lampsacus, &c. The inhabitants were once very warlike; but they greatly degenerated, and the words *Mysorum ultimus* was emphatically used to signify a person of no merit. The ancients generally hired them to attend their funerals as mourners, because they were naturally melancholy and inclined to shed tears. They were once governed by monarchs. They are supposed to be descended from the Mysians of Europe, a nation who inhabited that part of Thrace which was situated between Mount Hæmus and the Danube.

MYSON, a native of Sparta, one of the seven wise men of Greece. When Anacharsis consulted the oracle of Apollo, to know which was the wisest man in Greece, he received for answer, he who is now ploughing his fields. This was Myson.

MYSORE, or MYSOREAN DOMINIONS, a kingdom of Asia in the East Indies, consisting of the following territories usurped or subdued by the late Hyder Ali, and transmitted to his son Tippoo Saib the present sultan.

1. Mysore Proper, or Seringapatam (from its capital), forming the independent state of a Hindoo rajah, for near 200 years from its dismemberment, as a province of the Bejenagur empire, fell into the hands of Hyder Ali Khan about the year 1763, by cutting off the Delaway, or regent usurper of the government, and seizing the reins of administration himself; but without leaving even the shadow of any authority to a nominal rajah of his own creation, excepting in the formularies of justice or finance, and preserving on one side of the pagoda coin the impression of two swamies or divinities of the Hindoos, while the other was made to bear the initial letter of his proper name Hyder. The whole country now again reduced into the form of a province dependent on the New Mysorean dominion of a Mussulman in the person of Tippoo, is bounded on the west by the Balagaut hills of Koork, and those called Anemally, bordering the whole coast of Malabar; on the east it frontiers with the Carnatic Payengaut and its dependencies along the Coromandel coast; and, on the north, with the pergunnahs of Serah, Bangalore, and Colar, belonging to the Carnatic Balagaut-Bejapoury, in a longitudinal line little short of 200 English miles. From this latter boundary, in a form nearly triangular, it stretches 240 miles towards the south, where it terminates in a point at the extremity of Dindigul, near the pass of Goodalore, through the Anemally hills, on the confines of Travancore, and within 100 miles of Cape Comorin. It partakes of the two great divisions of country known in the Decan by the terms Balagaut and Payengaut, or upper and lower region. The former, comprehending the districts immediately dependent on the capital, and 43 subordinate forts, chiefly on eminences, is but indifferently watered by the several branches of the Caveri, at no great distance from its source; and must therefore, as well as in consequence of an elevated situation, precluded from foreign commerce, with scarcely any internal industry, be comparatively poor, as it is productive only of the smaller grains of joary and Bajary, or a species of Indian corn, with the different kinds of vetches common to India; from all which, however, a nett revenue, in money or kind, of seven lacks of hoons or pagodas, being about 27 lacks of rupees, is computed to be forth-coming to the state, after defraying the ordinary charges of collection, which here as in the rest of Hindostan, consist chiefly of an establishment of village peons or militia, reckoned 40,000 in number, for the whole province of Mysore supposed to contain 15,400 square geographic miles. The latter, or Payengaut division, making scarcely a third part of this extensive area, is better known to us under the name of Coimbatore, including the Districts of Caroor, Darampour, and Namcul, on both sides of the Caveri, with the valley of Dindigul, on the south, and the great pass of Palligautcherry towards Malabar on the west: it is extremely fertile and well cultivated; therefore, in proportion to its extent, more productive of revenue than the Balagaut territory, being estimated nett at 19 lacks of rupees. The rajahs of Koork, and other Palygars among the Gauts, from Bidenore south to Dindigul, occupy independently a considerable tract of country within the general description of Tippoo's dominions: but which being inaccessible to regular troops by hills or impervious woods, the Mysorean power hath never been able to conquer, further than to facilitate the catching of a few elephants, yearly by means of the natives.

2. Bedenore, or Ikeri, now Hydernagur, on the dissolution of the Canarine empire, of which it was a part, became an independent state under its Naicks of the race of Vencataputty, after which it fell under the divided female government of different rannies or queens, and so continued until conquered wholly by Hyder between the years 1763-5. This country is also divided into Alagaut and Payengaut; the latter stretching

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ftretching 140 miles along the fea-coaft from Declah, or the river Cangrecora, being the northern frontier of Malabar, north to Honawar or Onore, on the confines of Soonda, in different breadths of plain territory, from 40 to 50 miles, but which may in all form an area of 3200 fquare miles, ftill retaining the ancient name of Canara, and including the ports of Mangalore, Barcelore, Onore, &c. The former or elevated divifion beyond the Supramanny Gauts, and immediately dependent on the capital Bedenore, Hanampour, &c. is of great indefinite extent inland, on both fides of the Tumbhudra; perhaps twice more confiderable in fize, though not proportionably fo in value, to the maritime border. Both divifions, however, allowing for a revenue eftablifhment of about 22,000 village peons, are affeffed for feven lacks of Ikeri pagodas, which, at four rupees each, make a clear income to the exchequer of 28 lacks of rupees.

3. Soonda, in circumftances of hiftory or final conqueft, might be placed under the preceding head; as alfo from a fimilarity in its geographical defcription, with only the difference of being on a much fmaller fcale. The Payegaut, from the diftrict of Onore to the frontiers of Goa, along a fea-coaft of 60 miles, cannot comprehend above 1100 fquare miles of territory, in which the port of Carwar may be confidered the capital; while a much larger extent muft be allowed for that portion of the diftrict beyond the Gauts to the eaftward. The whole revenue, however, of both divifions, does not exceed two lacks of pagodas, or eight lacks of rupees.

4. Malabar. The country under this defcription, and conquered by Hyder in 1765-6, exclufive of Koork, is altogether Payengaut; ftretching along the fhore from Declah fouth to Cochin about 200 miles, and comprehending, in an area of perhaps 6000 fquare miles, the Samery's territory of Calicut, with the petty ftates of Cartinad, Cotiotie, Cherica, or Cananore, on the north, and the tributary kingdom of Cochin on the fouth;—the whole rated at a revenue of five lacks of pagodas, or about 19 lacks of rupees, after allowing for the maintenance of 18,000 village peons.

5. Barah Mhal, or twelve pergunnahs, was one of the earlieft conquered annexations of Hyder to the Myforean dominion, though in the war of 1768 it was over-run and for a while in poffeffion of the company's troops. The whole circar or diftrict of Jugdeo, compofed of heights and valleys on the confines of the Balagaut and Payengaut Carnatics, being one of the feven dependencies of Ginjee fubjected to the Mogul in 1698, was then fubdivided into 17 pergunnahs, and affeffed for a grofs revenue of 1,757,717 rupees. Of thefe fubdivifions, Amboor, Sautgur, &c. remain to the Payengaut: the reft in the hands of Tippoo, may comprehend, exclufive of the poligarry of Shili Naick, about 1800 fquare miles; but the nett revenue of the fame territory, after defraying the ordinary expences of collection, does not exceed five lacks of rupees at prefent.

Thefe five provinces of the Myforean empire, with the diftricts of Bangalore, Colar, &c. of the Carnatic-Balagaut Bejapoory, formed the whole of Hyder's dominion in the war 1768; and were calculated then to yield in all a net income of 119 lacks and an half of rupees, allowing an eftablifhment of 115,000 village peons to enforce the collections, and maintain internal peace.

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6. Petty ftates of Hindoo rajahs, fituated on the weft and north of the Hendery and Tumbhudra rivers, to the confines of Goa, and the Merhatta territories of Toorgul, Raibaug, and Meritch, forming the jageer of Perferam Bow beyond the fouthern branch of the Kiftnah. Some of thefe rajahfhips had been entirely conquered by the Mogul; but the moft confiderable of them never were fubdued by any Muffulman power until Hyder's conqueft of them between the years 1774-7, though different diftricts from each may have been difmembered for a while by the Mogul deputies of the Carnatic-Balagaut Bejapoory, and therefore annexed in the accounts of the revenue of that circar. The frontier forts, and dependencies, of Goojunder-gur, Darwar, Badamy, &c. near the fouthern branch of the Kiftnah towards the Merhattah dominion, compofed at one time the jageer of Ragenaut Row, and have frequently changed their mafters. They fell ultimately to Tippoo at the peace of 1784, but he was forced to pay chout for them to the Pefhwa. On the whole, all thefe ftates, of great indefinite extent and extremely poor, yield only a precarious revenue of 16 lacks of rupees to the Myforean.

7. Carnatic Balagaut Bejapoory, confifting, under the Mogul, of one circar of the fame name, and of which the capital was Serah. It comprehended 51 pergunnahs, of which Bangalore, Colar, &c. on the fouth, were feized by Hyder, immediately when he poffeffed himfelf of Myfore; but Anantpour, Penekonda, &c. on the north, with the reft of the Merhattah ftate of Gooty, did not fall into his hands until the year 1776, when he overcame and made prifoner the proprietor Morarow, who had rendered fignal fervice to the Englifh in the preceding Myforean war The whole circar was rated at a jumma *kaumil*, or total grofs revenue on the king's books, of 43,916,396 rupees: but the accuracy of this valuation is much to be doubted: becaufe it does not appear from the regifters of the foubah of Bejapour that the Mogul government ever afcertained the *dehatee* or village collections of either of the Carnatics, or went into greater detail than to fix the ftandard affeffment of the different pergunnahs; and becaufe the amount thus ftated feems too large a receipt from a country naturally fo poor and deftitute of commerce, probably in all its dimenfions not exceeding 10,000 fquare miles, and which was fo liable to internal difturbances or foreign invafion, that notwithftanding the number of ftrong holds to be found in it, every town required and has its own particular fortification. However this may be, the revenue actually forthcoming to Hyder in 1778, after defraying charges of collection and an eftablifhment of about 30,000 village peons, was only 3,205,206 rupees.

8. Carnatic-Balagaut-Hydrabady, comprehending the five circars of Sidhout, Kahmam, Ganjecottah, Gooty, and Gorrumkonda, which were fubdivived into 66 pergunnahs, rated by the Moguls kaumils 4,707,306 rupees: but from this amount is to be deducted the aggregate valuation of the pergunnahs or Chittoor, &c. now annexed to the Payengaut, together with the affeffment of the diamond-mines of Ganjecottah,

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jecottah, which are no longer productive, making in all an object of two lacks of rupees. The whole country thus defcribed, bounded by the circars of Adoni and Nundial on the north towards the Kiftnah, the Guntour circar and Carnatic Payengaut on the eaft, with that of the Balagaut Bejapoury on the fouth and weft, may in fquare dimenfions be nearly equal to this laft mentioned divifion of territory of about 10,000 fquare miles. It formed the inheritances for four generations of the Patan nabobs of Cuddapah, defcended from a collateral branch of the Sanore family, until Gooty and Gorrumkonda were taken by the Merhattahs in 1758, and then ultimately, with the remainder of Helim Khan's poffeffion, by Hyder in 1776-9. After deducting the amount of a few jageers and fome charitable land ftill left to the Mahomedans of this diftrict, with the expence of an eftablifhment at leaft of 23,000 village peons, the nett revenue of the whole province may be eftimated at 29 lacks of rupees.

9. Adoni, or circar of Imtiazghur on both fides of the Hendery river, fouth of the Tumbhudra or Tungubudra river, as far as and inclufive of Bellary, together with a fmall portion of the circar of Ghazipour or Nundial, difmembered from the nabobfhip of Karnool, all fituated in the foubah of Bejapour, comprehend the whole of Tippoo's conquefts and annexation to the Myforean empire, acquired fince the death of Hyder, and fubfequently to the treaty of Mongalore in 1784. In extent and revenue, this acquifition may be confidered of little account. The former cannot exceed 5000 fquare miles, and the latter fcarcely feven lacks of rupees, reckoning the petty zemindary of Bellary. But the fort of Adoni is of a confiderable importance, as being of the kind (on an infulated rock) thought the ftrongeft in Hindoftan, without excepting Dowlatabad or Gualior. It was ever the favourite ambitious object of conqueft to Hyder, the Merhattas and Nizam; and preferved only through the cautious policy of its proprietor, Baffalut Jung. When it came by inheritance into the weak inexperienced hands of his fon Mohabet Jung, it fell by treachery under the dominion of Tippoo; together with all its territorial dependencies, except the circar of Raichore, between the Kiftnah and Tumbhudra.

The extent of Tippoo's dominion, according to the lateft maps, has been computed at 80,000 fquare geographic miles, or 92,666 Englifh. Thus confidering it a triangle, of which the bafe runs nearly parallel to and not far fouth of the Kiftnah, in a longitudinal line of 340 Englifh miles, about the 16th degree of north latitude, or from the pagoda of Tripanti in the north-eaft angle to Kittoor in the north-weft. Towards the frontiers of Goa, of Bari, and the Merhattahs; then, one of its fides, along the Balagaut or mountainous ridge of the Malabar coaft, will be found to ftretch in a horizontal diftance 500 miles foutherly to the extreme point and pafs of Goodalore in that quarter; and its other fide from thence northerly, touching the frontiers of the Carnatic Payengaut, 470 miles in a parallel direction to the Coromandel coaft, until it reaches the further corner of the circar of Kahmam near the firft mentioned point at the pagoda of Tripanti. Beyond thefe three lines, the plains bordering the fhores of Canara aad Malabar are the only exclufive territory of confiderable extent belonging to Tippoo: and to balance it in fome degree, within the area of the triangle defcribed, it is to be remembered are fituated the independent or environed ftates of Sanore, Koork, &c. if not alfo a part of Karnool and Raichore. As the whole face of the country is known to be rugged, in many parts defolate, badly watered, and generally rifing abruptly near half a mile of perpendicular height above the level of the fea; it cannot be fuppofed that the foil is equally fertile with the lower lands of Hindoftan. In fact, though every advantage of induftry and population be allowed to a defpotic government, which cherifhes a numerous peafantry in exclufion of great intermediate landholders, yet the produce of the Balagaut altogether confifts merely of the neceffaries of life, and thefe of the coarfeft kind; juft enough to fubfift the inhabitants, after making fufficient provifion in pafture for the extraordinary number of horfes and other cattle maintained there for the military eftablifhment; while, in the Payengaut on the Malabar coaft, fome pepper, cardamums, fandal wood, and furplus grain beyond internal confumption, conftitute the only commercial funds of natural growth within the whole circle of the Myforean dominion. As to manufactures, except thofe of Salem and Bellary, if any exift in the country, they are not confiderable enough to be known abroad.

From the foregoing view of the nature, produce, and revenues of the Myforean empire, it may be concluded that the Englifh could have no lucrative profpects in their late conteft with Tippoo Sultan; but were compelled, for the prefervation of their own poffeffions in that quarter, to undertake his reduction as a reftlefs, cruel, ambitious, and depradatory neighbour. This has accordingly been effected by the good conduct of Lord Cornwallis; who, in the iffue of the war, has obliged him to cede half his dominions to the Company and its allies, adjacent to their refpective boundaries, and fubject to their felection.

MYSTERIES.

I
The gradual introduction of myfteries into religion.

RELIGION, in its original form, was fimple and intelligible. It was intended for the inftruction and edification of all ranks of men; and of confequence its doctrines were on a level with vulgar capacities. The Jewifh difpenfation was openly practifed: nothing was performed in fecret; every article was plain, open, and acceffible. The divine author of the Chriftain œconomy commanded his difciples to preach his doctrine in the moft public manner; "What ye have heard in fecret (fays he) preach openly; and what I have taught you in private teach ye publickly, and proclaim it on the houfe-tops:" Such are the charms of truth, and fuch the character of that religion which came down from heaven, that they, as it, were,

were, "delight in the light, and lift up their voice in the streets, and cry in the chief places of concourse."

But such is the depravity of the nature of man, that the noblest institutions degenerate in his hands. Religion itself, originally pure, simple, and amiable, under his management has often been transformed into pollution, perplexity, and deformity. The ministers of religion, whose province it was to guard the sacred deposit, and to secure it from foreign and spurious intermixtures, have generally been the first innovators, and the first and most industrious agents in corrupting its integrity and tarnishing its beauty. Avarice and ambition prompted that class of men to deviate from the original plainness and simplicity of religious institutions, and to introduce articles, rites and usages, which might furnish them with opportunities of gratifying these unhallowed and insatiable passions. Hence distinctions unknown to pure and undefiled religion were fabricated, and that heavenly institution, heretofore one, simple, indivisible, was divided into two partitions: the one popular and public: the other dark, secret, and mysterious. The latter of these we intend as the subject of this article.

2 Etymology and import of the term. The English word *mystery* is derived from the Greek μυστηριον; and in its modern acceptation imports something above human intelligence, something awfully obscure and enigmatical; any thing artfully made difficult; the secret of any business or profession. The word is often used by the founder of the christian religion, and more frequently by his apostles, especially St Paul. In these cases, it generally signifies those doctrines of Christianity which the Jews, prior to the advent of the Messiah, either did not or could not understand. The favourite doctrines of the Trinity in Unity, and the Unity in Trinity; the union of two natures in one and the same person, &c. were generally called *mysteries*, because they were thought infinitely above human comprehension. All these significations are out of the question at present. Our intention in this article is to lay before our readers the fullest and fairest account we have been able to collect, of those απορρητα, or *secret rites*, of the pagan superstition, which were carefully concealed from the knowledge of the vulgar, and which are universally known under the denomination of *mysteries*.

3 Object of this article.

The word Μυστηριον is evidently deduced from Μυστηρ; but the origin of this last term is not altogether so obvious. The etymologies of it exhibited by the learned are various; some of them absurd and inconsistent, others foolish and futile. Instead of fatiguing our readers with a detail of these, which would be equally unentertaining and uninteresting, we shall only produce one, which to us appears to come nearest the truth. The mysteries under consideration at present were certainly imported into Greece from the East. In those regions, then, we ought of course to look for the etymology of the word. *Mistor* or *mistur*, in Hebrew, signifies "any place or thing hidden or concealed." As this word implies a kind of definition of the nature of the thing intended, and as it is one of the excellencies of original languages to apply vocables with this propriety, we find ourselves strongly inclined to assign the word *mistur* as the root of the form Μυστηρ, *myster*

We have already observed, that the avarice and ambition of the pagan priesthood probably gave birth to the institution of the mysteries. To this observation we may now add, that the ministers of that superstition might possibly imagine, that some articles of the ritual were too profound to be comprehended by the vulgar; others, too sacred to be communicated to a description of men whom the institutions of civil society had placed in a situation not only subordinate but even contemptible. It was imagined, that things sacred and venerable would have contracted a taint and pollution by an intercourse with sordid and untutored souls. These appear to us the most probable motives for making that odious and pernicious distinction between the popular religion and that contained in the sacred and mysterious ritual. 4 Motives to the introduction of the mysteries.

The learned Bishop Warburton is positive, that the mysteries of the Pagan religion were the invention of legislators † and other great personages, whom fortune or their own merit had placed at the head of those civil societies which were formed in the earliest ages in different parts of the world. It is with reluctance, and indeed with diffidence, that we presume to differ in our sentiments from such respectable authority. Whatever hypothesis this prelate had once adopted, so extensive was his reading, and so exuberant his intellectual resources, that he found little difficulty in defending it by an appearance of plausibility, if not of rational argumentation. The large quotations he has adduced from Plato and Cicero, do indeed prove that the sages and legislators of antiquity sometimes availed themselves of the influence derived from the doctrines of the mysteries, and from the authority they acquired by the opinion of their having been initiated in them; but that those men were the inventors and fabricators of them, is a position for which his quotations do not furnish the most slender presumption. At the same time, we think it not altogether certain, that the doctrine of a divine providence, and a future state of rewards and punishments, were revealed in the mysteries with all the clearness and cogency which is pretended by his Lordship. 5 The hypothesis of Warburton ill founded.

† Divine Leg.

But granting that the fabric was raised by the hands of sages and legislators, we imagine it would be rather difficult to discover what emolument that description of men could propose to derive from the enterprise.—The institution was evidently, and indeed confessedly, devised to conceal from the million those very doctrines and maxims, which, had they known and embraced them, would have contributed most effectually to dispose them to submit to those wise regulations which their governors and legislators wished most ardently to establish. Experience has taught, that nothing has a mere commanding influence on the minds of the vulgar, than those very dogmas, which, according to the Bishop, were communicated to the initiated. A conviction of the Unity of the Deity, of his wisdom, power, goodness, omnipresence, &c. the steady belief of the immorality of the human soul, and of a future state of rewards and punishments, have in all ages, and in all countries, proved the firmest supports of legal authority. The very same doctrines, in the dawn of christianity, contributed of all other methods the most effectually to tame and civilize the savage

savage (A) inhabitants of the northern regions of Europe. Supposing those principles to have been inculcated by the mysteries, the most prudent plan legislators could have adopted, would have been to publish them to all mankind. They ought to have sent forth apostles to preach them to the savages whom they had undertaken to civilize. According to the learned prelate, they pursued the opposite course, and deprived themselves of those very arms by which they might have encountered and overthrown all the armies of savagism.

6 Mysteries of Eleusis said to be revealed publicly in Crete.

Of all the legislators of antiquity, the Cretan alone was prudent enough to see and adopt this rational plan. Diodorus the Sicilian informs us*, that the mysteries of Eleusis, Samothracia, &c. which were elsewhere buried in profound darkness, were among the Cretans taught publicly, and communicated to all the world. Minos, however, was a successful legislator; and his intercourse with Jupiter Idæus extended his influence and established his authority. He was not under the necessity of calling in the mysteries to his assistance: on the contrary, it is highly probable that the universal knowledge of the doctrines of the mysteries among his countrymen contributed in a considerable degree to facilitate his labour, and ensure his success.

* Lib. 5.

The divine Author of the Christian œconomy, viewed in the light of a human legislator, saw the propriety of this procedure. Nothing was concealed in his institutions; nothing was veiled with mystery, or buried in darkness. The success was answerable to the wisdom of the plan. The million flocked to the evangelical standard: the gospel was preached to the poor, to the illiterate and the vulgar; and the meanest of mankind eagerly embraced its maxims. Wherever it prevailed, it produced civilization, morality, sobriety, loyalty, and every other private and social virtue.—Upon the supposition that the mysteries had contained and inculcated the principles and practices which the prelate supposes they did, the civilizers of mankind, legislators, magistrates, and princes, ought to have combined to make them public for the sake of their own tranquillity, and the more effectual support of their authority and influence.

7 Mysteries the offspring of Egyptian priestcraft; but

Upon the whole, we are inclined to believe that the mysteries were the offspring of Egyptian priestcraft. They were instituted with a view to aggrandise that order of men, to extend their influence, and enlarge their revenues. To accomplish those selfish projects, they applied every engine towards besotting the multitude with superstition and enthusiasm. They taught them to believe, that themselves were the distinguished favourites of heaven; and that celestial doctrines had been revealed to them, too holy to be communicated to the profane rabble, and too sublime to be comprehended by vulgar capacities. It is, we confess, exceedingly probable, that after the mysteries were instituted, and had acquired an exalted reputation in the world, legislators, magistrates, judges, and potentates, joined in the imposture, with the same views and from the same principles. Princes and legislators, who found their advantage in overawing and humbling the multitude, readily adopted a plan which they found so artfully fabricated to answer those very purposes. They had interest enough with the sacerdotal (B) mystagogues, to induce them to allow them to participate in those venerable rites which had already established the authority of that description of men in whose hands they were deposited. The views of both parties were exactly congenial. The respect, the admiration, and dependence of the million, were the ultimate objects of their ambition respectively.—Priests and princes were actuated by the very same spirit. The combination was advantageous, and of consequence harmonious. For these reasons we have taken the liberty of differing from his lordship of Gloucester with respect to the persons who first instituted the secret mysteries of the Pagan religion.

8 adopted by legislators, &c.

9 Hypothesis of Mosheim.

Another writer, of considerable reputation in the republic of letters, is of opinion, that the mysteries were entirely commemorative; that they were instituted with a view to preserve the remembrance of heroes and great men, who had been deified in consideration of their martial exploits, useful inventions, public virtues, and especially in consequence of the benefits by them conferred on their contemporaries.—According to him, the (C) mysteries of Mithras were established for this very purpose. It would be no difficult matter to prove that the Persian deity of that name was the sun, and that his name and insignia jointly ascertain the truth of this assertion. The same writer extends this observation to the mysteries of the Egyptians, Phœnicians, Greeks, Hetruscans; and in a word, to all the institutions of that species throughout the world. In opposition to this singular opinion, it may be argued, we think with some show of reason, that the method of preserving the memory of great and illustrious men generally adopted, was the establishing festivals, celebrating games, offering sacrifices, singing hymns, dances, &c. We can recollect no secret mysteries instituted for that purpose at least in their original intention. If any usage of the commemorative kind was admitted, it was superinduced at some period posterior to the primary institution. At the same time, upon the supposition that the orgia of Bacchus were the same with those of the Egyptian Osiris, and that the mysteries of Ceres exhibited at Eleusis were copied from those of the Egyptian Isis, and allowing that the former was the sun, and the latter the moon; it will be difficult to find out the human persons whose exploits, adventures, inventions,

10 singular and indefensible.

(A) The Germans, Russians, and Scandinavians, who were never thoroughly civilized till the gospel was preached among them.

(B) The mystagogues were the ministers who acted the chief part in celebrating the mysteries.

(C) Principio hoc ego quidem controversia vacare, arbitror, mysteria quæ vocantur, ritus fuisse idcirco institutos, ne memoria periret veterum beneficiorum, inventorum, fatorum rerum gestarum quibus primi populorum conditores, aut alii præclari homines, decus nomen, et famam, inter suos sibi comparaverant. Neque hæc cuiquam sententia mirabilis videri poterit. *Cud. Syst. Intellect. ed Moshemii*, p. 329.

inventions, &c. were intended to be immortalized by those institutions. Upon the whole, the mysteries were performed in secret; they were intended to be communicated only to a few: of course, had they been instituted with a view to immortalize the memory of heroes and great men, the authors would have acted the most foolish and inconsistent part imaginable.—Instead of transmitting the fame of their heroes with eclat to posterity, they would by this procedure have consigned it to eternal oblivion.

11
Our first position supported by the character of the priests of Egypt.

We must then recur to our first position. The mysteries were the offspring of bigotry and priestcraft; they originated in Egypt, the native land of idolatry. In that country the priesthood ruled predominant. The kings were ingrafted into their body before they could ascend the throne. They were possessed of a third part * of all the land of Egypt. The sacerdotal function was confined to one tribe, and was transmitted unalienably from father to son. All the orientals, but more especially the Egyptians, delighted in mysterious and allegorical doctrines. Every maxim of morality, every tenet of theology, every dogma of philosophy, was wrapt up in a veil of allegory and mysticism. This propensity, no doubt, conspired with ambition and avarice to dispose them to a dark and mysterious system of religion. Besides, the Egyptians were a gloomy † race of men; they delighted in darkness and solitude. Their sacred rites were generally celebrated with melancholy airs, weeping, and lamentation. This gloomy and unsocial bias of mind must have stimulated them to a congenial mode of worship. In Egypt then we are to search for the origin of the mysteries. Both the nature of the institution and the genius of the people confirm this position; and historians, both ancient and modern, are agreed in admitting the certainty of the fact.

* Diodor. Sicul. Lib. I.

† Plutarch.

12
The Osiris the Isis of Egypt the Bacchus and Ceres of Greece.

The Osiris of Egypt, every body knows, was the original Bacchus; as the Isis of the same country was the Ceres of the Greeks. The rites of Osiris were performed with loud shrieks and lamentations when he was put into the coffin; and with the most extravagant mirth, when he was in a manner raised from the dead, or supposed to be found again. Their hymns were upon the whole always composed in melancholy affecting strains; and consisted of lamentations for the loss of Osiris, the mystic flight of Bacchus, the wandering of Isis, and the sufferings † of the gods. The Canaanites, who were a kindred tribe of the Mizraim or Egyptians, imitated them in their sacred rites. At Byblus, Berytus, Sidon, and afterwards at Tyre, they used particularly mournful dirges for the death of Adonis or Tammuz †, who was the same with the Egyptian Osiris, *i. e.* the sun.

† Plut. If. et Osir.

† Ezek. Chap 8. and Nonni Dionys.

13
Death of Osiris and wanderings of Isis.

The Egyptians, then, naturally inclined to gloom and secrecy, instituted a mode of worship congenial with their natural disposition of mind. The recess of the sun towards the southern hemisphere, was the death † of Osiris; the wanderings of Isis in search of her husband and brother, allegorically imported the longings of the earth * for the return of the fructifying influence of the solar heat.

† Macrob. Saturn.

* Plut. If. et Osir.

When that luminary returned towards the summer solstice, and grain, trees, fruits, herbs, and flowers adorned the face of nature, another festival was celebrated of a very different complexion from that of the former. In this season all Egypt was dissolved in the most extravagant mirth and jollity. During the celebration of those festivals, the priests formed allegorical representations of the sun and the earth (D). They personified the one and the other, and allegorized their motions, aspects, relations, sympathies, accesses, recesses, &c. into real adventures, peregrinations, sufferings, contests, battles, victories, defeats, and so forth. These, in process of time, were held up to the vulgar as real occurrences; and these in a few ages became the most essential articles of the popular creed. From this source were derived the conquests of Dionysius or Bacchus, so beautifully exhibited by Nonnus in his Dionysiacs; the wanderings of Io, wonderfully adorned by Æschylus; and the labours of Hercules, afterwards usurped by the Greeks.

14
The Egyptians deified departed heroes.

Whether the Egyptians deified mortal men in the earliest ages has been much controverted. Jablonski * has taken much pains to prove the negative. Diodorus ‡ assures us that they paid their monarchs a kind of divine adoration, even in their lifetime. Plutarch tells us plainly § that some were of opinion that Isis, Osiris, Horus, Anubis, Typhon, were once mortal persons, who were exalted into dæmons after their death. The Sicilian, in his history of Isis and Osiris, Pan, Hermes, &c. plainly represents them as human personages; and informs us, that the Egyptians imagined, that after their decease they transmigrated into particular stars. From these authorities, we are inclined to believe that the Egyptians, as well as the other pagans, did actually deify persons who had distinguished themselves in their days of nature by prowess, wisdom, useful arts, and inventions. This was a constant practice among the Greeks, who probably learned it from the people in question.

* Panth. Egypt.
‡ Lib i.
§ If. et Osir.

15
Secrets respecting the objects of worship revealed in the mysteries.

The exploits of those heroes had been disguised by allegorical traditions and hieroglyphical representations. They had been magnified beyond all dimensions, in order to astonish and intimidate the vulgar. They had been interlarded with the most extravagant fables, in order to gratify their propensity towards the marvellous. All these secrets were developed in the mysteries. The catechumens (E) were informed of every particular relating to the birth, the life, the exploits, the adventures, the misfortunes, and decease of those heroic personages, and when, and by what means, they had attained to the high rank of divinities. At the same time we think it highly probable, that those demigods were represented in their state of exaltation and heavenly splendour. The magicians of Egypt were abundantly qualified for exhibiting *angels in machines.* The souls of virtuous men, who had not been eminent enough to merit the honour of deification, were shown in all the perfection of Elysian felicity; and perhaps the

(D) Isis, among the Egyptians, sometimes signified the moon, and sometimes the earth.
(E) Catechumens were pupils who were learning the elements of any science.

the souls of tyrants, and of the children of (F) Typhon, were shown in Tartarus, suffering all the extremes of infernal punishment.. From these exhibitions the mystagogues might naturally enough take occasion to read their pupils suitable lectures on the happy tendency of a virtuous conduct, and the dishonour and misery consequent upon a contrary course. They might set before them immortal renown, deification, and elysium, on the one hand, and eternal infamy and misery on the other. This will probably be deemed the chief advantage accruing from this institution.

16 Chief advantage of the mysteries.

Besides the communications above-mentioned, the catechumens were taught many secrets of physiology, of the nature of the phenomena of the world. This Pharnutus* every where affirms, especially in his last book towards the end. Plutarch too informs us, that many of the Greek philosophers were of opinion, that most of the Egyptian fables were allegorical details of physical operations. Eusebius acquaints us §, that the physiology, not only of the Greeks, but likewise of the barbarians, was nothing else but a kind of science of nature, a concealed and dark theology, involved in fable and fiction, whose hidden mysteries were so veiled over with enigmas and allegories, that the ignorant million were as little capable of comprehending what was said as what was suppressed in silence. This, says he, is apparent from the poems of Orpheus and the fables of the Phrygians and Egyptians. Dionysius of Halicarnassus likewise observes ‡, that the fables of the Greeks detail the operations of nature by allegories. Proclus § makes the same observation concerning the people in question. The Egyptians, says he, taught the latent operations of nature by fables.

* De Nat. Deorum

§ Prop. Evangel.

‡ Antiq. Rom.

§ in Tim.

87 Physiological secrets expounded in the mysteries of Egypt.

These physiological secrets were no doubt expounded to the initiated; and that the Egyptian priests were deeply skilled in physiological science, can scarce be questioned, if we believe that Jannes and Jambres rivalled Moses with their enchantments. The preceding detail comprehends all that was revealed to the Epoptæ in the original Egyptian mysteries. What articles might have been introduced afterwards we cannot pretend to determine.

Be that as it may, one thing is certain, namely that the vulgar were excluded from all those choice secrets, which were carefully reserved for the nobility and sacerdotal tribes. To them it was given to know the mysteries of the kingdom of darkness; but to those who were without, all was mystery and parable. While the laity fed on husks, the clergy and quality feasted on royal dainties. The priests who had devised these allegories understood their original import, and bequeathed it as an inestimable legacy to their children. Here then we have the primary object of the mysteries, namely, to develope to the initiated the original and rational import of those allegorical and mystical doctrines which were tendered to the uninitiated, wrapt up in impenetrable allegory and obscurity. To the former, these were communicated and explained: The latter were obliged to stand at an awful distance, and retire as the *Procul, O procul este profani*, thundered in their ears.

These allegorical traditions originated in Egypt, (see MYTHOLOGY). It was the general bias of the oriental genius. The Egyptians, however according to the most authentic accounts (G), were the greatest proficients in that science. The original subject of these institutions were, we imagine, the articles we have specified above: but in process of time, according to the natural course of things, numerous improvements were made, and many new rites, ceremonies, usages, and even doctrines were superinduced, which were utterly unknown to the original hierophants (H). Simplicity is for the most part one of the distinguishing characters of a new institution; but succeeding architects generally imagine that something is still wanting to complete the beauty, the regularity, the uniformity, the magnificence, and perhaps the conveniency of the structure. Hence, at length, it comes to be so overloaded with adventitious drapery, that its primary elegance and symmetry is altogether defaced. This was the case with the earliest Egyptian mysteries. Their subject was at first simple and easy to be comprehended; in time it became complex, intricate, and unintelligible.

18 Temples where the mysteries were celebrated.

In order to celebrate those mysteries with the greater secrecy, their temples were so constructed as to favour the artifice of the priests. The fanes, in which they used to execute their sacred functions, and to perform the rites and ceremonies of their religion, were subterraneous apartments, constructed with such wonderful skill and dexterity, that every thing that appeared in them breathed an air of solemn secrecy. Their walls were covered with hieroglyphic paintings and sculpture, and the altar was situated in the centre of the apartment. Modern* travellers have of late years discovered some vestiges of them, and bear witness to the above description of those dark abodes (I). In those subterraneous mansions, which the priests of that ingenious nation had planned with the most consummate skill, the kings, princes, and great men of the state, encountered the dangers and hardships contrived to prove their prudence, fortitude, patience abstinence &c. These were appointed to try their merit; and by these the hierophants were enabled to decide whether or not they were duly qualified for receiving that benefit. Upon those occasions we may believe, abundance of those magical tricks were exhibited, for which the magicians of Egypt were so much celebrated among the ancients. The strange and astonishing sights, the alternate successions of light and darkness, the hideous spectres exposed to view, the frightful howlings re-echoed by these infernal domes, the scenes of Tartarus and

* Nardon, Shaw, Pococke, &c.

(F) Typhon was the evil genius, or devil of the Egyptians.

(G) As early as the age of Joseph, the Egyptians were skilled in the interpetations of dreams, divinations, &c. and in the age of Moses they were become wise men, magicians, &c.

(H) Hierophant imports a priest employed in explaining the doctrines, rites, &c. communicated to the initiated.

(I) See an excellent description of these subterraneous abodes, and of the process of probation carried on there, in a French romance, intitled *The life of Sethos* and Elysium, exhibited alternately and in quick succession, must have made a deep and lasting impression on the mind of the affrighted votary (K). These scenes we shall describe more fully in the sequel.

19 The Grecian infernal regions copied from the Egyptian mysteries.

From the scenes exhibited in celebrating the Egyptian mysteries, especially those of Isis and Osiris, the Greeks seem to have copied their ideas of the infernal regions, and the subterraneous mansions of departed souls. Many colonies of Egyptians settled in Greece. From these the ἀοιδοὶ (L), or most early bards of Greece, learned them imperfectly. Of course, we find Homer's account of the infernal regions, and of the state of departed souls, lame and incoherent. Succeeding bards obtained more full and more distinct information. Euripides and Aristophanes seem to have paved the way for the prince of Roman poets. Plato* and some of the other philosophers have shown by their descriptions or allusions, that the whole apparatus of Tartarus and elysium had become a hackneyed topic some centuries before Virgil was born. This incomparable poet borrowed his ideas from Homer, Aristophanes, Euripides, Plato, &c. These, under his plastic hand, in the sixth Æneid, grew into a system beautiful, regular, uniform, and consistent. The materials he has employed were created to his hand; he had only to collect, polish, arrange, and connect them.—The sentiments collected from the Platonic philosophy, and the inimitable episode copied from the annals of Rome, by the masterly skill which he has displayed in the application of them, form the chief excellencies of the piece. For the rest, he could well dispense with going to Eleusis (M): every old women in Athens and Rome could repeat them.

* Phædo.

20 Mysteries brought from Egypt into Persia and Greece

Egypt was then the native land of mysteries as well as of idolatry. Every god and goddess respectively had their mysteries: but as those of Isis and Osiris were the most celebrated, they of course became principal objects of pursuit as well as of imitation to the neighbouring nations. These, as is generally believed, were carried into Persia by Zoroastres, or Zerdusht, by whom they were consecrated to Mithras. On these we shall make some observations on the sequel.—Orpheus imported them into Thrace: Cadmus brought them into Bœotia, where they were sacred to Bacchus. Inachus established them at Argos in honour of Juno, the same with Isis (N); Cyniras in Cyprus, where they were dedicated to Venus. In Phrygia they were sacred to Cybele, the mother of the gods,

Our learned readers, who will probably reflect that the Egyptians were in ancient times inhospitable to strangers, will perhaps be surprised that this fastidious and jealous people were so ready to communicate the arcana of their religion to foreigners.—But they will please to recollect, that a great part of Greece was planted with colonies from Egypt, Phœnicia, Palestine, &c. This we could easily prove, did the bounds prescribed us admit such a digression. Orpheus, if not an Egyptian, was at least of oriental extraction. Inachus, Cadmus, and Melampus, are universally allowed to have been Egyptians. Frechtheus, in whose reign the Eleusinian mysteries were established, was an Egyptian by birth, or at least sprung from Egyptian ancestors. The Egyptians, then, in those early ages, did not view the Greeks in the light of aliens, but as a people nearly related either to themselves or the Phœnicians, who were their brethern. Upon this connection we imagine it was, that in later times most of the sages of Greece, aspecially of Athens, found so hospitable a reception among that people. They probably viewed them in the light of propagandi; apostles able and willing to disseminate their idolatrous rites. This observation, which might be supported by numberless authorities, did the nature of the present inquiry permit, will, we think, go a great way towards obviating the objection.

21 Mysteries of Mithras Bacchus, and Ceres, the most august.

Although, as has been observed, every particular deity had his own peculiar mysterious sacred rites, yet of all others those of Mithras, Bacchus (O), and Ceres, were deemed the most august, and were most universally and most religiously celebrated. To these, therefore, we shall in a good measure confine ourselves upon this occasion. If our readers shall become intimately acquainted with these, they may readily dispense with the knowledge of the rest, which are, indeed, no more than streams and emanations from these sources. We shall then, in the first place, present to our readers a brief sketch of the mysteries of Mithras.

Mithras, or according to the Persian, *Mihr*, was one of the great gods of the Asiatics. His worship was for many ages confined to Persia. Afterwards, however, it was propagated so far and wide that some have imagined they had discovered vestiges of it even in Gaul. *Mihr*, according to Dr Hyde*, signifies love, and likewise the *Sun*. If we might presume to differ from so respectable an authority, we should conjecture that it is a cognate of the Hebrew word *Muhir*, "excellentia, prestantia," That there was an analogy between the Hebrew and old Persian, is generally admitted by the learned. Be that as it may, Mithras was the sun (P) among the Persians; and in honour of

* Relig. vet. Persarum.

(K) Persons who had descended into Trophonius's vault were said to have been so terrified with shocking sights, that they never laughed during the remainder of their lives.

(L) These were strolling poets like our minstrels; who frequented the houses of the great men of Greece, and entertained the company upon public occasions with singing and tales of other times.

(M) Bishop Warburton has, with much ingenuity, and a vast profusion of reading, endeavoured to prove that Virgil borrowed the whole scenery of the sixth Æneid from the sources mentioned in the text.

(N) Isis was the moon, and the original Juno was the same planet.

(O) Bacchus was the Osiris of the Egyptians, and Ceres was the Isis of the same people.

(P) Mosheim, in his notes on Cudworth's Intellectual System, page 330, has taken much pains to prove that Mithras was a deified mortal; but we cannot agree with that learned man in this point.

22 Account of the mysteries of Mithras.

of that luminary this institution was established. Mithras, according to Plutarch (Q), was the middle god between Oramaz and Ariman, the two supreme divinities of Persia. But the fact is, the solar planet was the visible emblem of Oramaz, the good genius of the Persian tribes, and the same with the Osiris of the Egyptians. From these people, some have imagined that Zoroastres (R), or Zerdusht, burrowed his mysteries of Mithras. To this opinion we cannot give our assent, because the probationary trials to be under gone by the candidates among the former were much more savage and sanguinary than among the latter.—Both, however, were instituted in honour of the same deity, and probably the scenes exhibited, and the information communicated in both were analogous; a circumstance which perhaps gave birth to the opinion abovementioned.

The grand festival of Mithras was celebrated six days, in the middle of the month Mihr (S). Upon these days, it was lawful for the kings of Persia to get drunk and dance. On this festival we imagine, the candidates for initiation, having duly proved their vocation, were solemnly admitted to the paticipation of the mysteries.

Zoroastres (T) worshipped Mithras, or the Sun, in a certain natural cave, which he formed into a temple, and filled up in a manner exactly mathematical. There Mithras was represented as presiding over the lower world with all the pomp of royal magnificence. In it too were seen the symbols of Mithras and of the word, philosophically and mathematically exhibited, to be contemplated and worshipped. This deity was sometimes represented as mounted on a bull, which he is breaking, and which he kills with a sword. On some bas reliefs still existing, he appears as a young man with his tiara turned upward, after the manner of the Persian kings. He is clothed with a short tunic and breeches, after the Persian fashion. Sometimes he wears a small cloke. By his sides are seen other human figures, with tiaras of the same fashion on their heads, but without clokes. One of these figures commonly holds in his one hand a torch lifted up; in the other one turned downward. Sometimes over the cave is seen the chariots of the sun and moon, and divers constellations, such as cancer, scorpion, &c.

23 Probationary exercises previous to initiation.

In one of those caves the ceremonies of initiation were performed; but before the candidate could be admitted, he was forced to undergo a course of probationary exercises, so numerous and so rigorous that very few had courage and fortitude enough to go thro' them. He was obliged to live a life of virtue and abstinence for a space of seven years previous to the period of his initiation. Some months before it he was obliged to submit to a long and austere fast, which continued fifty days. He was to retire several days to a deep and dark dungeon, where he was successively exposed to all the extremes of heat and cold. Meantime he frequently underwent the bastinado, which the priests applied without mercy. Some say this fustigation continued two whole days, and was repeated no less than 15 times. In the course of these probationary exercises, the candidate was generally reduced to a skeleton; and we are told, that there have been several instances of persons who have perished in the attempt.

Upon the eve of the initiation, the aspirant was obliged to * brace on his armour, in order to encounter giants and savage monsters. In those spacious subterraneous mansions a mock hunting was exhibited. The priests and all the subordinate officers of the temple, transformed into lions, tigers, leopards, boars, wolves, and other savage creatures, assailed him with loud howlings, roaring, and yelling, and every instance of ferine fury. In those mock combats, the hero was often in danger of being really worried, and always came off with bruises and wounds. Lampridius informs us, that when the emperor Commodus was initiated, he actually carried the joke too far, and butchered one of the priests who attacked him in the figure of a wild beast. The Persians worshipped Mithras or the Sun by a perpetual fire: hence the votary was obliged to undergo a fiery trial; that is, to pass seven times through the sacred fire, and each time to plunge himself into cold water. Some have made these probationary penances amount to 80; others have thought that they were in all only 8. As we find no good authority for either of these numbers, we think ourselves at liberty to hazard the following conjecture: The number *seven* was deemed sacred over all the east. The Mythriac penances we imagine were either seven, or if they exceeded it, were regulated by seven repetitions of that number. The candidate having undergone all these torturing trials with becoming patience and fortitude, was declared a proper subject for initiation. But before his admission he was obliged to bind himself by the most solemn oath, with horrible imprecations annexed, never to divulge any single article of all that should be communicated to him in the course of his initiation.

* Jul. Firmicus.

24 Oath of secrecy.

25 Revelations in the mysteries of Mithras.

What απορρητα or *ineffable secrets* were imparted to the initiated, it is impossible at this distance of time to discover with any tolerable degree of certainty. We may, however, rest assured that the most authentic tradition concerning the origin of the universe; the nature, attributes, perfections, and operations, of Oromasd: the baleful influences of Ariman; and the benign

(Q) Isis and Osiris, page 369. l. 20, from the bottom. This philosopher makes Zoroaster, according to some, 5000 years prior to the Trojan war. This date is certainly extravagant. We cannot, however, agree with some moderns, who make him contemporary with Darius Hystaspes, the immediate successor of Cambyses, because it contradicts all antiquity.

(R) M. Silohwette, Differ. V. page 17. asserts that Zoroastres was initiated among the Egyptians.

(S) The month Mihr began September 30, and ended October 30.

(T) See Dr Hyde de Rel vet. Pers. page 16, 17. Mr Bryant's Anal. vol. i. page 232. Porphyr. de autro Nymph. page 254. This philosopher often mentions the cave of Mithras, and always attributes the institution of his rites to Zoroaster.

nign effects of the government of Mithras, were unfolded and inculcated. The secret phenomena of nature, as far as they had been discovered by the magi, were likewise exhibited; and the application of their effects, to astonish and delude the vulgar, were taught both in theory and practice. The exercise of public and private virtues was warmly recommended; and vice represented in the most odious and frightful colours. Both these injunctions were, we may suppose, enforced by a display of the pleasures of Elysium and the pains of Tartarus, as has been observed above in describing the mysteries of the Egyptians.

Those initiations are mentioned by Lampridius in the life of Commodus, and likewise by Justin * and Tertullian †, who both flourished in the second century. The last of these two speaks of a kind of baptism, which washed from the souls of the initiated all the stains which they had contracted during the course of their lives prior to their initiation. He at the same time mentions a particular mark which was imprinted upon them (U), of an offering of bread, and an emblem of the resurrection: which particulars, however, he does not describe in detail. In that offering, which was accompanied with a certain form of prayer, a vessel of water was offered up with the bread. The same father elsewhere informs us, that there was presented to the initiated a crown suspended on the point of a sword; but that they were taught to say, *Mithras is my crown*. By this answer was intimated, that they looked upon the service of that deity as their chief honour and ornament.

* Dial. cum Tryphone

† De Præscript. adver. Hæret.

After that the Teletæ (X) were finished, the pupil was brought out of the cave or temple, and with great solemnity proclaimed a lion of Mithras (Y); a title which imported strength and intrepid courage in the service of the deity. They were now consecrated to the god, and were supposed to be under his immediate protection; an idea which of course animated them to the most daring and dangerous enterprises.

The worship of Mithras was introduced into the Roman empire towards the end of the republic, where it made very rapid progress. When Christianity began to make a figure in the empire, the champions for paganism thought of proposing to men the worship of this *power of benevolence*, in order to counterbalance or annihilate that worship which the Christians paid to Jesus Christ the true *Sun* of righteousness. But this mode was soon abolished, together with the other rites of paganism. The Persian grandees often affected names compounded with Mithras; hence Mithridates, Mithrobarzanes, &c.: Hence too, the precious stone callet *Mithridat* *, which by the reflection of the sun sparkled with a variety of colours. There is likewise a certain pearl of many different colours, which they call *Mithras*. It is found among the mountains near the Red Sea; and when exposed to the sun, it sparkles with a variety of dyes. We find likewise a king of Egypt of that name who reigned at Heliopolis; who being commanded in a dream to erect an obelisk to the solar deity, reared a most prodigious one in the neighbourhood of that city.

* Solinus, cap. 10.

26
Mithras said to have sprung from a rock.

The votaries of Mithras pretended that he was sprung from a rock, and that therefore the place where the mystarious ceremonies were communicated to the initieted was always a cave. Many different reasons have been assigned for the origin of this rock-born deity, most of which appear to be unsatisfactory. If our readers will be obliging enough to accept of a simple and obvious conjecture, they may take the following: A rock is the symbol of strength and stability (Z): the dominion of Mithras, in the opinion of his votaries, was firm as a rock, and stable as the everlasting hills. If our readers should not admit the probability of this conjecture, we should beg leave to remit them to the learned Mr Bryant's *Analysis of Mythology*, where they will find this point discussed with deep research and wonderful ingenuity. Whatever may have been the origin of this opinion with relation to the birth of Mithras, it is certain that some reverence to rocks and caves was kept up a long time even after the establishment of Christianity Hence the prohibition given to some of the proselytes to that religion that they should no more presume to offer up their prayers *ad petras* at the rocks (A).

We shall conclude our account of the mysteries of Mithras with a passage from Mr Anquetil, to whom we are so much indebted for what knowledge we have of the Persian theology, and in which the functions of that deity are briefly and comprehensively delineated. "The peculiar functions of Mithras are to fight continually against Ahriman and the impure army of evil genii, whose constant employment is to scatter terror and desolation over the universe: to protect the frame of nature from the demons and their productions. For this purpose he is furnished with a thousand ears and a thousand eyes, and traverses the space between heaven and earth,

(U) In allusion to this practice of imprinting a sacred mark, probably on the forehead of the initiated, we find the injunction to the angel, Ezek. chap. ix. ver. 4. and the Revelation *passim*.

(X) The mysteries were called *Teletæ*, which imports, "the rites which confer perfection."

(Y) *Tertull. adv. marc.* p. 55, The priests of Mithras were called the *lions of Mithras*, and his priestesses *lionnesses*; some say *hyænas*. The other inferior ministers were called *eagles*, *hawks*, *ravens*, &c. and on their festivals they wore masks corresponding to their titles, after the Egyptian manner, where the priests appeared at the ceremonies with masks resembling the heads of lions, apes, dogs, &c. a circumstance which furnishes a presumption that the mysteries of Mithras were of Egyptian original.

(Z) Our Saviour probably alludes to this emblem, when he talks of *building his church on a rock*; and adds, *that the gates of hell should not prevail against it*.

(A) The Caledonian druids seem to have regarded certain stones with a superstitious veneration, in which the Catholics imitated them. There are in several places of Scotland large stones, which the vulgar call *lecre* stones, *i. e.* we imagine, *lecture*.

earth his hands armed with a club or mace. Mithras gives to the earth light and sun; he traces a course for the waters; he gives to men corn, pastures, and children: to the world virtuous kings and warriors; maintains harmony, upon earth, watches over the law, &c." As the history of Mithras, and the nature of his mysteries, are not generally known, we imagined it would be agreeable to many of our readers to have the most important articles relating to that subject laid before them as it were in detail.

27 Mysteries of Bacchus.

We now proceed to the orgia, or mysteries of Bacchus, which we shall introduce with a brief history of that deity. The original Dionysus or Bacchus was the Osiris of the Egyptians, which last was the Sun (B). Whether there was an Egyptian monarch of that name, as Diodorus Siculus affirms §, has no manner of connection with the present disquisition. The Greek name of that deity is plainly oriental, being compounded of *di*, "bright;" and *nasia* or *nasa*, in the Æolic dialect *nusa*, "a prince." This name was imported from the east by Orpheus, Cadmus, or by whoever else communicated the worship of Osiris to the Greeks. That the Dionysus of the Greeks was the same with the Osiris of the Egyptians, is universally allowed. Herodotus tells us expresly †, that *Osiris* is *Dionysus* in the Greek language; Martianus Capellus, quoted above, expresses the very same idea ‖. The original Osiris was the sun; but the Dionysus or Bacchus of the Greeks was the same with the Osiris of the Egyptians; therefore the Bacchus or Dionysus of the Greeks was likewise the same luminary.

§ Lib. i.

28 Bacchus the same with Osiris.

† Lib. ii. cap. 144.

‖ Theol. Egyp. lib. 2. cap 1.

The name *Osiris* has much embarrassed critics and etymologists. The learned Jablonski §, instead of delineating the character, attributes, operations, adventures, exploits, and peculiar department assigned this deity by his votaries, has spent much of his pains on trying to investigate the etymology of his name. If it is granted, which is highly probable, that the Hebrew and Egyptian tongues are cognate dialects, we should imagine that it is actually the *Chosher* or *Oshir* of the former language, which imports, "to make rich, to become rich." Indeed the words *Osiris* and *Isis* were not the vulgar names of the sun and moon among the Egyptians, but only epithets importing their qualities. The name of the sun among that people was *Phri* or *Phry*, and that of the moon *Ioh*, whence the Greek *Io*. The term *Osiris* was applied both to the sun and to the river Nile; both which by their influence contributed respectively to enrich and fertilize the land of Egypt.

§ Panth. Egyp.

It was a general custom among the orientals to denominate their princes and great men from their gods, demigods, heroes, &c. When the former were advanced to divine honours, they were in process of time confounded with their archetypes. The original divinities were forgotten, and these upstart deities usurped their place and prerogatives. In the earliest periods of the Egyptian monarchy, there appeared two illustrious personages, Osiris and Isis. These were the children of Cronus, and being brother and sister, they were joined in matrimony, according to the custom of the Egyptians. As the brother and husband had assumed the name of the *Sun*, so the sister and consort took that of *Isis*, that is, "the woman*," a name which the Egyptians applied both to the moon and to the earth, in consequence of the similarity of their nature, their mutual sympathy, and congenial fecundity.

* Horapol-lo, cap. 3.

29 Exploits of Osiris.

Osiris having left his consort Isis regent of the kingdom with Hermes as her prime minister, and Hercules as general of her armies, quitted Egypt with a numerous body of troops, attended by companies of fauns (C), satyrs, singing women, musicians, &c. traversed all Asia to the eastern ocean. He then returned homeward through the Upper Asia, Thrace, Pontus, Asia Minor, Syria, and Palestine. Wherever he marched he conferred numberless benefits on the savage inhabitants. He taught the art of cultivating the ground, preserving the fruits of the earth, and distinguishing the wholesome and nutritive from the unwholesome and poisonous. He instructed them in the culture of the vine, and where vines could not be produced, he communicated to them the method of producing a fermented liquor from barley, very little inferior to wine itself. He built many cities in different parts of the globe, planted numerous colonies (D), and wherever he directed his course instituted just and wholesome laws, and established the rites and ceremonies of religion, and left priests and catechists of his train to teach and inculcate the observance of them. In short, he left every where lasting monuments of his progress, and at the same time of his generosity and beneficence. Where he found the people docile and submissive, he treated them with kindness and humanity: if any showed themselves obstinate, he compelled them to submit to his institutions by force of arms.

At the end of three years, he returned to Egypt, where his brother Typhon, a wicked unnatural monster, had been forming a conspiracy against his life. This traiterous design he soon after accomplished in the following manner: He invited Osiris, with some other persons whom he had gained over, to an entertainment. When the repast was finished, he produced a beautiful coffer, highly finished, and adorned with studs of gold; promising to bestow it on the person whom it should fit best. Osiris was tempted to make the experiment. The conspirators nailed down the cover upon him, and threw the coffer into the river. This coffer, which was now become the coffin of Osiris, was, they tell us, wafted by the winds and waves to the neighbourhood of Byblus, a city of Phœnicia, where it was cast on shore, and left by the waves at the foot of a tamarind tree.

30 His death.

Isis, in the mean time, disconsolate and forlorn, attended

(B) See Macrob. lib. i. cap. 21. p. 247. bottom. Diogenes Laert. in proœmio, par. 10 Martian Capel. Lib. 2. Jablonski, vol. i. lib. ii. p 145. par. 3. Plut. Isis Osir. *passim*.

(C) Men and women dressed in the habits of those rural deities.

(D) Many have thought this expedition fabulous; but the numberless monuments of Egyptian architecture, sculpture, statuary, lately discovered in the east, confirm it.

31 Wanderings of Isis in search of his body.

tended by Anubis, was ransacking every quarter in search of her beloved Osiris. At length being informed by her faithful attendant and guardian, that his body was lodged somewhere in the neighbourhood of Byblus, she repaired to that city. There, they say, she was introduced to the queen, and after (E) a variety of adventures she recovered the corpse of her husband, which, of course, she carried back with her to Egypt; but the mischievous Typhon, ever on the watch, found her on the banks of the Nile; and having robbed her of her charge, cut the body into 14 parts, and scattered them up and down. Now, once more, according to the fable, Isis set out in quest of those parts, all of which, only one excepted, she found and interred in the place where she found them: and hence the many tombs of Osiris in that country. These tombs were denominated *taposins* by the natives. Many other fabulous adventures, were ascribed to those two personages, which it is not our province to enumerate at present. If our readers should wish to be more minutely informed on this subject, they may have recourse to the authors mentioned in the last quoted author, or to the learned Mr Bryant's Analysis of Ancient Mythology, and M. Cour de Gebelin, where they will find matter enough to gratify their curiosity.

32 The mysteries of Isis and Osiris instituted in commemoration of those adventures.

To commemorate those adventures, the mysteries of Isis and Osiris were instituted; and from them both those of Bacchus and Ceres, among the Greeks were derived. Of the Egyptian solemnity, we have an exact epitome in one of the fathers of the church to the following purpose; "Here follows (says he) an epitome of the mysteries of Isis and Osiris. They deplore annually, with deep lamentations and shaved heads, the catastrophe of Osiris over a buried statue of that monarch. They beat their breasts, mangle their arms, tear open the scars of their former wounds; that by annual lamentations the catastrophe of his miserable and fatal death may be revived in their minds. When they have practised these things a certain number of days, then they pretend that they have found the remains of his mangled body; and having found them, their sorrows are lulled asleep, and they break out into immediate joy." What Maxims of morality, secrets of physiology, or phenomena of astronomy, were couched under this allegorical process, is not our business to investigate in this place. We shall only observe, that, in all probability, Osiris and Isis were sovereigns of Egypt at a very early period: that they had conferred many signal benefits on their subjects, who, influenced by a sense of gratitude, paid them divine honours after their decease; that in process of time they were confounded with the sun and the moon; and that their adventures were at length magnified beyond all credibility, interlarded with fables, and allegories, and employed in the mysteries as channels to convey a variety of instructions to the initiated.

33 Transferred to Byblus and Tyre, where Osiris was called Adonis and Bacchus;

Be that as it may, it is certain that the very same mode of worship was established at Byblus, and in after ages transferred to Tyre. The Mizraim and Chanaanim were nearly connected by blood, and their religious ceremonies were derived from the very same source. By what medium the worship of Osiris at Abydus and Tyre was connected, we shall leave others to explain; we shall only observe, that among the Phœnicians this deity obtained the names *Adonis* and *Bacchus*. The former is rather an (F) epithet than a name; the latter is evidently an allusion to the weeping and lamentation (G) with which the rites were performed. We find another name of that divinity mentioned in Scripture (H), but that term is plainly of Egyptian original; we shall now proceed to the mysteries of Osiris as they were celebrated among the Greeks and Thracians, under the name of the *Orgia* of *Dionysus* or *Bacchus**.

* Diod. Sicul. Vossius de Idol.

34 And thence imported by Cadmus into Bœotia.

Orpheus the celebrated Thracian philosopher had travelled into Egypt in quest of knowledge: and from that country, according to the most authentic accounts, he imported the bacchanalian rites and institutions. Some have affirmed that this same Orpheus being intimately acquainted with the family of Cadmus, communicated these rites to them, and endeavoured to transfer them to the grandson of that hero, which grandson became afterwards the Grecian Bacchus. It is, however, we think, much more probable, that those rites were imported from Egypt or Phœnicia, by (I) Cadmus himself, who was a native of the former country, and is thought to have spent some time in the latter, before he emigrated in quest of a settlement in Bœotia. It is said that Semele, the daughter of Cadmus, and the mother of the Grecian Bacchus, was struck with lightning at the very instant of his birth. The child, was in all probability denominated *Bacchus* (K), from the sorrow and lamentation this melancholy accident had occasioned in the family. Cadmus, in order to conceal the dishonour of his daughter, might, we imagine, convey away his infant grandson to some of his relations in Phœnicia or

(E) For the conquests and adventures of Osiris and Isis, we must send our learned readers to Diod. Sic. Bibli, l. i. and Plut. Isis and Osiris, p. 256. et seq. which we have been obliged to abridge, in consequence of the narrow limits prescribed us.

(F) Adonis is evidently the Hebrew *Adoni*, "my lord," and imports the sovereignty of the deity.

(G) Bacchus is derived from the Phœnician word *bahab*, "to weep." This was the name embraced by the Romans.

(H) Exek chap. 8. ver. 14. *tammuz* is the name of one of the months of the Egyptian year.

(I) Cadmus and Melampus, who were both Egyptians, introduced the Bacchanalia into Greece. The Egyptian or oriental name of Bacchus was *Dinusi*, that is "the prince of light." Cadmus had learned the name *Bacchus* from the Phœnicians.

(K) We have omitted the immense farrago of fable relating to the connection between Jupiter and Semele, as of little importance to our readers.

or Egypt. There he was educated and instructed in all the mysteries of Isis and Osiris, and at the same time initiated in all the magical or juggling tricks of the Egyptian priests and Hierophants. Thus accomplished, when he arrived at manhood he returned to Thebes with the traditional retinue of the original deity of the same name; and claimed divine honours accordingly. This claim, however, was not admitted without much opposition; Pentheus, another grandson of Cadmus, was torn to pieces by the frantic Bacchanalians upon mount Citheron, because he attempted to interrupt them in celebrating the orgia. Some have thought that Cadmus lost his kingdom for the same reason; but this we think is by no means probable: we should rather imagine that the old prince was privy to the whole process, and that it was originally planned by him, with a view to attract the veneration of his new subjects, by making them believe that there was a divinity in his family.

35 The actions of Osiris attributed to the Grecian Bacchus.

Be that as it may, the vain-glorious Greeks attributed all the actions of the Egyptian hero to their new Bacchus: and according to their laudable practice, engaged him in numberless adventures in which his prototype had no share. Most of those are futile and unentertaining (L). The Greeks commonly adopted some oriental personage as the hero of their mythological rhapsodies. Him they naturalised and adopted into some Grecian family, and so he became their own. To him they ascribed all the adventures and exploits of the oriental archetype from whom he was copied. Consequently in the orgia (M), every thing was collected that had been imported from the east relating to Osiris; and to that farrago was joined all that the Grecian rhapsodists had thought fit to invent in order to amuse the credulous multitude. This, however, was not the whole of the misfortune: The adventures of Osiris were described by the Egyptian Hierophants, veiled with allegorical and hieroglyphical mysteries. These the persons who imported them into Greece did not thoroughly comprehend, or if they did, they were not inclined to communicate them sound and unsophisticated. Besides, many oriental terms were retained, the import of which was in process of time lost or distorted. Hence the religious ceremonies of the Greeks became a medley of inconsistencies. The mysteries of Bacchus, in particular, were deeply tinctured with this meretricious colouring; the adventures of the Theban pretender were grafted upon those of the Egyptian archetype, and out of this combination was formed a tissue of adventures disgraceful to human nature, absurd, and inconsistent. Indeed the younger or Theban Bacchus seems to have been a monster of debauchery; whereas the Egyptian is represented as a person of an opposite character. Of course the mysteries of the former were attended with the most shocking abominations.

36 Mysteries of Bacchus spread into Greece, &c.

These mysteries, as has been observed above, were first celebrated at Thebes the capital of Bœotia, under the auspices of the family of Cadmus. From this country they gradually found their way into Greece, and all the neighbouring parts of Europe. They were celebrated once every three years (N), because at the end of three years Osiris returned from his Indian expedition. As the Greeks had impudently transferred the actions of the Egyptian hero to their upstart divinity, the same period of time was observed for the celebration of those rites in Greece that had been ordained for the same purpose in Egypt.

37 Process of their celebration.

When the day appointed for the celebration of the orgia (O) approached, the priests issued a proclamation, enjoining all the initiated to equip themselves according to the ritual, and attend the procession on the day appointed. The votaries were to dress themselves in coats of deer-skins, to loose the fillets of their hair, to cover their legs with the same stuff with their coats, and to arm themselves with thyrsi, which were a kind of spears wholly of wood entwined with leaves and twigs of the vine or ivy. It is said that the Bacchanalians, especially the Thracians, used often to quarrel and commit murder in their drunken revels; and that in order to prevent those unlucky accidents, a law was enacted, that the votaries instead of real spears should arm themselves with those sham weapons which were comparatively inoffensive. The statue of the deity, which was always covered with vine or ivy leaves, was now taken down from its pedestal, and elevated on the shoulders of the priests. The cavalcade then proceeded nearly in the following manner:

First of all, hymns were chanted in honour of Bacchus, who was called the *Power of dances, smiles, and jests*; while at the same time he was deemed equally qualified for the exploits of war and heroism. Horace, in some of his dithyrambic odes, has concisely pointed out the subjects of those Bacchanalian songs. In the collection of hymns fabulously attributed to Orpheus, we find several addressed to this deity (P), each

(L) Nonnus, an Egyptian of Pentapolis, has collected all the fabulous adventures of Bacchus, and exhibited them in a beautiful but irregular poem: To this we must refer our learned readers. Of the Dionysiacs we have a most judicious sketch, *Geblin. Calend.* p. 553. et seq.

(M) The orgia belonged to all the Mydones, but to those of Bacchus in a peculiar manner.

(N) Hence these orgia were called *Trieteria.*

(O) According to Clem. Alexand. Cohort. p. 12. Pott. the word *orgia* is derived from *orge,* which signifies "anger," and originated from the resentment of Ceres against Jupiter, in consequence of a most outrageous insult he had offered her with success. We should rather imagine it derived from the Hebrew word *argoz*, signifying a "chest or coffer," alluding to the casket which contained the sacred symbols of the god.—The Egyptians or Phœnicians might write and pronounce, argoz, *orgoz*, or in some manner nearly resembling *orgia.*

(P) These stand between the 41 and 52; one to Lenæus, or the presser; one to Libnites, or the winnower; one to Bessareus, or the vintager; one to Sabazius the god of rest; to Myses or the Mediator, &c.

each under a different title, derived from the different appellations of the god. All these names are of oriental original, and might easily be explained, did the bounds prescribed us admit of etymological disquisitions.

The hymn being finished, the first division of the votaries proceeded, carrying a pitcher of wine, with a bunch of the vine. Then followed the he-goat; an animal odious to Bacchus, because he ravages the vines. The chanting the hymns, the sacrificing the he-goat, and the revels, games, and diversions, with which the celebration of those rites was attended, gave birth to the dramatic poetry of the Greeks; as the persons habited in the dress of Fauns, Sylvians, and Satyrs (Q), furnished the name of another species of poetry of a more coarse and forbidding aspect.

38 The mysterious coffer, with its contents.

Then appeared the mysterious coffer or basket, containing the secret symbols of the deity. These were the phallus (R), some grains of sesama, heads of poppies, pomegranates, dry stems, cakes baked of the meal of different kinds of corn, salt, carded wool, rolls of honey, and cheese; a child, a serpent (S), and a fan (T). Such was the furniture of the sacred coffer carried in the solemn Bacchanalian procession. The inventory given by some of the fathers ‡ of the church is somewhat different. They mention the dye, the ball, the top, the wheel, the apples, the looking-glass, and the fleece. The articles first mentioned seem to have been of Egyptian original; the last were certainly superinduced by the Greeks, in allusion to his being murdered and torn in pieces when he was a child by the machinations of Juno, who prevailed with the Titans to commit the horrid deed. These last seem to have been memorials of his boyish play-things; for, says Maternus, "the Cretans §, in celebrating the rites of the child Bacchus, acted every thing that the dying boy either said, or did, or suffered. They like wise (says he) tore a live bull in pieces with their teeth, in order to commemorate the dismembering of the boy." For our part, we think, that if such a beastly rite was practised, it was done in commemoration of the savage manner of life which had prevailed among men prior to the more humane diet invented and introduced by Isis and Osiris. Be that as it may, we learn from Porphyry*, that in the island of Chios they used to sacrifice a man to Bacchus, and that they used to mangle and tear him limb from limb. This was no doubt practised in commemoration of the catastrophe mentioned above.

‡ Clem. Alexand.

§ De errore Prof. Gent.

39 Human sacrifices.

* De Abstinentia.

The orgia of this Pagan god were originally simple enough; but this unsophisticated mode was of no long continuance, for riches soon introduced luxury, which quickly infected even the ceremonies of religion. On the day set apart for this solemnity, men and women crowned with ivy, their hair dishevelled, and their bodies almost naked, ran about the streets, roaring aloud *Evohe* (U) Bacche. In this rout were to be seen people intoxicated at once with wine and enthusiasm, dressed like Satyrs, Fauns, and Silenuses, in such scandalous postures and attitudes, with so little regard to modesty and even common decency, that we are persuaded our readers will readily enough forgive our omitting to describe them. Next followed a company mounted upon asses, attended by Fawns, Bacchanals, Thyades, Mimallonides, Naids, Tityri, &c. who made the adjacent places echo to their frantic shrieks and howlings. After this tumultuous herd were carried the statues of victory and altars in form of vinesets crowned with ivy, smoking with incense and other aromatics. Then appeared several chariots loaded with thyrsi, arms, garlands, casks, pitchers, and other vases, tripods, and vans. The chariots were followed by young virgins of quality, who carried the baskets and little boxes, which in general contained the mysterious articles above enumerated. These, from their office, were called *cistophoræ*. The phallophori (X) followed them, with a chorus of Itophallophori habited like Fauns, counterfeiting drunk persons, singing in honour of Bacchus songs and catches suited to the occasion. The procession was closed by a troop of Bacchanalians crowned with ivy, interwoven with branches of yew and with serpents*. Upon some occasions, at those scandalous festivals, naked women whipped themselves, and tore their skin in a most barbarous manner. The procession terminated on mount Citheron, when it set out from Thebes; and in other places, in some distant unfrequented desert, where the votaries practised every species of debauchery with secrecy

40 Total contempt of decency.

* Ovid. Met.

(Q) Dacier, Casaubon, and other French critics, have puzzled and perplexed themselves to little purpose about the origin of this word, without considering that it was coeval to dramatic poetry.

(R) The phallus was highly respected by the Egyptians, and was used as the emblem of the fecundity of the human race.

(S) That reptile was in high veneration among the Egyptians. See Euseb. Præp. Evang. l. i. pag. 26. Steph. where we have a minute detail of the symbolical properties of that creature, according to Taautos the great legislator of that people.

(T) Servius in Georg. I. Virg. ver. 166. Mystica *vanus* Jacchi. The fan, says he, is an emblem of that purifying influence of the mysteries by which the initiated were cleansed from all their former pollutions, and qualified for commencing a holy course of life.

(U) Clem. Alexand. Cohort. pag. 11. Pott. derives this word from *Cheveh*, the mother of mankind, who first opened the gate to that and every other error: but we are rather inclined to believe that it comes from the oriental word *Hevé*, which signifies a "serpent;" which among the Egyptians was sacred to the sun, and was likewise the emblem of life and immortality. It then imported a prayer to Bacchus for life, vigour, health, and every other blessing.

(X) The phallus was the symbol of the fructifying power of Nature. The Itophallus was the type of that power in act.

crecy and impunity. Orpheus saw the degeneracy of those ceremonies; and in endeavouring to reform them he probably lost his life. Pentheus suffered in the like attempt, being torn in pieces by the Bacchanalians on the mount Citheron, among whom were his own mother and his aunts. The Greeks, who were an airy jovial people, seem to have paid little regard to the plaintive part of the orgia; or rather, we believe, they acted with howling and frantic exclamations, often inhanced by a combination of drunkenness, ecstasy, and enthusiastic fury.

What secrets, religious, moral, political, or physical were communicated to the votaries, it is impossible to determine with any degree of certainty.—

41 Doctrines inculcated in the orgia.

One thing we may admit, namely, that the doctrines discovered and inculcated in the orgia, were originally the very same which the apostles of the sect had imbibed in Egypt and Phœnicia; and of which we have given a brief account near the beginning of this article. It is however, probable that the spurious or Theban Bacchus had superadded a great deal of his own invention, which, we may believe, was not altogether so sound and salubrious as the original doctrine. However that may be, the initiated were made to believe that they were to derive wonderful advantages from the participation of these rites, both in this life and that which is to come. Of this, however, we shall talk more at length by and by in our account of the Eleusinian mysteries.

To detail the etymology of the names of this Pagan deity, the fables relating to his birth, his education, his transformations, his wars, peregrinations, adventures, the various and multiform rites with which he was worshiped, would swell this article to a most immoderate size. If any of our readers should wish to be more minutely and more accurately acquainted with this subject, we must beg leave to remit them to Diod. Sic. Apollod. Bibl. Euripid. Bacchæ. Aristophane Ranæ, Nonn Dionys. and among the moderns, to Ban. Mythol. Voss. de. origi. Idol. Mons. Fourmount, Reflections sur l'origine anciens peuples, Mr Bryant's Analys. and especially to Mons Cour de Gebelin, Calendries ou Almanach. That prince of etymologists, in his account of the festival of Bacchus, has given a most acute and ingenious explication of the names and epithets of that deity. For our part, we have endeavoured to collect and exhibit such as we judged most important, most entertaining, and most instructive, to the less enlightened classes of our readers.

42 Eleusinian mysteries instituted in honour of Ceres.

We now proceed to the Eleusinian mysteries, which, among the ancient Greeks and Romans, were treated with a superior degree of awe and veneration. These were instituted in honour of Ceres, the goddess of corn; who, according to the most authentic accounts, was the Isis of the Egyptians. The mysteries of Osiris and Isis have been hinted at in the preceding part of this article. They were originally instituted in honour of the sun and moon, and afterwards consecrated to an Egyptian prince and princess; who, in consequence of their merits, had been deified by that people. We know of no more exact and brilliant description of the ceremonies of that goddess, in the most polished ages of the Egyptian superstition, than what we meet with in the witty and florid Apuleius *, to which we must take the liberty to refer our more curious readers. Our business at present shall be to try to investigate by what means, and upon what occasion those mysteries were introduced into Attica, and established at Eleusis. A passage from Diodorus Siculus §, which we shall here translate, will, we think, throw no inconsiderable light on that abstruse part of the subject.

* Lib. II.

§ Lib. I.

"In like manner with him (Cecrops), says that judicious historian, they tell us, that Erectheus, a prince of Egyptian extraction, once reigned at Athens. Of this fact they produce the following evidence: A scorching drought, during the reign of this prince, prevailed over almost all the habitable world, except Egypt; which, in consequence of the humidity of its soil, was not affected by that calamity. The fruits of the earth were burnt up; and at the same time multitudes of people perished by famine. Erectheus, upon this occasion, as he was connected with Egypt, imported a vast quantity of grain from that country to Athens. The people, who had been relieved by his magnificence, unanimously elected him king. Being invested with the government, he taught his subjects the mysteries of Ceres at Eleusis and the mode of celebrating the sacred ceremonies, having tranferred from Egypt the ritual for that purpose. In those times the goddess is said to have made her appearance at Athens three several times; because, according to tradition, the fruits of the earth which bear her name were then imported into Attica. On this account the seeds and fruits of the earth were said to be the invention of that deity. Now the Athenians themselves acknowledge, that, in the reign of Erectheus, the fruits of the earth having perished for want of rain, the arrival of Ceres in their country did actually happen, and that along with her the blessing of corn was restored to the earth. They tell us at the same time, that the teletæ and the mysteries of that goddess were then received and instituted at Eleusis."

43 On what occasion introduced into Attica.

Here then we have the whole mystery of the arrival of Ceres in Attica, and the institution of her mystery at Eleusis unveiled. The whole is evidently an oriental allegory. The fruits of the earth had been destroyed by a long course of drought; Egypt, by its peculiar situation, had been preserved from that dreadful calamity. Erectheus, in consequence of his relation to the Egyptians, imported from their country a quantity of grain, not only sufficient for the consumption of his own subjects, but also a great overplus to export to other parts of Greece, Sicily, Italy, Spain, &c. Triptolemus, another Egyptian, was appointed by Erectheus to export this superfluous store. That hero, according to Pherecydes, was the son of Oceanus and Tellus, that is, of the sea and the earth; because his parents were not known, and because he came to Elensis by sea. The ship in which he sailed, when he distributed his corn to the western parts of the world, was decorated with the figure of a winged dragon: therefore, in the allegorical style of his country he was said to be wafted through the air in a chariot drawn by dragons. Those creatures, every body knows, were held sacred by the Egyptians.

Wherever Triptolemus disposed of his corn thither were extended the wanderings of Ceres. In order to elucidate

elucidate this point, we must observe that along with the grain imported from Egypt, Erectheus, or Triptolemus, or both transported into Attica a cargo of priests and priestesses from the temples of Busiris, a city which lay in the § centre of the Delta, where the goddess Isis had a number of chapels erected for her worship. The presidents of these ceremonies, like all other bigots, gladly laid hold on this opportunity of propagating their religious rites, and disseminating the worship of the deities of their country. That the Egyptian priests were zealous in propagating the dogmas of their superstition, is abundantly evident from the extensive spreading of their rites and ceremonies over almost all Asia and a considerable part of Europe. The Greek and Roman idolaty is known to have originated from them; and numberless monuments of their impious worship are still extant in Persia ‡, India, Japan, Tartary, &c. Our inferenee then is, that the worship of Isis was introduced into every country where Triptolemus sold or disposed of his comodities.—Hence the wanderings of Ceres in search of her daughter Proserpine, who is generally called *Core.* The famine occasioned by the drought destroying the fruits of the ground, imports the loss of Proserpine. The restoration of the corn in various parts of the earth, by fresh supplies from Egypt from time to time, imports the wanderings of Ceres in quest of Proserpine. The whole process is an oriental allegory. The disappearing of the fruits of the earth, of which Proserpine, or Persephone*, or Peresephone (Y), is the emblem, is the allegorical rape of that goddess. She was seized and carried off by Pluto, sovereign of the infernal regions. The seed committed to the earth in that dry season appeared no more, and was, consequently, said to dwell under ground with Pluto. It was then that Ceres, that is, corn imported from Egypt, set out in quest of her daughter. Again, when the earth recovered her pristine fertility, the Core, or maid, was found by her mother Ceres, that is, the earth; for Isis, among the Egyptians frequently signified the earth. The wandeings of Isis in search of Osiris furnished the model for the peregrinations of Ceres.

§ Herod. Lib. 2.

‡ Asiatic Researches, vol. i. and ii.

* Plutarch. Isis et Osir.

44 Different names of Ceres.

Ceres, the Roman name of the goddess of corn, was unknown to the modern greeks, They always denominated her *Damater* (Z), which is rather an epithet than a proper name. The Greeks, who always affected to pass for originals, we think suppressed the Egyptian name on purpose, to conceal the country of that deity. As a proof of the probability of this conjecture it may be observed, that they metamorphosed the wanderings of Isis in search of Osiris into the peregrinatious of Ceres in quest of Proserpine. The Romans, who were less ambitious of the character of originality, retained one of her oriental names (A). Ceres, says Diodorus, appeared thrice in Attica during the reign of Erectheus; which seems to import, that fleets loaded with corn had thrice arrived in that country from Egypt during that period.

45 Contentions at Athens respecting Minerva and Neptune the immediate cause of fixing the mysteries at Eleusis.

Cecrops the first king of Attica had established the worship of the Saitic Athena or Minerva in that region and consecrated his capital to that deity. Erectheus, in his turn introduced the worship of Isis or Damater who in all appearance was the tutelar deity of Busiris his native city. The subjects of Cecrops were a colony of Saites, and readily embraced the worship of Minerva; but the aborigines of that district being accustomed to a maritime, perhaps to a piratical course of life, were more inclined to consecrate their city to Neptune the god of the sea, and to constitute him their guardian and protector. Cecrops by a stratagem secured the preference to Minerva his favourite divinity. Erectheus, in order to give equal importance to his patroness, had the address to institute the Eleusinian mysteries; and to accomplish his design laid hold on the opportunity abovementioned.

This appears to us the most probable account of the origin and institution of the Eleusinian mysteries; for which the Sicilian historian has indeed furnished the clue. We shall now proceed to detail some other circumstances which attended the original institution of these far-famed ceremonies.

* Appollod Bibl. Lib. 3. cap. 13.

46 Circumstances attending the first appearance of Ceres in Attica.

The archpriestess who personated the newly imported deity was entertained by one Celeus*, who was either viceroy of that petty district of which Eleusis was the capital, or some considerable personage in that city or its neighbourhood. Upon her immediate arrival, according to the fabulous relations of the Greeks, a farce was acted not altogether suitable to the character of a goddess whose mysteries were one day to be deemed so sacred and austere. These coarse receptions, and other indecencies attending the first appearance of the goddess, that is the Egyptian dame who assumed her character, were copied from the like unhallowed modes of behavionr practised on occasion of the solemn processions of her native country. These scommata, or coarse jokes, had an allegorical signification in Egypt; and among the most ancient Greeks the very same spirit was universally diffused by the oriental colonists who from time to time arrived and settled among them. In process of time they abandoned the figurative and allegorical style, in consequence of their acquaintance with philosophy and abstract reasoning.

(Y) This word seems to be formed of two Hebrew terms, *pheri* "fruit," and *tzaphon*; or *tzephon,* "abscondit, recondidit."

(Z) Damater is compounded of the Chaldiac particle *da* "the," and *mater* "mother." As Isis often signified the earth, the Greeks naturally adopted that title; because, according to them, that element is the mother of all living. In the very same manner they discarded the word *Juno,* an original title of the moon; and substituted *Hera,* which intimates "mistress or lady."

(A) According to some of the Latin etymologists, *Ceres,* or rather *Geres,* is derived from *gero* "to bear, to carry," because the earth bears all things; or because that element is the general fruit-bearer. But as this term came to Italy immediately from the east, and not by the medium of Greece, we would rather incline to adopt an oriental etymology. The Hebrew word *cheres* signifies *arare* "to plow:" a name naturally applicable to the goddess of husbandry.

reasoning. In the ceremonies of religion, however, the same allegorical and typical representations which had been imported from the east were retained; but the Grecian hierophants in a short time lost every idea of their latent import, and religious, moral, or physical interpretation. Accordingly, this shameful rencounter between Ceres and Banbo (B), or Jambe, was retained in the mysteries, though we think it was copied from Egypt, as was said above, where even that obscene action was probably an allegorical representation of something very different from what appeared to the Greeks.

At the same time that Ceres arrived in Attica, Bacchus likewise made his appearance in that country. He was entertained by one Icarus; whom, as a reward for his hospitality, he instructed in the art of cultivating the vine, and the method of manufacturing wine. Thus it appears that both agriculture and the art of managing the vintage were introduced into Athens much about the same time. Ceres was no other than a priestess of Isis; Bacchus was no doubt a priest of Osiris. The arrival of those two personages from Egypt, with a number of inferior priests in their train, produced a memorable revolution in Athens, both with respect to life, manners, and religion. The sacred rites of Isis, afterwards so famous under the name of the Eleusinian mysteries, date their institution from this period.

Ceres and Bacchus, who they were.

When this company of propaganda arrived at Eleusis, they were entertained by some of the most respectable persons who then inhabited that district. Their names, according to Clem. Alexand. were Banbo, Dysaulis, Triptolemus, Eumolpus, and Eubulus. From Eumolpus were descended a race of priests called Eumolpidæ, who figured at Athens many ages after. Triptolemus was an ox-herd, Eumulpus a shepherd, and Eubulus a swine-herd. These were the first apostles of the Eleusinian mysteries. They were instructed by the Egyptian missionaries; and they, in their turn, instructed their successors. Erectheus, or, as some say, Pandion, countenanced the seminary, and built a small temple for its accomodation in Eleusis, a city of Attica, a few miles west from Athens, and originally one of the twelve districts into which that territory was divided. Here then we have arrived at the scene of those renowned mysteries, which for the space of near 2000 years were the pride of Athens and the wonder of the world.

48 Eleusinian mysteries divided in to greater and lesser.

The mysteries were divided into the greater and lesser. The latter were celebrated at Agræ, a small town on the river Ilyssus; the former were celebrated in the month which the Athenians called Boedromion (C); the latter in the month Anthesterion (D). The lesser mysteries, according to the fabulous legends of the Greeks, were instituted in favour of the celebrated Hercules. That hero being commanded by Eurystheus to bring up Cerberus from the infernal regions, was desirous of being initiated in the Eleusinian mysteries before he engaged in that perilous undertaking. He addressed himself to Eumolpus the hierophant for that purpose. There was a law among the Eleusinians prohibiting the initiation of foreigners. The priest not daring to refuse the benefit to Hercules who was both a friend and benefactor to the Athenians, advised the hero to get himself adopted by a native of the place, and so to elude the force of the law. He was accordingly adopted by one Pyolius, and so was initiated in the lesser mysteries which were instituted for the first time upon that occasion. This account has all the air of a fable. The lesser mysteries were instituted by way of preparation for the greater.

49 Austerities and rites previous to initiation.

The person who was to be initiated in the lesser mysteries, as well as in the greater, was obliged to practise the virtue of chastity a considerable time before his admission. Besides, he was to bind himself by the most solemn vows not to divulge any part of the mysteries. At the same time, he was, according to the original institution, to be a person of unblemished moral character. These were preliminaries indispensably necessary in order to admission. A bull was sacrificed to Jupiter, and the hide of that animal called by a peculiar name (Διος Κωδιον), was carefully preserved and carried to Eleusis, where it was spread under the feet of the initiated. The candidate was then purified by bathing in the river Ilyssus, by aspersions with salt water or salt, with laurel barley, and passing through the fire: all which rites were attended with incantations and other usages equally insignificant and ridiculous. Last of all, a young sow was sacrificed to Ceres; and this animal, according to the ritual, behoved to be with pigs: and before it was killed it was to be washed in Cantharus, one of the three harbours which formed the Piræus.

50 Into the lesser mysteries; of which

All these ceremonies duly performed, the candidate was carried into the hall appointed for the purpose of initiation. There he was taught the first elements of those arcana which were afterwards to be more fully and more clearly revealed in the more august mysteries of Eleusis. The pupils at Agræ were called *Mystæ*, which may intimate probationers; whereas those of Eleusis were denominated *Epoptæ*, importing that they saw as they were seen.

51 There were several stages, with long intervals between them.

The lesser mysteries were divided into several stages, and candidates were admitted to them according to their quality and capacity respectively. Those who were initiated in the lowest were obliged to wait five years before they were admitted to the greater. Those who had partaken of the second kind underwent a noviciate of three years; those who had been admitted to the third, one of two years; and those who had gone through the fourth were admitted to the greater at the end of one year; which was the shortest period of probation a candidate for that honour could legally undergo. Such was the process generally observed in administering the lesser mysteries.

With

(B) Apollod Bib. ubi supra. Clem. Alexand. Cahod. page 17. where the story is told with very little reserve.

(C) The third month of the Athenian year, answering to our September.

(D) The eighth month, answering to our February; but Meursius makes it November.

52 None but natives of Athens originally admitted to the greater mysteries.

With respect to the greater mysteries, it is probable that originally none but the natives of Attica were admitted to partake of them. In process of time, however, the pale was extended so far and wide as to comprehend all who spoke the Greek language. All foreigners were debarred from those sacred rites. They tell us, however, that Hercules, Bacchus, Castor and Pollux, Æsculapius and Hippocrates, were initiated in an extraordinary manner, from a regard to their high character and heroic exploits. All barbarians, too, were excluded: yet Anacharsis the Scythian was indulged that privilege, in consequence of his reputation for science and philosophy. All persons guilty of manslaughter, though even accidentally or involuntarily, all magicians, enchanters; in a word, all impious and profane persons, were expressly prohibited the benefit of this pagan sacrament. At last, however, the gate became wider, and crowds of people, of all nations, kindreds, and languages, provided their character was fair and irreproachable, rushed in by it. In process of time the Athenians initiated even their infants; but this, we imagine, must have been a kind of lustration or purification from which it was supposed that they derived a kind of moral ablution from vice, and were thought to be under the peculiar protection of the goddess.

53 Celebration lasted nine days; but

The celebration of the mysteries began on the 15th day of the month Boedromion; and, according to the most ancient authors, lasted nine days. Meursius has enumerated the transactions of each day, which are much too numerous to fall within the compass of this article; we must therefore refer our curious reader to the author just mentioned. Some days before the commencement of the festival, the præcones, or public criers, invited all the initiated, and all the pretenders to that honour, to attend the festival, with clean hands and a pure heart, and the knowledge of the Greek language.

54 Was performed only during the night.

On the evening of the 15th day of the month called *Boedromion* the initiations commenced. Our readers will observe, that all the most sacred and solemn rites of the pagan superstition were performed during the night: They were indeed generally works of darkness. On this day there was a solemn cavalcade of Athenian matrons from Athens to Eleusis in carriages drawn by oxen. In this procession the ladies used to rally one another in pretty loose terms, in imitation, we suppose, of the Isiac procession described by Herodotus, which has been mentioned above. The most remarkable object in this procession was the Mundus Cereris, contained in a small coffer or basket. This was carried by a select company of Athenian matrons, who, from their office, were styled *Camphoeræ*. In this coffer were lodged the comb of Ceres, her mirror, a serpentine figure, some wheat and barley, the pudenda of the two sexes, and perhaps some other articles which we have not been able to discover. The procession ended at the temple, where this sacred charge was deposited with the greatest solemnity.

55 The Mundus Cereris

We have no description of the temple of Eleusis upon record. Pausanias intended to have described it; but says he was diverted from his design by a dream ||. Strabo informs us that the mystic sanctuary was as large as a theatre, and that it was built by Ictinus *. In the porche, or outer part of this temple the candidates were crowned with garlands of flowers, which they called *himera*, or "the desirable." They were at the same time dressed in new garments, which they continued to wear till they were quite worn out. Then they washed their hands in a laver filled with holy water; a ceremony which intimated the purity of their hearts and hands. Before the doors were locked, one of the officers of the temple proclaimed with a loud voice a stern mandate, enjoying all the uninitiated to keep at a distance from the temple, and denouncing the most terrible menaces if any should dare to disturb or pry into the holy mysteries. Nor were these menannces without effect; for if any person was found to have crowded into the sanctuary even through ignorance, he was put to death without mercy. Every precaution having been taken to secure secrecy, the initiatory ceremonies now began. But before we describe these, we must lay before our readers a brief account of the ministers and retainers of these secrets of paganism.

|| Lib. 9.

* See Eleusis.

56 Dress of the candidates.

57 Care to keep the uninitiated at a distance.

58 The hierophant.

The chief minister of these far-famed mysteries was the Hierophant. He was styled *King*, and enjoyed that dignity during life, and was always by birth an Athenian. He presided in the solemnity, as is evident from his title. This personage, as we learn from Eusebius, represented the Demiurgus, or Creator of the world. "Now in the mysteries of Eleusis (says that father) the hierophant is dressed out in the figure of the demiurgus." What this demiurgus was, we learn from the same writer. As this whole institution was copied from the Egyptians, we may rest assured that the figure of the Eleusinian Demiurgus was borrowed from the same quarter. "As for the symbols of the Egyptians (says he, quoting from Porphyry *) they are of the following complexion. The Demiurgus, whom the Egyptians call *Cneph*, is figured as a man of an azure colour, shaded with black, holding in his right hand a sceptre and in his left a girdle, and having on his head a royal wing or feather wreathed round." Such, we imagine, was the equipment of the Eleusinian hierophant. This person was likewise styled *Prophet*. He was to be of the family of the Eumolpidæ; was obliged to make a vow of perpetual chastity, and even his voice, hair, and attitude, were adjusted to the ritual.

* Prep. Evan.

59 The daduchus.

The next minister was the Daduchus, or torch-bearer; who, according to the father above quoted, was attired like the sun. This minister resembled the sun, because that luminary was deemed the visible type of the supreme Demiurgus, and his vicegerent in governing and arranging the affairs of this lower world.

60 The priests.

The third was the person who officiated at the altar. He was habited like the moon. His office was to implore the favour of the gods for all the initiated. We should rather imagine, that the person at the altar, as he resembled the moon, was intended to represent the goddess herself: for the Egptian Isis, who was the archetype of Ceres was sometimes the moon and sometimes the earth.

61 The herald.

The sacred herald was another principal actor in this solemn exhibition. His province was to recite every thing that, according to the ritual, was to be communicated to the novices; and he probably represented Thyoth or Thoth, that is Hermes or Mercury, the interpreter of the gods.

The curators. Besides these, there were five epimeletæ or curators, of whom the king was one, who jointly directed the whole ceremonial. Lastly there were ten priests to offer the sacrifices. There were no doubt many officers of inferior note employed upon these occasions, but these were only insignificant appendages, whose departments have not been transmitted to posterity.

After this detail of the ministers of this solemn service, we return to the *mystæ*, or candidates for initiation. Some of the fathers of the church † mention a hymn composed by the celebrated Orpheus, which was sung by the mystagogue or king upon that occasion. This hymn appears to us one of those spurious compositions which abounded in the first ages of Christianity, and which the pious apologists often adopted without sufficient examination. That some sacred hymn was chanted upon that occasion, we think highly probable; but that the one in question was either composed by Orpheus, or used at the opening of these ceremonies, to us appears somewhat problematical.

† Justin. Euseb. Clem.

63 The petroma. Before the ceremony opened, a book was produced, which contained every thing relating to the teletæ. This was read over in the ears of the mystæ; who were ordered to write out a copy of it for themselves. This book was kept at Eleusis in a sacred repository, formed by two stones exactly fitted to each other, and of a very large size. This repository was called *petroma*. At the annual celebration of the greater mysteries, these stones were taken asunder, and the book taken out; which, after being read to the mystæ, was replaced in the same casement.

64 Commencement of the initiations. The initiations began with a representation of the wanderings of Ceres, and her bitter and loud lamentations for the loss of her beloved daughter. Upon this occasion, no doubt, a figure of that deity was displayed to the mystæ, while loud lamentations echoed from every corner of the sanctuary. One of the company having kindled a firebrand at the altar, and sprung to a certain place in the temple, waving the torch with the utmost fury, a second snatched it from him, roaring and waving it in the same frantic manner: then a third, fourth, &c. in the most rapid succession. This was done to imitate Ceres, who was said to have perlustrated the globe of the earth with a flaming pine in her hand, which she had lighted at mount Etna.

65 Questions put to the mystæ. When the pageant of the goddess was supposed to arrive at Eleusis, a solemn pause ensued, and a few trifling questions were put to the mystæ: What these questions were, is evident from the answers, "I have fasted; I have drunk the liquor: I have taken the contents out of the coffer, and having performed the ceremony, have put them into the hamper: I have taken them out of the hamper, and put them again in the coffer." The meaning of these answers, we conjecture, was this; "I have fasted as Ceres fasted while in search of her daughter: I have drunk of the wort as she drank when given her by Banbo; I have performed what Ceres taught her first disciples to perform, when she committed to them the sacred hamper and coffer." After these interrogatories and the suitable responses, the *mundus Cereris* was displayed before the eyes of the mystæ, and the *mystagogue* or hierophant; or perhaps the sacred herald by his command, read a lecture on the allegorical import of those sacred symbols. This was heard with the most profound attention; and a solemn silence prevailed throughout the fane. Such was the first act of this religious farce, which perhaps consisted originally of nothing more.

66 Traditions respecting the origin of the universe. After the exposition of the *mundus Cereris*, and the import of her wanderings, many traditions were communicated to the mystæ concerning the origin of the universe and the nature of things. The doctrines delivered in the greater mysteries, says Clem. Alex. "relate to the nature of the universe. Here all instruction ends. Things are seen as they are: and nature and the things of nature, are given to be comprehended." To the same purpose Cicero: "Which points being explained and reduced to the standard of reason, the nature of things, rather than that of the gods, discovered." The father of the universe, or the supreme demiurgus, was represented as forming the chaotic mass into the four elements, and producing animals, vegetables, and all kinds of organized beings, out of those materials. They say that they were informed of the secrets of the anomalies of the moon; and the eclipses of the sun and moon; and, according to Virgil,

Unde hominum genus, et pecudes, unde imber et ignes.

What system of cosmogony those hierophants adopted, is evident from the passage above quoted from Eusebius: and, from the account immediately preceding, it was that of the most ancient Egyptians, and of the orientals in general. This cosmogony is beautifully and energetically exhibited in Plato's Timæus, and in the genuine spirit of poetry by Ovid in the beginning of his Metamorphoses.

67 Exploits of the gods, and The next scene exhibited upon the stage, on this solemn occasion, consisted of the exploits and adventures of the gods, demigods, and heroes, who had, from time to time, been advanced to divine honours. These were displayed as passing before the mystæ in pageants fabricated for that important purpose. This was the original mode among the Egyptians, and was no doubt followed by their Eleusinian pupils. Those adventures were probably demonstrated to have been allegorical, symbolical, hieroglyphical, &c. at least they were exhibited in such a favourable point of view as to dispel those absurdities and inconsistencies with which they were sophisticated by the poets and the vulgar.

68 Their origin. With respect to the origin of those fictitious deities, it was discovered that they had been originally men who had been exalted to the rank of divinity, in consequence of their heroic exploits, their useful inventions, their beneficent actions, &c. This is so clear from the two passages quoted from Cicero, by bishop Warburton †, that the fact cannot be contradicted. But that prelate has not informed us so precisely, whether the mystagogues represented them as nothing more than dead men, in their present state, or as beings who were actually existing in a deified state, and executing the functions assigned them in the rubric of paganism. Another query naturally occurs, that is, to what purpose did the mystagogues apply this communication? That the hierophants did actually

† Div. Leg.

actually represent those deified mortals in the latter predicament, is obvious from another passage quoted from Cicero by the same prelate, which we shall transcribe as translated by him; "What think you of those who assert that valiant, or famous, or powerful men, have obtained divine honours after death: and that these are the very gods now become the objects of our worship, our prayers, and adoration? Euhemerus tells us, when these gods died, and where they lie buried. I forbear to speak of the sacred and august rites of Eleusis. I pass by Samothrace and the mysteries of Lemnos, whose hidden rites are celebrated in darkness, and amidst the thick shades of groves and forests." If, then those deified mortals were become the objects of worship and prayers, there can be no doubt of the belief of their deified existence. The allusion to the Eleusinian and other pagan mysteries towards the close of the quotation, places the question beyond the reach of controversy. But though, according to this account, "there were gods many and lords many;" yet it is evident from the passage quoted from Eusebius in the preceding part of this article, that the unity of the Supreme Being was maintained, exhibited, and inculcated. This was the original doctrine of the Hierophants of Egypt: It was maintained by Thales and all the retainers of the Ionian school. It was the doctrine of Pythogoras, who, probably gleaned it up in the country just mentioned, in connection with many other dogmas which he had the assurance to claim as his own.

69
Unity of the Supreme Being maintained in the mysteries.

But however the unity, and perhaps some of the most obvious attributes of the Supreme Author of nature, might be illustrated and inculcated, the tribute of homage and veneration due to the subordinate divinities was by no means neglected. The initiated were taught to look to the *dii majorum gentium* with a superior degree of awe and veneration, as beings endowed with an ineffable measure of power, wisdom, purity, goodness, &c. These were, if we may use the expression, the prime favourites of the Monarch of the universe, who were admitted into his immediate presence, and who received his behests from his own mouth, and communicated them to his subordinate officers, prefects, lieutenants, &c. These they were exhorted to adore; to them they were to offer sacrifices, prayers, and every other act of devotion, both on account of the excellency of the nature and the high rank they bore at the court of heaven. They were instructed to look up to hero-gods and demi-gods, as beings exalted to the high rank of governors of different parts of nature, as the immediate guardians and protectors of the human race; in short, as gods near at hand, as prompters to a virtuous course, and assistants in it; as ready upon all occasions to confer blessings upon the virtuous and deserving. Such were the doctrines taught in the teletæ with respect to the nature of the Pagan divinities, and the worship and devotion enjoined to be offered them by the mysteries.

70
Offices of the other gods.

71
Excellent plan for accomplishing the ends proposed in the mysteries.

As the two principal ends proposed by these initiations were the exercise of heroic virtues in men, and the practice of sincere and uniform piety by the candidates for immortal happiness, the hierophants had adopted a plan of operations excellently accommodated to both these purposes. The virtuous conduct and heroic exploits of the great men and demigods of early antiquity, were magnified by the most pompous elogiums, enforced with suitable exhortations to animate the votaries to imitate so noble and alluring an example. But this was not all; the heroes and demigods themselves were displayed in pageants, or vehicles of celestial light. Their honours, offices, habitations, attendants, and other appendages, in the capacity of demons, were exhibited with all the pomp and splendor that the sacerdotal college were able to devise. The sudden glare of mimic light, the melting music stealing upon the ear, the artificial thunders reverberated from the roof and walls of the temple, the appearance of fire and etherial radiance the vehicles of flame, the effigies of heroes and demons adorned with crowns of laurel emitting rays from every sprig, the fragrant odours and aromatic gales, which breathed from every quarter, all dexterously counterfeited by sacerdotal mechanism, must have filled the imagination of the astonished votaries with pictures at once tremendous and transporting; Add to this, that every thing was transacted in the dead of night amidst a dismal gloom: whence the most bright effulgence instantaneously burst upon the sight. By this arrangement the aspirants to initiation were wonderfully animated to the practice of virtue while they lived, and inspired with the hope of a blessed immortality when they died. At the same time, their awe and veneration for the gods of their country was wonderfully enhanced by reflecting on the appearances above described. Accordingly Strabo very judiciously observes, "that the mystical secrecy of the sacred rites preserves the majesty of the Deity, imitating its nature, which escapes our apprehension. For these reasons, in celebrating the teletæ, the demons were introduced in their deified or glorified state.

But as all the candidates for initiation might not aspire to the rank of heroes and demigods, a more easy and a more attainable mode of conduct, in order to arrive at the palace of happiness, behoved to be opened. Private virtues were inculcated, and these too were to meet a condign reward. But alas, this present life is too often a chequered scene, where virtue is depressed and trodden under foot, and vice lifts up its head and rides triumphant. It is a dictate of common sense, that virtue should sooner or later emerge, and vice sink into contempt and misery. Here then the conductors of the mysteries properly and naturally, adopted the doctrine of a future state of rewards and punishments. The dogma of the immortality of the human soul was elucidated, and carefully and pathetically inculcated. This doctrine was likewise imported from Egypt; for Herodotus † informs us, "that the Egyptians were the first people who maintained the immortality of the human soul." The Egyptian immortality, however, according to him, was only the metempsychosis or transmigration of souls. This was not the system of the ancient Egyptians, nor indeed of the teletæ. In these, a metempsychosis was admitted; but that was carried forward to a very distant period, to wit, to the grand Egyptian period of 36,000 years.

72
Private virtues inculcated by the doctrine of a future state.

† Lib. 2.

As the Mystagogues well knew that the human mind is more powerfully affected by objects presented to the eyes than by the most engaging instructions conveyed by

73 Emblems of Elysium and Tartarus.

by the ear, they made the emblems of Elysium and Tartarus pass in review before the eyes of their novices. There the Elysian scenes, so nobly described by the Roman poet, appeared in mimic splendor; and on the other hand, the gloom of Tartarus, Charon's boat, the dog of hell, the furies with tresses of snakes, the tribunal of Minos and Rhdamanthus, &c. were displayed in all their terrific state. Tantalus, Ixion, Sisyphus, the daughters of Danaus, &c. were represented in pageants before their eyes. These exhibitions were accompanied with most horrible cries and howlings, thunders, lightning, and other objects of terror, which we shall mention in their proper place.

No contrivance could be better accommodated to animate the pupils to the practice of virtue on the one hand, or to deter them from indulging vicious passions on the other. It resembled opening heaven and hell to a hardened sinner. The practices inculcated in celebrating the mysteries are too numerous to be detailed in this imperfect sketch. The worship of the gods was strictly enjoined, as has been shown above. The three laws generally ascribed to Triptolemus were inculcated, 1. To honour their parents; 2. To honour the gods with the first fruits of the earth; 3. Not to treat brute animals with cruelty. These laws were imported from Egypt, and were communicated to the Eleusinians by the original missionaries. Cicero makes the civilization of mankind one of the most beneficial effects of the Eleusinian institutions: "Nullum mihi, cum multa eximia divinaque videntur Athenæ tuæ peperisse; tum nihil melius illus mysteriis, quibus ex agresti immanique vita, exculti ad humanitatem, et mitigati sumus; inatiaque, ut appellantur, ita revera principia vitæ cognovimus; neque solum cum lætitia vivendi rationem acceppimus, sed etiam cum spe meliore moriendi." Hence it is evident, that the precepts of humanity and morality were warmly recommended in these institutions. The virtue of humanity was extended, one may say, even to the brute creation, as appears from the last of Triptolemus's laws above quoted. Some articles were enjoined in the teletæ which may appear to us of less importance, which, however, in the symbolical style of the Egyptians, were abundantly significant. The initiated were "commanded to abstain from the flesh of certain birds and fishes: from beans, from pomegranates and apples, which were deemed equally polluting. It was taught, that to touch the plant of asparagus was as dangerous as the most deadly poison. Now, says Porphyry, who ever is versed in the history of the *visions*, knows for what reason they were commanded to abstain from the flesh of birds."

74 The three laws of Triptolemus.

75 The initiated bound themselves by oaths to observe the precepts of the mysteries.

The initiated then bound themseves by dreadful oaths to observe most conscientiously and to practise every precept tendered to them in the course of the teletæ; and at the same time never to divulge one article of all that had been heard or seen by them upon that occasion. In this they were so exceedingly jealous, that Æschylus the tragedian was in danger of capital punishment for having only alluded to one of the Eleusinian arcana in a tragedy of his; and one of the articles of indictment again Diagoras the Melian was, his having spoken disrespectfully of the mysteries, and dissuaded people from partaking of them. It must then be allowed, that the institution of the mysteries was of infinite advantage to the pagan world. They were indeed a kind of sacraments, by which the initiated bound themselves by a solemn vow to practise piety towards the gods, justice and humanity towards their fellow-men, and gentleness and tenderness towards the inoffensive part of the brute creation. The pagans themselves were so thoroughly convinced of this fact, that in their disputes with the apologists for Christianity, they often appealed to the teletæ, and contrasted their maxims with the most sublime doctrines of that heavenly institution.

In order to impress these maxims the more deeply upon the minds of the novices, and to fix their attention more stedfastly upon the lectures which were delivered them by the mystagogue or the sacred herald, a mechanical operation was played off at proper intervals during the course of the celebration. "Towards the end of the celebration (says Stobæus), the whole scene is terrible; all is trembling, shuddering, sweat, and astonishment. Many horrible spectres are seen, and strange cries and howlings uttered. Light succeeds darkness; and again the blackest darkness the most glaring light. Now appear open plains, flowery meads, and waving groves; where are seen dances and choruses; and various holy phantasies enchant the sight. Melodious notes are heard from far, with all the sublime symphony of the sacred hymns. The pupil now is completely perfect, is initiated, becomes free, released, and walks about with a crown on his head, and is admitted to bear a part in the sacred rites." Aristides de Myst. Eleus. calls Eleusis "a kind of temple of the whole earth, and of all that man beholds done in the most dreadful and the most exhilerating manner. In what other place have the records of fable sung of things more marvellous? or in what region upon earth have the objects presented to the eye bore a more exact resemblance to the sounds which strike the ear? What object of sight have the numberless generations of men and women beheld comparable to these exhibited in the ineffable mysteries?" To the same purpose, Pletho, in the oracles of Zoroastres, informs us, "that frightful and shocking apparitions, in a variety of forms, used to be displayed to the mystæ in the course of their initiation." And a little after, he adds, "that thunder and lightning and fire, and every thing terrible which might be held symbolical of the divine presence, was introduced." Claudian, in his poem *De Rapta Proserpina*, gives an elegant though brief, description of this phenomenon, which throws some light on the passages above quoted.

76 Horrible spectres and pleasing scenes alternately exhibited.

"*Jam mihi cernuntur trepides delubra moveri*
"*Sedibus et clarum dis pergere culmina lucem.*
"*Adventum testata Dea, jam magnus ab imis*
"*Auditur fremitus terris, templumque remugit*
"*Cecropidum.*"

The sight of those appearances was called the *Antopsia*, or "the real presence:" hence those rites were sometimes called *Epoptica*. The *Epoptæ* were actually initiated, and were admitted into the *Sanctum Sanctorum*, and bore a part in the ceremonial; whereas the *mystæ*, who had only been initiated in the lesser mysteries at Agræ, were obliged to take their station in the porch of

77 A kind of baptismal ablution in the mysteries.

of the temple. The candidates for initiation bathed themselves in holy water, and put on new cloaths, all of linen, which they continued to wear till they were quite torn, and then they were consecrated to Ceres and Proserpine. From the ceremony of bathing they were denominated *Hydrani;* and this again was a kind of baptismal ablution. Whether the phrases of *washing away sin, putting on the Lord Jesus Christ, putting off the old man with his deeds, putting on a robe of righteousness, being buried in baptism,* the words *mystery, perfect, perfection* which occur so frequently in the New Testament, especially in the writings of the apostle St Paul, are borrowed from the pagan mysteries, or from usages current among the Jews, we leave to our more learned readers to determine.

78 The initiated declared perfect men.

The Epoptæ having sustained all those fiery trials heard and seen every thing requisite, taken upon them the vows and engagements above narrated, and, in a word, having shown themselves good soldiers of Ceres and Proserpine, were now declared *perfect men.* They might, like Cebes's *virtuous man,* travel wherever they chose: those wild beasts (the human passions) which tyrannise over the rest of mankind, and often destroy them, had no longer dominion over them. They were now not only *perfect* but *regenerated* men. They were now crowned with laurel, as was said above, and dismissed with two barbarous words, Κογξ, ὀμπαξ, *Konx ompax,* of which perhaps the Hierophants themselves did not comprehend the import. They had been introduced by the first Egyptian missionaries, and retained in the sacra after their signification was lost. This was a common practice among the Greeks. In the administration of their religious ceremonies, they retained many names of persons, places, things, customs, &c. which had been introduced by the Phœnicians and Egptians, from whom they borrowed their system of idolatry. Those terms constituted the language of the gods, so often mentioned by the prince of poets. To us the words in question appear to be Syriac, and to signify, *Be vigilant, be innocent.*

Numerous and important were the advantages supposed to redound to the initiated, from their being admitted to partake of the mysteries, both in this life and that which is to come. First, they were highly honoured, and even revered, by their contemporaries. Indeed, they were looked up to as a kind of sacred persons: they were, in reality, consecrated to Ceres and Proserpine. Secondly, they were obliged by their oath to practise every virtue, religious, moral, political, public, and private. Thirdly they imagined, that sound advice and happy measures of conduct were suggested to the initiated by the Eleusinian goddesses. Accordingly, says Pericles the celebrated Athenian statesman, "I am convinced, that the deities of Eleusis inspired me with this sentiment, and that this stratagem was suggested by the principal of the mystic rites." There is a beautiful passage in Aristophanes's * comedy of the Ranæ to the very same purpose, of which we shall subjoin the following periphrasis. It is sung by the chorus of the initiated.

* Act I.

Let us to flow'ry meads repair,
  With deathless roses blooming,
Whose balmy sweets impregn the air,
  Both hills and dales perfuming.
Since fate benign our choir has join'd,
  We'll trip in mystic measure:
In sweetest harmony combin'd
  We'll quaff full draughts of pleasure.
For us alone the pow'r of day
  A milder light dispenses;
And sheds benign a mellow'd ray
  To cheer our ravish'd senses:
For we beheld the mystic show,
  And brav'd Eleusis' dangers.
We do and know the deeds we owe
  To neighbours, friends, and strangers.

Euripides, in his Bacchæ (E). introduces the chorus extolling the happiness of those who had been acquainted with God by participating in the holy mysteries, and whose minds had been enlightened by the mystical rites. They boast, "that they had led a holy and unblemished life, from the time that they had been initiated in the sacred rites of Jupiter Idæus, and from the time that they had relinquished celebrating the nocturnal rites of Bacchus, and the banquets of raw flesh torn off living animals." To this sanctity of life they had no doubt engaged themselves, when they were initiated in the mysteries of that god. The Eleusinian Epoptæ derived the same advantages from their sacramental engagements. Fourthly, the initiated were imagined to be the peculiar wards of the Eleusinian goddesses. These deities were supposed to watch over them, and often to avert impending danger, and to rescue them when beset with troubles.—Our readers will not imagine that the initiated reaped much benefit from the protection of his Eleusinian tutelary deities; but it was sufficient that they believed the fact, and actually depended upon their interposition. Fifthly, the happy influences of the teletæ, were supposed to administer consolation to the Epoptæ in the hour of dissolution; for, says Isocrates "Ceres bestowed upon the Athenians two gifts of the greatest importance; the fruits of the earth, which were the cause of our no longer leading a savage course of life; and the teletæ, for they who partake of these entertain more pleasant hopes both at the end of life, and eternity afterwards." Another author * tells us, "that the initiated were not only often rescued from many hardships in their lifetime, but at death entertained hopes that they should be raised to a more happy condition." Sixthly, After death, in the Elysian fields, they were to enjoy superior degrees of felicity, and were to bask in eternal sunshine, to quaff nectar, and feast upon ambrosia, &c.

* Aristides de Myst. El.

79 Interestedness of the priests.

The priests were not altogether disinterested in this salutary process. They made their disciples believe, that the souls of the uninitiated, when they arrived in the infernal regions, should roll in mire and dirt, and with very great difficulty arrive at their destined mansion.

(E) Act I. near the beginning, and in many other places.

‡ Phædo. sion. Hence Plato introduces Socrates ‡ observing, "that the sages who instituted the teletæ had positively affirmed, that whatever soul should arrive in the infernal mansions *unhousell'd* and *unaneall'd*, should lie there immersed in mire and filth." And as to a future state (says Aristides), "the initiated shall not roll in mire and grope in darkness: a fate which awaits the unholy and uninitiated." It is not hard to conceive with what a commanding influence such doctrines as these must have operated on the generality of mankind.

80
Remarks of Diogenes and Antisthenes.

When the Athenians advised Diogenes to get himself initiated, and enforced their arguments with the above considerations, "It will be pretty enough (replied the philosopher) to see Agesilaus and Epaminondas wallowing in the mire, while the most contemptible rascals who have been initiated are strutting in the islands of bliss."

When Antisthenes was to be initiated in the Orphic mysteries, and the priest was boasting of the many astonishing benefits which the initiated should enjoy in a future state ‡, "Why, forsooth, (says Antisthenes), 'tis wonder your reverence don't e'en hang yourself in order to come at them the sooner."

‡ Diog. Laert.

81
All the world crowd to Eleusis.

When such benefits were expected to be derived from the mysteries, no wonder if all the world crowded to the Eleusinian standard. After the Macedonian conquests, the Hierophants abated much of their original strictness. By the age of Cicero, Eleusis was a temple whether all nations resorted to partake of the benefits of that institution. We find that almost all the great men of Rome were initiated. The Hierophants, however, would not admit Nero on account of the profligacy of his character. Few others were refused that honour; even the children of the Athenians were admitted. But this, we think, was rather a lustration or consecration, than an initiation. Perhaps it paved the way for the more august ceremony, as the Christian baptism does among us for the other sacrament.

82
Degeneracy of the mysteries.

That this institution gradually degenerated, can hardly be questioned; but how much, and in what points, we have not been able to investigate. The fathers of the church, from whom that charge is chiefly to be collected, are not always to be trusted, especially when they set themselves to arraign the institutions of Paganism. There were indeed several ancient authors, such as Melanthius, Menander, Sotades, &c. who wrote purposely on the subject in question, but their works are long since irrecoverably lost. For this reason, modern writers, who have professedly handled it, have not always been successful in their researches. The two who have laboured most indefatigably, and perhaps most successfully, in this field, are Meursius and Warburton. The former, in his *Liber Singularis*, has collected every thing that can be gleaned from antiquity relating to the ceremonial of these institutions, without, however, pointing out their orignal, or elucidating the end and import of their establishment. The latter has drawn them into the vortex of a system which has in many instances led him to ascribe to them a higher degree of merit than we think they deserve. These instances we would willingly have noticed in our progress, had the limits prescribed us admitted such a discussion

If we may believe Diodorus the Sicilian, these mysteries, which were celebrated with such wonderful secrecy at Eleusis, were communicated to all mankind among the Cretans. This, however, we think, is rather problematical. We imagine that excellent historian has confounded the mysteries of Cybele with those of the Eleusinian Ceres. These two deities were undoubtedly one and the same, that is, the moon or the earth. Hence it is probable, that there was a striking resemblance between the sacred mysteries of the Cretans and Eleusinians.

This institution continued in high reputation to the age of St Jerome, as appears from the following passage; "Hierophantæ quoque Atheniensium legant usque hodie cicutæ sorbitione castrari." The emperor Valentinianus intended to have suppressed them; but Zozimus ‡, informs us, that he was diverted from his design by the proconsul of Greece. At length Theodosius the elder, by an imperial edict prohibited the celebration of these as well as of all the other sacra of Paganism. These mysteries, instituted in the reign of Erectheus, maintained their ground to the period just mentioned, that is, near 2000 years; during which space, the celebration of them never had been interrupted but once. When Alexander the Great massacred the Thebans and razed their city, the Athenians were so much affected with this melancholy event, that they neglected the celebration of that festival.

‡ Adverf. Jovin.

83
Abolished by the emperor Theodosius.

84
Other mysteries among the pagans of less celebrity.

There were almost numberless other mysterious institutions among the ancient Pagans, of which these sketched above were the most celebrated. The Samothracian mysteries, instituted in honour of the Cabiri, were likewise of considerable celebrity, and were supposed to confer much the same blessing with the Eleusinian, but were not of equal celebrity. The Cabiri were Phœnician and likewise Egyptian ‡ deities. The learned Bochart has explained their origin, number, names and some part of their worship. The Orphic mysteries were likewise famous among the Thracians. Orpheus learned them in Egypt, and they were nearly the same with the sacra Bacchanalia of the Greeks. There were likewise the mysteries of Jupiter Idæus in great request among the Cretans, those of the Magna Mater or Cybele, celebrated in Phrygia. To enumerate and detail all these would require a complete volume. We hope our readers will be fully satisfied with the specimen exhibited above. We are convinced many things have been omitted which might have been inserted, but we have collected the most curious and the most important.—Every one of the positions might have been authenticated by quotations from authors of the most undoubted credibility, but that process would have swelled the the article beyond all proportion.

‡ Sanchoniathon and Herodotus.

MYSTICAL,

MYSTICAL, something mysterious or allegorical. Some of the commentators on the sacred writings, besides a literal find also a mystical meaning. The sense of scripture, say they, is either that immediately signified by the words and expressions in the common use of language; or it is mediate, sublime, typical, and mystical. The literal sense they again divide into proper literal, which is contained in the words taken simply and properly; and metaphorical literal, where the words are to be taken in a figurative and metaphorical sense. The mystical sense of scripture they divide into three kinds: the first corresponding to faith, and called *allegorical;* the second to hope, called *anagogical;* and the third to charity, called the *tropological sense*. And sometimes they take the same word in scripture in all the four senses: thus the word *Jerusalem*, literally signifies the capital of Judea: allegorically, the church militant: tropologically, a believer; and anagogically, heaven. So that passage in Genesis, *let there be light and there was light*, literally signifies corporeal light: by an allegory, the Messiah in the tropological sense, grace; and anagogically, beatitude, or the light of glory.

MYSTICS, *mystici*, a kind of religious sect, distinguished by their professing pure, sublime, and perfect devotion, with an entire disinterested love of God, free from all selfish considerations.

The mystics, to excuse their fanatic ecstacies and amorous extravagancies, alledge that passage of St Paul, *The Spirit prays in us by sighs and groans that are unutterable.* Now if the Spirit, say they, pray in us, we must resign ourselves to its motions, and be swayed and guided by its impulse, by remaining in a state of mere inaction.

Passive contemplation is that state of perfection to which the mystics all aspire.

The authors of this mystic science, which sprung up towards the close of the third century, are not known; but the principles from which it was formed are manifest. Its first promoters preceded from the known doctrine of the Platonic school, which was also adopted by Origen and his disciples, that the divine nature was diffused through all human souls, or that the faculty of reason, from which proceed the health and vigour of the mind, was an emanation from God into the human soul, and comprehended in it the principles and elements of all truth, human and divine. They denied that men could by labour or study excite this celestial flame in the breast; and therefore they disapproved highly of the attempts of those, who by definitions, abstract theorems, and profound speculations, endeavoured to form distinct notions of truth, and to discover its hidden nature. On the contrary, they maintained that silence, tranquility, repose, and solitude, accompanied with such acts as might tend to extenuate and exhaust the body, were the means by which the hidden and internal word was excited to produce its latent virtues, and to instruct men in the knowledge of divine things. For thus they reasoned; those who behold with a noble contempt all human affairs, who turn away their eyes from terrestrial vanities, and shut all the avenues of the outward senses against the contagious influences of a material world, must necessarily return to God, when the spirit is thus disengaged from the impediments that prevented that happy union. And in this blessed frame they not only enjoy inexpressible raptures from their communion with the Supreme Being, but also are invested with the inestimable privilege of contemplating truth undisguised and uncorrupted in its native purity, while others behold it in a vitiated and delusive form.

The number of the Mystics increased in the fourth century, under the influence of the Grecian fanatic, who gave himself out for Dionysius the Areopagite, disciple of St Paul, and probably lived about this period: and by pretending to higher degrees of perfection than other Christians, and practising greater austerity, their cause gained ground, especially in the eastern provinces, in the fifth century. A copy of the pretended works of Dionysius was sent by Balbus to Lewis the Meek in the year 824, which kindled the holy flame of mysticism in the western provinces, and filled the Latins with the most enthusiastic admiration of this new religion.

In the twelfth century, these mystics took the lead in their method of expounding scripture; and by searching for mysteries and hidden meaning in the plainest expressions, forced the word of God into a conformity with their visionary doctrines, their enthusiastic feelings, and the system of discipline which they had drawn from the excursions of their irregular fancies. In the thirteenth century, they were the most formidable antagonists of the schoolmen, and towards the close of the fourteenth, many of them resided and propagated their tenets almost in every part of Europe. They had, in the fifteenth centnry, many persons of distinguished merit in their number; and in the sixteenth century, previous to the reformation, if any sparks of real piety subsisted under the despotic empire of superstition, they were only to be found among the mystics.

The principles of this sect were adopted by those called *Quietests* in the seventeenth century, and, under different modifications, by the Quakers and Methodists.

MYSTRUM, a liquid measure among the ancients, containing the fourth part of the Cyathus, and weighing two drams and an half of oil, or two drams two scruples of water or wine. It nearly answers to our spoonful.

MYTELENE See METYLENE.

MYTENS (Daniel), of the Hague, was an admired painter in the reigns of king James and king Charles. He had certainly (Mr Walpole says) studied the works of Rubens before his coming over. His landscape in the back grounds of his portraits is evidently in the style of that school; and some of his works have been taken for Vandyck's. The date of his arrival is not certain. At Hampton-court are several whole lengths of princes and princesses of the house of Brunswick-Lunenburgh, and the portrait of Charles Howard earl of Nottingham; at Kensington is Mytens's own head. At Knowle, Lionel Cranfield earl of Middlesex, lord treasurer, with his white staff, whole length. At Lady Elizabeth Germain's at Drayton is a very fine whole length of Henry Rich earl of Holland, in a striped habit, with a walking stick. At St James's is Jeffery Hudson the dwarf, holding a dog by a string, in a landscape, coloured warmly and freely like Snyder or Rubens. Mytens drew the same figure in a very large picture of Charles I. and his Queen,

Queen, which was in the poſſeſſion of the late earl of Dunmore. The picture of the queen of Scots at St James's is a copy by Mytens. Mytens remained in great reputation till the arrival of Vandyck, who being appointed the king's principal painter, the former in diſguſt aſked his Majeſty's leave to retire to his own country; but the king learning the cauſe of his diſſatisfaction treated him with much kindneſs, and told him that he could find ſufficient employment both for him and Vandyck. Mytens conſented to ſtay, and even grew intimate, it is probable, with his rival, for the head of Mytens is one of thoſe painted among the profeſſors by that great maſter. Whether the ſame jealouſy operated again, or real decline of buſineſs influenced him, or any other cauſe, Mytens did not ſtay much longer in England. We find none of his works here after the year 1630. Yet he lived many years afterwards. Houbraken quotes a regiſter at the Hague dated in 1656, at which time it ſays Mytens painted part of the ceiling of the town-hall there; the ſubject is, Truth writing hiſtory on the back of Fame.

MYTENS (Martin), painter of portraits and hiſtory, was born at Stockholm in 1695, and at 11 years of age ſhowed an extraordinary genius. When he had practiſed for ſome years, he determined to ſeek for improvement at Rome, and in his progreſs to examine every thing curious in other cities of Europe. His firſt excurſion was to Holland, and from thence he proceeded to London, where he practiſed minature and enamel painting, to which he had always a ſtrong tendency, and by his performances in that way gained a ſufficiency to maintain himſelf, without being any incumbrance to his parents. In 1717 he viſited Paris, and proved ſo fortunate as to obtain the favour of the duke of Orleans, and to have the honour to paint the portrait of that prince, and alſo the portraits of Louis XV. and the Czar Peter. In 1721 he arrived at Vienna, where he was graciouſly received; and having with great applauſe painted the portraits of the emperor, the empreſs, and the moſt illuſtrious perſons at that court, during a reſidence of above two years, he proceeded on his intended journey to Italy. Having viſited Venice and ſpent two years at Rome, he went to Florence, where the grand duke Gaſton I. ſhowed him all poſſible marks of eſteem; and having engaged him for ſome time in his ſervice he made him conſiderable preſents, and placed the portrait of Mytens among the heads of the illuſtrious artiſts in his gallery. He alſo received public teſtimonies of favour from the king and queen of Sweden, each of them having preſented him with a chain of gold and a medal, when he viſited that court, after his return from Italy. At laſt he ſettled at Vienna, where he obtained large appointments from the court; and lived univerſally eſteemed for his uncommon merit, and equally valued for his perſonal accompliſhments. He died in 1755.

There were ſome other painters of the name of *Mytens*, but of inferior note.

MYTHOLOGY.

1 Definition.

IS a term compounded of two Greek words, and in its original import it ſignifies any kind of fabulous doctrine: In its more appropriated ſenſe, it means thoſe fabulous details concerning the objects of worſhip which were invented and propagated by men who lived in the early ages of the world, and by them tranſmitted to ſucceding generations, either by written records or by oral tradition.

As the theology and mythology of the ancients are almoſt inſeparably connected, it will be impoſſible for us to develope the latter, without often introducing ſome obſervations relating to the former. We muſt therefore intreat the indulgence of our readers, if upon many occaſions we ſhould hazard a few ſtrictures on the names, characters, adventures, and functions of ſuch pagan divinities as may have furniſhed materials for thoſe fabulous narrations which the nature of the ſubject may lead us to diſcuſs.

2 Origin of fable.

With reſpect to *fable*, it may be obſerved in general, that it is a creature of the human imagination, and derives its birth from that love of the *marvellous* which is in a manner congenial to the ſoul of man.—The appearances of nature which every day occur, objects, actions, and events, which ſucceed each other, by a kind of rotine, are too familiar, too obvious, and unintereſting, either to gratify curioſity or to excite admiration. On the other hand, when the moſt common phenomena in nature or life are new modelled by the plaſtic power of a warm imagination: when they are diverſified, compounded, embelliſhed, or even arranged and moulded into forms which ſeldom or perhaps never occur in the ordinary courſe of things;—novelty generates admiration, a paſſion always attended with delightful ſenſations. Here then we imagine we have diſcovered the very ſource of *fiction* and *fable*.—They originated from that powerful propenſity in our nature towards the *new* and *ſupprifing*, animated by the delight with which the contemplation of them is generally attended.

Many circumſtances contributed to extend and eſtabliſh the empire of fable. The legiſlator laid hold on this bias of human nature, and of courſe employed *fable* and *fiction* as the moſt effectual means to civilize a rude, unpoliſhed world. The philoſopher, the theologiſt, the poet, the muſician, each in his turn, made uſe of this vehicle to convey his maxims and inſtructions to the ſavage tribes. They knew that *truth*, ſimple and unadorned, is not poſſeſſed of charms powerful enough to captivate the heart of man in his preſent corrupt and degenerate ſtate. This conſideration, which did indeed reſult from the character of their audience, naturally led them to employ fiction and allegory from this was derived the allegorical taſte of the ancients, and eſpecially of the primary ſages of the eaſt.

Though almoſt every nation on the face of the globe, however remote from the centre of population, however ſavage and averſe from cultivation, has fabricated

3 Boldneſs of the oriental mythology.

and adopted its own ſyſtem of mythology; the Orientals, however, have diſtinguiſhed themſelves in a peculiar manner, by the boldneſs, the inconſiſtency, and the extravagance of their mythology. The genial warmth of thoſe happy climes, the fertility of the ſoil, which afforded every neceſſary, every conveniency, and often every luxury of life, without depreſſing their ſpirits by laborious exertions; the face of nature perpetually blooming around them, the ſkies ſmiling with uninterrupted ſerenity; all contributed to inſpire the orientals with a glow of fancy and a vigour of imagination rarely to be met with in leſs happy regions. Hence every object was ſwelled beyond its natural dimenſions. Nothing was great or little in moderation, but every ſentiment was heightened with incredible hyperbole. The magnificent the ſublime, the vaſt, the enormous, the marvellous, firſt ſprung up, and were brought to maturity, in thoſe native regions of fable and fairyland. As nature in the ordinary courſe of her operations, exhibited neither objects nor effects adequate to the extent of their romantic imaginations, they naturally deviated into the fields of fiction and fable. Of conſequence, the cuſtom of detailing fabulous adventures originated in the eaſt, and was from thence tranſplanted into the weſtern countries.

As the allegorical taſte of the eaſtern nations had ſprung from their propenſity to fable, and as that propenſity had in its turn originated from the love of the marvellous; ſo did allegory in proceſs of time contribute its influence towards multiplying fables and fiction almoſt *in infinitum*. The latent import of the allegorical doctrines being in a few ages loſt and obliterated, what was originally a moral or theological tenet, aſſumed the air and habit of a perſonal adventure.

4 Propenſity to perſonification a ſource of eaſtern mythology.

The propenſity towards perſonification, almoſt univerſal among the orientals, was another fruitful ſource of fable and allegory, That the people of the eaſt were ſtrongly inclined to perſoniſy inanimate objects and abſtract ideas, we imagine will be readily granted, when it is conſidered, that in the formation of language they have generally annexed the affection of ſex to thoſe objects. Hence the diſtinction of grammatical genders, which is known to have originated in the eaſtern parts of the world. The practice of perſoniſying virtues, vices, religious and moral affections, was neceſſary to ſupport that allegorical ſtyle which univerſally prevailed in thoſe countries. This mode of writing was in high reputation even in Europe ſome centuries ago; and to it we are indebted for ſome of the moſt noble poetical compoſitions now extant in our own language. Thoſe productions, however, are but faint imitations of the original mode of writing ſtill current among the eaſtern nations. The Europeans derived this ſpecies of compoſition from the Mooriſh inhabitants of Spain, who imported it from Arabia, their original country.

5 The effects of hieroglyphic writing on mythology.

The general uſe of hieroglyphics in the eaſt, muſt have contributed largely towards extending the empire of mythology. As the the import of the figures employed in this method of delineating the ſigns of ideas was in a great meaſure arbitrary, miſtakes muſt have been frequently committed in aſcertaining the notions which they were at the firſt intended to repreſent. When the developement of theſe arbitrary ſigns happened to be attended with uncommon difficulty, the expounders were obliged to have recourſe to conjecture. Thoſe conjectural expoſitions were for the moſt part tinctured with that bias towards the marvellous which univerſally prevailed among the primitive men. This we find is the caſe even at this day, when moderns attempt to develope the purport of emblematical figures, preſerved on ancient medals, entaglions, &c.

The wiſe men of the eaſt delighted in obſcure enigmatical ſentences. They ſeem to have diſdained every ſentiment obvious to vulgar apprehenſion. The words of the wiſe, and their dark ſayings, often occur in the moſt ancient records both ſacred and prophane. The ſages of antiquity uſed to vie with each other for the prize of ſuperior wiſdom, by propounding riddles, and dark and myſterious queſtions, as ſubjects of inveſtigation. The conteſt between Solomon and Hiram, and that between Amaſis king of Egypt and Polycrates tyrant of Samos, are univerſally known.—As the import of thoſe enigmatical propoſitions was often abſolutely loſt, in ages when the art of writing was little known, and ſtill leſs practiſed, nothing remained but fancy and conjecture, which always verged towards the regions of fable. This then, we think, was another ſource of mythology.

6 Mythology reduced to a kind of ſyſtem in Egypt.

The Pagan prieſts, eſpecially in Egypt, were probably the firſt who reduced mythology to a kind of ſyſtem. The ſacerdotal tribe, among that people, were the grand depoſitaries of learning as well as of religion. That order of men monopoliſed all the arts and ſciences. They ſeem to have formed a conſpiracy among themſelves, to preclude the laity from all the avenues of intellectual improvement. This plan was adopted with a view to keep the laity in ſubjection, and to enhance their own importance. To accompliſh this end, they contrived to perform all the miniſtrations of their religion in an unknown tongue, and to cover them with a thick veil of fable and allegory. The language of Ethiopia became their ſacred dialect, and hieroglyphics their ſacred character.—Egypt, of courſe, became a kind of fairyland, where all was jugglery, magic, and enchantment. The initiated alone were admitted to the knowledge of the occult myſtical exhibitions, which, in their hands, conſtituted the eſſence of their religion. From theſe the vulgar and profane were prohibited by the moſt rigorous penalties (See Mysteries). The Egyptians, and indeed all the ancients without exception, deemed the myſteries of religion too ſacred and ſolemn to be communicated to the herd of mankind, naked and unreſerved; a mode by which they imagined thoſe ſacred and ſublime oracles would have been defiled and degraded. "Procul. o procul eſte profani—Odi profanum vulgus et arceo." Egypt was the land of graven images; allegory and mythology were the veil which concealed religion from the eyes of the vulgar; fable was the groundwork of that impenetrable covering.

7 In the earlieſt ages of the world mythology had no exiſtence.

In the earlieſt and moſt unpoliſhed ſtage of ſociety we cannot ſuppoſe fable to have exiſted among men. Fables are always *tales of other times*, but at this period other times did not reach far enough backward to afford thoſe fruits of the imagination ſufficient time to arrive at maturity. Fable requires a conſiderable ſpace of time to acquire credibility, and to riſe into reputation. Accordingly, we find that both the Chineſe and Egyptians, the two most ancient nations whose annals have reached our times, were altogether unacquainted with fabulous details in the most early and least improved periods of their respective monarchies. It has been shown almost to a demonstration, by a variety of learned men, that both the one and the other people, during some centuries after the general deluge, retained and practised the primitive Noachic religion, in which fable and fancy could find no place; all was genuine unsophisticated truth.

8 Fabulous cosmogonies, the first mythological details.

As soon as the authentic tradition concerning the origin of the universe was either in a great measure lost, or at least adulterated by the inventions of men, fable and fiction began to prevail. The Egyptian *Thoth* or Thyoth, or Mercury Trismegistus, and Mochus the Phœnician, undertook to account for the formation and arrangement of the universe, upon principles purely mechanical. Here fable began to usurp the place of genuine historical truth. Accordingly, we find that all the historians of antiquity, who have undertaken to give a general detail of the affairs of the world, have ushered in their narration with a fabulous cosmogony. Here imagination ranged unconfined over the boundless extent of the primary chaos. To be convinced of the truth of this assertion, we need only look into Sanchoniathon's Cosmogony, Euseb. Præp. Evan. l. 1. sub init. and Diodorus Sic. l. 1. From this we suppose it will follow, that the first race of fables owed their birth to the erroneous opinions of the formation of the universe.

Having now endeavoured to point out the origin of mythology, or fabulous traditions, we shall proceed to lay before our readers a brief detail of the mythology of the most respectable nations of antiquity, following the natural order of their situation.

9 Chinese mythology.

The Chinese, if any credit be due to their own annals, or to the missionaries of the church of Rome, who pretend to have copied from them, were *the first of the nations*. Their fabulous records reach upwards many myriads of years before the Mosaic æra of the creation. The events during that period of time, if any had been recorded, must have been fabulous as the period itself. These, however, are buried in eternal oblivion. The missionaries, who are the only sources of our information with relation to the earliest periods of the Chinese history, represent those people as having retained the religion of Noah many centuries after the foundation of their empire. Upon this supposition, their cosmogony must have been sound and genuine, without the least tincture of those fabulous ingredients which have both disguised and disgraced the cosmogonies of most other nations.

10 Birth and inventions of Fohi.

According to the most authentic accounts, *Fohe* or *Fohi* laid the foundation of that empire about 4000 years ago. This emperor, according to the Chinese, was conceived in a miraculous manner. His mother, say they, one day as she was walking in a desert place, was surrounded by a rainbow; and, being impregnated by this meteor, was in due time delivered of that celebrated legislator. This personage, like the Athenian Cecrops, was half a man and half a serpent. His intellectual powers were truly hyperbolical. In one day he discovered 50 different species of poisonous herbs. He taught his countrymen the whole art of agriculture in the space of a very few years. He instructed them how to sow five different sorts of grain, He invented boats and nets for fishing, the art of fabricating porcelain, the management of silk-worms, the manufacturing of silk, &c. In a word that wonderful personage was inspired by Heaven with knowledge, which qualified him for composing that incomparable body of laws which are even at this day the wonder of the world. Our readers will admit, that this whole detail is fabulous and chimerical. The most learned part of them will readily observe, that the Chinese, in ascribing the invention of all the useful arts to their Fohi, are perfectly agreed with almost all the other nations of antiquity. The Indians ascribe every invention to *Budha*, or *Vishnou*, or *Foe;* the Persians to *Zerdusht* or *Zoroastres*; the Chaldeans to their man of the sea, whom they call *Oannes;* the Egyptians to *Thoth* or *Thyoth;* the Phœnicians to *Melicerta;* the Greeks to the family of the *Titans;* and the Scandinavians to *Odin*, &c.

11 Miraculous birth of Confucius.

About 55 years before the Christian æra, appeared the famous Chinese philosopher *Con-fu-tse*, or Confucius. Concerning the birth of this prince of philosophers, the Chinese have propagated the following legendary tale. His mother walking in a solitary place was impregnated by the vivifying influence of the heavens. The babe, thus produced, spake and reasoned as soon as it was born. Confucius, however, wrought no miracles, performed no romantic exploits, but lived an austere ascetic life, taught and inculcated the doctrines of pure morality, and died, remarkable only for superior wisdom. religious, moral, and political.

12 Lao-kiun and his doctrines.

About the year of Christ 601. flourished the Sectary *Lao-kiun*. His mother carried him 30 years in her womb, and was at last delivered of him under a plum tree. This philosopher was the Epicurus of the Chinese. His disciples, who were denominated *Fao-sse*, i. e. heavenly doctors, were the first who corrupted the religion of the Chinese. They were addicted to magic, and introduced the worship of good and bad dæmons. Their doctrine was embraced by a long succession of emperors. One of these princes, called *You-ti*, had been deprived by death of a favourite mistress, whom he loved with the most extravagant passion. The emperor, by the magical skill of one of these doctors, obtained an interview with his deceased mistress, a circumstance which rivetted the whole order in the affection and esteem of the deluded prince. Here our reader will observe the exact counterpart of the fable of Eurydice, so famous in the mythology of the Greeks and Romans. That such a system of religious principles must have abounded with mythological adventures is highly probable; but as the missionaries, to whom we are chiefly indebted for our information relating to the religion of the Chinese, have not taken the pains to record them, we find it impossible to gratify the curiosity of our readers on that head.

13 Introduction of the worship of Fo, and of the doctrine of the metempsychosis into China.

The worship of the idol Fo, or Foe, was transplanted from India into China about the 56th year of the Christian æra, upon the following occasion. One of the doctors of the Fao-sse had promised a prince of the family of Tehou, and brother of the emperor Ming-ti, to make him enter into communion with the spirits. At his solicitation an ambassador was dispatched into India, in order to inquire where the true religion

gion was to be found. There had been a tradition, ſay the miſſionaries, ever ſince the age of Confucius, that the true religion was to be found in the weſt.— The ambaſſador ſtopt ſhort in India: and finding that the god Foe was in high reputation in that country, he collected ſeveral images of that deity painted on chintz, and with it 42 chapters of the canonical books of the Hindoos, which, together with the images, he laid on a white elephant, and tranſported into his native country. At the ſame time he imported from the ſame quarter the doctrine of the tranſmigration of ſouls, which is firmly believed in China to this day. The doctrine and worſhip of Foe, thus introduced, made a moſt rapid progreſs all over China, Japan, Siam, &c. The prieſts of Foe are called among the Siameſe, *Talopoins;* by the Tartars, *Lamas*; by the Chineſe, *Ho-chang;* and by the people of Japan, *Bonzes*, By this laſt appellation they are generally known in Europe.

14 The worſhippers of Foe great mythologiſts.

An infinitude of fable was invented and propagated by the diſciples of Foe, concerning the life and adventures of their maſter. If the earlier ages of the Chineſe hiſtory are barren of mythological incidents, the later periods, after the introduction of the worſhip of Foe, furniſhed an inexhauſtible ſtore of miracles, monſters, fables, intrigues, exploits, and adventures, of the moſt villainous complexion. Indeed, moſt of them are ſo abſurd, ſo ridiculous, and at the ſame time ſo impious and profane, that we are convinced our readers will eaſily diſpenſe with a detail from which they could reap neither entertainment nor inſtruction. Such as may find themſelves diſpoſed to rake into this abominable puddle, we muſt refer to the reverend fathers du Halde, Couplet, Amiot, Kircher, and other members of the propaganda, in whoſe writings they will find wherewithal to ſatiſfy, and even to ſurfeit, their apetite.

15 Hindoo mythology.

The Hindoos, like the other nations of the eaſt, for a long time retained the worſhip of the true God. At length, however, idolatry broke in, and, like an impetuous torrent, overwhelmed the country. Firſt of all, the genuine hiſtory of the origin of the univerſe was either utterly loſt, or diſguiſed under a variety of fictions and allegories. We are told that *Brimha*, the ſupreme divinity of the Hindoos, after three ſeveral efforts, at laſt ſuceeeded in creating four perſons, whom he appointed to rule over all the inferior creatures.— Afterwards Brimha joined his efficient power with Biſhon and Rulder; and by their united exertions they produced ten men, whoſe general appellation is *Munies*, that is, the inſpired. The ſame being, according to another mythology, produced four other perſons, as imaginary as the former; one from his breaſt, one from his back, one from his lip, and one from his heart. Theſe children were denominated *Bangs;* the import of which word we cannot pretend to determine. According to another tradition, Brimha produced the Bramins from his mouth, to pray, to read, to inſtruct; the Chiltern from his arms, to draw the bow, to fight, to govern; the Bice from his belly or thighs, to nouriſh, to provide the neceſſaries of life by agriculture and commerce; the Soder from his feet, for ſubjection to ſerve, to labour, to travel. The reader will ſee at once, in theſe allegorical perſons, the four caſts or ſepts into which the Hindoo nation has, time immemorial, been divided. Theſe are ſome of their moſt celebrated mythological traditions with relation to the origin of the univerſe.

16 Hindoo traditions relating to the deluge, &c.

The Hindoos have likewiſe ſome mythological opinions which ſeem to relate to the general deluge. They tell us, that deſiring the preſervation of herds and of brahmans, of genii and of virtuous men, of *vedas* of law, and of precious things, the Lord of the univerſe aſſumes many bodily ſhapes; but though he pervades, like the air, a variety of beings, yet he is himſelf unvaried, ſince he has no quality in him ſubject to change. At the cloſe of the laſt *calpa*, there was a general deſtruction, occaſioned by the ſleep of Brahme, whence his creatures in different worlds were drowned in a vaſt ocean. Brahme being inclined to ſlumber after a lapſe of ſo many ages, the ſtrong dæmon *Hayagri va* came near him, and ſtole the *vedas* which had flowed from his lips. When *Heri*, the preſerver of the univerſe, diſcovered this deed of the prince of *Dainavas*, he took the ſhape of a minute fiſh called *Sap-hari*. After various transformations, and an enormous increaſe of ſize in each of them, the Lord of the univerſe loving the righteous man (A); who had ſtill adhered to him under all theſe various ſhapes, and intending to preſerve him from the ſea of deſtruction cauſed by the depravity of the age, thus told him how he was to act: "In ſeven days from the preſent time, O thou Tamer of enemies! the three worlds will be plunged in an ocean of death; but in the midſt of the deſtroying waves a large veſſel ſent by me for thy uſe ſhall ſtand before thee." The remaining part of the mythology ſo nearly reſembles the Moſaic hiſtory of Noah and the general deluge, that the former may be a ſtrong confirmation of the truth of the latter. To dry up the waters of the deluge, the power of the Deity deſcends in the the form of a *boar*, the ſymbol of ſtrength, to draw up and ſupport on his tuſks the whole earth, which had been ſunk beneath the ocean. Again, the ſame power is repreſented as a tortoiſe ſuſtaining the globe, which had been convulſed by the violent aſſaults of dæmons, while the gods charmed the ſea with the mountain *Mandar*, and forced it to diſgorge the ſacred things and animals, together with the water of life which it had ſwallowed. All theſe ſtories, we think relate to the ſame event, ſhadowed by a moral, a metaphyſical, and an aſtronomical allegory; and all three ſeem connected with the hieroglyphical ſculptures of the old Egyptians.

The Hindoos divide the duration of the world into four *Yugs* or *Jugs*, or *Jogues*, each conſiſting of a prodigious number of years. In each of thoſe periods, the age and ſtature of the human race have been gradually diminiſhed; and in each of them mankind has gradually declined in virtue and piety, as well as in age and ſtature. The preſent period they call the *Collæ*, i. e. the corrupt Jogue, which they ſay is to laſt 400,000

(A) He was Sovereign of the world. His name was *Mana*, or Statgavrata; his patronymic name was *Vaiſvata* or child of the Sun.

400,000 years, of which near 5000 years are already past. In the last part of the preceeding Jogue, which they call the *Dwa paar*, the age of man was contracted into 1000 years, as in the present it is confined to 100. From this proportional diminution of the length of the human life, our readers will probably infer, that the two last Jogues bear a pretty near resemblance to the Mosaic history of the age of the antediluvian and postdiluvian patriarchs; and that the two first are imaginary periods prior to the creation of the world, like those of the Chinese, Chaldeans, and Egyptians.

17
The world subject to various dissolutions and resuscitations.

According to the mythology of the Hindoos the system of the world is subject to various dissolutions and resuscitations. At the conclusion of the Collæ Jogue, say they, a grand revolution will take place, when the solar system will be consumed by fire, and all the elements reduced to their original constituent atoms. Upon the back of these revolutions, Brimha, the supreme deity of the Hindoos, is sometimes represented as a new born infant, with his toe in his mouth, floating on a camala or water flower, sometimes only on a leaf, of that plant, on the surface of the vast abyss. At other times he is figured as coming forth of a winding shell; and again as blowing up the mundane foam with a pipe at his mouth. Some of these emblematical figures and attitudes, our learned readers will probably observe, nearly resemble those of the ancient Egyptians.

But the vulgar religion of the ancient Hindoos was of a very different complexion; and opens a large field of mythological adventures. We have observed above, that the Fo or Foe of the Chinese was imported from India; and now we shall give a brief detail of the mythological origin of that divinity. We have no certain account of the birth-place of this imaginary deity.—His followers relate, that he was born in one of the kingdoms of India near the line, and that his father was one of that country. His mother brought him into the world by the left side, and expired soon after her delivery. At the time of her conception, she dreamed that she had swallowed a white elephant; a circumstance which is supposed to have given birth to the veneration which the kings of India have always shown for a white animal of that species. As soon as he was born, he had strength enough to stand erect without assistance. He walked abroad at seven, and pointing with one hand to the heavens, and with the other to the earth, he cried out, "In the heavens, and on the earth there is no one but me who deserves to be honoured." At the age of 30, he felt himself all on a sudden filled with the divinity; and now he was metamorphosed into Fo or Pagod, according to the expression of the Hindoos. He had no sooner declared himself a divinity, than he thought of propagating his doctrine, and proving his divine mission by miracles. The number of his disciples was immense; and they soon spread his dogmas over all India, and even to the higher extremities of Asia.

18
Birth, &c. of the god Fo.

19
Doctrines of Fo derived from Egypt.

One of the principle doctrines which Fo and his disciples propagated, was the metempsychosis or transmigration of souls. This doctrine, some imagine, has given rise to the multitude of idols reverenced in every country where the worship of Fo is established. Quadrupeds, birds, reptiles, and the vilest animals, had temples erected for them because, say they, the soul of the god, in his numerous transmigrations, may have at one time or other inhabited their bodies.

Both the doctrine of transmigration and of the worship of animals seems, however, to have been imported from Egypt into India. If the intercourse between these two countries was begun at so early a period as some very late writers have endeavoured to prove, such a supposition is by no means improbable. The doctrine of the transmigration of souls was early established among the Egyptians. It was, indeed, the only idea they formed of the soul's immortality. The worship of animals among them seems to have been still more ancient. If such an intercourse did actually exist, we may naturally suppose that colonies of Egyptian priests found their way into India, as they did afterwards into Asia Minor, Italy and Greece. That colonies of Egyptians did actually penetrate into that country, and settle there, many centuries before the nativity, is a fact that cannot be called in question, for reasons which the bounds prescribed us on this article will not allow us to enumerate. We shall only observe, that from the hieroglyphical representations of the Egyptian deities seem to have originated those monstrous idols which from time immemorial have been worshipped in India, China, Japan, Siam, and even in the remotest parts of Asiatic Tartary.

20
The incarnations of Vishnou.

Foe is often called *Budha*, *Budda*, and sometimes *Vishnou*; perhaps, indeed, he may be distinguished by many other names, according to the variety of dialects of the different nations among which his worship was established. An infinitude of fables was propagated by his disciples concerning him after his death. They pretended that their master was still alive; that he had been already born 8000 times; and that he had successively appeared under the figure of an ape, a lion, a dragon, an elephant, a boar, &c. These were called the incarnations of Vishnou. At length he was confounded with the Supreme God; and all the titles, attributes, operations, perfections, and ensigns of the Most High were ascribed to him. Sometimes he is called Amida, and represented with the head of a dog, and worshipped as the guardian of mankind. He sometimes appears as a princely personage, issuing from the mouth of a fish. At other times, he wears a lunette on his head, in which are seen cities, mountains, towers, trees, in short, all that the world contains. These transformations are evidently the children of allegorical or hieroglyphical emblems, and form an exact counterpart to the symbolical worship of the Egyptians.

The enormous mass of the mythological traditions which have in a manner deluged the vast continent of India, would fill many volumes: We have selected the preceding articles as a specimen only, by which our readers may be qualified to judge of the rest. If they find themselves disposed to indulge their curiosity at greater length, we must remit them to Thevenot's and Hamilton's Travels, to Monf. Aquetil in his Zond. Avesta Halhed's Introduction to his translation of the Code of Gentoo Laws, Col. Dow's History of Hindostan, Grose's Voyage to the East Indies, Asiatic Researches, vol. 1. and 2.

21 Persian mythology

The mythology of the Persians is, if possible, still more extravagant than that of the Hindoos. It supposes the world to have been repeatedly destroyed, and repeopled by creatures of different formation, who were successively annihilated or banished for their disobedience to the Supreme Being. The monstrous griffin *Sinergh* tells the hero *Caherman* that she had already lived to see the earth seven times filled with creatures and seven times a perfect void; that, before the creation of Adam, this globe was inhabited by a race of beings called *Peri* and *Dives* whose character formed a perfect contrast. The Peri are described as beautiful and benevolent: the dives are deformed, malevolent, and mischievous, differing from infernal demons only in this, that they are not as yet confined to the pit of hell. They are for ever ranging over the world, to scatter discord and misery among the sons of men. The Peri nearly resemble the fairies of Europe; and perhaps the Dives gave birth to the giants and magicians of the middle ages. The Peri and Dives wage incessant wars; and when the Dives make any of the Peri prisoners, they shut them up in iron cages, and hang them on the highest trees, to expose them to public view, and to the fury of every chilling blast.

22 Peri and Dives.

When the Peri are in danger of being overpowered by their foes, they solicit the assistance of some mortal hero; which producees a series of mythological adventures, highly ornamental to the strains of the Persian bards, and which, at the same time, furnishes an inexhaustible fund of the most diversified machinery.

One of the most celebrated adventurers in the mythology of Persia is *Tahmuras*, one of their most ancient monarchs. This prince performs a variety of exploits, while he endeavours to recover the fairy Merjan. He attacks the Dive Demrush in his own cave; where, having vanquished the giant or demon, he finds vast piles of hoarded wealth: these he carries of with the fair captive. The battles, labours, and adventures of Rostan, another Persian worthy, who lived many ages after the former, are celebrated by the Persian bards with the same extravagance of hyperbole with which the labours of Hercules have been sung by the poets of Greece and Rome.

23 Persia the birth place of chivalry and romance.

The adventures of the Persian heroes breathe all the wildness of atchievement recorded of the knights of Gothic romance. The doctrine of enchantments, transformations, &c. exhibited in both, is a characteristic symptom of one common original. Persia is the genuine classic ground of eastern mythology, and the source of the ideas of chivalry and romance: from which they were propagated to the regions of Scandinavia, and indeed to the remotest corners of Europe towards the west.

Perhaps our readers may be of our opinion, when we offer it as a conjecture, that the tales of the war of the Peri and Dives originated from a vague tradition concerning good and bad angels: nor is it, in our opinion, improbable that the fable of the wars between the gods and giants, so famous in the mythology of Greece and Italy, was imported into the former of these countries from the same quarter. For a more particular account of the Persian mythology, our readers may consult Dr Hyde de Relig. vet. Pers. Medor. &c. D. Herbelot's Bibl. Orient, and Mr Richardson's introduction to his Persian and Arabic Dictionary.

24 Chaldean mythology

The mythology of the Chaldeans, like that of the other nations of the east, commences at a period myriads of years prior to the æra of the Mosaic creation. Their cosmogony, exhibited by Berosus, who was a priest of Belus, and deeply versed in the antiquities of his country, is a piece of mythology of the most extravagant nature. It has been copied by Eusebius (Chron. l. i. p. 5.): it is likewise to be found in Syncellus, copied from Alexander Polyhistor. According to this historian, there were at Babylon written records preserved with the greatest care, comprehending a period of fifteen myriads of years. Those writings likewise contained a history of the heavens and the sea, of the earth, and of the origin of mankind. "In the beginning (says Berosus, copying from Oannes, of whom we shall give a brief account below) there was nothing but darkness and an abyss of water, wherein resided most hideous beings produced from a twofold principle. Men appeared with two wings; some with two and some with four faces. They had one body, but two heads; the one of a man the other of a woman. Other human figures were to be seen, furnished with the legs and horns of goats. Some had the feet of horses behind, but before were fashioned like men, resembling hippocentaurs." The remaining part of this mythology is much of the same complexion; indeed so extravagant, that we imagine our readers will readily enough dispense with our translating the sequel. "Of all these (says the author) were preserved delineations in the temple of Belus at Babylon. The person who was supposed to preside over them was called *Omorea*, This word, in the Chaldean language, is *Thaleth*, which the Greeks call θαλαττα but it more properly imports the moon. Matters being in this situation, *their* god (says Eusebius), *the* god (says Syncellus) came and cut the woman asunder; and out of one half of her he formed the earth, and out of the other he made the heavens; and, at the same time, he destroyed the monsters of the abyss." This whole mythology is an allegorical history copied from hieroglyphical representations, the real purport of which could not be decyphered by the author. Such, in general, were the consequences of the hieroglyphical style of writing.

25 Oannes the legislator of the Chaldeans.

Oannes, the great civilizer and legislator of the Chaldeans, according to Apollodorus, who copied from Berosus, was an amphibious animal of a heterogeneous appearance. He was endowed with reason and a very uncommon acuteness of parts. His whole body resembled a fish. Under the head of a fish he had also another head, and feet below similar to those of a man, which were subjoined to the tail of the fish. His voice and language were articulate and perfectly intelligible, and there was a figure of him still extant in the days of Berosus. He made his appearance in the Erythrean or Red Sea, where it borders upon Babylonia. This monstrous being conversed with men by day; but at night he plunged into the sea, and remained concealed in the water till next morning. He taught the Babylonians the use of letters and the knowledge of all the arts and sciences. He instructed them in the method of building houses, constructing temples, and all other edifices. He taught them to compile laws and religious ceremonies, and explained to them the principles of mathematics, geometry and astronomy. In a word, he communicated to them every thing necessary, useful and ornamental: and so universal were his instructions, that not one single article had ever been added to them since the time they were first communicated. Helladius is of opinion that this strange personage, whoever he was, came to be represented under the figure of a fish, not because he was actually believed to be such, but because he was clothed with the skin of a seal. By this account our readers will see that the Babylonion Oannes is the exact counterpart of the Fo-hi of the Chinese, and the Thyoth or Mercury Trismegistus of the Egyptians. It is likewise apparent, that the idea of the monster compounded of the man and the fish has originated from some hieroglyphic of that form grafted upon the appearance of man. Some modern mythologists have been of opinion that Oannos was actually Noah the great preacher of righteousness: who as some think, settled in Shinar or Chaldea after the deluge, and who, in consequence of his connection with that event, might be properly represented under the emblem of *the Man of the Sea*.

26 The nativity of the goddess of beauty and love.

The nativity of Venus, the goddess of beauty and love, is another piece of mythology famous among the Babylonians and Assyrians. An egg, say they, of a prodigious size, dropt from heaven into the river Euphrates. Some doves settled upon this egg, after that the fishes had rolled it to the bank. In a short time this egg produced Venus, who was afterwards called the *Dea Syria*, the Syrian goddess. In consequence of this tradition (says Hyginus), pigeons and fishes became sacred to this goddess among the Syrians, who always abstained from eating the one or the other. Of this imaginary being we have a very exact and entertaining history in the treatise *De Dea Syria* generally ascribed to Lucian.

In this mythological tradition our readers will probably discover an allusion to the celebrated *Mundane egg*: and at the same time the story of the fishes will lead them to anticipate the connection between the sea and the moon. This same deity was the Atargatis of Ascalon, described by Diodorus the Sicilian; the one-half of her body a woman, and the other a fish. This was no doubt a hieroglyphic figure of the moon, importing the influence of that planet upon the sea and the sex. The oriental name of this deity evidently points to the moon; for it is compounded of two Hebrew words (B), which import "the queen of the host of heaven."

27 The fable of Semiramis.

The fable of Semiramis is nearly connected with the preceding one. Diodorus Siculus has preserved the mythological history of this deity, which he and all the writers of antiquity have confounded with the Babylonian princess of the same name. That historian informs us, that the word *Semiramis*, in the Syrian dialect, signifies "a wild pigeon;" but we apprehend that this term was a name or eipithet of the moon, as it is compounded of two words (C) of an import naturally applicable to the lunar planet. It was a general practice among the Orientals to denominate their sacred animals from that deity to which they were consecrated. Hence the Moon being called *Semiramis*: and the pigeon being sacred to her divinity, the latter was called by the name of the former.

As the bounds prescribed this article renders it impossible for us to do justice to this interesting piece of mythology we must beg leave to refer our readers for farther information to Diod. Sic. l. ii. Hyginus Poet. Astron. fab. 197. Pharnutus de Nat. Deor. Ovid. Metam l. iv. Athen. in Apol. Izetzes Chil. ix. cap. 275. Seld. de Diis Syr. Syrit. ii. p. 183.

28 Little known of Arabian mythology

We should now proceed to the mythology of the Arabians, the far greatest part of which is, however, buried in the abyss of ages; though, when we reflect on the genius and character of that people, we must be convinced that they too, as well as the other nations of the east, abounded in fabulous relations and romantic compositions. The natives of that country have always been enthusiastically addicted to poetry, of which fable is the essence. Wherever the muses have erected their throne, fables and miracles have always appeared in their train. In the Koran we meet with frequent allusions to well-known traditionary fables. These had been transmitted from generation to generation by the bards and rhapsodists for the entertainment of the vulgar. In Arabia, from the earliest ages, it has always been one of the favourite entertainments of the common people, to assemble in the serene evenings around their tents, or on the platforms with which their houses are generally covered, or in large halls erected for the purpose, in order to amuse themselves with traditional narrations of the most distinguished actions of their most remote ancestors. Oriental imagery always embellished their romantic details. The glow of fancy, the love of the marvellous, the propensity towards the hyperbolical, and the vast, which constitute the essence of oriental description, must ever have drawn the relation aside into the devious regions of fiction and fairy-land. The religion of Mahomet beat down the original fabric of idolatry and mythology together. The Arabians fables current in modern times, are borrowed or imitated from Persian compositions; Persia being still the grand nursery of romance in the east.

29 Egyptian mythology

In Egypt we find idolatry, theology, and mythology, almost inseparably blended together. The inhabitants of this region, too, as well as of others in the vicinity of the centre of population, adhered for several centuries to the worship of the true God. At last, however, conscious of their own ignorance, impurity, imperfection, and total unfitness to approach an infinitely perfect Being, distant, as they imagined, and invisible, they began to cast about for some beings more exalted and more perfect than themselves, by whose mediation they might prefer their prayers to the supreme Majesty of heaven. The luminaries of heaven, which they imagined were animated bodies, naturally presented themselves. These were splendid and glorious beings. They were thought to partake of the divine nature: they were revered as the satraps, prefects,

(B) *Adar* or *Hadar*, "*magnificus*;" and *Gad*, "*exercitus turmi*."

(C) *Shem* or *Sem*, "a sign," and *ramath*, "high."

prefects, and representatives of the supreme Lord of the universe. They were visible, they were beneficient; they dwelt nearer to the gods, they were near at hand, and always accessible. These were, of course, employed as mediators and intercessors between the supreme Divinity and his humble subjects of this lower world. Thus employed, they might claim a subordinate share of worship, which was accordingly assigned them. In process of time, however, that worship, which was originally addressed to the Supreme creator by the mediation of the heavenly bodies, was in a great measure forgotten, and the adoration of mankind ultimately terminated on those illustrious creatures. To this circumstance, we think, we may ascribe

30 Origin of Zabiism.

the origin of that species of idolatry called *Zabiism*, or the worship of the host of heaven, which overspread the world early and almost universally. In Egypt this mode of worship was adopted in all its most absurd and most enthusiastic forms: and at the same time the most heterogeneous mythology appeared in its train. The mythology of the ancient Egyptians was so various and multiform, so complicated and so mysterious, that it would require many volumes even to give a superficial account of its origin and progress, not only in its mother country, but even in many other parts of the eastern and western world. Besides, the idolatry and mythology of that wonderful country are so closely connected and so inseparably blended together, that it is impossible to describe the latter without at the same time developing the former. We hope, therefore, our readers will not be disapointed if, in a work of this nature, we touched only upon some of the leading or most interesting articles of this complicated subject.

31 Reign of gods and demigods, &c. in Egypt.

The Egyptians confounded the revolutions of the heavenly bodies with the reigns of their most early monarchs. Hence the incredible number of years included in the reign of their eight superior gods, who, according to them, filled the Egyptian throne successively in the most early periods of time. To these, according to their system, succeeded twelve demigods, who likewise reigned an amazing number of years. These imaginary reigns were no other than the periodical revolutions of the heavenly bodies preserved in their almanacks, which might be carried back, and actually were carried back, at pleasure. Hence the fabulous antiquity of that kingdom. The imaginary exploits and adventures of these gods and demigods furnished an inexhaustible fund of mythological romances. To the demigods succeeded the kings of the cynic cycle, personages equally chimerical with the former. The import of this epiphet has greatly perplexed critics and etymologists. We apprehend it is an oriental word importing *royal* dignity, elevation of rank. This appellation intimated, that the monarchs of that cycle, admitting that they actually existed, were more powerful and more highly revered than their successors. After the princes of the cynic cycle comes another race, denominated *Nekyes*, a title likewise implying royal, splendid, glorious. These

32 Birth, exploits, and transformation of the gods.

cycles figure high in the mythological annals of the Egyptians, and have furnished materials for a variety of learned and ingenious disquisitions. The wars and adventures of Osiris, Orus, Typhon, and other allegorical personages who figure in the Egyptian rubric; the wanderings of Isis, the sister and wife of Osiris; the transformation of the gods into divers kinds of animals; their birth, education, peregrinations, and exploits;—compose a body of mythological fictions so various, so complicated, so ridiculous, and often so apparently absurd, that all attempts to develope and explain them have hitherto proved unsuccessful. All, or the greatest part, of those extravagant fables, are the offspring of hieroglyphical or allegorical emblems devised by the priests and sages of that nation, with a view to conceal the mysteries of their religion from that class of men whom they stigmatized with the name of the uninitiated rabble.

33 Worship of brute animals, &c.

The worship of brute animals and of certain vegetables universal among the Egyptians, was another exuberant source of mythological adventures. The Egyptian priests, many of whom were likewise profound philosophers, observed or pretended to observe, a kind of analogy between the qualities of certain animals and vegetables, and those of some of their subordinate divinities. Such animals and vegetables they adopted, and consecrated to the deities to whom they were supposed to bear this analogical resemblance: and in process of time they considered them as the visible emblems of those divinities to which they were consecrated. By these the vulgar addressed their archetypes: in the same manner, as in other countries, pictures and statues were employed for the very same purpose. The mob, in process of time, forgetting the emblematical character of those brutes and vegetables, addressed their devotion immediately to them; and of course these became the ultimate objects of vulgar adoration.

After that these objects, animate or inanimate, were consecrated as the visible symbols of the deities, it soon became fashionable to make use of their figures to represent those deities to which they were consecrated. This practice was the natural consequence of the hieroglyphical style which universally prevailed among the ancient Egyptians. Hence Jupiter Ammon was represented under the figure of a ram, Apis under that of a cow, Osiris of a bull, Pan of a goat, Thoth or Mercury of an ibis, Bubastis or Diana of a cat, &c. It was likewise a common practice among those deluded people to dignify these objects, by giving them the names of those deities which they represented. By this mode of dignifying these sacred emblems, the veneration of the rabble was considerably enhanced, and the ardour of their devotion inflamed in proportion. From these two sources, we think, are derived the fabulous transformations of the gods, so generally celebrated in the Egyptian mythology, and from it imported into Greece and Italy. In consequence of this practice, their mythological system was rendered at once enormous and unintelligible.

34 Mercury Trismegistus the author of the Egyptian mythology.

Their Thoth, or Mercury Trismegistus, was, in our opinion, the inventor of this unhappy system. This personage, according to the Egyptians, was the original author of letters, geometry, astronomy, music, architecture in a word, of all the elegant and useful arts, and of all the branches of science and philosophy. He it was who first discovered the analogy between the divine affections, influences, appearances, operations, and the corresponding properties, qualities, and instincts

instincts of certain animals, and the propriety of dedicating particular kinds of vegetables to the service of particular deities.

The priests, whose province it was to expound the mysteries of that allegorical hieroglyphical religion (see MYSTERIES), gradually lost all knowledge of the primary import of the symbolical characters. To supply this defect, and at the same time to veil their own ignorance, the sacerdotal instructors had recourse to fable and fiction. They heaped fable upon fable, till their religion became an accumulated chaos of mythological absurdities.

Two of the most learned and most acute of the ancient philosophers have attempted a rational explication of the latent import of the Egyptian mythology; but both have failed in the attempt; nor have the moderns, who have laboured in the same department, performed their part with much better success. Instead, therefore, of prosecuting this inexplicable subject, which would swell this article beyond all proportion, we must beg leave to refer those who are desirous of further information to the following authors, where they will find enough to gratify their curiosity, if not to inform their judgment: Herodotus, lib. ii. Diodorus Siculus, lib. i. Plut. Isis and Osiris; Jamblichus de Myst. Egypt. Horapolio Hieroglyp. Egypt. Macrob. Sat. cap. 23. among the ancients: and among the moderns. Kircher's Oedip. Voss. de orig. et prog. Idol. Mr Bryant's Annalysis of Anc. Mythol. Monf. Gebelin Monde prim.; and above all, to the learned Jablonski's Panth. Egyptiorum.

35 Phœnician mythology

The elements of Phœnician mythology have been preserved by Eusebius, Præp. Evang. sub. init. In the large extract which that learned father hath copied from Philo Biblius's translation of Sanchoniatho's History of Phœnicia, we are furnished with several articles of mythology Some of these throw considerable light on several passages of the sacred history: and all of them are strictly connected with the mythology of the Greeks and Romans. There we have preserved a brief but entertaining detail of the fabulous adventures of Uranus, Cronus, Dagon, Thyoth or Mercury, probably the same with the Egyptian hero of that name. Here we find Muth or Pluto, Æphcestus or Vulcan, Æsculapius, Nereus, Poseedon or Neptune &c. Astarte, or Venus Urania, makes a conspicuous figure in the catalogue of Phœnician worthies: Pallas or Minerva is planted on the territory of Attica; in a word, all the branches of the family of the Titans, who in after ages figured in the rubric of the Greeks, are brought upon the stage, and their exploits and adventures briefly detailed.

36 Grecian mythology derived from Egypt and Phœnicia.

By comparing this fragment with the mythology of the Atlantidæ and that of the Cretans preserved by Diodorus the Sicilian, lib. v. we think there is good reason to conclude, that the family of the Titans, the several branches of which seem to have been both the authors and objects of a great part of the Grecian idolatry, originally emigrated from Phœnicia. This conjecture will receive additional strength, when it is considered, that almost all their names recorded in the fabulous records of Greece, may be easily traced up to a Phœnician original. We agree with Herodotus, that a considerable part of the idolatry of Greece may have been borrowed from the Egyptians; at the same time, we imagine it highly probable, that the idolatry of the Egyptians and Phœnicians were, in their original constitution, nearly the same. Both systems were Sabiism, or the worship of the host of heaven. The Pelasgi according to Herodotus, learned the names of the gods from the Egyptians; but in this conjecture he is certainly warped by his partiality for that people. Had those names been imported from Egypt, they would no doubt have bewrayed their Egyptian original; whereas, every etymologist will be convinced that every one is of Phœnician extraction.

The adventures of Jupiter, Juno Mercury, Apollo, Diana, Mars, Minerva, or Pallas, Venus, Bacchus, Ceres, Proserpine, Pluto, Neptune, and the other descendants and coadjutors of the ambitious family of the Titans, furnish by far the greatest partof the mythology of Greece. They left Phœnicia, we think, about the age of Moses; they settled in Crete, a large and fertile island; from this region they made their way into Greece, which, according to the most authentic accounts, was at that time inhabited by a race of savages. The arts and inventions which they communicated to the natives; the mysteries of religion which they inculcated; the laws, customs, polity, and good order, which they established; in short, the blessings of humanity and civilization, which they every where disseminated, in process of time, inspired the unpolished inhabitants with a kind of divine admiration. Those ambitious mortals improved this admiration into divine homage and adoration. The greater part of the worship, which had been formerly addressed to the luminaries of heaven, was now transferred to those illustrious personages. They claimed and obtained divine honours from the deluded rabble of enthusiastic Greeks. Hence sprung an inexhaustible, fund of the most inconsistent and irreconcileable fictions.

37 Hence the inconsistent fictions of the Greek poets.

The foibles and frailties of the deified mortals were transmitted to posterity, incorporated as it were with the pompous attributes of supreme divinity. Hence the heterogeneous mixture of the mighty and the mean which chequers the characters of the heroes of the Iliad and Odyssey. The Greeks adopted the oriental fables; the import of which they did not understand. These they accommodated to heroes and illustrious personages, who had figured in their own country in the earliest periods. The labours of Hercules originated in Egypt, and evidently relate to the annual progress of the sun in the zodiac, though the vain glorious Greeks accommodated them to a hero of their own, the reputed son of Jupiter and Alcmena. The expedition of Osiris they borrowed from the Egyptians, and transferred to their Bacchus, the son of Jupiter and Semele the daughter of Cadmus. The transformation and wanderings of Io are evidently transcribed from the Egyptian romance of the travels of Isis in quest of the body of Osiris, or of the Phœnician Astarte, drawn from Sanconiathon. *Io* or *Ioh* is in reality the Egyptian name of the moon; and Astarte was the name of the same planet among the Phœnicians. Both these fables are allegorical representations of the anomalies of the lunar planet, or perhaps of the progress of the worship of that planet in different parts of the world. The fable of the conflagration occasioned by Phaeton is clearly of oriental extraction, and alludes to an excessive drought which in the early periods

periods of time scorched Ethiopia and the adjacent countries. The fabulous adventures of Perseus are said to have happened in the same regions, and are allegorical representations of the influence of the solar luminary; for the original Perseus was the sun. The rape of Proserpine and the wanderings of Ceres: the Eleusinian mysteries; the orgia or sacred rites of Bacchus; the rites and worship of the Cabiri—were imported from Egypt and Phœnicia: but strangely garbled and disfigured by the Hierophants of Greece. The gigantomachia, or war between the gods and the giants, and all the fabulous events, and varieties of that war, form an exact counterpart to the battles of the Peri and Dives, celebrated in the romantic annals of Persia.

38 The Greeks ignorant of oriental languages.

A considerable part of the mythology of the Greeks sprung from their ignorance of the oriental languages. They disdained to apply themselves to the study of languages spoken by people whom, in the pride of their heart, they stigmatised with the epithet of *barbarians*. This aversion to every foreign dialect was highly detrimental to their progress in the sciences. The same neglect or aversion has, we imagine, proved an irreparable injury to the republic of letters in all succeeding ages. The aoids or strolling bards laid hold on those oriental legends, which they sophisticated with their own additions and improvements, in order to accommodate them to the popular taste. These wonderful tales figured in their rhapsodical compositions, and were greedily swallowed down by the credulous vulgar. Those fictions, as they rolled down, were constantly augmented with fresh materials, till in process of time their original import was either forgotten or buried in impenetrable darkness. A multitude of these Hesiod has collected in his Theogonia, or generation of the gods, which unhappily became the religious creed of the illiterate part of the Greeks. Indeed, fable was so closely interwoven with the religion of that airy volatile people, that it seems to have contaminated not only their religious and moral, but even their political tenets.

39 Oracle of Dodona.

The far-famed oracle of Dodona was copied from that of Ammon of Thebes in Egypt: The oracle of Apollo at Delphos was an emanation from the same source: The celebrated Apollo Pythius of the Greeks was no other than *Ob* or *Aub* of the Egyptians, who denominated the basilisk or royal snake *Ov Cai*, because it was held sacred to the sun. *Ob* or *Aub* is still retained in the Coptic dialect, and is one of the many names or epithets of that luminary. In short, the ground-work of the Grecian mythology is to be traced in the east. Only a small part of it was fabricated in the country; and what was imported pure and genuine was miserably sophisticated by the hands through which it passed, in order to give it a Grecian air, and to accommodate its style to the Grecian taste. To enlarge upon this topic would be altogether superfluous, as our learned readers must be well acquainted with it already, and the unlearned may without much trouble or expence furnish themselves with books upon that subject.

[39] Roman mythology borrowed from Greece.

The Roman mythology was borrowed from the Greeks. That people had addicted themselves for many centuries to the arts of war and civil polity. Science and philosophy were either neglected or unknown. At last they conquered Greece, the native land of science, and then "Græcia capta ferum, victorem cepit arte et intulit agresti Latio." This being the case, their mythology was, upon the whole, a transcript from that of Greece. They had indeed gleaned a few fables from the Pelasgi and Hetruscans, which, however, are of so little consequence, that they are scarce worth the trouble of transcribing.

The mythology of the Celtic nations is in a good measure lost. There may possibly still remain some vestiges of the Druidical superstition in the remotest parts of the Highlands and islands of Scotland; and perhaps in the uncivilized places of Ireland. These we presume, would afford our readers but little entertainment, and still less instruction. Instead therefore of giving a detail of those uninteresting articles, we shall beg leave to refer our readers to Ossian's Poems, and Col. Valency's Collections of Irish Antiquities, for satisfaction on that subject.

The mythology of the northern nations, *i. e.* of the Norwegians, Danes, Swedes, Icelanders, &c. are uncommonly curious and entertaining. The Edda and Voluspa contain a complete collection of fables which have not the smallest affinity with those of the Greeks and Romans. They are wholly of an oriental complexion, and seem almost congenial with the tales of the Persians above described. The Edda was compiled in Iceland in the 13th century. It is a kind of system of the Scandinavian mythology: and has been reckoned, and we believe justly, a commentary on the Voluspa, which was the Bible of the northern nations. 40 Mythology of the northern nations.

Odin or Othin, or Woden or Waden, was the supreme divinity of those people. His exploits and adventures furnish the far greatest part of their mythological creed. That hero is supposed to have emigrated from the east; but from what country or at what period is not certainly known. His atchievments are magnified beyond all credibility. He is represented as the god of battles, and as slaughtering thousands at a blow. His palace is called *Valhal*: it is situated in the city of Midgard, where, according to the fable, the souls of heroes who had bravely fallen in battle enjoy supreme felicity. They spend the day in mimic hunting-matches, or imaginary combats. At night they assemble in the palace of Valhalla, where they feast on the most delicious viands, dressed and served up by the *Valkyriæ*, virgins adorned with celestial charms, and flushed with the bloom of everlasting youth. They solace themselves with drinking mead out of the skulls of enemies whom they killed in their days of nature. Mead, it seems, was the nectar of the Scandinavian heroes. 41 Odin or Woden,

Sleepner, the horse of Odin, is celebrated along with his master. Hela, the Hell of the Scandinavians, affords a variety of fables equally shocking and heterogeneous. Loke, the evil genius or devil of the northern people, nearly resembles the Typhon of the Egyptians. Signa or Sinna is the consort of Loke; from this name the English word *sin* is derived. The giants Weymur, Ferbanter, Belupher, and Hellunda, perform a variety of exploits, and are exhibited in the most frightful attitudes. One would be tempted to imagine, that they perform the exact counterpart of the giants of the Greek and Roman mythologists. Instead of glancing at these ridiculous and uninteresting fables, 42 The hell and devil of the Scandinavians.

fables, which is all that the limits prescribed us would permit, we shall take the liberty to lay before our readers a brief account of the contents of the Voluspa, which is indeed the text of the Scandinavian mythology.

43 The Voluspa. The word *Voluspa* imports, "the prophecy of Vola or Fola." This was perhaps a general name for the prophetic ladies of the north, as Sybil was appropriated to women endowed with the like faculty in the south. Certain it is, that the ancients generally connected madness with the prophetic faculty. Of this we have two celebrated examples; the one in Lycophron's Alexandria, and the other in the Sybil of the Roman Poet. The word *vola* signifies "mad or foolish;" whence the English words *fool*, *foolish*, *folly*. *Spa*, the latter part of the composition, signifies "to prophecy," and is still current among the common people in Scotland, in the word *Spæ*, which has nearly the same signification,

The Voluspa consists of between 200 and 300 lines. The prophetess having imposed silence on all intelligent beings, declares that she is about to reveal the works of the Father of nature, the actions and operations of the gods, which no mortal ever knew before herself. She then begins with a description of the chaos; and then proceeds to the formation of the world, the creation of the different species of its inhabbitants, giants, men, and dwarfs. She then explains the employments of the fairies or destinies, whom the northern people call *nornies*, the functions of the deities, their most memorable adventures, their disputes with Loke, and the vengeance that ensued. She at last concludes with a long and indeed animated description of the final state of the universe, and its dissolution by a general conflagration.

In the catastrophe, Odin and all the rabble of the pagan divinities, are to be confounded in the general ruin, no more to appear on the stage of the universe. Out of the ruins of the former world, according to the Voluspa, a new one shall spring up, arrayed in all the bloom of celestial beauty.

Such is the doctrine exhibited in the fabulous Voluspa. So congenial are some of the details therein delivered, especially their relating to the final dissolution of the present system, and the succession of a new heaven and a new earth, that we find ourselves strongly inclined to suspect, that the original fabrication of the work was a semipagan writer, much of the same complexion with the authors of the Sybilline oracles, and of some other apocryphal pieces which appeared in the world during the first ages of Christianity.

44 Mythology of Mexico and Peru. In America, the only mythological countries must be Mexico and Peru. The other parts of that large continent were originally inhabited by savages, most of them as remote from religion as from civilization. The two vast empires of Mexico and Peru had existed about 400 years only before the Spanish invasion. In neither of them was the use of letters understood; and of course the ancient opinions of the natives relating to the origin of the universe, the changes which succeeded, and every other monument of antiquity, was obliterated and lost. Clavigero has indeed enumerated a vast canaille of sanguinary gods worshipped by the Mexicans; but produces nothing either entertaining or interesting with respect to their mythology. The information to be derived from any other quarter is little to be depended upon. It passes through the hands of bigoted missionaries or other ecclesiastics, who were so deeply tinctured with fanaticism, that they viewed every action, every sentiment, every custom, every religious opinion and ceremony of those half civilized people, through a false medium. They often imagined they discovered resemblances and analogies between the rites of those savages and the dogmas of Christianity, which no where existed but in their own heated imagination.

The only remarkable piece of mythology in the annals of the Peruvians, is the pretended extraction of Manco Capac the first Inca of Peru, and of Mama Ocolla his consort. These two illustrious personages appeared first on the banks of the lake Titiaca. They were persons of a majestic stature, and clothed in decent garments. They declared themselves to be the children of the Sun, sent by their beneficient parent, who beheld with pity the miseries of the human race, to instruct and to reclaim them. Thus we find these two legislators availed themselves of a pretence which had often been employed in more civilized regions to the very same purposes. The idolatry of Peru was gentle and beneficent, that of Mexico gloomy and sanguinary. Hence we may see, that every mode of superstition, where a divine revelation is not concerned, borrows its complexion from the characters of its professors.

In the course of this article, our readers will observe that we have not much enlarged upon the mythology of the Greeks and Romans; that subject, we imagine to be so universally known by the learned and so little valued by the vulgar, that a minute discussion of it would be altogether superfluous. Besides, we hope it will be remembered that the narrowness of the limits prescribed us would scarce admit of a more copious detail. We would flatter ourselves, that in the course of our disquisitions we have thrown out a few reflections and observations, which may perhaps prove more acceptable to both descriptions of readers.

Mytilus. MYTILUS, the Mussel, in ichthyology: a genus of animals, belonging to the order of vermes testacea. The animal is an ascidia: the shell bivalve often affixed to some substance by a beard; the hinge without a tooth, marked by a longitudinal hollow line. Of these animals there are a great many species, some of them inhabiting the seas, others the rivers and ponds. Several of them are remarkable for the beauty of their internal shell, and for the pearls which are sometimes found in them.

1. The edulis, or edible mussel, has a strong shell, slightly incurvated on one side, and angulated on the other.

Mytilus. Mytilus.

other. The end near the hinge is pointed; the other rounded. When the epidermis is taken off, it is of a deep blue colour. It is found in immense beds, both in deep water and above low-water mark. The finest mussels in Britain are those called *Hambleton hookers*, from a village called *Hambleton* in that country. They are taken out of the sea, and placed in the river Weir, within reach of the tide, where they grow very fat and delicious. This species inhabits the European and Indian seas. Between the tropics it is largest, and smallest within the polar circle. It is said to be hurtful if too often eat, or in too great quantities; and is even sometimes poisonous.

2. The modiolus, or great mussel, with a strong shell, blunted at the upper end: one side angulated near the middle; from thence dilating towards the end, which is rounded. It dwells in the Mediterranean, Indian European, and American seas: and its flesh, which is a deep orange colour, is eatable. It is the greatest of the mussels known in Britain; being from six to seven inches in length; it lies at great depths; often seizes the baits of ground-lines, and is taken up with the hooks.

3. The cygneus, or swan mussel, with a thin brittle shell, very broad and convex, marked with concentric striæ; attenuated towards one end, dilated towards the other; decorticated about the hinge; the colour a dull green; the length six inches, breadth three and a half. It is an inhabitant of the European rivers frequenting chiefly their mouths.

4. The anatinus, or duck mussel, has a shell more oblong and less convex than the last: is very brittle and semitransparent; the space round the hinges like the last; the length about five inches, breadth two. It is found in Europe in fresh waters. Both it and the cygneus are devoured by swans and ducks; whence their names: crows also feed on these mussels, as well as on different other shell fish; and it is diverting to observe, that when the shell is too hard for their bills they fly with it to a great height, drop the shell on a rock, and pick out the meat when the shell is fractured by the fall.

5. The crystagalli, or cock's-comb mussel, has the shell folded or plaited as it were, spiny, and both lips rugged. It makes its abode the coral beds of the Indian ocean.

6. The margaritiferus, or pearl bearing mussel, has the shell compressed and flat, nearly orbicular, the base transverse, and imbricated with dentated coats. It dwells in the ocean of either India. This is the *matter perlarum* of Rumphius, or mother-of-pearl shell. On the inside it is exquisitely polished, and of the whiteness and water of pearl itself. It has also the same lustre on the outside after the external laminæ have been taken off by aquafortis and the lapidary's mill. Mother-of-pearl is used in inlaid works, and in several toys, as snuff-boxes, &c.

7. The lithophagus, or stone-eating mussel, has the shell cylindric, the extremities both ways being rounded. It inhabits the Indian, European, and mediterranean seas, penetrating and eating away marbles corals, &c. The Indian shell is softer and nearly tough like leather, but the European is more brittle.

8. The violacea, or violet mussel, has the shell longitudinally furrowed, the rim very obtuse, somewhat formed like the mytilus edulis, but considerably larger and more flattened, of a beautiful violet colour. Inhabits the southern ocean. There are about 50 other species.

Mussels not only open and shut their shells at pleasure, but they have also a progressive motion; they can fasten themselves where they please; they respire water like fishes; and some even flutter about on its surface so as to inhale air. If they lie in shallow places, a small circular motion is seen above the heel of the shell: and a few moments after, they cast out the water by one single stroke at the other end of the shell. The mouth is situated near the sharp angle of the animal, and is furnished with four floating fringes in the shape of mustachios which may perhaps answer the purpose of lips. The barbs which surround the edge of almost half the mussel, are a wonderful web of hollow fibres which serve as fins or organs of respiration, as vessels for the circulation of the fluids, and probably, as some philosophers suppose, as wedges for opening their shells; for we observe two large muscles or tendons for the purpose of shutting them; but we in vain look for their antagonists, or those which are destined to open them. When the mussel wishes to open itself, it relaxes the two muscles or tendons, and swells the fringes, which act as wedges and separate the shells. The animal shuts up itself by the contraction of two thick fibrous muscles which are fixed internally to each end of the shells; and these shells are lined all arround with a membrane or epidermis, which unites them so closely together when they are soaked in water, that not the smallest drop can escape from the muscle. When mussels choose to walk (A), they often contrive to raise themselves on the sharp edge of their shells, and put forth a fleshy substance susceptible of extension, which serves them as a leg to drag themselves along, in a kind of groove or furrow which they form in the sand or mud, and which supports the shell on both sides. In ponds, these furrows are very observable. From the same member or leg hang the threads

(A) The common sea or edible mussel has, from its being for the most part found fastened to the rocks, been supposed by many wholly incapable of progressive motion; but this M. Reaumur has shown to be an errroneous opinion. It is a common practice in France, at such seasons of the year as do not afford sun enough to make salt, to throw the common sea-mussels, which the fishermen catch about the coasts, into the brine-pits. They have an opinion that this renders their flesh the more tender and delicate, as the rain which falls at these seasons makes the waters of the pits much less salt than the common sea-water. The mussels are on this occasion thrown carelessly in, in several different parts of the pits; yet, at whatever distance they have been thrown in, the fishermen, when they go to take them out, always find them in a cluster together; and as there is no current of water in these places, nor any other power of motion which can have brought the mussels together, it seems

Mytilus threads by which the animals fasten (B) themselves to rocks or to one another.

According to the observations of M. Mery of the Paris Academy, and the subsequent experiments of other naturalists, mussels are all androgynous: and, from a peculiar generative organization, each individual is of itself capable of propagating its species, and annually does it without the intercourse of any other. This is altogether singular, and different from what takes place in snails, earth-worms, and other hydrogenous or hermaphroditical animals; for though each individual of these contains the parts of both sexes, yet there is always a congress of two animals for the propagation of the species. The parts of generation are two

seems very evident that they must voluntarily have marched from the places where they were at first, to have met thus together. This progressive motion is wholly performed by means of what we call the *tongue* of the mussel, from its shape; but, from its use in this case, appears to rather merit the name of a *leg*, or an *arm*, as by laying hold of any distant substance, and then forcibly contracting itself again, it draws along the whole body of the animal. The same part, when it has moved the animal to a proper place, serves also to fix it there, being the organ by which it spins the threads which we call its *beard*, by which it is held to a rock, or to another mussel. The motion of the mussel, by means of this part, is just the same with that of a man laid flat on his belly, who would draw himself along by laying hold of any thing with one hand and then drawing himself to it.

(B) Mussels are well known to have a power of fastening themselves either to stones, or to one another's shells, in a very strong and firm manner; but the method of doing this was not well understood till the observations of Mr Reaumur explained it. Every one who opens and examines a common mussel, will find, that in the middle of the fish there is placed a little blackish or brownish body resembling a tongue. This in large mussels is near half an inch long, and a little more than the sixth of an inch in breadth, and is narrower at the origin than at the extremity: from the root of this tongue, or that part of it which is fastened to the body of the fish, there are produced a great number of threads, which, when fixed to any solid substance, hold the mussel firmly in its place; these threads are usually from an inch to two inches in length, and in thickness from that of a hair to that of a hog's bristle. They issue out of the shell in that part were it naturally opens, and fix themselves to any thing that lies in their way, to stones, to fragments of shells, or which is the most common case, to the shells of other mussels; whence it happens that there are usually such large quantities of mussels found together. These threads are expanded on every side, and are usually very numerous, 150 having been found issuing from one shell: they serve the office of so many cables; and, each pulling in a proper direction, they keep the mussel fixed against any force that can be offered from whatever part it come. The filaments are well known to all who eat mussels, who ever carefully separate them under the name of the *beard*; and Mr Reaumur has found that while the animal is living in the sea, if they are all torn away by any accident, the creature has a power of substituting others in their room; he found that if a quantity of mussels were detached from one another and put into a vessel of any kind, and in that plunged into the sea, they in a little time fastened themselves both to the sides of the vessel and to one another's shells; the extremity of each thread seemed in this case to serve in the manner of a hand to seize upon any thing that it would fix to, and the other part, which was slender and smaller, to do the office of an arm in condncting it.

To know the manner of the mussels performing this operation, this diligent observer put some mussels into a vessel in his chamber, and covered them with sea water; he there saw that they soon began to open their shells, and each put forth that little body before described by its resemblance to a tongue, and at the root of which these threads grow; they extended and shortened this part several times, and thrust it out every way, often giving it not less than two inches in length, and trying before, behind, and on every side with it, what were the proper places to fix threads at: at the end of these trials they let it remain fixed for some time on the spot which they chose for that purpose, and then drawing it back into the shell with great quickness, it was easy to see that they were then fastened by one of these threads to the spot where it had before touched and remained fixed for a few minutes; and in repeating this workmanship the threads are increased in number one at every time, and being fixed in different places they sustain the fish at rest against any common force.

The several threads were found to be very different from one another; the new formed ones being ever whiter, more glossy, and more transparent than the others: and it appeared on a close examination, that it was not, as might have been most naturally supposed, the office of the tongue to convey the old threads one by one to the new places where they were now to be fixed, but that these in reality were now become useless; and that every thread we see now formed, is a new one made at this time; and in fine, that nature has given to some sea-fishes, as well as to many land-insects, a power of spinning those threads for their necessary uses: and that mussels and the like fish are under water, what caterpillars and spiders are at land.—To be well assured of this, however, Mr Reaumer cut off the beard or old threads of a mussle as close as he could, without injuring the part; and the proof of the opinion of their spinning new ones at pleasure was now brought to this easy trial, whether these mussels, so deprived of their old ones, could fix themselves as soon as others which were possessed of theirs, and cold throw out their threads to as considerable distances.—The experiment proved the truth of the conjecture; for those whose beards or old threads were cut off, fixed

Mytilus. two ovaries and two seminal vesicles. Each ovary and vesicle has its proper duct. It is through those four channels that the eggs and the seed of the mussel are conveyed to the anus, where those two principles unite at their issue, which answers the purpose of generation. It is in the spring that mussels lay their eggs; there being none found in them but in winter. M. Lewenhoek, in several mussels which he dissected, discovered numbers of eggs or embryo mussels in the ovarium, appearing as plainly as if he had seen them by the naked eye, and all lying with their sharp ends fastened to the string of vessels by which they receive nourishment. The minute eggs, or embryos, are by the parent placed in due order, and in a very close arrangement on the outside of the shell, where, by means of a gluey matter, they adhere very fast, and continually increase in size and strength, till becoming perfect mussels, they fall off and shift for themselves, leaving the holes where they were placed behind them. This abundance the mussel shells very plainly show, when examined by the microscope, and sometimes the number is 2000 or 3000 in one shell: but it is not certain that these have been all fixed there by the mussel within; for these fish usually lying in great numbers near one another, the embryos of one are often affixed to the shell of another. The fringed edge of the mussel, which Lewenhoek calls the *beard*, has in every the minutest part of it such variety of motions as is inconceivable; for being composed of longish fibres, each fibre has on both sides a vast many moving particles. Mytilus.

The mussel is infested by several enemies in its own element; according to Reaumur it is in particular the prey of a small shell-fish of the trochus kind. This animal attaches itself to the shell of the mussel, pierces it with a round hole, and introduces a sort of tube five or six lines long, which it turns in a spiral direction, and with which it sucks the substance of the mussel. Mussels are also subject to certain diseases, which have been supposed to be the cause of those bad effects which sometimes happen from the eating of them. These are stated by Dr Mœhring, in the 7th vol. of the German Ephemerides, to be the moss and the scab. The roots of the moss being introduced into the shell the water penetrates through the openings, and gradually dissolves the mussel. The scab is formed by a sort of tubercles which are produced by the dissolution of the shell. Certain small crabs, which are sometimes found in mussels, likewise tend to make them unwholesome.

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fixed themselves as soon as those in which they were left, and spread their threads to as great a distance every way.

When the mechanism of this manufacture was thus far understood, it became a natural desire to inquire into the nature of the part by which it was performed. This has hitherto been mentioned under the name of the tongue, from its shape; but it is truly the arm of the fish; and whenever it happens to be loosened from its company, or fixed in a wrong place, it serves the animal to drag its whole body shell and all along, and to perform its several motions. It fixes itself to some solid body; and then strongly contracting its length, the whole fish must necessarily follow it, and be pulled towards the place where it is fixed. This is an use, however, that this part is so rarely put to, that it is not properly to be esteemed a leg or an arm for this: but, according to its more frequent employment, may much better be denominated the organ by which the threads are spun. Though this body is flat in the manner of a tongue for the greater part of its length, it is however rounded or cylindric about the base or insertion, and it is much smaller there than in any other part: there are several muscular ligaments fastened to it about the root or base, which hold it firmly against the middle of the back of the shell; of these ligaments there are four which are particularly observable, and which serve to move the body in any direction. There runs all along this body a slit or crack, which pierces very deeply into its substance, and divides it as it were into two longitudinal sections; this is properly a canal, and along this is thrown the liquor which serves to form the threads; and it is in this canal or slit that these threads are moulded into their form. Externally, this appears only a small crack or slit, because the two fleshy sections of the parts almost meet and cover it; but it is rounded and deep within, and is surrounded with circular fibres. This canal is carried regularly on from the tip of the tongue, as it is called, to its base, where it becomes cylindric; the cylinder in this part being no other than a close tube or pipe, in which this open canal terminates. The cylindric tube contains a round oblong body, of the nature of the threads, except that it is much larger; and from the extremity of this all the threads are produced, this serving as a great cable to which all the other little cordages dispersed towards different parts are fixed. The tube or pipe in which this large thread is lodged, seems the reservoir of the liquor of which the other threads are formed; all its internal surface being furnished with glands for its secretion.

The mussel, like many other sea-fishes, abounds in this liquor; and if at any time one touch with a finger the base of this spinning organ, one draws away with it a viscous liquor in form of several threads, like those of the caterpillar, spider, and the other spinning land-animals. The threads fix themselves with equal ease to the most smooth and glossy, as to rougher bodies; if the mussels are kept in glass-jars of sea-water, they as firmly fasten themselves to the glass as to any other body. Mussels, be they ever so young, have this property of spinning; and by this means they fasten themselves in vast numbers to any thing which they find in the sea. Mr Reaumur has seen them, when as small as millet-seeds, spin plentifully, though their threads, proportioned to their own weight, are much finer and smaller than those of larger mussels.

The eating of muſſels has ſomtimes produced eryſipetalous inflammations, cutaneous eruptions, inſupportable itching all over the body, great reſtleſſneſs and agitation; and though theſe complaints are eaſily removed by oil, milk, and emetics, and have ſeldom or never proved mortal, yet they have an alarming aſpect, and make the patient ſuffer grievouſly. Theſe noxious effects have been ſuppoſed to be owing to the muſſels or part of them having been diſeaſed. Some authors however have pretended that thoſe effects never take place but between the vernal and autumnal equinox: and M. Beunie, phyſician at Antwerp, in a memoir on this ſubject, ſeems inclined to adopt this opinion; for he recommends abſtinence from muſſels during the months of May, June, July, and Auguſt. The cauſe of theſe noxious effects in the muſſel is, according to this author, altogether accidental. They are occaſioned, he ſays, by a kind of ſtella marina, a little ſea inſect pretty common about the mouth of the Scheldt, which ſometimes lodges itſelf in the muſſel in queſt of food; and whoſe ſpawn is ſo cauſtic and inflammatory, that, even when applied outwardly to the ſkin, it produces itching and ſwellings that are painful in a high degree. The itching occaſioned by touching the ſpawn of the ſtella marina is removed by vinegar; and this known fact induced Dr Beunie to preſcribe the internal uſe of vinegar, after bleeding, evacuations, and emetics. His method conſiſts in recommending a large quantity of refreſhing beverage, and, every hour, three ounces of vinegar diluted in water. The remedy, however, ſeems rather to confirm the opinion of thoſe who impute the diſorder in queſtion to an unperceived commencement of putrefaction in the muſſel; as vinegar is known to be a powerful antiſeptic, and there is no ſort of putrefaction more noxious and offenſive than that of fiſh.—Upon the whole, the edulis, or eatable muſſel, though a rich food, is difficult of digeſtion. In its beſt ſtate it is even noxious to ſome conſtitutions; and when affected by diſeaſe is in ſome degree poiſonous. Muſſels are apt to do moſt harm when eaten raw. They ought always to be boiled with onions, well waſhed with vinegar, and ſeaſoned with pepper; and even thus qualified, they ſhould not be eaten to exceſs or too frequently.

Freſh-water muſſels are not ſo good eating as the ſea-muſſel. The river muſſel, according to M. Poupart, ſwims in the water, and ſometimes appears to flutter on its ſurface. But we believe it more commonly creeps upon the mud, where it remains almoſt always at reſt. The pond muſſel is always larger than that which is found in rivers; and it is a more ſolitary animal. In its motion it makes tracks in the ſand and mud, as already obſerved; and it penetrates into it two or three inches, and ſometimes more. Pearls of conſiderable beauty are found in ſeveral river muſſels; of this kind are the Scots muſſels, thoſe of Valognes in Lorrain, of St Savinier, of Bavaria, and of the marſhes near Augſburg.

MYTTOTON, a coarſe kind of food, uſed by the labouring people among the Greeks, and ſometimes among the Romans. It was made of garlic, onions, eggs, cheeſe, oil, and vinegar, and reckoned very wholeſome.

MYUS (anc. geog.), one of the twelve towns of Ionia; ſeated on the Meander, at the diſtance of 30 ſtadia from the ſea. In Strabo's time it was incorporated with the Mileſians, on account of the paucity of its inhabitants, from its being formerly overwhelmed with water, for which reaſon the Ionians conſigned its ſuffrage and religious ceremonies to the people of Miletus. Artaxerxes allotted this town to Themiſtocles, in order to furniſh his table with meat: Magneſia was to ſupport him in bread, and Lampſacus in wine. The town now lies in ruins.

MYXINE, the HAG: a genus of inſects belonging to the order of vermes inteſtini. It hath a ſlender body, carinated beneath; mouth at the extremity, cirrated; the two jaws pinnated; an adipoſe or rayleſs fin round the tail and under the belly. The only remarkable ſpecies is the glutinoſa, about eight inches long. It inhabits the ocean; enters the mouths of fiſh when on the hooks of lines that remain a tide under water, and totally devours the whole, except ſkin and bones. The Scarborough fiſhermen often take it in the robbed fiſh, on drawing up their lines. Linnæus attributes to it the property of turning water into glue.

N

N, A liquid conſonant, and the 13th letter of the Greek, Latin, Engliſh, &c. alphabets.

The *n* is a naſal conſonant; its ſound is that of a *d*, paſſed through the noſe; ſo that when the noſe is ſtopped by a cold, or the like, it is uſual to pronounce *d* for *n*. M. l'Able de Dangeau obſerves, that in the French, the *n* is frequently a mere naſal vowel, without any thing of the conſonant in it. He calls it the Sclavonic vowel. The Hebrews call their *n nun*, which ſignifies child, as being ſuppoſed the offspring of *m*; partly on account of the reſemblance of ſound, and partly on that of the figure. Thus from the *m*, by omitting the laſt column, is formed *n*; and thus from the capital N, by omitting the firſt column, is formed the Greek minuſcle ν, Hence for *biennies*. &c. the Latins frequently uſe *limus*; &c. and the ſame people convert the Greek ν, at the end of a word, into an *m*, as φαρμακον, *pharmacum*. &c. See M.

N before *p*, *b*, and *m*, the Latins change into *m*, and frequently into *l* and *r*: as in *in-ludo*, *illudo*; *in-rigo*,

rigo, irrigo, &c.: in which they agree with the Hebrews, who in lieu of *nun*, frequently double the following consonants: and the Greeks do the same; as when for *Manlius*, they write Μαλλιος, &c. The Greeks also, before κ, γ, χ, ν, changed the ν into γ: in which they were followed by the ancient Romans; who, for *Angulus*, wrote *Aggulus*; for *anceps, agcepts*, &c.

The Latins retrench the *n* from Greek nouns ending in ων; as Λεων, *Leo*; Δρακων, *Draco*: on the contrary, the Greeks add it to the Latin ones ending in *o*; as Κατων, Νερων, *Cato, Nero*.

N, among the ancients, was a numeral letter, signifying 900; according to the verse in Baronius,

N, quoque nongentos numero designat habendos.

And when a line was struck over it, N̄, nine thouusand. Among the ancient lawyers *N. L.* stood for *non liquet*, i. e. the cause is not clear enough to pass sentence upon. N, or N°, in commerce, &c. is used as an abbreviation of *numero*, number.

NAARDA, Nearda, *Neerda*, or *Nehardea*, (anc-geog.), a town situated on the confines of Mesopotamia and Babylonia; populous, and with a rich and extensive territory, not easily to be attacked by an enemy, being surrounded on all sides by the Euphrates and strong walls (Josephus). In the lower age the Jews had a celebrated school there.

NAAS, a borough and post town of Ireland, in the county of Kildare, and province of Leinster. It is the shire town of that county, and alternately with Athy the assizes town. It is distant above 15 miles south west of Dublin, in N. Lat. 53. 10. W. Long. 6. 50. It sends two members to parliament; and gives title of viscount to the family of Burke. It has five fairs in the year.—This place was anciently the residence of the kings of Leinster: the name signifies "the place of elders." for here the states of that province assembled during the 6th, 7th, and 8th centuries, after the Naasteighan of Carmen had been anathematised by the Christian clergy. On the arrival of the English it was fortified; many castles were erected, the ruins of which are partly visible; and parliaments were held there. At the foot of the mount or rath are the ruins of a house founded in 1484, for eremites of the order of St Augustin. In the 12th century the baron of Naas founded a priory dedicated to St John the baptist, for Augustinian regular canons. In the centre of this town the family of Eustace erected a monastery for Dominican friars, dedicated to St Eustachius; and it apears that their possessions in Naas were granted them in the year 1355. This place was a strong hold during the civil wars.

NABATENE, or Regio Nabataeorum, according to Jerome, comprised all the country lying between the Euphrates and the Red Sea, and thus contained Arabia Deserta, with a part of the Petræa; so called from Nabaioth, the first born of Ismael. According to Diodorus, it was situated between Syria and Egypt. The people Nabatæi (1 Maccabees, Diodorus Siculus); inhabiting a desart and barren country; they lived by plundering their neighbours according to Diodorus. Nabathæus the epithet.

NABIS, tyrant of Sparta, reigned about 204 B. C.; and is reported to have exceeded all other tyrants so far, that upon comparison, he left the epithets of *gracious* and *merciful* to Dionysius and Phalaris. He is said to have contrived an instrument of torture in the form of a statue of a beautiful woman whose rich dress concealed a number of iron spikes in her bosom and arms. When any one therefore opposed his demands, he would say "If I have not talents enough to prevail with you, perhaps my woman Apega may persuade you." The statue then appeared; which Nabis taking by the hand, led up to the person, who being embraced by it, was thus tortured into compliance. To render his tyranny less unpopular, Nabis made an alliance with Flaminius the Roman general, and pursued with the most inverate enmity the war which he had undertaken against the Achæans. He besieged Gythium, and defeated Philopœmen in a naval battle. His triumph was short, the general of the Achæans soon repaired his losses, and Nabis was defeated in an engagement, and killed as he attempted to save his life by flight, about 194 years before the Christian era.

NABLOUS, a province of Syria anciently celebrated under the name of the *kingdom of Samaria*. Its capital, likewise called *Nablous*, is situated near to Sichem on the ruins of the Niepolis of the Greeks, and is the residence of a shaik, who is subordinate to the pache of Damascus, from whom he farms the tribute to the province.

NABLUM, in Hebrew, *Nebel*, was an instrument of music among the Jews. It had strings like the harp, and was played upon by both hands. Its form was that of a Greek v. In the Septuagint and vulgate, it is called *nablum, psalterion, lyra*; and sometimes *cithara*.

NABO, or Nebo, in mythology, a deity of the Babylonians, who possessed the next rank to Bel. It is mentioned by Isai. chap. xlviii. Vossius apprehends that Nabo was the moon, and Bel the sun; but Grotius supposes that Nabo was some celebrated prophet of the country; which opinion is confirmed by the etymology of the name, signifying, according to Jerom, "one that presides over prophesy."

NABOB, properly Navab, the plural of *Naib*, a deputy. As used in Bengal, it is the same as Nazim. It is a title also given to the wives and daughters of princes, as well as to the princes themselves.

NABONASSAR, first king of the Chaldeans or Babylonians: memorable for the Jewish æra which bears his name, which is generally fixed in 3257, beginning on Wednesday February 26th in the 3967th of the Julian period, 747 years before Christ. The Babylonians revolting from the Medes, who had overthrown the Assyrian monarchy, did, under Nabonassar found a dominion, which was much increased under Nebuchadnezzar. It is probable, that this Nabonassar is that Baladin in the second of Kings xx. 12. father of Merodach, who sent ambassadors to Hezekiah. See 2 Chron. xxxii.

NABOPOLASSAR, king of Babylon: he joined with Astyages the Mede, to destroy the empire of Assyria; which having accomplished, they founded the two empires of the Medes under Astyages, and the Chaldeans under Nabopolassar, 627 B. C.

NABUCHADNEZZAR, or Nabuchodonosor II. king of Assyria, son of Nabopolassar. and styled the *Great*, was associated by his father in the empire, 607 B. C. and the following year he took Jehoiakim king

king of Judah prifoner, and propofed to carry him and his fubjects in captivity into a Babylon; but upon his fubmiffion, and promiffing to hold his kingdom under Nabuchodonofor, he was permitted to remain at Jerufalem. In 603 B. C. Jehoiakim attempted to fhake off the Affyrian yoke, but without fuccefs; and this revolt brought on the general captivity. Nabuchadnezzar having fubdued the Ethiopians, Arabians, Idumæans, Philiftines, Syrians, Perfians, Medes, Affyrians, and almoft all Afia; being puffed up with pride, caufed a golden ftatue to be fet up, and commanded all to worfhip it; which Daniel's companions refufing to do, they were caft into the fiery furnace. But as he was admiring his own magnificence, by divine fentence he was driven from men, and in the fcripture ftyle is faid to have eaten grafs as oxen: i. e. he was feized with the difeafe called by the Greeks *lycanthropy*, which is a kind of madnefs that caufes perfons to run into the fields and ftreets in the night, and fometimes to fuppofe themfelves to have the heads of oxen or to be made of glafs. At the end of feven years his reafon returned to him, and he was reftored to his throne and glory. He died 562 B. C. in the 43d year of his reign: in the 5th of which happened that eclipfe of the fun mentioned by Ptolemy, which is the fureft foundation of the chronology of his reign.

NADIR in aftronomy, that part of the heavens which is diametrically oppofite to the zenith or point directly over our heads.

NÆNIA, the goddefs of funerals at Rome. Her temple was without the gates of the city. The fongs which were fung at funerals were alfo called *nænio*. They were generally filled with the praifes of the deceafed; but fometimes they were fo unmeaning and improper, that the word became proverbial to fignify nonfenfe.

NAERDEN, a ftrong town of the United Provinces in Holland, feated at the head of the canals of the province. The foundations of it were laid by William of Bavaria, in 1350. It was taken by the Spaniards in 1572, and by the French in 1672; but it was retaken by the prince of Orange the next year. It ftands at the fouth end of the Zuyder Zee, in E. Long. 5. 3. N. Lat. 51. 27.

NÆVIUS (Cneius), a famous poet of Campania, was bred a foldier; but quitted the profeffion of arms, in order to apply himfelf to poetry, which he profecuted with great diligence. He compofed a hiftory in verfe, and a great number of comedies: But it is faid, that his firft performance of this laft kind fo difpleafed Metellus on account of the fatyrical ftrokes it contained, that he procured his being banifhed from the city; on which he retired to Utica in Africa, where he at length died, 202 B. C. We have only fome fragments left of his works.

There was another NÆVIUS a famous augur in the reign of Tarquin, who, to convince the king and the Romans of his preternatural power, cut a flint with a rafor, and turned the ridicule of the populace to admiration. Tarquin rewarded his merit by erecting him a ftatue in the comitium, which was ftill in being in the age of Auguftus. The rafor and flint were buried near it under an altar, and it was ufual among the Romans to make witneffes in civil caufes fwear near it. This miraculous event of cutting a flint with a rafor though believed by fome writers, is treated as fabulous and improbable by Cicero, who himfelf had been an augur.

NÆVUS, a mole on the fkin, generally called a *mother's mark;* alfo the tumor known by the name of a *wen*.

All preternatural tumors on the fkin, in the form of a wart or tubercle, are called *excrefcences;* by the Greeks they are called *acrothymia;* and when they are born with a perfon, they are called *nævi materni*, or *marks from the mother*. A large tumor, depending from the fkin is denominated *farcoma*. Thefe appear on any part of the body: fome of them differ not in their colour from the reft of the fkin; whilft others are red, black, &c. Their fhapes are various; fome refembling ftrawberries, others grapes, &c. Hiefter advifes their removal by means of a ligature, a cautery, or a knife, as circumftances beft fuit.

As to the tumor called a *wen*, its different fpecies are diftinguifhed by their contents. They are encyfted tumors; the matter contained in the firft three following is infpiffated lymph, and that in the fourth is only fat. Monf. Littre was the firft who particularly defcribed the fourth kind; and to the following purpofe he fpeaks of them all. A wen is faid to be of three forts, according to the kind of matter it contains: that whofe contents refemble boiled rice, or curds, or a bread-poultice, is called *atheroma;* if it refembles honey, it is named *meliceris;* and if it is like fuet, it is denominated *fteatoma;* but there is a fourth fort, which may be called *lipome*, becaufe of its fat contents refembling greafe. He fays that he has feen one on the fhoulders of a man, which was a thin bag, of a tender texture, full of a foft fat, and that it had all the qualities of common greafe. And though the fat in the lipome refembles that in the fteatoma, yet they cannot be the fame: for the matter of the fteatoma is not inflammable, nor does it melt; or if it does, it is with great difficulty and imperfectly; whereas it is the contrary with the lipome. When the man who had the above named lipome was fatigued, or had drank freely of ftrong liquors, his lipome was inflamed for fome days after, and its contents rarefying increafed the fize of the tumor.

The lipome feems to be no other than an enlargement of one or more of the cells of the adipofe membrane, which is filled only with its natural contents. Its foftnefs and largenefs diftinguifh it in general from the other fpecies, though fometimes the fatty contents will be fo hard as to deceive. As this kind of wen does not run between the mufcles, nor is poffeffed of any confiderable blood-veffels, it may always be cut off with eafe and fafety.

As to the other kind of wens, their extirpation may or may not be attempted, according as their fituation is with refpect to adjacent veffels, the wounding of which would endanger the patient's life.

NAGERA, or NAGARA, a town of Spain, in Old Caftile, and the territory of Rioja, with the a title of a dutchy and fortrefs: famous for a battle fought in its neighbourhood in 1369. It is fituated in a fertile country, on a brook called *Naferilla*. W. Long. 2. 20. N. Lat. 42. 25,

NAGRACUT, a town of India, the capital of a kingdom of the fame name in the dominions of the

Great Mogul, with a rich temple to which the Indians go in pilgrimage. It is seated on the river Ravi. E. Long. 78. 10. N. Lat. 33. 12.

NAHUM, or the *Prophecy of Nahum*, a canonical book of the Old Testament.

Nahum, the seventh of the 12 lesser prophets, was a native of Elkoshai, a little village of Galilee. The subject of his prophecy is the destruction of Nineveh, which he describes in the most lively and pathetic manner: his style is bold and figurative, and cannot be exceeded by the most perfect masters of oratory. This prophecy was verified at the siege of that city by Astyages, in the year of the world 3378, 622 years before Christ.

NAIADES (fab. hist.), certain inferior deities who presided over rivers, springs, wells, and fountains. The Naiades generally inhabited the country, and resorted to the woods or meadows near the stream over which they presided. They are represented as young and beautiful virgins, often leaning upon an urn from which flows a stream of water. Ægle was the fairest of the Naiades, according to Virgil. Their name seems to be derived from *ναειν, to flow*. They were held in great veneration among the ancients; and often sacrifices of goats and lambs were offered to them, with libations of wine, honey, and oil. Sometimes they received only offerings of milk, fruit, and flowers,

NAIANT, in heraldry, a term used in blazoning fishes, when borne in an horizontal posture, as if swimming.

NAIAS, in botany: A genus of the monandria order, belonging to the dioecia class of plants; and in the natural method ranking with those of which the order is doubtful. The male calyx is cylindrical and bifid; the corolla quadrifid; there is no filament; nor is there any female calyx or corolla; there is one pistil; and the capsule is ovate and unilocular.

NAID, the interior of the great desart of Arabia, inhabited by a few scattered tribes of feeble and wretched Arabs, See Arabia.

NAIL, unguis, in anatomy. See there, n° 81.

Nails, in building, &c. small spikes of iron, brass, &c. which being drove into wood, serve to bind several pieces together, or to fasten something upon them.

Nails were made use of by the ancient Hebrews for cancelling bonds; and the ceremony was performed by striking them through the writing. This seems to be alluded to in scripture, where God is said by our crucified Saviour to have "blotted out the handwriting of ordinances that was against us, and to have taken it out of the way, nailing it to his cross." Col. ii. 14. For the cause and ceremony of driving the annual nail, or *clavus annalis*, among the Romans, see *Annalis Clavas*.

Nail, is also a measure of length, containing the 16th part of a yard.

Nailing of Cannon. When circumstances make it necessary to abandon cannon, or when the enemy's artillery are seized, and it is not however possible to take them away, it is proper to nail them up, in order to render them useless: which is done by driving a large nail or iron spike into the vent of a piece of artillery, to render it unserviceable. There are various contrivances to force the nail out, as also sundry machines invented for that purpose, but they have never been found of general use; so that the best method is to drill a new vent.

One Gasper Vimercalus was the first who invented the nailing of cannon. He was a native of Bremen and made use of his invention first in nailing up the artillery of Sigismund Malatesta.

NAIN (Lewis Sebastian de), one of the most learned and judicious critics and historians France has produced, was the son of a master of the requests, and born at Paris in 1637. At ten years old he went to school at Port Royal, and became one of the best writers of that institution. Sacy, his intimate friend and counsellor, prevailed with him in 1676 to receive the priesthood; which, it seems, his great humility would not before suffer him to aspire to. This virtue he seems to have possessed in the extreme; so that Bossuet, seeig one of his letters to father Dami, with whom he had some little dispute, besought him merrily "not be always upon his knees before his adversary, but raise himself now and then up." He was solicited to push himself in the church, and Buzanval, bishop of Beauvois, wished to have him for his successor; but Nain, regardless of dignities, wished for nothing but retirement. In this he did indeed most effectually bury himself: and, joining the mortifications of a religious life to an indefatigable pursuit of letters, he wore himself entirely out, so as to die in 1698, aged 61, though he was formed for a longer life. His principal works are, 1. Memoirs on the ecclesiastical history of the six first ages of the church, 16 vols 4to. 2. The history of the emperors, 6 vols 4to. These works are deduced from original sources, and composed with the utmost fidelity and exactness.

Nain or Naim, situated at the bottom of mount Hermon on the north side, was anciently a city of the tribe of Issachar, in the province of Galilee. It was near the gates of this city that our Saviour restored to life the only son of a widow, and where he inspired Mary Magdalen to come and mourn for her sins at his feet. These circumstances alone make this place worthy of notice: for at present Nain is only a hamlet inhabited by Christians, Mahometans, and Hebrews, where there is not a single monument to attract the curiosity of the traveller.

NAIRES, Nahers, or Nayers, in modern history, a name which is given by the Malabrians to the military of their country, who form a very numerous class or tribe, out of which the sovereigns of Malabar choose their body-guard.

NAIRN, a county of Scotland, comprehending the west part of Murray. It is bounded on the north by Murray frith, on the west and south by Inverness, and on the east by Elgin. The length of it amounts to 20 miles, and the breadth to 14. The air is temperate and salubrious, and the winters are remarkably mild. The face of the country is rough and mountainous; yet there are some fruitful straths, or valleys, which produce good crops of oats and barley: but in general the country is much better adapted for pasturage. Here are also large woods of fir, and other trees, that afford shelter to the game, of which there is great plenty. A strath is a long, narrow valley, with a river running through the bottom. Of these, the most remarkable

remarkable in this county, are Strathnairn, on the river of that name, in the south-west part of the shire; and on the south-east side, Stratherin, on both sides of Findhorne river. Nairn is well watered with streams, rivulets, and lakes, abounding with fish. In the southern part there is a small lake, called *Moy*, surrounding an island, on which there is a castle belonging to the laird of M'Intosh; but the greater part of the shire is peopled by the Frasers, a warlike Highland clan, whose chief, the Lord Lovat, lost his life on a scaffold for having been concerned in the late rebellion. Here are a great number of villages; but no towns of note except Nairn, supposed to be the *Tuessis* of Ptolemy, situated at the mouth of the river which bears the same name; a royal borough, which gave a title of *lord* to an ancient family, forfeited in the rebellion of 1715. The harbour, which opened in the Murray frith, is now choaked up with sand; and the commerce of the town is too inconsiderable to deserve notice. The people in general subsist by feeding sheep and black cattle. About four miles from Nairn stands the castle of Calder, on the river of that name, belonging to a branch of the family of Campbell. In this neighbourhood we find a quarry of free-stone, and many signs of copper. About six miles to the north west of Nairn, a new fort has been lately built by order of the government, at a place called *Ardeseer* a small isthmus upon the Murray frith, which it is intended to command.

NAISSANT, in heraldry, is applied to any animal issuing out of the midst of some ordinary, and showing only his head, shoulders, fore-feet, and legs, with the tip of his tail; the rest of his body being hid in the shield, or some charge upon it; in which it differs from *issuant*, which denotes a living creature arising out of the bottom of any ordinary or charge.

NAISSUS (anc. geog.) a town of Dardania, a district of Mœsia Superior, said to be the birth-place of Constantine the Great, which seems probable from his often residing at that place. *Naissitani*, the people (Coin). Now called *Nissa*, a city of Servia. E. Long. 23° N. Lat. 43°.

NAKED SEEDS, in botany, those that are not inclosed in any pod or case.

NAKIB, in the oriental dignities the name of an officer who is a deputy to the cadiliskier, or, as he may be called, the lord high chancellor of Egypt, appointed by the grand signior. His office is to carry the standard of Mahomet.

NAKOUS, an Egyptian musical instrument, made like two plates of brass, and of all sizes, from two inches to a foot in diameter; they hold them by strings fastened to their middles, and strike them together so as to beat time. They are used in the Cophtic churches and in the Mahometan processions.

NAMA, in botany: A genius of the digynia order, belonging to the pentandria class of plants: and in the natural method, ranking under the 13th order, *Succulentæ*. The calyx is pentaphyllous, the corolla quinquepartite, the capsule unilocular and bivalved.

NAME, denotes a word whereby men have agreed to express some idea; or which serves to denote or signify a thing or subject spoken of. See WORD.

This the grammarians usually call a *noun*, *nomen*, though their noun is not of quite so much extent as our name. See NOUN.

Seneca, Lib. II. *de Beneficiius*, observes that there are a great number of things which have no name; and which, therefore, we are forced to call by other borrowed names. *Ingens est* (says he) *rerum copia sine nomine, quas cum propriis appellationibus signare non possumus, alienis accommodatis utimur:* which may show why, in the course of this dictionary, we frequently give divers senses to the same word.

Names are distinguished into *proper* and *appellative*.

Proper NAMES, are those which represent some individual thing or person, so as to distinguish it from all other things of the same species; as, *Socrates*, which represents a certain philosopher.

Appellative or *General NAMES*, are those which signify common ideas; or which are common to several individuals of the same species; as, *horse*, *animal*, *man*, *oak*, &c.

Proper names are either called *Christian*, as being given at baptism; or surnames; The first imposed for distinction of persons answering to the Roman *prænomen;* the second, for the distinction of families, answering to the *nomen* of the Romans, and the *patronymicum* of the Greeks.

Originally every person had but one name; as among the Jews, *Adam*, &c. among the Egyptians, *Busiris;* among the Chaldees, *Ninus;* the Medes, *Astyages;* the Greeks, *Diomedes;* the Romans, *Romulus:* the Gauls, *Divitiacus;* the Germans, *Ariovistus;* the Britons, *Cassibelan;* the English, *Hengist*, &c. And thus of other nations, except the savages of Mount Atlas, whom Pliny and Marcellinus represent as *anonyme*, "nameless."

The Jews gave the name at the circumcision; *viz.* eight days after the birth: the Romans, to females the same day, to males the ninth; at which time they held a feast, called *nominalia*.

Since Christianity has obtained, most nations have followed the Jews, baptizing and giving the name on the eighth day after the birth; except our English ancestors, who till of late, baptised and gave the name on the birth day.

The first imposition of names was founded on different views, among different people; the most common was to mark the good wishes of the parents, or to entitle the children to the good fortune a happy name seemed to promise. Hence, *Victor*, *Castor*, *Faustus*, *Statorius*, *Prolus*, &c.

Accordingly, we find such names, by Cicero called *bona nomina*, and By Tacitus *fausta nomina*, were first enrolled and ranged in the Roman musters; first called to serve at the sacrifices, in the foundation of colonies, &c.—And, on the contrary, Livy calls Atrius Umber, *abominandi omnis nomen:* and Plautus, on occasion of a person named *Lyco*, i. e. "greedy wolf," says;

> *Vosmet nunc facite conjecturam cæterum*
> *Quid id sit hominus, cui* Lyco *nomen fiet.*

Hence, Plato recommends it to men to be careful in giving happy names; and the Pythagoreans taught expressly, that the minds, actions, and successes of men were according to their names, genius, and fate. Thus

 Panormitan

Panormitan, *ex bono nomine oritur bona præsumptio;* and the common proverb, *Bonum nomen bonum omen:* and hence the foundation of the onomomantia. See ONOMOMANTIA.

It is an obſervation deſerving attention, ſays the Abbé Barthelemi, that the greater part of names found in Homer are marks of diſtinction. They were given in honour of the qualities moſt eſteemed in the heroic ages. From the word *polemos*, which ſignifies war, have been formed *Tlepolemus* and *Archepto emus*, the names of two heroes mentioned in the Iliad. The former name ſignifies *able to ſupport*, and the latter, *able to direct, the labours of war.* By adding to the word *mache*, or *battle*, certain prepoſitions and different parts of ſpeech, which modify the ſenſe in a manner always honourable, are compoſed the names *Amphimachus*, *Antimachus*, *Promachus*, *Telemachus*. Proceeding in the ſame way with the word *honorea*, "ſtrength or intrepidity," they formed the names *Agapenor*, "he who eſteems valour;" *Agenor*, "he who directs it." From *thoes*, "ſwift," are derived *Alcathoes*, *Panthoes*, *Perithoes*, &c. From *nous*, "mind or intelligence," come *Aſtynoes*, *Arſinoes*, *Autenoes*, &c. From *medes*, "counſel," *Agamedes*, *Eumedes*, *Lycomedes*, *Thraſymedes;* and from *clios*, "glory," *Amphicles*, *Agacles*, *Iphicles*, *Patroclus*, *Cleobulus*, with many others.

Hence Camden takes it for granted, that the names, in all nations and languages, are ſignificative, and not ſimple ſounds for mere diſtinction ſake. This holds not only among the Jews, Greeks, Latins, &c. but even the Turks; among whom, Abdalla ſignifies *God's ſervant;* Soliman, *peaceable*; Mahomet, *glorified*, &c. And the ſavages of Hiſpaniola, and throughout America, who, in their languages, name their children, *Gliſtering Light*, *Sun Bright*, *Fine Gold*, *&c.;* and they of Congo, by the names of precious ſtones, flowers, &c.

To ſuppoſe names given without any meaning, however by the alternation of languages their ſignification may be loſt, that learned author thinks is to reproach our anceſtors; and that contrary to the ſenſe of all ancient writers. Porphyry notes, that the barbarous *names*, as he calls them, were very emphatical, and very conciſe: and accordingly it was eſteemed a duty to be φερωνυμοι, or *ſui nominis homines:* as Severus, Probus, and Aurelius, are called *ſui nominis imperatores*.

It was the uſual way of giving names, to wiſh the children might diſcharge their names. Thus when Gunthram king of France named Clotharius at the font, he ſaid, *Creſcat puer, & hujus ſit hominis executor.*

The ancient Britons, Camden ſays generally took their names from colours, becauſe they painted themſelves; which names are now loſt, or remain hid among the Welſh. When they were ſubdued by the Romans, they took Roman names, ſome of which ſtill remain, corrupted: though the greateſt part became extinct upon the admiſſion of the Engliſh Saxons, who introduced the German names, as *Cridda*, *Penda*, *Oſwald*, *Edward*, &c.—The Danes, too, brought with them their names; as *Suayne*, *Harold*, *Knute*, &c. The Normans, at the Conqueſt, brought in other German names, as originally uſing the German tongue: ſuch as *Robert*, *William*, *Richard*, *Henry*, *Hugh*, &c. after the ſame manner as the Greek names: *Aſpaſius*, *Boethius*, *Symmachus*, &c. were introduced into Italy upon the diviſion of the empire. After the Conqueſt, our nation, which had ever been averſe to foreign names, as deeming them unlucky, began to take Hebrew names; as *Matthew*, *David*, *Sampſon*, &c. The various names anciently or at preſent obtaining among us, from what language or people ſoever borrowed, are explained by Camden in his Remains. As to the period when names began to be multiplied, and ſurnames introduced, &c. ſee SURNAME.

Of late years it has obtained among us to give ſurnames for Chriſtian names; which ſome diſlike, on account of the confuſion it may introduce. Camden relates it as an opinion, that the practice firſt began in the reign of Edward VI. by ſuch as would be godfathers, when they were more than half fathers. Upon which ſome were perſuaded to change their names at confirmation; which, it ſeems, is uſual in other countries.—Thus, two ſons of Henry II. of France, chriſtened *Alexander* and *Hercules*, changed them at confirmation into *Henry* and *Francis*. In monaſteries, the religious aſſume new names at their admittance, to ſhow they are about to lead a new life, and have renounced the world, their family, and even their name: *v. g.* ſiſter Mary *of the incarnation*, brother Henry *of the Holy Sacrament*, &c. The popes alſo changed their names at their exaltation to the pontificate; a cuſtom firſt introduced by pope Sergius, whoſe name till then, as Platina informs us, was *Swineſnout*. But Onuphrius refers it to John XII. or XIII. and at the ſame time adds a different reaſon for it from that of Platina, viz. That it was done in imitation of St Peter and St Paul, who were firſt called *Simon* and *Saul*.

Among the ancients, thoſe deified by the Heathen conſecrations had new names given them; as Romulus was called *Quirinus;* Melicertes, *Portunus* or *Portumnus*, &c.

New names were alſo given in adoptions, and ſometimes by teſtament: thus L. Æmilius, adopted by Scipio, took the name of *Scipio Africanus;* and thus Auguſtus, who at firſt was called *C. Octavius Thurinus*, being adopted by the teſtament of Julius Cæſar into his name and family, took the name of *Caius Julius Cæſar Octavianus*.

Names were alſo changed at enfranchiſements into new cities. Thus Lucumo, at his firſt being made free of Rome, took the name *Lucius Tarquinius Priſcus*, &c.; and ſlaves, when made free, uſually aſſumed their maſters names. Thoſe called to the equeſtrian order, if they had baſe names, were always new named, *nomine ingenuorum veterumque Romanorum.* And among the primitive Chriſtians, it was the practice to change the names of the catechumens: Thus the renegado Lucianus, till his baptiſm, was called *Lucius*.

Toward the middle of the 15th century, it was the fancy of the wits and learned men of the age, particularly in Italy, to change their baptiſmal names for claſſical ones. As Sanazarius, for inſtance, who altered his own plain name *Jacopo* to *Actius Syncerus*. Numbers did the ſame, and among the reſt Platina the hiſtorian at Rome, who, not without a ſolemn ceremonial,

remonial, took the name of *Callimachus* instead of *Philip*. Pope Paul II. who reigned about that time, unluckily chanced to be suspicious, illiterate, and heavy of comprehension. He had no idea that persons could wish to alter their names unless they had some bad design, and actually scrupled not to employ imprisonment and other violent methods to discover the fancied mystery. Platina was most cruelly tortured on this frivolous account: he had nothing to confess; so the pope, after endeavouring in vain to convict him of heresy, sedition, &c. released him after a long imprisonment.

NAMPTWICH, or NANTWICH, a town of Cheshire in England, situated on the Weever river, 14 miles S. E. from Chester and 162 miles from London. It lies in the Vale-Royal, and is one of the largest and best built towns in the county, the streets being very regular, and adorned with many gentlemens houses. The inhabitants drive a trade, not only by its large market on Saturday for corn and cattle, and its great thoroughfare to Ireland, but by its cheese and its fine white salt, which are made here to the greatest perfection: and by shoes made here and sent to London to the warehouses. It is governed by a constable, &c. who are guardians of the salt-springs. It is divided by the Weever into two equal parts, which is not navigable any farther than Winsford bridge. The Chester canal, lately completed, terminates in a handsome broad bason near this place. In this town were several religious foundations, now no more. The church is a handsome pile of building in the form of a cross, with an octangular tower in the middle. There are here three fairs.

NAMUR, a province of the Netherlands, lying between the rivers Sambre and Maese; bounded on the north by Brabant, on the east and south by the bishopric of Leige, and on the west by Hainault. It is pretty fertile, has several forests, marble quarries, and mines of iron, lead, and pit-coal; and is about 30 miles long and 20 broad. Namur is the capital town.

NAMUR, a large, rich, and very strong town of the Netherlands, capital of the county of Namur, with a strong castle, several forts, and a bishop's see. The most considerable forts are, Fort-William, Fort-Maese, Fort Coquelet, and Fort-Espinor. The castle is built in the middle of the town, on a craggy rock. It was besieged by king William in 1695, who took it in the sight of an army of 100,000 French, though there were 60,000 men in garrison. Namur is now a barrier-town, and has a Dutch garrison. It was ceded to the house of Austria in 1713, but taken by the French in 1746; and restored by the treaty of Aix-la-Chapelle. It is situated between two mountains, at the confluence of the rivers Maese and Sambre, in E. Long. 4. 57. N. Lat. 50. 25.

NAN-TCHANG-FOU, the capital of Kiang-si, a province of China. This city has no trade but that of porcelain, which is made in the neighbourhood of Jao-tcheou. It is the residence of a viceroy, and comprehends in its district eight cities; seven of which are of the third class, and only one of the second. So much of the country is cultivated, that the pastures left are scarcely sufficient for the flocks.

NANCI, a town of France, and capital of Lorrain, is situated on the river Meuse, in the centre of the province. It is divided into the Old and New Towns. The first, though irregularly built, is very populous, and contains the ducal palace; the streets of the New Town are as straight as a line, adorned with handsome buildings, and a very fine square. The primatial church is a magnificent structure, and in that of the Cordeliers are the tombs of the ancient dukes. The two towns are separated by a canal; and the new town was very well fortified, but the king of France has demolished the fortifications. It has been taken and retaken several times; particularly by the French, to whom it was ceded in 1736, to enjoy it after the death of Stanislaus.

NANI (John-Baptist), was born in 1616. His father was procurator of St Mark, and ambassador from Venice to Rome. He was educated with attention, and made considerable improvement. Urban VIII. a just valuer of merit, soon perceived that of young Nani. He was admitted into the college of senators in 1641, and was shortly after nominated ambassador in France, where he signalized himself by his compliant manners. He procured considerable succours for the war of Candia against the Turks: and became, after his return to Venice, superintendant of the war office and of finances. He was afterwards ambassador to the empire; where he rendered those services to his country which, as a zealous and intelligent citizen, he was well qualified to discharge. He was again sent into France in 1660 to solicit fresh succours for Candia; and on his return was appointed procurator of St Mark. He died November 5, 1678, at the age of 63, much regretted by his countrymen. The senate had appointed him to write the History of the Republic; which he executed to the satisfaction of the Venetians, although the work was less admired by foreigners, who were not proper judges of the accuracy with which he stated the facts, of the purity of his diction, nor of the simplicity of his style; although it must be acknowledged that his narrative is much interrupted by too frequent parentheses. In writing his history of Venice he has given an universal history of his times, especially with respect to the affairs of the French in Italy. This history which is continued from 1613 to 1671, was printed at Venice in 2 vols 4to, in the years 1662 and 1679.

NAN-KING, a city of China, and capital of the province of King-nan, is said to have been formerly one of the most beautiful and flourishing cities in the world. When the Chinese speak of its extent they say, if two horsemen should go out by the same gate, and ride round it on full speed, taking different directions, they would not meet before night. This account is evidently exaggerated; but it is certain, that Nan-king surpasses in extent all the other cities of China. We are assured that its walls are five leagues and a half in circumference.

This city is situated at the distance of a league from the river Yang-tse-kiang; it is of an irregular figure: the mountains which are within its circumference having prevented its being built on a regular plan. It was formerly the imperial city; for this reason it was called *Nan-King*, which signifies, "the Southern

Court:"

Court:" but since the six grand tribunals have been transfered from hence to Peking, it is called *Kiangning* in all the public acts.

Nan-king has lost much of its ancient splendour: it had formerly a magnificent palace, no vestige of which is now to be seen; an observatory at present neglected, temples, tombs of the emperors, and other superb monuments, of which nothing remains but the remembrance. A third of the city is deserted, but the rest is well inhabited. Some quarters of it are extremely populous and full of business; particularly the manufacture of a species of cotton cloth, of which great quantities are imported into Europe under the name of *Nankin*. The streets are not so broad as those of Peking; they are, however, very beautiful, well-paved, and bordered with rich shops.

In this city resides one of those great mandarins, called *Tsong-gtou*, who takes cognizance of all important affairs, not only of both the governments of the province, but also of those of the province of Kiang-si. The Tartars have a numerous garrison here, commanded by a general of their own nation; and they occupy a quarter of the city, separated from the rest by a plain wall.

The palaces of the mandarins, whether Chinese or Tartars, are in this city neither larger nor better built than those in the capital cities of other provinces. Here are no public edifices corresponding to the reputation of so celebrated a city, excepting its gates, which are very beautiful, and some temples, among which is the famous porcelain tower. It is 200 feet high, and divided into nine stories by plain boards within, and without by cornices and small projections covered with green varnished tiles. There is an ascent of 40 steps to the first story; between each of the others there are 21.

The breadth and depth of the river Yang-tse-kiang formerly rendered the port of Nan-king very commodious; but at present large barks, or rather Chinese junks, never enter it; whether it be that it is shut up by sand banks, or that the entrance of it has been forbid, in order that navigators may insensibly lose all knowledge of it.

In the Months of April and May a great number of excellent fish are caught in this river near the city, which are sent to court; they are covered with ice, and transported in that manner by barks kept entirely on purpose. Although this city is more than 200 leagues from Peking, these boats make such expedition, that they arrive there in eight or nine days. This city, though the capital of the province, has under its particular jurisdiction only eight cities of the third class. The number of its inhabitants are said to be 1,000,000, without comprehending the garrison of 40,000 men. E. Long. 119. 25. N. Lat. 32. 46.

NANSIO, an island of the Archipelago, a little to the north of the island of Santorino, 16 miles in circumference; but has no harbour. The mountains are nothing but bare rocks, and there are not springs sufficient to water the fields. There are a vast number of patridges, whose eggs they destroy every year to preserve the corn, and yet vast numbers of them are always produced. The ruins of the temple of Apollo are yet to be seen, and consist chiefly of marble columns, E. Long. 26. 20. N. Lat. 36. 15.

NANTES, an ancient, rich, and very considerable town of France, in Bretagne, with a bishop's see, an university, and a mint. It is one of the most considerable places in the kingdom; contains the richest merchants: and was formerly the residence of the dukes of Bretagne, where they built a very strong castle on the side of the river, and which is strongly fortified. There are several parishes, and a great many religious houses, and the cathedral contains the tombs of the ancient dukes. There are several fine bridges over the river Loire, which is navigable. The suburbs are so large, on account of the number of people that come from all parts to settle here, that they exceed the city. The Spaniards trade here, with wine, fine wool, iron, silk, oil, oranges, and lemons: and they carry back cloth, stuffs, corn, and hard-ware. The Dutch send salt fish, and all sorts of spices: and in return have wine and brandy. The Swedes bring copper; and the English lead, tin, and pit-coal. It was in this place that Henry IV. promulgated the famous edict in 1598, called the *Edict of Nantes*, and which was revoked in 1685. Nantes was anciently, like almost every considerable city in Europe, very strongly fortified. Peter de Dreux, one of the dukes of Bretagne, surrounded it with walls. which have only been demolished within these few years. The bridge is an object of curiosity, It is near a mile and a half in length, being continued across all the little islands in the Loire, from north to south. The territory of Nantes lies on both sides the Loire, and feeds a great number of cattle. Large vessels can come no higher than Port Launai, which is 12 miles from Nantes. W. Long. 1. 31. N. Lat. 47. 13.

MANTUEIL (Robert), the celebrated designer and engraver to the cabinet of Louis XIV. was born at Rheims in 1630. His father, though but a petty shopkeeper, gave his son a liberal education; who having a taste for drawing, cultivated it with such success, that he became the admiration of the whole town: but marrying young, and not being able to maintain, his family he took a journey to Paris, where he made his talents known by a stratagem.—Seeing several abbés at the door of an eating-house, he asked the mistress for an ecclesiastic of Rheims, whose name he had forgot, but that she might easily know him by a picture of him which he showed: the abbés crowding round, were so charmed with it, that he seized the opportunity of offering to draw any of their pictures for a small mattter. Customers came so fast, that he soon raised his price, and brought his family to Paris, where his reputation was quickly established. He applied himself particularly to taking portraits in crayons, which he afterwards engraved for the use of academical theses; and in this way he did the portrait of the king, and afterwards engraved it as big as the life; a thing never before attempted. The king was so pleased with it, that he created the place of designer and engraver to the cabinet for him, with a pension of 1000 livres. He died in 1678: and an entire collection of his prints amounts to upwards of 240.

NANTWICH. See NAMPTWICH.

NAPÆA, in botany: A genius of the polyandria order, belonging to the polydelphia class of plants: and in the natural method ranking under the 37th order, *Clonmnifera* The calyx is single and cylindric the

Naphtha. the arilli coalited and monospermous. There are two species; both of them with perennial roots, composed of many thick fleshy fibres, which strike deep into the ground, and are connected at the top into large heads; the stalks grow to seven or eight feet high, producing white flowers, tubulous at bottom, but spreading open at top, and dividing into five obtuse segments. Both these plants are natives of Virginia and other parts of North America: from the bark of some of the Indian kinds a sort of fine hemp might be procured, capable of being woven into very strong cloth. They are easily propagated by seed, which will thrive in any situation.

NAPHTHA, an inflammable substance of the bituminous kind, of a light brown colour, and incapable of decomposition, though frequently adulterated with heterogeneous mixtures. By long keeping it hardens in the air into a substance resembling a vegetable resin; and in this state it is always of a black colour, whether pure or mixed with other bodies. According to Mongez, there are three kinds of naphtha, the white, reddish, and green or deep-coloured; and it is in fact a true petrol or rock oil, of which the lightest and most inflammable is called *naphtha*. It is said to be of an extremely fragrant and agreeable smell though very different in this respect from vegetable oils. It is also transparent, extremely inflammable, disolves resins and balsams, but not gum-resins nor elastic gum. It dissolves in the essential oils of thyme and lavander, but is insoluble in spirit of wine and ether. It burns with a bluish flame, and is as inflammable as ether, like which it also attracts gold from aqua-regia.

Naphtha, according to Cronstedt, is collected from the surface of some wells in Persia; but Mr Kirwan informs us, that it issues out of white, yellow, or black clays, in Persia and Media. The finest is brought from a peninsula in the Caspian Sea, called by Kempfer, *okesra*. It issues out through the earth into cisterns and wells, purposely excavated for collecting it at Aaku in Persia. Different kinds of this substance are also found in Italy, in the duchy of Modena, and in Mount Ciaro, 12 leagues from Plaisance.

The formation of naphtha and petroleum is by most naturalists and chemists ascribed to the decomposition of solid bitumens by the action of subterraneous fires; naphtha being the lightest oil, which the fire disengages first; what follows gradually acquiring the colour and consistence of petrol. Lastly, the petrolea, united with some earthy substances, or altered by acids, assume the appearance of mineral pitch, pissasphaltum, &c. This opinion seems to be supported by the phenomena attending the distillation of amber; where the first liquor that rises is a true naphtha; then a petroleum of a more or less brown colour: and lastly, a black substance like jet, which being farther urged by the fire leaves a dry friable matter, &c. It is further observed that nature frequently produces all the different kinds of petrolea near the same spot; of which we have an instance at Mount Testin in the duchy of Modena in Italy. Some, however, are of opinion, that these mineral oils or bitumens are formed from the vitriolic acid, and various oily and fat substances found in the bowels of the earth.

NAPHTHALI, or NEPHTHALI (Josh. xix.), one of the tribes of Israel; having Zabulon on the south, Asher on the west, the Jordan on the east, and on the north Antilibanus. Naphthali, Napier.

NAPIER (John), baron of Merchiston, in Scotland, inventor of the logarithms, was the eldst son of Sir Archibald Napier of Merchiston, and born in the year 1550. Having given early discoveries of great natural parts, his father was careful to have them cultivated by a liberal education. After going through the ordinary courses of philosophy at the university of St Andrew's, he made the tour of France, Italy, and Germany. Upon his return to his native country, his literature and other fine accomplishments soon rendered him conspicuous, and might have raised him to the highest offices in the state; but declining all civil employments, and the bustle of the court, he retired from the world to pursue literary researches, in which he made an uncommon progress, so as to have favoured mankind with sundry useful discoveries. He applied himself chiefly to the study of mathematics; but at the same time he did not neglect that of the Holy Scriptures. In both these he hath discovered the most extensive knowledge and profound penetration. His essay upon the book of the Apocalypse, indicates the most acute investigation, and an uncommon strength of judgment; though time hath discovered, that his calculations concerning particular events had proceeded upon fallacious data. This work has been printed abroad in several languages; particularly in French at Rochelle in the year 1693, 8vo, announced in the title as revised by himself. Nothing, says lord Buchan, could be more agreeable to the Rochellers or to the Huguenots of France at this time, than the author's annunciation of the pope as antichrist, which in this book he has endeavoured to set forth with much zeal and erudition.—But what has principally rendered his name famous, was his great and fortunate discovery of logarithms in trigonometry, by which the ease and expedition in calculation have so wonderfully assisted the science of astronomy and the arts of practical geometry and navigation. That he had begun about the year 1593 the train of enquiry which led him to that great atchievement in arithmetic, appears from a letter to Crugerus from Kepler in the year 1624; wherein, mentioning the *Canon Mirificus*, he writes thus: "Nihil autem supra Neperianam rationem esse puto: etsi Scotus quidem literis ad Tychonem, anno 1594, scriptis jam spem fecit Canonis illius mirifici;" which allusion agrees with the idle story mentioned by Wood in his *Athenæ Oxon.* and explains it in a way perfectly consonant to the rights of Napier as the inventor.

When Napier had communicated to Mr Henry Briggs, mathematical professor in Gresham college, his wonderful canon for the logarithms, that learned professor set himself to apply the rules in his *Imitatio Nepeirea*; and in a letter to archbishop Usher, in the year 1615, he writes thus: "Napier, baron of Merchiston, hath set my head and hands at work with his new and admirable logarithms. I hope to see him this summer if it please God; for I never saw a book which pleased me better, and made me more wonder." The following passage from the life of Lilly the astrologer is quoted by lord Buchan as giving a picturesque

resque view of the meeting betwixt Brigs and the inventor of the logarithms at Merchiston near Edinburgh. "I will acquaint you (says Lilly) with one memorable story related unto me by John Marr, an excellent mathematician and geometrician, whom I conceive you remember. He was servant to king James I. and Charles I. When Merchiston first published his logarithms, Mr Briggs, then reader of the astronomy lectures at gresham college in London, was so much surpised with admiration of them, that he could have no quietness in himself until he had seen that noble person whose only invention they were: he acquaints John Marr therewith, who went into Scotland before Mr Briggs, purposely to be there when these two so learned persons should meet. Mr Briggs appoints a certain day when to meet at Edinburgh; but failing thereof, Merchiston was fearful he would not come. It happened one day as John Mar and the baron Napier were speaking of Mr Briggs; 'Ah, John (said Merchiston), Mr Briggs will not now come.' At the very instant one knocks at the gate; John Marr hasted down, and it proved to be Mr Briggs to his great contentment. He brings Mr Briggs up to the Baron's chamber, where almost one quarter of an hour was spent, each beholding the other with admiration before one word was spoken. At last Mr Briggs began: 'Sir, I have undertaken this long journey purposely to see your person, and to know by what engine of wit or ingenuity you came first to think of this most excellent help into astronomy, *viz.* the logarithms; but Sir, being by you found out, I wonder nobody else found it out before, when now being known it appears so easy.' He was nobly entertained by baron Napier; and every summer after that, during the laird's being alive, this venerable man Mr Briggs went purposely to Scotland to visit him."

Earl of Buchan's Account of the Writings and Inventions of Napier of Merchiston.

There is a passage in the life of Tycho Brahe by Gassendi which may mislead an attentive reader to suppose that Napier's method had been explored by Herwart at Hoenburg: It is in Gassendi's Observations on a Letter from Tycho to Herwart of the last day of August 1599. "Dixit Hervartus nihil morari se solvendi cujusquam trianguli difficultatem; solere se enim multiplicationum, ac divisionum vice additiones solum, subtractiones 93 usurpare (qhod ut fieri posset, docuit postmodum suo Logarithmorum Canone Neperus.)" But Herwart here alludes to his work afterwards published in the year 1610, which solves triangles by prostaphæresis; a mode totally different from that of the logarithms.

Kepler dedicated his *Ephemerides* to Napier, which were published in the year 1617; and it appears from many passages in his letter about this time that he held Napier to be the greatest man of his age in the particular department to which he applied his abilities. "And indeed (says our noble biographer), if we consider that Napier's discovery was not like those of Kepler or of Newton, connected with any analogies or coincidences which might have led him to it, but the fruit of unassisted reason and science, we shall be vindicated in placing him in one of the highest niches in the temple of fame. Kepler had made many unsuccessful attempts to discover his canon for the periodic motions of the planets, and hit upon it at last as he himself candidly owns on the 15th of May 1618: and Newton applied the palpable tendency of heavy bodies to the earth to the system of the universe in general: but Napier sought out his admirable rules by a slow scientific progress arising from the gradual evolution of truth."

The last literary exertion of this eminent person was the publication of his *Rabdology and Promptuary* in the year 1617, which he dedicated to the Chancellor Seton; and soon after died at Merchiston on the 3d of April O. S. of the same year, in the 68th year of his age and 23d of his happy invention.—The particular titles of his published works are: 1. A plain discovery of the Revelation of St John. 2. *Mirifici ipsius canonis constructio et logarithmorum, ad naturales ipsorum numeros habitudines.* 3. *Appendix de alia atque præstantiore logarithmorum specie constituenda, in qua scilicet unitas logarithmus est.* 4. *Rhabdologiæ, sue numerationis per virgulas, libri duo.* 5. *Propositiones quædam eminentissimæ, ad triangula sphærica mira facultate resolvenda.* To which may be added, 6. His Letter to Anthony Bacon (the orginal of which is in the archbishop's library at Lambeth), intitled. "Secret inventions, profitable and necessary in these days for the defence of this island, and withstanding strangers enemies to god's truth and religion;" which the earl of Buchan has caused to be printed in the Apendix to his Account of Napier's Writings. This letter is dated June 2, 1596, about which time it appears the author had set himself to explore his logarithmic canon.

This eminent person was twice married. By his first wife, who was a daughter of Sir James Stirling of Keir, he had only one son named Archibald, who succeeded to the estate. By his second wife, a daughter of Sir James Chisholm of Cromlix, he had a numerous issue.—*Archibald Napier*, the only son of the first marriage, was a person of fine parts and learning. Having more a turn to public business than his father had, he was raised to be a privy counsellor by James VI. under whose reign he also held the offices of treasurer-depute, justice-clerk, and senator of the college of justice. By Charles I. he was raised to the peerage by the title of *Lord Napier*.

Napier's *Rods*, or *Bones*, an instrument invented by Baron Napier, whereby the multiplication and division of large numbers is much facilitated.

As to the Construction of Napier's Rods: Suppose the common table of multiplication to be made upon a plate of metal, ivory, or pasteboard, and then conceive the several columns (standing downwards from the digits on the head) to be cut asunder: and these are what we call *Napier's rods for Multiplication.* But then there must be a good number of each; for as many times as any figure is in the multiplicand, so many rods of that species (*i. e.* with that figure on the top of it) must we have; though six rods of each species will be sufficient for any example in common affairs; there must be also as many rods of o's.

But before we explain the way of using these rods, there is another thing to be known, *viz.* that the figures on every rod are written in an order different from that in the table. Thus the little square space or division in which the several products of every column are written, is divided into two parts by a line across from the upper angle on the right to the lower on the left; and if the product is a digit it is set in the

the lower diviſion; if it has two places, the firſt is ſet in the lower, and the ſecond in the upper diviſion; but the ſpaces on the top are not divided; alſo there is a rod of digits, not divided, which is called the *index rod*, and of this we need but one ſingle rod. See the figure of all the different rods, and the index, ſeparate from one another, in Plate CCCXLIV.

Multiplication by Napier's Rods. Firſt lay down the index-rod; then on the right of it ſet a rod, whoſe top is the figure in the higheſt place of the multiplicand: next to this again, ſet the rod whoſe top is the next figure of the multiplicand; and ſo on in order to the firſt figure. Then is your multiplicand tabulated for all the nine digits; for in the ſame line of ſquares ſtanding againſt every figure of the index-rod, you have the product of that figure; and therefore you have no more to do but to transfer the products and ſum them. But in taking out theſe products from the rods, the order in which the figures ſtand obliges you to a very eaſy and ſmall addition: thus, begin to take out the figure in the lower part, or units place. of the ſquare of the firſt rod on the right; and the figure in the upper part of this rod to that in the lower part of the next, and ſo on; which may be done as faſt as you can look on them. To make this practice as clear as poſſible, take the following example.

Example: To multiply 4768 by 385. Having ſet the rods together for the number 4768 (*ibid.* nº 2.) againſt 5 in the index, I find this number, by adding

according to the rule,	- -	23840
Againſt 8, this number	- -	38144
Againſt 3, this number	- -	14304
Total product	- - -	1835680

To make the uſe of the rods yet more regular and eaſy, they are kept in a flat ſquare box, whoſe breadth is that of ten rods, and the length that of one rod, as thick as to hold ſix (or as many as you pleaſe) the capacity of the box being divided into ten cells, for the different ſpecies of rods. When the rods are put up in the box (each ſpecies in its own cell diſtinguiſhed by the firſt figure of the rod ſet before it on the face of the box near the top), as much of every rod ſtands without the box as ſhows the firſt figure of that rod: alſo upon one of the flat ſides without and near the edge, upon the left hand, the index rod is fixed; and along the foot there is a ſmall ledge; ſo that the rods when applied are laid upon this ſide, and ſupported by the ledge which makes the practice very eaſy; but in caſe the multiplicand ſhould have more than nine places, that upper face of the box may be made broader. Some make the roads with four different faces, and figures on each for different purpoſes.

Diviſion by Napier's Rods. Firſt tabulate your diviſor; then you have it multiplied by all the digits, out of which you may chooſe ſuch convenient diviſors as will be next leſs to the figures in the dividend, and write the index anſwering in the quotient, and ſo continually till the work is done. Thus 2179788, divided by 6123, gives in the quotient 356.

Having tabulated the diviſor 6123, you ſee that 6123 cannot be had in 2179; therefore take five places, and on the rods find a number that is equal or next leſs to 21797, which is 18699; that is, 3 times the diviſor: wherefore ſet 3 in the quotient, and ſubtract 18369 from the figures above, and there will remain 3428; to which add 8, the next figure of the dividend, and ſeek again on the rods for it, or the next leſs, which you will find to be five times; therefore ſet 5 in the quotient, and ſubtract 30615 from 34288, and there will remain 3673; to which add 8, the laſt figure in the dividend, and finding it to be juſt 6 times the diviſor, ſet 6 in the quotient.

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6123)2179788(356
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NAPLES, a kingdom of Italy, comprehending the ancient countries of Samnium, Campania, Apulia, and Magna Græcia. It is bounded on all ſides by the Mediterranean and Adriatic, except on the north-eaſt, where it terminates on the Eccleſiaſtical ſtate. Its greateſt length from ſouth-eaſt to north-weſt is about 280 Engliſh miles; and its breadth from north-eaſt to ſouth-weſt, from 96 to 120.

The ancient hiſtory of this country falls under the articles Rome and Italy; the preſent ſtate of it, as well as of the reſt of Italy, is owing to the conqueſts of Charlemagne. When that monarch put an end to the kingdom of the Lombards, he obliged the dukes of Friuli, Spoleto, and Benevento, to acknowledge him as king of Italy; but allowed them to exerciſe the ſame power and authority which they had enjoyed before his conqueſt. Of theſe three dukedoms Benevento was by far the moſt powerful and extenſive, as it comprehended almoſt all the preſent kingdom of Naples; that part of Farther Calabria beyond the rivers Savuto and Peto, a few maritime cities in Hither Calabria, with the city of Acripoli, and the promontory in its neighbourhood called *Capo di Licoſa;* and laſtly, the dukedoms of Gaeta, Naples, and Amalfi, which were very inconſiderable, and extended along the ſhore only about 100 miles, and were interrupted by the Gaſtaldate or county of Capua.

1 Extent of the duchy of Benevento.

2 Arechis duke of Benevento revolts from Charlemagne.

This flouriſhing and extenſive dukedom was at this time governed by Arechis, who had married one of the daughters of the laſt king of the Lombards, and had ſubmitted, and taken the oath of allegiance to the emperor Charles. However, a few years after, he renounced his allegiance to the Franks, declared himſelf an independent ſovereign, and was acknowledged as ſuch by all the inhabitants of his duchy. To ſtrengthen himſelf againſt Pepin king of Italy, who reſided at Ravenna, he enlarged and fortified the city of Benevento, and likewiſe built Salerno on the ſea coaſt ſurrounding it with a very ſtrong and high wall. He engaged in ſeveral wars with the Greeks, whom he ſometimes obliged to give him hoſtages; but having invaded the territories of the pope, whom Pepin could not aſſiſt, Charlemagne was prevailed on to return to Italy. Arechis, unable to oppoſe ſuch a formidable enemy, ſent his eldeſt ſon, Romauld, to Rome, with an offer of ſubmiſſion: but, at the inſtigation of the pope, Charles refuſed the offer,

Naples.

offer, and detained his ſon priſoner; after which he ravaged the country, and made himſelf maſter of Capua. Other deputies, however proved more ſucceſsful; and in the year 787, a peace was concluded on theſe conditions: That Arechis and the Beneventans ſhould renew their allegiance to the Franks: that he ſhould pay a yearly tribute to Pepin: deliver up all his treaſure; and give his ſon Grimoald and his daughter
3 Submits. Adelgiſa, with twelve others, as hoſtages for his fidelity: however after many intreaties, Adelgiſa was reſtored to her father.

4 Revolts a ſecond time. Charles had no ſooner left Italy, than Arechis forgot all his engagements, and began to negociate with Irene, empreſs of Conſtantinople, and her ſon Conſtantine, for expelling the Franks out of Italy. For himſelf, he deſired the honour of patriciate, and the dukedom of Naples with all its dependencies; and, in return, promiſed to acknowledge the Greek emperor as his ſovereign, and to live after the manner of the Greeks. He required, however, to be ſupported by a Greek army; and that his brother-in-law Adalgiſus, ſon to Deſiderius the laſt king of the Lombards, ſhould be ſent over into Italy, to raiſe a party among his countrymen. Theſe conditions were readily accepted, on condition that prince Romuald ſhould be ſent as an hoſtage; ambaſſadors were ſent to Naples with the enſigns of the patrician order, namely the mantle of cloth of gold, the ſword, the comb, and the ſandals; but before the ceremony could be performed, prince Romuald died, and ſoon after him his father: whoſe death was ſuppoſed to have been haſtened by that of his ſon.

After the death of Arechis, the Beneventans ſent a moſt ſubmiſſive embaſſy to Charlemagne, intreating him to ſend them Grimoald, the late king's ſon, and
5 Grimoald continues for ſome time faithful to the Franks. only lawful heir to his crown; threatening at the ſame time to revolt if their prince was denied them. Charles readily granted their requeſt, and allowed Grimoald to depart, after he had agreed to the following conditions, viz. That he ſhould oblige the Lombards to ſhave their beards; that in writings, and on money, the name of the king ſhould be put before that of the prince; and that he ſhould cauſe the walls of Salerno, Acerenza, and Conſia, to be entirely demoliſhed.—The new king was received by his ſubjects with the utmoſt joy; and for ſome time continued faithful to his engagements, excepting only the laſt article, which he either neglected or eluded. So far, however, was he from aſſiſting the Greeks, that he gave notice of their machinations to Pepin king of Italy; raiſed an army to oppoſe his uncle Adalgiſus; and being joined by Hildebrand duke of Spoleto, and Vinigiſe the general of Pepin, he attacked the Greeks in Calabria ſoon after they had landed, entirely defeated and took his uncle priſoner, and, as is ſaid, put him to a cruel death. Yet in a ſhort time Grimoald contracted an alliance with the Greek emperor by marrying his niece Wanzia; and in the fifth year of his reign a war broke out between him and Pepin, which continued for twelve years; at the end of which time a truce was concluded. Grimoald ſurvived this pacification only three years, and was ſucceded by his treaſurer Grimoald II. who ſubmitted to Charlemagne after the death of Pepin; and from this time the Beneventans were looked upon as tributaries of the weſtern emperors.

As yet, however, the city of Naples did not own allegiance to the dukes of Benevento, but was held by the eaſtern emperors; and frequent wars took place between the Beneventans and Neapolitans. This happened to be the caſe when Grimoald II. aſcended the throne. He concluded a peace with them; which however was of no long continuance; for Theodore, governor of Naples, having granted protections to Dauferius a noble Beneventan, who had been concerned in a conſpiracy againſt his prince, Grimoald marched againſt the city of Naples, and inveſted it by ſea and land. Theodore ſtill refuſed to deliver up the traitor, and a general engagement both by land and ſea was the conſequence; in which the Neapolitans were defeated with ſo great ſlaughter, that the ſea was ſtained with their blood for more than ſeven days. Theodore then conſented to deliver up Dauferius, with 8000 crowns for the expences of the war; and Grimoald not only pardoned Dauferius, but received him into favour; the traitor, however, reflecting on the heinouſneſs of his crime, was ſeized with remorſe; and went a pilgrimage to the holy land, carrying a large ſtone in his mouth, by way of penance, which he never took out but at his meals.

In the year 821, Grimoald was murdered by Radelchis count of Conſia, and Sico gaſtald of Acerenta, 6 Is murdered, and ſucceeded by Sico.
the latter of whom ſucceeded to the dukedom of Benevento. Radelchis being ſoon after ſeized with remorſe, became a monk; while Sico aſſociated his ſon Sicardo with him in the government; and both, being of an ambitious and reſtleſs diſpoſition, ſought a pretence for attacking the Neapolitans. This was ſoon found, and the city was inveſted by ſea and land.

The walls were furiouſly battered; and part of them 7 Naples beſieged by Sico;
being beat down, Sico prepared for a general aſſault. Stephen, at that time duke of Naples, pretended to ſubmit; but that he might prevent the city from being pillaged, intreated Sico to put off his entry till the morning, and in the mean time ſent out his mother and his two children as hoſtages. Sico conſented to his requeſt; but next morning found the breach built up, and the Neapolitans prepared for their defence. Exaſperated at their perfidy, he renewed his attacks with vigour, but without any ſucceſs; the beſieged defending themſelves with the utmoſt obſtinacy. At laſt, perceiving that they ſhould not be able to hold out much longer, they conſented to a peace on the following conditions, viz. That the Neapolitans ſhould pay an annual tribute to the princes of Benevento, and conſent to the tranſporting of the body of St Januarius from his church without the walls of Naples to Benevento. Theſe conditions being ratified, Sico returned with great honour to Benevento; but ſoon after renewed the war, under pretence that the Neapolitans had neglected to pay the ſtipulated ſum; and hoſtilities continued till his death, which happened in 833.

Sico was ſucceeded in the government of Benevento 8 And by his ſucceſſor Sicardo.
by his ſon Sicardo, who had married the daughter of Dauferius; and being influenced by the evil counſels of Roffrid his wife's brother, oppreſſed his ſubjects to ſuch a degree that they conſpired againſt his life. He beſieged Naples with a powerful army, and took poſſeſſion of Acerra and Atella, both of which he fortified. But Bonus, the Neapolitan duke, defended himſelf

himself so vigorously, that the Beneventans were obliged to retire, and even to abandon Acerra and Atella, the fortifications of which were immediately demolished. At last Sicardo agreed to a peace for five years, on the intercession of Lothaire, emperor, and king of Italy; but his chief motive was thought to have been the fear of the Saracens, whom the duke of Naples had called over from Africa to his assistance: for no sooner were they sent back than Sicardo attempted to delay the conclusion of the treaty: but the emperor interposing his authority, a peace was concluded in the year 836, after the war had continued with very little intermission, for 16 years.

9 The Saracens called in by the duke of Naples.

Soon after the conclusion of this peace, the Saracens landed at Brindisi; and having made themselves masters of the place, ravaged all the neighbouring country, Sicardo marched against them with a numerous army; but the Saracens having dug a great number of ditches which they slightly covered over, found means to draw the Beneventans in among them, whereby they were repulsed with great loss. However, Sicardo, having reinforced his army, marched again to attack them; but the Saracens, despairing of success, pillaged and burnt Brindisi, and then retired with their booty, and a great many captives, to Sicily. Sicardo then, without any apparent provocation, attacked the city of Amalfi, levelled its walls with the ground, carried off all its wealth, and the body of its tutelar saint Triphomen. A great many of the inhabitants were transported to Salerno: and by promoting alliances between the inhabitants of both places, he endeavoured to unite Amalfi to his own principality as firmly as possible.

During all these transactions, Sicardo had tyrannized over his subjects in such a manner, that at last he became intolerable. Among other acts of injustice, he imprisoned his own brother Siconolphus; compelled him to turn priest; and afterwards sent him bound to Tarento, where he caused him to be shut up in an old tower that had been built for a cistern. By such acts of tyranny his nobles were provoked to conspire against him; and in the year 839 he was murdered in his tent.

10 Sicardo, murdered by Radelchis, which brings on a civil war.

On the death of Sicardo, Radelchis, his secretary or treasurer was unanimously elected prince of Benevento; but Siconolphus, the last king's brother, having regained his liberty, formed a great party against the new prince. Radelchis did not fail to oppose him with a formidable army: and a most ruinous civil war ensued. Both parties by turns called in the Saracens: and these treacherous allies acted sometimes against one, and sometimes against the other; or turned their arms against both, as seemed most suitable to their own interest. Thus the war continued with the utmost animosity for 12 years, during which time the principality was almost entirely ruined: till at last the emperor Lewis interposed, and obliged the competitors to agree to a partition of the principality. By this treaty, Radelchis promised to acknowledge Siconolphus and his successors as lawful princes of the principality of Salerno, which was declared to contain Tarento, Latiniano, Cassano, Cossenzo, Laino, Lucania, Consia, Montella, Rota, Salerno, Sarno, Ciraterium Furculo, Capua, Feano, Sora, and the half of the Gastaldate of Acerenza, where it joins Latiano and Consia. The boundery betwixt Benevento and Capua was fixed at St Angelo and Cerros; Alli Peregrini was made the boundary betwixt Benevento and Salerno, and Staffilo betwixt Benevento and Consia. The monasteries of Monte Cassino and St Vincent were declared to be immediately under the protection of the emperor: both princes stipulated that no hostilities should be committed by either against the subjects of each other; and promised to join their forces in order to drive out the Saracens. Soon after this pacification, however, both Radelchis and Siconolphus died; the former appointing his son Radelgarius, or Radelcar, to succeed him; and the latter leaving an infant son, Sico, to the care of his godfather, Peter.

11 The principality divided.

12 Unsuccessful war with the Saracens.

The war with the Saracens proved very unsuccessful; neither the united efforts of the princes, nor the assistance of the emperor Lewis himself, being able to expel the infidels; and, in 854, Adelgise the second son of Radelchis, who had now succeeded, on the death of his brother Radelcar, to the principality of Benevento, was obliged to pay them an annual subsidy. Two years after, Lando, Count of Capua, revolted from the prince of Salerno, and could not be reduced. In the mean time, Sico, the lawful prince of Salerno, had been poisoned by Count Lando, and the principality usurped by Ademarius, the son of Peter above mentioned; but in 861, Ademarius himself was seized and imprisoned by Gauferius, the son of Dauferius formerly mentioned. This was occasioned by his cruelty and rapaciousness, which entirely alienated the hearts of his subjects from him, and encouraged Gauferius to become the head of the conspirators. The Saracens in the mean time committed terrible ravages throughout the Beneventan territories; which at last obliged Adelgise to enter into an alliance with Gauferius, and both together sent a most humble embassy to the emperor Lewis, requesting him to take them under his protection. About the same time an embassy arrived from Constantinople, proposing a junction of the forces of the eastern and western empires against the infidels; upon which Lewis gave orders for assembling a formidable army, But in the mean time Adelgise fell off from his alliance, and made peace with the Saracens; nay, according to some he encouraged them in their incursions, and it was at his desire that they invaded the duchy of Capua, and afterwards that of Naples, which they ravaged in a most barbarous manner. The Neapolitans in conjunction with the duke of Spoleto and the Count of Marsi, endeavoured to oppose them; but being defeated, the Saracens continued their ravages with redoubled fury, and retired to Bari, which was their capital city with an immense booty.

In 866, Lewis arrived at Sora, with his army; and having marched to Capua, was there joined by Landulph, the bishop and count, with a body of Capuans: but Landulph soon after persuading his countrymen to desert, Lewis marched against that city, which he took after a siege of three months, and almost totally destroyed. In the end of the year he was joined by Gauferius with his quota of troops, having ordered the eyes of Ademarius to be put out in his absence. Lewis confirmed him in the principality, and marched with his army to Benevento, where Adelgise received

ceived him with great respect. Having reduced some inconsiderable places belonging to the Saracens, Lewis soon after invested Bari; but as the Saracens received continual supplies from their countrymen settled in Sicily, and besides were protected by the Neapolitans, he could not reduce the place till the year 871, though he had received considerable assistance from his brother Lotharius, and the Greek emperor had sent him a fleet of 200 sail. The expulsion of the Saracens was completed the same year by the taking of Tarento; after which the emperor returned with great glory to Benevento, resolving next to carry his arms into Sicily, and expel the infields from thence also. But his future schemes of conquest were frustrated by a quarrel between him and Adelgise. The latter, pretending to have been insulted by the empress, and oppressed by the French, seized the emperor himself, and kept him prisoner for 40 days. His imprisonment would probably have been of much longer continuance, had not a body of Saracens arrived from Africa, who being joined by such of their countrymen as had concealed themselves in Italy, laid siege to Salerno with an army of 30,000 men, ravaging the neighbouring country at the same time with the utmost barbarity. By this new invasion Adelgise was so much alarmed, that he set the emperor of liberty, but first obliged him to swear that he would not revenge the insult that had been offered him, and that he would never return to Benevento. Lewis having then joined his forces to those of the prince of Salerno, soon obliged the Saracens to raise the siege of Salerno; but though they were prevented from taking that city, they entirely destroyed the inhabitants of Calabria, leaving it, according to the expression of one of the historians of that time, "as desolate as it was at the flood"

13 They are at last expelled.

14 But soon return.

In the year 873, Lewis being absolved from his oath by the pope, went to Benevento, and was reconciled to Adelgise; but soon after this reconciliation he died, and the Saracens continued their ravages to such a degree that the inhabitants of Bari were constrained to deliver up their city to the Greeks. At the same time, the Salernitans, Neapolitans, Cajetans, and Amalfitans, having made peace with the Saracens, were compelled to agree to their proposal of invading the territories of the Roman pontiff. His holiness exerted himself to the utmost, both with spiritual and temporal weapons, in order to defend his right; but was at last reduced to the necessity of becoming a tributary to the infidel, and promising to pay them a large sum annually.

15 The pope becomes their tributary.

In the mean time, all Italy was thrown into the greatest confusion by the death of Charles the Bald, who died of poison at Pavia, as he was coming to the pope's assistance. Sergius duke of Naples continued a firm friend to the infidels; nor could he be detached from their interests even by the thunder of a papal excommunication; but unluckily happening to fall into the hands of his brother, Athanasius bishop of Naples the zeal of that prelate prompted him to put out his eyes and send him a close prisoner to Rome; for which the highest encomiums were bestowed on him by the holy father.

In the 876, Adelgise was murdered by two of his nephews; one of whom, by name *Gaideris*, seized the principality. About the same time Landulph bishop of Capua dying, a civil war ensued among his children, though their father's dominions had been divided among them according to his will. The princes of Salerno and Benevento, the duke of Spoleto, and Gregory the Greek governor of Bari and Otranto, took different sides in the quarrel, as they thought most proper: and to complete the confusion, the new bishop was expelled, and his brother, though a layman, chosen to that office, and even consecrated by the pope who wrote to Gauferius, forbidding him to attack Capua under pain of excommunication. But though Gauferius was, in general, obedient to the pope's commands, he proved refractory in this particular, and laid siege to Capua, for two years successively.

Thus the Capuan territories were reduced to the most miserable situation; being obliged to maintain at the same time the armies of the prince of Benevento and the duke of Spoleto. The Saracens, in the mean time, took the opportunity of strengthening themselves in Italy: and Athanasius, notwithstanding the great commendations he had received from the pope for putting out his brother's eyes, consented to enter into an alliance with them, in conjunction with whom he ravaged the territories of the pope as well as those of Benevento and Spoleto, plundering all the churches, monasteries, towns, and villages, through which they passed. At the same time the prince of Salerno was obliged to grant them a settlement in the neighbourhood of his capital; the duke of Geeta invited them to his assistance, being oppressed by the count of Capua and even the pope himself was obliged to make peace with them, and to grant them a settlement on the north side of the Carigliano, where they fortified themselves, and continued for more than 40 years.

To put a stop to the confusion which reigned in Italy, the pope now thought proper to restore the bishop of Capua, who had been expelled, but allowed his brother to reside in the city, and govern one half of the diocese; but notwithstanding this partition, the civil dissensions continued with the utmost violence, the nearest relations murdering or banishing each other according as the fortune of the one or the other prevailed.—Athanasius, notwithstanding all the pope's remonstrances, continued his alliance with the Saracens; in conjunction with whom he ravaged the territory of Benevento, and fomented the divisions in Capua, in hopes of being able to make a conquest of it. At last his holiness thought proper to issue a sentence of excommunication against him, but this attached him to the Saracens more than ever; insomuch that he sent to Suchaim, king of the Saracens in Sicily, desiring him to come over and command a great body of his countrymen who had settled at the foot of Mount Vesuvius. Suchaim accepted the invitation, and immediately turned his arms against Athanasius; allowing his troops to live at discretion in the territory of Naples where they ravished the women and plundered the inhabitants. These calamities were, by the superstitious Neapolitans, imagined to be a consequence of the sentence of excommunication; and therefore they used their utmost endeavours to persuade the prelate to conclude a league with some Christian prince and renounce all connection with the infidels. In this they at last proved successful, and Athanasius concluded an alliance with Guaimarius prince of Salerno;

no; in consequence of which the Saracens were obliged to quit the Neapolitan territories, and retire to Agrapoli. Athanasius then directed his force against Capua, of which he made himself master in the year 882. The Saracens, however, still continued their incursions, and ravaged several provinces in such a manner, that they became entirely desolate.

These confusions continued for a long time; during

16 The Saracens almost entirely cut off.

which the Greeks found an opportunity of making themselves masters of Benevento, and had well nigh become masters also of Salerno; but in this they failed through the treachery of the bishop, and in the year 896 they were totally expelled by the bishop, four years after that they had become masters of it. In 915 the Saracens received such an overthrow at Carigliano, that scarce one of them remained. However, a new body soon arrived from Africa, and infested the sea-coasts for some time longer. A war also ensued between Landulph and the Greeks; which concluded disadvantageously for the former, who was obliged to submit to the emperor of Constantinople in 943.

In 961, Otho the Great, king of Germany, invaded Italy with a powerful army against Berengarius III. and, marching to Rome, received the imperial crown from the hands of the Pope. In 964, he erected Capua into a principality, received homage from the other princes of Lombardy, and formed a design of recovering Puglia and Calabria from the Greeks. But in this last scheme he failed; and after various hostilities a treaty was concluded, and the young princess Theophania married to Otho's son, afterwards emperor.

All this time the Saracens continued their incursions; and the Greeks had gained ground so much, that they were now in possession of two thirds of the present kingdom of Naples; but in the year 1002 or 1003,

17 The Normans first known in Italy.

the Normans first began to be remarkable in Italy. They had, about a century before, embraced Christianity, and become very zealous in all the superstitions which were then practised. They were particularly zealous in visiting sacred places, especially Rome, and the holy sepulchre at Jerusalem; and being naturally of a very martial disposition, they forced through great bodies of Greeks and Saracens who opposed their passage. About this time 40, or, as others write, 100, of these Normans, returning from Jerusalem by sea, landed at Salerno in the habit of Pilgrims where they were honourably received by Guaimarius. During their residence at Salerno, a great body of Saracens landed, and invested the city. Guaimarius, not being in a condition to oppose the invaders by force was preparing to pay them a large sum of money, which they demanded, when the Normans proposed to attack them; and, having got arms and horses from the prince, they engaged the infidels with such fury and bravery, that they entirely defeated them, and obliged them to fly to their ships. By this complete victory Guaimarius was filled with such admiration of the valour of these strangers, that he entreated them to remain in his country; offering them lands and the most honourable employments: but not being able to prevail with them to stay in Italy, or even accept of his presents; at their departure he sent some ambassadors with them to Normandy, in vessels loaded with exquisite fruits, rich furniture for horses, &c. in order to allure the valiant Normans to leave their own country. This kind invitation encouraged a Norman chief, named *Osmond Drengot*, to settle in Italy about the year 1015; having killed another lord in a duel, which obliged him to leave his own country, in order to avoid the resentment of his sovereign, Robert duke of Normandy. In the mean

18 They return and defeat the Greeks.

time, the city of Bari had revolted from the Greeks, and chosen one Mello for their leader, whose wife and children happened soon after to fall into the hands of their enemies, and were sent prisoners to Constantinople. No sooner, therefore did Mello hear of the arrival of these adventurers, than he engaged them to assist him; and having drawn together a considerable army, defeated the Greeks with great slaughter, and obliged them to abandon their camp. In this engagement the Normans distinguished themselves by their bravery: and the news of their success soon brought from Normandy an innumerable multitude of their countrymen with their wives and children. By this reinforcement, Mello gained two other victories, took a great many towns; and obliged the Greeks to

19 But are at last defeated by them.

abandon a large territory; but, in 1019, they were utterly defeated, and every thing recovered by the Greeks. The Greek general, Bajanus, continued to go on with such surprising success, that he almost entirely re-established the affairs of his countrymen in Italy, and made a distinct province of the western part of Puglia, which he called *Capatanata*, and which to this day retains the name of *Capitanata*. His great progress at last alarmed the emperors of Germany; and, in 1027, Pandulphus prince of Capua made himself master of Naples; but was obliged three years afterwards, to leave it, by the Normans, who built the city of Aversa, which was now erected into a county. In consequence of this piece of good fortune, great numbers of Norman adventurers migrated into Italy among whom were William, Drogo, and Umbert, three of the sons of Tancred duke of Hautville, from whose posterity those princes were descended, who first conquered the island of Sicily from the Saracens, and formed the present kingdom of Naples.

In 1040, the Greek emperor Michael Paleologus, in order to secure the affection of his fickle subjects, undertook the conquest of Italy from the Saracens, and for that purpose sent a general named *Michael Maniacus* into Sicily. This commander, hearing of the great reputation of the Normans, sent to Guaimarius, prince of Salerno, intreating him to grant him some of those warriors. His request was most willingly hearkened to by the prince of Salerno, who, to encourage the Normans to engage in the expedition promised them some additional rewards besides the emperor's pay.

20 The Normans pass over into Sicily.

William, Drogo, and Umbert, accordingly marched from Salerno with 300 of their countrymen; and passing over into Sicily, distinguished themselves most remarkably in the conqest of that island. Maniacus acknowledged, that the recovery of Messina was chiefly owing to their valour: and William with his Normans gained a complete victory over the Saracens before Syracuse, where he killed the governor of the city in single combat. Maniacus made himself master of Syracuse, and almost entirely reduced the whole island; but being accused of treason, was next year carried prisoner to Constantinople. His successor Doceanus, being

being a man of no abilities, quickly loſt the whole iſland except Meſſina, and treated his Norman auxiliaries with the utmoſt contempt. He would not allow them any ſhare of the booty; and even cauſed one Ardoin, a noble Lombard, and aſſociate and interpreter of the Normans, to be whipped round the camp, becauſe he refuſed to part with the horſe of a Saracen whom he had ſlain in ſingle combat. The conſequences of this tyrannical behaviour were very fatal to the Greeks. Ardoin ſoon after obtained leave to return to Italy under pretence of a vow, and all the Normans embarked at night along with him; but inſtead of going to Rome, Ardoin went immediately to Averſa, where he perſuaded count Rainulphus, ſovereign of that province, to join with him in the deſign he had formed of attacking the Greek provinces in Italy, which, he ſhowed him would be an eaſy conqueſt, as the inhabitants ſubmitted with great reluctance to the Greeks, and the provinces were at that time almoſt entirely defenceleſs. Rainulphus approved of the ſcheme, and raiſed 300 ſoldiers, whom he ſent under 12 officers,

21 Their conqueſts.

to join the other Normans under the ſons of Tancred; and made an agreement with Ardoin, that the conqueſts ſhould be equally divided among the chief leaders. Their firſt enterpriſe was the reduction of Melphis one of the ſtrongeſt cities in Puglia, which preſently ſurrendered; and they increaſed its fortifications ſo much, that it thenceforth became impregnable. Soon after this they made themſelves maſters of Venoſa, Aſcoli, and Lavello, with very little oppoſition. Doceanus, alarmed with the rapidity of their conqueſts, immediately left Sicily, and marched with his army into Puglia, where he attacked the invaders near the river Oliviento; but after a fierce engagement, he was obliged to retire with conſiderable loſs. The Greeks were ſoon after defeated a ſecond time at Cannæ; and in a third engagement, which happened near the river Ofanto, the army of Doceanus was entirely routed, and he himſelf obliged to fly to Bari. On this bad ſucceſs Doceanus was ordered to return to his command in Sicily, and another general was ſent with an army into Puglia. This new commander, however, had no better ſucceſs than his predeceſſor; for his army was entirely defeated in an engagement with the Normans, and he himſelf taken priſoner. Atenulphus, brother to one of the princes of Benevento, on whom the Normans had conferred the chief command, ſet at liberty the captive general without conſulting them, on receiving from him a conſiderable ſum of money. With this the Normans were ſo much diſpleaſed, that they deprived Atenulphus of his command, and beſtowed it on Argyrus, ſon to the late Mello, who had eſcaped from Conſtantinople, and now aſſumed the title of *duke and prince of Italy*. Before this time alſo Maniacus, whom we have formerly mentioned, had returned to Italy; and to ſtrike the greater terror into the revolted cities, had executed a number of people of all ages and ſexes with great inhumanity. Soon after this Maniacus openly rebelled againſt the Greek emperor Conſtantinus, and prevailed upon his own army to proclaim him emperor, beginning hoſtilities immediately againſt the Greek cities. Argyrus at the ſame time took Giovenazzo and beſieged Trani, and ſoon after beſieged Maniaces himſelf in Tarento; but he, being afraid of falling into the hands of the Normans, fled to Otranto, and from thence to Bulgaria, where, being entirely defeated by one of the emperors generals, he was taken priſoner, and had his head ſtruck off.

The Normans having now conquered the greateſt part of Puglia, proceeded to make a diviſion of their conqueſt, in which, after each commander had got his proper ſhare, the city of Melſis was left common to all, and appropriated as a place for aſſembling to conſult about the moſt important affairs of the nation. Argyrus alone was neglected in this diviſion; but he, having gained the favour of the emperor by expelling the rebel Maniacus from Italy, was by him created duke of Bari, on purpoſe to check the power of the Normans, with the title of *prince and duke of Puglia*. The Normans, however, were too powerful to be much awed by Argyrus, and behaved with great inſolence to the neighbouring princes; but as they could not be expelled by force, and were confirmed in their conqueſts by Henry II. emperor of Germany in 1047, the Greek emperor attempted to get rid of them, by ſending Argyrus with large ſums of money to bribe them to enter into his ſervice againſt the Perſians. But they, perceiving the ſnare, replied, that they were reſolved not to leave Italy unleſs they were expelled by force; upon which Argyrus made uſe of the ſame money in bribing the Puglians to aſſaſſinate theſe invaders. This

22 Great numbers of them maſſacred.

brought on a maſſacre, in which greater numbers of Normans periſhed than had fallen in all the late wars. Argyrus attempted to take advantage of the confuſion produced by this maſſacre, but was defeated; after which he had recourſe to Pope Leo, beſeeching him to deliver Italy from theſe cruel tyrants: but this ſcheme proved ſtill more unſucceſsful than the others had been; for the pope himſelf was defeated and taken priſoner; and, in conſequence of the reſpect ſhowed him by the Normans, granted them, as a fief of the holy ſee, all the conqueſts they had made or ſhould make in Calabria and Sicily.

23 They are confirmed by the pope in all their conqueſts.

Soon after this, the Norman power became extremely formidable; the famous Robert Guiſcard aſcended the throne in 1056. He made great progreſs in the conqueſt of Calabria, and reduced moſt of the cities which held for the Greeks in theſe parts. About the ſame time the counts of Capua were expelled from their territory; and the abbot Deſiderius mentions his having ſeen the children of Landulphus V. the laſt count, going about as vagabonds, and begging for their ſupport. The pope, alarmed by theſe conqueſts. excommunicated the Normans in wholeſale, pretending that they had ſeized ſome of the territories belonging to the church; but, by the pretended ſubmiſſion of Robert, he not only was perſuaded to take off the ſentence of excommunication, but to inveſt him with the provinces of Apulia, Calabria, and Sicily. After this, he continued the war againſt the Greeks with great ſucceſs. In 1071, in conjunction with his brother Roger, he conquered the iſland of Sicily, and

24 Sicily conquered by Robert Guiſcard,

gave the inveſtiture of the whole iſland to him with the title of *count*, reſerving to himſelf only the half of Palermo, Meſſina, and the valley of Demona. The like ſucceſs attended his arms againſt Salerno in 1074; but after this, having unadviſedly taken ſome places from the pope, he again fell under the ſentence of excommunication; yet he was reconciled to him in 1080, and received

received a second time the investiture of all his dominions. The next year he undertook an expedition against the Greeks; and though the emperor was assisted by a Venetian fleet, Robert made himself master of the island of Corfu, reduced Durazzo, and great part of Romania; insomuch that by the success of his arms, and his near approach to Constantinople, he struck an universal terror among the Greeks. But while Robert was thus extending his conquests, he was alarmed by the news of a formidable rebellion in Italy, and that the emperor Henry had taken the city of Rome, and closely shut up the pope in the castle of St Angelo. Robert therefore, leaving the command of the army to his son Boemund, returned to Italy, where he immediately dispersed the rebels, and released the pope, while his son gained a considerable victory over the Greeks. After this Robert made great preparations for another expedition into Greece, in order to second his son Boemund. Alexius Comnenius, who was about this time declared emperor by the Greek army, being assisted by the Venetian fleet, endeavoured to oppose his passage, but was entirely defeated, with the loss of a great many galleys. But a final stop was now put to his enterprises by his death, which happened in the island of Corfu in 1085.

Though the power of the Normans was thus thoroughly established in Italy and Sicily, and though the prince of Benevento was in 1130 invested by the the pope with the title of king of Sicily; yet by reason of the civil dissensions which took place among themselves and the general confusion which reigned in Italy in those ages, they were obliged, notwithstanding all their valour, to submit to the emperor in 1195. By him the Sicilians were treated with so great cruelty, that the empress Constantia was induced to conspire against him in 1197, took him prisoner, and released him only on condition of his sending off his army immediately for the Holy Land. This was complied with; but the emperor did not long survive that reconciliation, being poisoned, as was supposed, by order of the empress.

25 And by the emperor of Germany.

In 1254 the pope claimed the kingdom as a fief devolved on the church in consequence of a sentence of deposition pronounced against king Frederic at the council of Lyons: and, in 1263, the kingdom was, in consequence of this right, conferred on Charles count of Anjou. After much contention and bloodshed, the French thus became masters of Sicily and Naples. Their government was insupportably tyrannical; and at the same time the haughtiness of their king so provoked the pope, that he resolved to humble him.—Charles had resolved on an expedition against Constantinople; and for this purpose had fitted out a fleet of 100 galleys, 30 large ships, 200 transports besides many other smaller vessels, on board of which he intended to embark 10,000 horse, and a numerous army of foot. This formidable armament greatly alarmed the emperor Michael Paleologus: for which reason he entered into a negociation with John di Procida, a noble Salernitan, lord of the isle of Procida in the bay of Naples, who had formed a scheme for a general revolt in the island of Sicily. John, though a nobleman, was also a physician, and had been counsellor to two former princes, and even to king Charles himself: but being stripped of his estate by the king under pretence of treason, and his wife being debauched by the French, he retired to Constantia queen of Arragon, where he was created a baron of the kingdom of Valencia, by her husband king Peter, and Lord of Luxen, Bénizzano, and Palma. As he was greatly exasperated against the French, he employed many spies both in Puglia and Sicily; and being informed that the Sicilians were totally disaffected to the French, he came to the island in disguise, and concerted a plan with the most powerful of the malcontents for a revolution in favour of Constantia, though she derived the right only as being the daughter of a former usurper named *Manfred*. Procida then set out for Constantinople, where in some private conferences with the emperor, he persuaded him, that the most probable means of defeating Charles's scheme was by assisting the Spaniards and Sicilian malcontents. Paleologus accordingly granted him a large sum of money, and on his departure sent one of his secretaries along with him, who, landing in Sicily, had a conference with the chief conspirator. John, having received letters from them disguised himself in the habit of a Franciscan, and went to Suriano in the neighbourhood of Rome. As he well knew the enmity which subsisted between the pope and king Charles, he disclosed his design to his holiness; who readily entered into his measures, wrote to Peter to hasten his armament, promising him the investiture of the island as soon as he had taken possession of it; and by refusing the assistance he had promised to Charles, obliged him for the present to delay his expedition. In the beginning of the year 1280, Procida returned to Arragon, and by showing the letters from the pope and Sicilian barons, prevailed on Peter to embark in his design, by assuring him of the assistance of Paleologus. The king of Arragon accordingly prepared a formidable fleet under pretence of invading Africa, and is even said to have received 20,000 ducats from Charles, in order to assist him in his preparations.

26 The French become masters of Sicily and Naples.

But while John went on thus successfully with his scheme, all his measures were in danger of being broke by the death of pope Nicholas. The new pope, Martin IV. was entirely in the interest of Charles, on whom, in 1281, he conferred the senatorial dignity of Rome. Procida, however, still resolved to prosecute his scheme; and leaving Italy, had another conference with the conspirators in Sicily: after which, he again went to Constantinople, and obtained from Paleologus 30,000 ounces of gold, with which he immediately returned to Arragon. The death of Nicholas had damped the ardour of Peter; but, being urged with great earnestness by John, he again renewed his preparations; which alarmed the pope and the king of France. In consequence of this they sent a message to him, desiring to know against what Saracens he designed to employ his armament. In this particular Peter refused to satisfy them; upon which they earnestly counselled Charles to guard against an invasion; but he neglected their advice, being wholly intent on his eastern expedition, and encouraged by a revolt which had happened in Greece; and to facilitate his expedition, he prevailed on the pope to excommunicate the Greeks, on pretence that they had broken some of the articles of union concluded at the council of Lyons a few years before. Peter in the mean time continued his

Naples.

27 They are massacred.

his preparations with great diligence, intending to put to sea the following summer. Procida had returned to Palermo, to wait for a favourable opportunity of putting his design in execution, which was soon afforded him by the French. On Easter Monday, March 30th, 1282, the chief conspirators had assembled at Palermo; and, after dinner, both the Palermitans and French went in a grand procession to the church of Monreale, about three miles without the city. While they were sporting in the fields, a bride happened to pass by with her train, who being observed by one Drochettus, a Frenchman, he ran to her, and began to use her in a rude manner, under pretence of searching for concealed arms. A young Sicilian, exasperated at this affront, stabbed him with his own sword; and a tumult ensuing, 200 French were immediately murdered. The enraged populace then ran to the city crying, out, "Let the French die, Let the French die;" and, without distinction of age or sex, slaughtered all of that nation they could find, even such as had fled to the churches. The conspirators then left Palermo, and excited the inhabitants to murder the French all over the island, excepting in Messina, which city at first refused to be concerned in the revolt. But, being invited by the Palermitans to throw off the French yoke, a few weeks after, the citizens in a tumultuous manner destroyed some of the French; and pulling down the arms of king Charles, and erecting those of the city, chose one Baldwin for their governor, who saved the remaining French from the fury of the populace, and allowed them to transport themselves, with their wives and children, to Italy. Eight thousand persons are said to have been murdered on this occasion.

Immediately after this massacre, the Sicilians offered their allegiance to the king of Arragon; who accepted of the invitation, and landed with his forces at Trapani. From thence he went to Palermo, where he was crowned king of Sicily with great solemnity, and Charles left the island with precipitation. The day after he landed his army in Italy, the Arragonian fleet arrived, took 29 of his galleys, and the next day burnt 80 transports in presence of his army. Soon after this Charles sent an embassy to Peter, accusing him of perfidy, in invading his dominions in time of peace; and, according to some, challenged him at the same time to decide the matter by single combat. Others say, that the challenge was given by Peter. Certain it is, however, that a challenge was given, and to appearance accepted: but Peter determined to employ much more effectual means in support of his pretensions than trusting to a duel; and therefore pushed on his operations most vigorously, while his adversary trifled away his time: and thus he at last became master of the contested kingdom; which, however, he did not long enjoy, dying about the end of the year 1285.

By his will, Peter left the kingdom of Arragon to his eldest son Alphonsus, and Sicily to Don James his other son, who was also to succeed to the kingdom of Arragon in case Alphonsus should die without male issue. Accordingly, Don James was solemnly crowned at Palermo the 2d of February 1286. In 1295, however, he deserted them, and tamely resigned up his right to Charles, son to him abovementioned, in a manner perhaps unparalleled. On his resignation the Sicilians conferred the crown upon his brother Don Frederic: after which the war continued with great violence till the year 1303, when a peace was concluded, and the kingdoms of Naples and Sicily formally disjoined; Frederic being allowed to keep the latter, under the name of *Trinacria;* and Charles being confirmed in the possession of the former which he quietly enjoyed till his death in 1309.

28 The kingdoms of Naples and Sicily disjoined.

Naples continued to be governed by its own kings till the beginning of the 16th century, when the kings of France and Spain contended for the sovereignty of this country. Frederic, at that time king of Naples, resigned the sovereignty to Lous XII. on being created duke of Anjou, and receiving an annual pension of 30,000 ducats. But, in 1504, the French were entirely defeated by the Spaniards, and obliged to evacuate the kingdom; and the following year Louis renounced all pretentions to the crown, which from that time hath remained almost constantly in the hands of the Spaniards.

29 The Spaniards become masters of Naples.

The government of the Spaniards proved no less oppresive to the Neapolitans than that of others had been. The kings of Spain set no bounds to their exactions, and of consequence the people were loaded with all manner of taxes; even the most indispensable necessaries of life not being exempted. In 1647, a new tax was laid on fruit; which the people looked upon as the most grievous oppression, the chief part of their subsistence, during the summer months, being fruit, which in the kingdom of Naples is very plentiful and delicious. The edict for collecting the new duty was no sooner published, than the people began to murmur in a tumultuous manner; and when the viceroy came abroad, they surrounded his coach, bawling out to have their grievances redressed. They were encouraged in their sedition, by the news that the citizens of Palermo had actually revolted on account of the imposition of new duties. The viceroy, therefore, apprehensive of greater disorders, began to think of taking off the tax; but those who farmed the tax having bribed some of his favourites, he was by their means persuaded not to abolish it. The indignation of the people, who had suspected his intention, was now greatly increased, especially as they were privately excited by several malcontents. The farmers of the revenue, and all those concerned in raising the taxes, had incurred the hatred and detestation of the people, particularly of Tommaso Aniello, commonly called *Massaniello of Amalfi*, a fisherman, whose wife, having been discovered in smuggling a small quantity of meal, was imprisoned, and condemned to pay a fine of 100 ducats.

30 A general revolt.

31 Account of Massaniello.

Massaniello, a few years before, had come to Naples from Amalfi, where his father had been a fisherman. At this time he was about 24 years of age, and the father of four children. He was of a middling stature, and an agreeable aspect; was distinguished for his boldness, activity, and integrity: and had a great influence with his companions, by whom he was beloved and esteemed. As he was obliged even to sell his furniture to pay the heavy fine, he had conceived an implacable hatred against the farmers of the taxes, and was also moved with compassion for the miserable state of the city and kingdom. He therefore formed a design, with some of his companions, to raise a tumult in the market-place on the festival-day of the Carmelites, usually celebrated about the middle of July, when between

Naples.

tween 500 and 600 youths entertain the people by a mock-fight; one half of them in the character of Turks, defending a wooden castle, which is attacked and stormed by the other half in the character of Christians. Massaniello being appointed captain of one of these parties, and one Pione, who was privy to his design, commanding the other, for several weeks before the festival they were very diligent in reviewing and training their followers, who were armed with sticks and reeds: but a small and unforeseen accident tempted them to begin their enterprise without waiting for the festival.

On the 7th of July a dispute happenning in the market-place betwixt the tax-gatherers and some gardeners of Pozzuolo who had brought some figs into the city, whether the buyer or seller should pay the duty; after the tumult had continued several hours, Massaniello, who was present with his company, excited the mob to pillage the office built in the market for receiving the duty, and to drive away the officers with stones. The elect of the people, who by deciding against the gardeners, had increased the tumult ran to the palace and informed the viceroy, who most imprudently neglected all means of putting a stop to the commotion. Massaniello, in the mean time, being joined by great numbers of people, ordered his young troop to set fire to all the offices for the taxes through the city; which command being executed with dispatch, he then conducted them directly to the palace, where the viceroy, instead of ordering his Spanish and German guards to disperse them, encouraged their insolence by timidly granting their demands. As they rushed into the palace in a furious manner, he escaped by a private door, and endeavoured to save himself in *Castel del Ovo;* but being overtaken by the rioters in the streets, he was trampled upon by them, and pulled by the hair and whiskers. However, by throwing some handfuls of gold among them, he again escaped, and took sanctuary in a convent of Minims, where, being joined by the archbishop of Naples, cardinal Filomarini, and several nobles by their advice he signed a billet, by which he abolished all taxes upon provisions. As a means to quell the tumult, he likewise desired the cardinal to offer Massaniello a pension of 2400 crowns, who generously rejected the bribe, and declared, that if the viceroy would keep his word, he would find them obedient subjects.

It was now expected that the tumult would cease; but Massaniello, upon his return to the market-place, being joined by several malcontents, among whom were Genuino and one Peronne, who had formerly been a captain of the Sibirri, he was advised by them to order the houses of those concerned in raising the tax to be burned; which were accordingly in a few days reduced to ashes, with all their rich furniture. Massaniello being now absolute master of the whole city, and being joined by great numbers of people of desperate fortunes, he required the viceroy who had retired to the *Castel Nuovo,* to abolish all the taxes, and to deliver up the writ of exemption granted by Charles V. This new demand greatly embarrassed the viceroy; but to appease the people, he drew up a false deed in letters of gold, and sent it to them by their favourite the duke of Matalone, who had before been in confinement. The fraud, however, being discovered, the duke was pulled from his horse and maltreated by the mob, and at length committed as a prisoner to Perone. This accident, to the great joy of the viceroy, enraged the people against the nobility, several of whom they killed, burnt the houses of others, and threatened to extirpate them all. Massaniello, in the mean time tattered and half naked, commanded his followers, who were now well armed, and reckoned about 100,000 men, with a most absolute sway. He eat and slept little, gave his orders with great precision and judgement, appeared full of moderation, without ambition and interested views. But the duke of Matalone having procured his liberty by bribing Peronne, the viceroy imitated his example, and secretly corrupted Genuino to betray his chief. A conspiracy was accordingly formed against Massaniello by Matalone and Peronne; the duke, who was equally exasperated against the viceroy, proposing, that after his death his brother D. Joseph should head the rebels.

Massaniello in the mean time by means of the cardinal archbishop, was negociating a general peace and accommodation; but while both parties were assembling in the convent of the Carmelites, the banditti hired by Matalone made an unsuccessful attempt upon Massaniello's life. His followers immediately killed 150 of them. Peronne and D. Joseph being discovered to be concerned in the conspiracy were likewise put to death, and the duke with great difficulty escaped. Massaniello by this conspiracy was rendered more suspicious and severe. He began to abuse his power by putting several persons to death upon slight pretences; and, to force the viceroy to an accomodation, he cut off all communication with the castles, which were unprovided with provision and ammunition.—The viceroy likewise being afraid lest the French should take advantage of the commotion, earnestly desired to agree to a treaty: which was accordingly concluded on the fifth day of the insurrection, by the mediation of the archbishop. By the treaty it was stipulated that all duties imposed since the time of Charles V. should be abolished: that the writ of exemption granted by that emperor should be delivered to the people; that for the future no new taxes should be imposed; that the vote of the elect of the people should be equal to the votes of the nobility; that an act of oblivion should be granted for all that was past; and that the people should continue in arms under Massaniello till the ratification of the treaty by the king.

32 A treaty concluded between Massaniello and the viceroy.

By this treaty, no less than 10,000 persons, who fattened upon the blood of the public, were ruined.—The people, when it was solemnly published, manifested an extreme joy, believing they had now recovered all their ancient rights and privileges. Massaniello, at the desire of the viceroy, went to the palace to visit him, accompanied by the archbishop, who was obliged to threaten him with excommunication, before he would consent to lay aside his rags and assume a magnificent dress. He was received by the duke with the greatest demonstrations of respect and friendship, while the duchess entertained his wife, and presented her with a robe of cloth of silver, and some jewels.—The viceroy to preserve some shadow of authority, appointed him captain-general; and at his departure made him a present of a golden chain of great value, which with great difficulty he was prevailed upon to accept;

33 Massaniello appointed captain-general.

Naples. accept; but yielded at length to the intreaties of the cardinal. Next day in consequence of the commission granted him by the viceroy, he began to exercise all the functions of sovereign authority: and having caused a scaffold to be erected in one of the streets, and several gibbets, he judged all crimes, whether civil or military, in the last resort: and ordered the guilty to be immediately put to death, which was the punishment he assigned to all offences. Though he neglected all forms of law, and even frequently judged by physiognomy, yet he is said not to have overlooked any criminal or punished any innocent person.

His grandeur and prosperity was of very short continuance; for his mind becoming distracted and delirious for two or three days, he committed a great many mad and extravagant actions; and on the 18th of July was assassinated with the consent of the viceroy.

34 Is assassinated.

The tumult did not end with the death of Massaniello: on the contrary, the people now expelled the Spaniards from most of the cities throughout the kingdom; and this general insurection being the subject of discourse at Rome, the duke of Guise, who happened then to be at the pope's court, took the opportunity, at the instigation of his holiness, to offer his service to the Neapolitans against the Spaniards. The duke was prompted by his ambition to engage in this enterprise, especially as he himself had some distant pretensions to the crown. The Spaniards in the mean time made a vigorous attack on the city; but were repulsed by the people, who now formally renounced their allegiance to them. In a short time, however their city being surprised by the new viceroy, the count d'Oniate, and the duke of Guise himself taken prisoner, the people returned to their allegiance, and thus all the attempts of the French on Naples were frustrated. Since that time the Spaniards continued in peaceable possession of the kingdom till the year 1707, when it was was taken from them by prince Eugene. It was formally ceded to the emperor by the treaty of Rastadt in 1713; but was recovered by the Spaniards in 1734, and the king of Spain's eldest son is now king of Naples and Sicily. for a particular account of these revolutions, see the articles SPAIN and SICILY.

35 The people return to their allegiance.

36 Climate, produce, &c. of Naples.

The climate of Naples is extremely hot, especially in July, August, and September. In winter there is seldom any ice or snow, except on the mountains.—On account of its fertility it is justly termed an earthly paradise; for it abounds with all sorts of grain, the finest fruit and garden productions of every kind, with rice, flax, oil, and wine, in the greatest plenty and perfection. It affords also saffron, manna, alum, vitriol, sulphur, rock crystal, marble and several sorts of minerals, together with fine wool, and silk. The horses of his country are famous, and the flocks and herds very numerous. Besides these products, of which a considerable part is exported, there are manufactures of snuff, soap and glass wares. Waistcoats, caps, stockings, and gloves, are also made of the hair or filaments of a shell fish, which are warmer than those of wool, and of a beautiful glossy green. In this kingdom likewise is found that called the *Phrygian stone*, or *pietra, fungifera*, which, being laid in a damp shady place, will yield mushrooms, sometimes of a very large size, especially if the stone is sprinkled with hot water. See AGARICUS.

As to the mountains of this country, the principal are those of the Apennine, which traverse it from South to North; and Mount Vesuvius, which, as is well known, is a noted Volcano, five Italian miles from Naples. The side of the mountain next the sea yields wine, particularly the two famed wines called *Vino Greco* and *Lachrymæ Christi*. One of the greatest inconveniences to which this kingdom is exposed is earthquakes, which the eruptions of Mount Vesuvius contribute in some measure, to prevent. Another inconveniency, which however is common to it with other hot countries, is the great number of reptiles and other insects, of which some are very poisonous.

With respect to religion, it is on a very bad footing here. The number of convents and monasteries is astonishing. It is said the clergy and convents possess two thirds of the whole kingdom; nay, some maintain, that were the kingdom divided into five parts, four would be found in the hands of the church. Notwithstanding this power and influence of the clergy, they have not been able hitherto to get the inquisition established here. In the year 1731, measures were taken for lessening the number of convents; and lately the order of Jesuits hath been suppressed. The papal bulls cannot be made public without the king's permission; nor are protestants compelled to kneel in the churches, or at meeting the host; and in Lent they can very easily procure flesh meat. In the year 1740 the Jews were allowed to settle in the kingdom during the term of 50 years, and several privileges were granted them during that period; at the expiration of which the grant was supposed to be renewed unless they were expresly ordered to quit the country. 37 Religion.

The revenue of the kingdom, is generally computed at 3,000,000 of crowns: but, as Mr Addison observes, there is no country in Europe which pays greater taxes, and where, at the same time, the public is less the better for them, most of them going to the enriching of the private persons to whom they are mortgaged. 38 Revenue, &c.

The military force of this kingdom is said to consist of about 30,000 men of which the Swiss regiments are the best. As to the marine, it consists only of a few galleys. The only order here is that of St Januarius, which was instituted by Don Carlos in the year 1738.

The king of Naples, or of the two Sicilies, is an hereditary monarch. The high colleges are the council of state, the privy-council, the treasury, the Sicily-council, the council, of war, &c. This kingdom is a papel fief; and the king in acknowledgment of the pope's feudal right, sends him every year a white palfry, and a purse of 6000 ducats. The title of the king's eldest son is *prince of Calabria*. The number both of the high and low nobility in the kingdom of Naples is very great. "I am assured (says Dr Moore§) that the king of Naples counts among his subjects 100 persons with the title of prinee, and a still greater with that of duke. Six or seven of these have estates which produce from 10 to 12 or 13,000 l. a year; a considerable number have fortunes of about half the value; and the annual revenue of many is not above 1000 l. or 2000 l. The inferior orders of the nobility are much poorer. Many counts and marquisses have not above 300 l. or 400 l. a year of paternal estate; many have still less; and not a few enjoy the title without any estate whatever. These nobles, however, are excessively

§ View of Society. &c in Italy.

Naples.

excessively fond of splendor and show, which appears in the brilliancy of their equipages, the number of their attendants, the richness of their dress, and the grandeur of their titles. The finest carriages are painted, gilt, varnished, and lined, in a richer and more beautiful manner than has yet become fashionable either in England or in France. They are often drawn by six and sometimes by eight horses. Before the carriage, it is the mode to have two running footmen, and behind three or four servants in the richest liveries. The ladies and gentlemen within the coaches glitter in all the brilliancy of lace, embroidery, and jewels.—This finery is not confined to the persons within and without the coaches; it is extended to the horses, whose heads, manes, and tails, are ornamented with the rarest plumage, and set off with ribbons and artificial flowers."

We shall mention a circumstance from which an idea may be formed of the grandeur of a Neapolitan palace, and the number of domestics which some of the nobility retain. "I dined (continues our author) at the prince Iacci's, where we passed through 12 or 13 large rooms before we arrived at the dining-room. There were 36 persons at table served by the prince's domestics, and each guest had a footman behind his chair, while other domestics belonging to the prince remained in the adjacent rooms and in the hall. No estate in England could support such a number of servants, paid and fed as English servants are; but in Naples the wages are very moderate indeed, and the greater number of men-servants, belonging to the first families, give their attendance through the day only, and find beds and provisions for themselves. It must be remembered also, that few of the nobles give any entertainments; and those who do not are said to live very sparingly; so that the whole of their revenue, whatever it may be, is expended on articles of show."

In the kingdom of Naples, the hereditary jurisdiction of the nobles over their vassals subsists in the full rigour of the feudal government. The peasants therefore are poor; and it depends entirely on the personal character of the master, whether their property be not the least of their grievances. As this power is too often abused, the importance of the nobility depends in a great measure on the favour of the king, who, under pretence of any offence, can confine them to their estates, or imprison them at pleasure. Unless this prince were so very impolitic as to disgust all the nobility at once, and so unite the whole body against him, he has little to fear from their resentment. Even in case of such an union, as the nobles have lost the affection of their vassals, what could they do in opposition to a standing army of 30,000 men, entirely devoted to the crown? The government of Naples, therefore, is in fact a despotic monarchy, though something like the form of a feudal constitution in its ancient purity is still kept up by the biennial summons of the general assembly. This convention, which consists of the nobility and commons, is called together every two years, to deliberate on the customary free-gift to the crown.

The inhabitants of this country have at all times borne but an indifferent character among other nations. "From the few hints dropped by the classic authors, we collect that the ancient Neapolitans were a race of Epicureans, of a soft indolent turn, averse from martial exercises, passionately fond of theatrical amusements and music, expert in all the refined arts that administer to the caprices of luxury, extravagant in their expressions and gestures, and dupes to various sorts of superstition. If we make allowance for a quantity of northern blood which has joined the original Grecian stream, and imparted a roughness not yet worn off by the mildness of the climate, we shall find the modern Neapolitans very like the ancient.—Provisions being here plentiful and cheap, the lower class of people work but little. Their delight is to bask in the sun, and do nothing. Persons of a middle rank frequent places of public resort; and very few of any rank attend to their proper business with the zeal and activity we are wont to meet with in the professional men of colder countries. Gluttony is a predominant vice, while instances of ebriety are comparatively rare. In the female sex, the passion for finery is almost superior to every other; and, though chastity is not the characteristic virtue of the country, Mr Swinburne doubts § whether a Neapolitan woman would not nine times out of ten prefer a present to a lover. That furious jealousy for which the nation was once so remarkable, is now greatly abated. The breach of the conjugal vow sometimes occasions quarrels and assassinations among people of an inferior station; and in the metropolis, assassinations are often perpetrated from much less cogent motives. Of these vices, many are doubtless owing to that slavery and oppression under which they groan, and to a radical defect in the administration of justice, though the kingdom is divided into 12 provinces or jurisdictions.

§ Travels in the Two Sicilies.

Naples, anciently *Parthenope*, afterwards *Neapolis*, the capital of the kingdom of that name in Italy, lies in the province called *Terra di Lavora*, which is the richest and best inhabited of the whole kingdom, and comprehends a part of the ancient Campania Felix, or the Happy. This city is fabled to owe its foundation to a syren, and to have received its ancient name from its supernatural foundress. Whatever be its origin, it is the first for neatness, and the second for extent, of all the cities in Italy. It was formerly a place of strength; but its walls at present being of no real defence, its safety depends of course upon the force of its armies. It is most advantageously situated, having a delicious country on one side, and a noble bay of the Mediterranean on the other, with an excellent harbour. The circumference, including the suburbs, is said not to be less than 18 Italian miles, and the number of the inhabitants therein little less than 400,000. The houses are of stone, flat-roofed, and generally lofty and uniform; but many of them have balconies, with lattice-windows. The streets are well paved; but they are not lighted at night, and in the day-time are disfigured, in many places, by stalls on which provisions are exposed to sale. Here are a great number of fine churches, convents, fountains, and palaces of the nobility, many of whom constantly reside here. It is usual to walk on the tops of the houses in the evenings, to breathe the sweet cool air, after a hot sultry day. The climate here is so mild and warm, even in the winter, that plenty of green pease, artichokes, asparagus, and other vegetables, may

may be had so early as the beginning of the new year, and even all the winter. This city swarms with monks and nuns of all sorts, to such a dgerce, that there are no less than 19 convents of the Dominicans alone, 18 of the Franciscans, 8 of the Augustines, and an equal proportion of the rest. The magnificence of many of the churches exceeds imagination. In a cloyster of the Carthusian monastery is a crucifix, said to be done by Michael Angelo, of inimitable workmanship.

To repel hostile attempts by sea, which, from its situation, maritime powers might be tempted to make, Naples has, to the west, the Castel del Uovo, a confused pile of ancient buildings, and some modern batteries. The rock upon which this fortress stands was originally called *Megara*, then *Lucullanum*, and was considered as a place of strength so early as in the year 475. Along the line of the shore towards the east are some batteries on the points of land, the bastions of the arsenal, and above it the lofty wall of the Castel Nuovo. This last fortress has been the usual refuge of the sovereigns and viceroys in all civil wars and tumults; for which reason they have long fixed their residence near its walls. A block-house and batteries defend the mouth of the harbour, and at the eastern extremity of the town is the Torrione de Carmine, better known by the figure it made in Massaniello's rebellion than by its extent or military strength. The castle of Saint Elmo commands Naples in every direction, and is in reality calculated rather to annoy and awe the citizens than to defend them from foreign invaders. The city is indeed far from being secure against a bombardment; for the sea is so deep, that a large vessel may come up to the very mole in defiance of the block house and batteries, &c. Pictures, statues, and antiquities, are not so common in Naples as might be expected in so great and ancient a city, many of the most valuable pieces having been sent to Spain by the viceroys. The bay is one of the finest in the world, being almost of a round figure, of about 30 miles in diameter, and three parts of it sheltered with a noble circuit of woods and mountains. The city stands in the bosom of this bay, in as pleasant a situation, perhaps, as in the world. Mr Keysler says, they reckon about 18,000 *donne libere*, or courtezans in the city, and Dr Moore computes the number of *lazzarani* or blackguards at above 30,000. The greater part of these wretches have no dwelling-houses, but sleep every night under porticos, piazzas, or any kind of shelter they can find. Those of them who have wives and children, live in the suburbs of Naples near Peusilippo, in huts, or in caverns or chambers dug out of that mountain. They are generally represented as a lazy, licentious, and turbulent set of people, as indeed by far the greater part of the rabble are, who prefer begging or robbing, or running errands, to any fixed and permanent employment. Yet there are in Naples some flourishing manufactures, particularly of silk stockings, soap, snuff-boxes of tortoise shells and the lava of Mount Vesuvius, tables, and ornamental furniture of marble. The city is supplied with a vast quantity of water, by means of a very costly aqueduct, from the foot of Mount Vesuvius. Mr Addison says, it is incredible how great a multitude of retainers to the law there are in Naples, who find continual employment from the fiery temper of the inhabitants. There are five piazzas or squares in the city, appropriated to the nobility, viz. those called *Capuna*, *Nido*, *Montagna*, *Porto*, and *Porta Nova*. Of all the palaces, that of the king is not only the most magnificent, but also in the best style of architecture. The cathedral, though Gothic, is a very grand splendid edifice. It is here that the head and blood of St Januarius, the tutelary saint of Naples, are kept, the latter in two glass or crystal vials. The pretended liquefaction of the dried blood, as soon as brought near the head of the saint, is a thing well known; Mr Addison says, it is one of the most bungling tricks he ever saw †. The harbour is spacious, and kept in good repair. It is fortified with a mole, which runs above a quarter of a mile into the sea, and at the extremity has a high lantern to direct ships safely into the harbour. Luxury here is restrained by severe sumptuary laws, and the women are more closely confined than in any other city of Italy. Here is an university and two academies of wits, the one called *Gli Ardenti*, and the other *Gli Otiosi*. The nunnery for ladies of quality is said to be the largest in the whole world, containing no less than 350 nuns, besides servants. The Mount of Piety, or the office for advancing money to the poor, on pledges, at a low interest, or without any, has an income of upwards of 50,000 ducats. The arsenal is said to contain arms for 50,000 men. The walls of the city consist of hard black quarry stones, called *piperno*.—Instead of ice, vast quantities of snow are used for cooling their liquors, not so much as water being drank without it; so that, it is said, a scarcity of it would as soon occasion a mutiny as a dearth of corn or provisions. Certain persons, who farm the monopoly of it from the government, supply the city all the year round from a mountain about 18 miles off, at so much the pound. Naples stands 110 miles south-east from Rome, 164 north-east from Palermo in Sicily, 217 south-east from Florence, and 300 from Venice. E. Long. 14. 20. N. Lat. 40. 55.

† See Chemistry, n° 800.

NARBO (anc. geog.), a town of the Volcæ Tectosages, called also *Narbo Martius*, from the Legio Martia, the colony led thither 59 years before the consulate of Cæsar, (Velleius); increased with a colony of the Decumani or tenth legion by Cæsar. An ancient trading town on the Atax, which discharges itself into the sea through the Lacus Rubresus, or Rubrensis. Capital of the Gallia Narbonensis; surnamed *Colonia Julia Paterna*, from Julius Cæsar, the father of Augustus by adoption. Now called *Narbonne*, a city of Languedoc.

NARBONNE, is a city of France in Lower Languedoc, with an archbishop's see, and is particularly famous for its honey. It is seated on a canal cut from the river Aude, which being but three miles from the sea, vessels come up it laden with merchandise, which renders it a place of some trade. But though it pretends to the most remote antiquity under the Celtic kings, in ages anterior even to the Roman conquests, which under these latter masters gave its name to all the *Gallia Narbonensis*, and was a colony of the first consideration, it is now dwindled to a wretched solitary town, containing scarce 8000 inhabitants, of whom three fourths are priests and women. The streets and buildings are mean and ruinous; it has indeed a commu-

Narcissus. nication with the Mediterranean, from which Narbonne is only about three leagues distant, by means of a small river which intersects the place; but their commerce is very limited, and chiefly consists in grain which they export to Cette and Marseilles. No marks of Roman magnificence remain, except several inscriptions in different parts of the city. It is divided into the city and the town, which are joined together by a bridge, with houses on each side, in which the richest merchants live. There are several churches and convents, and the metropolitan church has a handsome steeple. E. Long. 2. 6. N. Lat. 43. 11.

NARCISSUS, in fabulous history, the son of the river Cephissus and Liriope the daughter of Oceanus, was a youth of great beauty. Tiresias foretold that he should live till he saw himself. He despised all the nymphs of the country; and made Echo languish till she became a mere sound, by refusing to return her passion; but one day coming weary and fatigued from the chace, he stopped on the bank of a fountain to quench his thirst; when, seeing his own form in the water, he became so in love with the shadowy image that he languished till he died. On which the gods, being moved at his death, changed him into the flower which bears his name.

Narcissus, in botany: A genus of the monogynia order, belonging to the hexandria class of plants; and in the natural method ranking under the 9th order, *Spathaceæ*. There are six petals; the nectarium is funnel-shaped, and monophyllous; the stamina are within the nectarium. The most remarkable species are.

1 The bastard narcissus, or common yellow English daffodil, grows wild in great plenty in many of the woods and coppices. and under hedges in several parts of England. In the counties round London the herb folks bring prodigious quantities in the spring of the year, when in bloom, root and all, and sell them about the streets Its commonness renders it of but little esteem with many; considered, however, as an early and elegant flower, of exceeding hardiness and easy culture, it merits a place in every garden.

2. The bicolor, or two-coloured incomparable narcissus, hath a large, oblong, bulbous root; crowned with long, narrow, dark-green leaves, 12 or 14 inches long; an upright flower-stalk, about 15 inches high, terminated by an uniflorous spatha, protruding one large flower with white petals, and a bell-shaped, spreading, golden nectarium, waved on the margin, and equal in length with the corolla; flowering in April. The varieties are, common single-flowered—semi-double-flowered, with the interior petals some white and some yellow—with sulphur-coloured flowers.

3. The poeticus, poetic daffodil, or common white narcissus, is well known. Of this there are varieties with purple cupped flowers—yellow cupped flowers—double-flowered: all of them with entire white petals. It is the ancient celebrated narcissus of the Greek and Roman poets, which they so greatly extol for its extreme beauty and fragrance.

The bulbocodium, hath a small bulbous root, crowned with several narrow, subulate, rush-like leaves, six or eight inches long: amidst them a slender taper flower-stalk, six inches high, terminated by an uniflorous spatha, protruding one yellow flower, having the nectarium much larger than the petals, and very broad and spreading at the brim; flowering in April. From the large spreading nectarium of this species, which being three or four times longer than the petals, narrow at bottom, and widening gradually to the brim, so as to resemble the shape of some old fashoned hoop peticoats, it obtained the name *hoop-petticoat narcissus*. Narcissus.

3. The serotinus, or late-flowering small autumnal narcissus, hath a small bulbous root; crowned with a few narrow leaves; amidst them a jointed flower-stalk eight or nine inches high, terminated by an uniflorous spatha, protruding one white flower, having a short, six-parted, yellow nectarium; flowering in autumn.

6. The tazetta, or multiflorous daffodil, commonly called *polyanthus narcissus*, hath a very large, roundish, bulbous root: long, narrow plain leaves; an upright flower-stalk, rising from 10 or 12 inches to a foot and a half high; terminated by a multiflorous spatha, protruding in many large, spreading, white and yellow flowers, in a cluster, having bell-shaped nectariums shorter than the corolla; flowering in February, March and April, and is very fragrant. The varieties of this are very numerous, consisting of about eight or nine principal sorts, each of which having many intermediate varieties: amount in the whole greatly above an hundred in the Dutch florists catalogues, each variety distinguished by a name according to the fancy of the first raiser of it. They are all very pretty flowers, and make a charming appearance in the flower-borders, &c. they are also finely adapted for blowing in glasses of water, or in pots, to ornament rooms in winter.

7. The jonquilla, or jonquil, sometimes called *rush, leaved daffodil*, hath an oblong, bulbous, brown root-sending up several long, semi-taper, rush-like, bright-green leaves; amidst them an upright green flower-stalk, a foot or 15 inches high; terminated by a multiflorous spatha, protruding many yellow flowers, often expanded like a radius, each having a hemispherical, crenated nectarium, shorter than the petals; flowering in April, and mostly of a fine fragrance. The varieties are, jonquil minor with single flowers—jonquil major with single flowers—starry flowered—yellow and white flowered—white-flowered—semi-double-flowered—double-flowered—and large double inodorous jonquil: all of them multiflorous, the single in particular; but sometimes the doubles produce only two or three flowers from a spatha, and the singles commonly six or eight. All the sorts have so fine a shape, so soft a colour, and so sweet a scent, that they are some of the most agreeable spring-flowers.

8. The calathinus, or multiflorous yellow narcissus, hath a large bulbous root; crowned with long, narrow, plane leaves; and amidst them an erect, robust flower-stalk, terminated by a multiflorous spatha, protruding many large, entire, yellow flowers, having a bell-shaped, slightly crenated nectarium, equal in length with the petals.

9. The odorous, odoriferous, or sweet-scented starry yellow narcissus, hath a bulbous root; narrow leaves; erect flower-stalk, a foot or more high, terminated by a sub-multiflorous spatha, protruding sometimes but

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one, and ſometimes ſeveral entirely yellow flowers, having a campanulated, ſix-parted, ſmooth nectarium, half the length of the petals.

10. The triandrus, or triandrous ruſh-leaved white narciſſus, hath a bulbous root; very narrow, ruſh-like leaves; erect flower-ſtalk, terminated by an uniflorous ſpatha, protruding one ſnowy-white flower, having a bell-ſhaped, crenated nectarium, half the length of the petals, and with moſtly triandrous or three ſtamina.

11. The trilobus, or trilobate yellow narciſſus, hath a bulbous root; narrow ruſh-like leaves; erect flower ſtalks, terminated by a ſub-multiflorous ſpatha, protruding ſometimes but one or two, and ſometimes ſeveral, yellow flowers, having a bell ſhaped, three-lobed nectarium, half the length of the petals.

12. The minor, or yellow winter daffodil, hath a ſmall bulbous root; plane leaves eight or ten inches long, and more than half a one broad; an erect flower-ſtalk, terminated by an uniflorous ſpatha protruding one nodding yellow flower, with ſpear-ſhaped petals, having an obconic, ſix-parted, waved nectarium, equal to the length of the corolla; flowering in winter, or very early in ſpring.

All theſe 12 ſpecies of narciſſus are of the bulbous-rooted tribe, and univerſally perennial in root, but annual in leaf and flower-ſtalk; all of them riſing annually in ſpring, immediately from the crown of the bulb, firſt the leaves, and in the midſt of them the flower-ſtalk, one only from each root, entirely naked or leafleſs, each terminated by a ſpatha or ſheath, which opens on one ſide to protrude the flowers, and then withers; the flowers, as before obſerved, are all hexapetalous, each furniſhed with a nectarium in the centre, and are univerſally hermaphrodite; they are large and conſpicuous, appearing moſtly in the ſpring-ſeaſon, generally from March or April until June, ſucceeded by ripe ſeed in July; then the leaves and flower-ſtalks decay, and the roots deſiſt from growing for ſome time; at which period of reſt is the only proper time to take up or tranſplant the roots from one place to another or to ſeparate the offsets; for they all multiply abundantly by offset young bulbs from the main root, inſomuch that a ſingle bulb will in one or two years be increaſed into a large cluſter of ſeveral bulbs, cloſely placed together, and which every ſecond or third year ſhould be taken up at the above period in order to be ſeparated; and each offset ſo ſeparated commences a diſtinct plant: which being planted again in autumn, produces flowers the following ſummer, alike in every reſpect to thoſe of their reſpective parent bulbs. All the ſpecies are ſo hardy that they proſper in any common ſoil of a garden: obſerving, however, to allow the finer ſorts of *polyanthus narciſſus*, in particular, principally a warm dry ſituation; all the others may be planted any where in the open dry borders and flower-beds.

NARCOTICS, in medicine, ſoporiferous drugs, which bring on a ſtupefaction. Among narcotics the moſt eminent are thoſe uſually prepared for medicinal uſes from the poppy, eſpecially opium; as alſo all thoſe prepared from mandragoras, hyoſcyamus, ſtramonium, and datura.

NARDO, a pretty populous town in the kingdom of Naples, and in the Terra d'Otranto, with the title of a duchy and a biſhop's ſee. E. Long. 18. 27. N. Lat. 43. 28.

In this little city are 8000 inhabitants. The ſteeple of its cathedral is built in a very uncommon but ſhowy ſtyle of Gothic architecture. Luca Giordano and Solimeni have adorned the church with ſome agreeable paintings. This place was part of the Balzo eſtate. The Aquavras were the next poſſeſſors: they are thought to have come from the Marca di Ancona. In 1401, in conſideration of their relationſhip to Pope Boniface IX. Laudiſlaus erected their manor of Ari into a dukedom, an honour till then ſeldom granted to any but princes of the blood royal. Claudius Aquaviva, a famous general of the Jeſuits, who died in 1615, was of this family.

NARDUS, in botany: A genus of the monogynia order, belonging to the triandria claſs of plants; and in the natural method ranking under the 4th order, *Gramina*. There is no calyx; the corolla is bivalved.

This plant was highly valued by the ancients, both as an article of luxury and medicine. The *unguentum nardium* was uſed at baths and feaſts as a favourite perfume. Its value is evident from that paſſage of ſcripture, where our Saviour's head was anointed with a box of it, with which Judas found fault. From a paſſage in Horace it appears that this ointment was ſo valuable among the Romans, that as much as could be contained in a ſmall box of precious ſtone was conſidered as a ſort of equivalent for a large veſſel of wine, and a proper quota for a gueſt to contribute at an entertainment, according to the ancient cuſtom;

——————*Nardo vina merebere.*
Nardi parvus onyx eliciet cadum.

The plant had a great character among the ancients as a medicine, both internally taken and externally applied. It has a place in the liſt of all antidotes from thoſe of Hippocrates (given on the authority of Myrepſus and Nicholaus Alexandrinus) to the officinals which have kept their ground till lately, under the names of *Mithridate* and *Venice treacle*. Galen and Alexander Trallian recommend it in the dropſy and gravel; Celſus and Galen in pains of the ſtomach and bowels, both internally given and externally applied. Galen preſcribed the oleum nardium to the emperor Marcus Aurelius when afflicted with a cholera morbus. It was externally applied to the ſtomach on wool; and the ſucceſs was ſo great, that he ever afterwards enjoyed the higheſt confidence of that emperor. In a work attributed to Galen, alſo, it is mentioned that a medicine compoſed of this and ſome other aromatics was found uſeful in long protracted fevers; and the natives of India at preſent conſider it as a very efficacious remedy in fevers. Its ſenſible qualities, indeed, promiſe it to be of conſiderable efficacy in ſome caſes, as it has a pungency of taſte ſuperior to contrayerva, and little inferior to ſerpentaria.

But though the name of this plant, with the uſes and virtues of it, has long been familiar in the writings of botaniſts and phyſicians, the genus and ſpecies of the plant have only been aſcertained very lately. In the Philoſophical Tranſactions for 1790, Dr Blane gives an account of it from a letter ſent him by his brother from Lucknow, dated in December 1786.—According to this gentleman's relation, being one day

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Nardus. on a hunting party with the nabob visier, after crossing the river Rapty, about 20 miles from the foot of the northern mountains, he was surprised to find the air perfumed with an aromatic smell, which, as he was told, proceeded from the roots of the grass that were bruised or torn out of the ground by the nabob's elephants and horses. The country was wild, uncultivated, and entirely covered with this kind of grass, which grew in large tufts close to each other, and from three to four feet long. As none of it was in flower, it being then the winter season, and the grass having besides been burnt down by order of the nabob, our author caused some of the roots to be dug up, in order to plant it in his garden at Lucknow.—Here it prospered exceedingly; and shot up spikes to the height of six feet. A specimen was sent to Sir Joseph Banks, who found it to belong to the genus of andropogon, different from any species hitherto described by botanists. "There is great reason, however (says Dr Blane), to think that it is the true nardus Indica of the ancients; for, 1. The circumstance of its discovery corresponds in a striking manner with an occurrence related by Arrian in his History of Alexander's expedition into India. During the march of that hero through the desarts of Gedrosia, the air was perfumed by the spikenard, which was trampled under foot by the army; and the Phœnicians, who accompanied them, collected great quantities of it, as well as of myrrh, to carry them into their own country to make merchandise of them. This last circumstance seems further to ascertain it to have been the true nardus; for the Phœnicians, who even in war appear to have retained their true genius for commerce, could no doubt distinguish the proper quality of thus commodity. I am informed by major Rennel, that Gedrosia answers to the modern Mackran, or Kedgemackran, a maritime province of Persia, situated between Kermon (the antient Carmania), and the river Indus, being of course the frontier province of Persia towards India; and that it appears from Arrian's account, and from a Turkish map of Persia, that this desart lies in the middle tract of country between the river Indus and the Persian gulf, and within a few days march of the Arabian or Erythræan sea. By this the ancients meant the northern part of the Ethiopic ocean, which washes the southern coasts of Arabia and Persia; not what we now call the Red Sea, as its name would seem to imply, for this by the ancients was called the *Arabian Gulph*. 2. Though the accounts of the ancients concerning this plant are very defective, it is plain that it was of the natural order of grammina; for the term *arista*, so often applied to it, was appropriated by them to the fructification of grains and grasses, and seems to be a word of Greek original, to denote the most excellent portion of those plants, which are the most useful in the vegetable creation for the sustenance of animal life; and nature has also kindly made them the most abundant in all parts of the habitable earth. Galen says, that though there are various sorts of nardus, the term ναρδος σταχυς, or *spikenard*, should not be applied to any but the nardus Indica. It would appear that the nardus Celtica was a plant of a quite different habit, and is supposed to have been a species of valeriana.

"The description of the Nardus Indica by Pliny does not indeed correspond with the appearance of our specimen; for he says it is *frutex radice pingui et crassa*, whereas ours has small fibrous roots. But as Italy is very remote from the native country of this plant, it is reasonable to suppose that others more easily procurable used to be substituted for it; and the same author says, that there were nine different plants by which it could be imitated and adulterated. There is a *Nardus Assyria* mentioned by Horace; and Dioscorides mentions the *Nardus Syriaca* as a species different from the *Indica*, which certainly was brought from some of the remote parts of India; for both Dioscorides and Galen, by way of fixing more particularly the country from whence it came, call it the *Nardus Gangites*. 3. *Garcias ab Horto*, a Portuguese who resided many years at Goa in the 16th century, has given a figure of the roots or rather of the lower parts of the stalks, which corresponds with our specimen, and he says that there is but this one species of nardus known in India, either for the consumption of the natives, or for exportation to Persia and Arabia. 4. The sensible qualities of this are superior to what commonly passes for it in the shops, being possessed both of more fragrancy and pungency, which seems to account for the preference given to it by the ancients.

"There is a question, concerning which Matthiolus, the commentator of Dioscorides, bestows a good deal of argument, viz. whether the roots or stalks were the parts esteemed for use, the testimony of the ancients themselves on this head being ambiguous. The roots of this specimen are very small, and possess sensible qualities inferior to the rest of the plant; yet it is mentioned in the account above recited, that the virtues reside principally in the husky roots. It is evident, that by the husky roots must here be meant the lower part of the stalks and leaves, where they unite to the roots; and it is probably a slight ambiguity of this kind that has given occasion to the ambiguity that occurs in the ancient accounts."

The sensible qualities of this plant do not depend upon an essential oil, but on some fixed principle like those of cardamoms or ginger. Dr Blane tried to extract its virtues with boiling water, maceration in wine or proof spirits, but it yielded them sparingly and with difficulty to any of these menstrua. The Indians gave an infusion of it in hot water, with a small quantity of black pepper as a febrifuge.

Nardus. Narea. NAREA, the most southerly province of the empire of Abyssinia; a kingdom still governed by its own princes, who have the title of *Beneros*. Its territory was formerly more extensive than at present, the Galla having almost quite surrounded it, especially on the south-east and north. The country to the west is the most unknown part of Africa; the kingdom itself stands like a fortified place in the middle of a plain, being an high and mountainous country. A great many rivers, rising in the fourth and fifth degrees of north latitude, spread themselves over the level part of the country, and fill it with marshes all the way from south by east to north, or north-west.—These marshes are bounded by mountains, of which those nearest the marshes are overgrown with coffee trees, the largest, if not the only ones, which grow in this country. The kingdom of Narea Proper is interspersed with small, unwholesome, but very fertile valleys, Narea. Narration.

valleys. The mountainous country of Caffa adjoins immediately to Narea, and is said to be governed by a separate prince: but the Galla having settled themselves in all the flat ground to the very edge of the marshes, have in a great measure cut off the communication with Abyssinia for a long time past. The Nareans who inhabit the mountainous country have the lightest complexion of any people in Abyssinia; but those who inhabit the borders of the marshes are perfectly black, and have the features and woolly heads of negroes; but the mountaineers of Narea, and much more those of Caffa, are fair complexioned, more so than even the Neapolitans or Sicilians. It is said that snow has been seen to lie on some of the mountains of Caffa; but Mr Bruce imagines this to be a mistake, and thinks that it must have been hail.

Narea abounds with cattle, grain and all kinds of provisions, both in the high and low country. The medium of commerce is gold, which they sell by weight; but the principle articles of trade are coarse cotton cloths, antimony, beads, and incense, which are carried from this country to the kingdom of Angola, and the parts of the African continent towards the Atlantic. The people are exceedingly brave; and though they had been driven out of the low country by multitudes of Galla, they now bid them defiance, and drive them from their frontiers whenever they come too near. The Narean prisoners taken in these skirmishes are sold to the Mahometan merchants at Gondar; and at Constantinople, Cairo, or in India, the women are more esteemed than those of any other part of the world. Both sexes have a cheerful, kind disposition, and attach themselves inviolably to their masters, if properly treated. The people of Narea and Caffa speak a language peculiar themselves.

NARRATION, in oratory, poetry, and history, a recital or rehearsal of a fact as it happened, or as it is supposed to have happened. See ORATORY, n° 26. 123.

Concerning NARRATION *and Description*, we have the following rules and observations in the Elements of Criticism.

1. The first rule is, That in history the reflections ought to be chaste and solid; for while the mind is intent upon truth, it is little disposed to the operation of the imagination. Strada's Belgic history is full of poetical images, which, being discordant with the subject, are unpleasant; and they have a still worse effect, by giving an air of fiction to a genuine history. Such flowers ought to be scattered with a sparing hand, even in epic poetry; and at no rate are they proper till the reader be warmed, and by an enlivened imagination be prepared to relish them: in that state of mind, they are agreeable; but while we are sedate and attentive to an historical chain of facts, we reject with disdain every fiction.

2. Vida, following Horace, recommends a modest commencement of an epic poem; giving for a reason, that the writer ought to husband his fire. Besides, bold thoughts and figures are never relished till the mind be heated and thoroughly engaged, which is not the reader's case at the commencement. Homer introduces not a single simile in the first book of the Iliad, nor in the first book of the Odyssey. On the other hand, Shakespeare begins one of his plays with a sentiment too bold for the most heated imagination:

Bedford. Hung be the heav'ns with black, yield day
to night!
Comets, importing change of times and states,
Brandish your crystal tresses in the sky,
And with them scourge the bad revolting stars,
That have consented unto Henry's death!
Henry the Fifth, too famous to live long!
England ne'er lost a king of so much worth.

First part Henry VI.

The passage with which Strada begins his history, is too poetical for a subject of that kind: and at any rate too high for the beginning of a grave performance.

3. A third rule or observation is, That where the subject is intended for entertainment solely, not for instruction, a thing ought to be described as it appears, not as it is in reality. In running, for example, the impulse upon the ground is proportioned in some degree to the celerity of motion; though in appearance it is otherwise, for a person in swift motion seems to skim the ground, and scarcely to touch it. Virgil, with great taste, describes quick running according to appearance; and raises an image far more lively than by adhering scrupulously to truth:

Hos super advenit volsca de gente Camilla,
Agmen agens equitum et florentes ære catervas,
Bellatrix: non illa colo calathisve Minervæ
Fœmineas assueta manus; sed prælia virgo
Dura pati, cursuque pedum prævertere ventos.
Illa vel intactæ segetis per summa volaret
Grammina: nec teneras cursu læsisset aristas:
Vel mare per medium, fluctu suspensa tumenti,
Ferret iter: celeris nec tingeret æquore plantas.

Æneid. vii. 803.

4. In narration as well as in description, objects ought to be painted so accurately as to form in the mind of the reader distinct and lively images. Every useless circumstance ought indeed to be suppressed, because every such circumstance loads the narration: but if a circumstance be necessary, however slight, it cannot be described too minutely. The force of language consists in raising complete images, which have the effect to transport the reader as by magic into the very place of the important action, and to convert him as it were into a spectator, beholding every thing that passes. The narrative in an epic poem ought to rival a picture in the liveliness and accuracy of its representations: no circumstance must be omitted that tends to make a complete image; because an imperfect image, as well as any other imperfect conception, is cold and uninterresting. We shall illustrate this rule by several examples giving the first place to a beautiful passage from Virgil:

Qualis *populeâ* mœrens Philomela sub umbrâ
Amissos queritur fœtus, quos durus *arator*
Observans nido *implumes* detraxit.

Georg. lib. 4. *l.* 511.

The poplar, plowman, and unfledged young, though not essential in the description, tend to make a complete image, and upon that account are an embellishment.

Again:

Narration. Again:

Hic viridem Æneas *frondenti ex ilice* metam
Conſtituit, ſignum nautis. *Æneid.* v. 129.

Horace addreſſing to fortune:

Te pauper ambit ſollicita prece
Ruris colonus: te dominam æquoris,
Quicumque Bithynâ laceſſit
Carpathium pelagus carinâ.
Carm. lib. 1. *ode* 35.

—— Illum ex mœnibus hoſticis
Matrona bellantis tyranni
Proſpiciens, et adulta virgo,
Suſpiret: Eheu, ne rudis agminum
Sponſus laceſſat regius aſperum
Tactu leonum, quem cruenta
Per medias rapit ira cædes.
Carm. lib. 3. *ode* 2.

Shakeſpeare ſays, "You may as well go about to turn the ſun to ice by fanning in his face with a *peacock's* feather." The peacock's feather, not to mention the beauty of the object, completes the image: an accurate image cannot be formed of that fanciful operation, without conceiving a particular feather; and one is at a loſs when this is neglected in the deſcription. Again, "The rogues ſlighted me into the river with as little remorſe, as they would have drown'd a bitch's blind puppies, fifteen i'th' litter."

Old Lady. You would not be a queen.
Anne. No, not for all the riches under heaven.
Old Lady. 'Tis ſtrange: a three-pence bow'd would hire me, old as I am, to queen it.
Henry VIII. act. 2. *ſc.* 5.

In the following paſſage, the action, with all its material circumſtances, is repreſented ſo much to the life, that it would ſcarce appear more diſtinct to a real ſpectator; and it is the manner of deſcription that contributes greatly to the ſublimity of the paſſage.

He ſpake; and, to confirm his words, out flew
Millions of flaming ſwords, drawn from the thighs
Of mighty cherubim; the ſudden blaze
Far round illumin'd hell: highly they rag'd
Againſt the Higheſt, and fierce with graſped arms,
Claſh'd on their ſounding ſhields the din of war,
Hurling defiance toward the vault of heav'n.
Milton. b. 1.

The following paſſage from Shakeſpeare falls not much ſhort of that now mentioned in particularity of deſcription:

O you hard hearts! you cruel men of Rome!
Knew you not Pompey? Many a time and oft
Have you climb'd up to walls and battlements,
To tow'rs and windows, yea, to chimney-tops,
Your infants in your arms: and there have ſat
The live-long day with patient expectation
To ſee great Pompey paſs the ſtreets of Rome;
And when you ſaw his chariot but appear,
Have you not made an univerſal ſhout,
That Tyber trembled underneath his banks,
To hear the replication of your ſounds,
Made in his concave ſhores?
Julius Cæſar, act. 1. *ſc.* 1.

The following paſſage is ſcarce inferior to either of those mentioned: Narration.

"Far before the reſt, the ſon of Oſſian comes: bright in the ſmiles of youth, fair as the firſt beams of the ſun. His long hair waves on his back: his dark brow is half beneath his helmet. The ſword hangs looſe on the hero's ſide; and his ſpear glitters as he moves. I fled from his terrible eye, King of high Temora." *Fingal.*

The Henriade of Voltaire errs greatly againſt the foregoing rule; every incident is touched in a ſummary way, without ever deſcending to circumſtances. This manner is good in a general hiſtory, the purpoſe of which is to record important tranſactions: but in a fable it is cold and unintereſting; becauſe it is impracticable to form diſtinct images of perſons or things repreſented in a manner ſo ſuperficial.

It is obſerved above, that every uſeleſs circumſtance ought to be ſuppreſſed. The crowding ſuch circumſtances is, on the one hand, not leſs to be avoided, than the conciſeneſs for which Voltaire is blamed, on the other. In the Æneid, Barce, the nurſe of Sichæus, whom we never hear of before nor after, is introduced for a purpoſe not more important than to call Anna to her ſiſter Dido: and that it might not be thought unjuſt in Dido, even in this trival circumſtance, to prefer her huſband's nurſe before her own, the poet takes care to inform his reader, that Dido's nurſe was dead. To this may be oppoſed a beautiful paſſage in the ſame book, where, after Dido's laſt ſpeech, the poet, without detaining his readers by deſcribing the manner of her death, haſtens to the lamentation of her attendants:

Dixerat; atque illam media inter talia ferro
Collapſam aſpiciunt comites, enſemque cruore
Spumantem, ſparſaſque manus. It clamor ad alta
Atria, concuſſam bacchatur fama per urbem;
Lamentis gemituque et fœmineo ululatu
Tecta fremunt, reſonat magnis plangoribus æther.
Lib. 4. l. 663.

As an appendix to the foregoing rule, may be added the following obſervation. That to make a ſudden and ſtrong impreſſion, ſome ſingle circumſtance, happily ſelected, has more power than the moſt laboured deſcription. Macbeth, mentioning to his lady ſome voices he heard while he was murdering the King, ſays,

There's one did laugh in ſleep, and one cry'd Murder!
They wak'd each other; and I ſtood and heard them;
But they did ſay their prayers, and addreſs them
Again to ſleep.
Lady. There are two lodg'd together.
Macbeth. One cry'd, God bleſs us! and, Amen! the other;
As they had ſeen me with theſe hangman's hands.
Liſtening their fear, I could not ſay, Amen,
When they did ſay, God bleſs us.
Lady. Conſider it not ſo deeply.
Macbeth. But wherefore could not I pronounce Amen?
I had moſt need of bleſſing, and Amen
Stuck in my throat.

Lady.

Lady. Theſe deeds muſt not be thought
After theſe ways; ſo, it will make us mad.
Macbeth. Methought, I heard a voice cry,
Sleep no more!
Macbeth doth murder ſleep, &c. *Act* 2. *ſc*. 3.

Deſcribing prince Henry:

I ſaw young Harry, with his beaver on,
His cuiſſes on his thighs, gallantly arm'd,
Riſe from the ground like feather'd Mercury;
And vaulted with ſuch eaſe into his ſeat,
As if an angel dropt down from the clouds,
To turn and wind a fiery Pegaſus,
And witch the world with noble horſemanſhip.
Firſt part Henry IV. act 4 *ſc*. 2.

King Henry. Lord Cardinal, if thou think'ſt on
Heaven's bliſs.
Hold up thy hand, make ſignal of thy hope.
He dies, and makes no ſign!
Second part Henry VI act. 3. *ſc*. 10.

The ſame author, ſpeaking ludicrouſly of an army debilitated with diſeaſes, ſays,

"Half of them dare not ſhake the ſnow from off their caſſocks, leſt they ſhake themſelves to pieces."

"I have ſeen the walls of Balclutha, but they were deſolate. The flames had reſounded in the halls: and the voice of the people is heard no more. The ſtream of Clutha was removed from its place by the fall of the walls. The thiſtle ſhook there its lonely head: the moſs whiſtled to the wind. The fox looked out from the windows; and the rank graſs of the wall waved round his head. Deſolate is the dwelling of Morna: ſilence is in the houſe of her fathers." *Fingal.*

To draw a character is the maſter ſtroke of deſcription. In this Tacitus excels: his portraits are natural and lively, not a feature wanting or miſplaced. Shakeſpeare, however, exceeds Tacitus in livelineſs; ſome characteriſtical circumſtance being generally invented or laid hold of, which paints more to the life than many words. The following inſtances will explain our meaning, and at the ſame time prove our obſervation to be juſt.

Why ſhould a man, whoſe blood is warm within,
Sit like his grandſire cut in alabaſter?
Sleep when he wakes, and creep into the jaundice,
By being peeviſh? I tell thee what, Anthonio,
(I love thee, and it is my love that ſpeaks),
There art a ſort of men, whoſe viſages
Do cream and mantle like a ſtanding pond;
And do a wilful ſtillneſs entertain,
With purpoſe to be dreſs'd in an opinion
Of wiſdom, gravity, profound conceit:
As who ſhould ſay, I am Sir Oracle,
And when I ope my lips, let no dog bark!
O my Anthonio! I do know of thoſe,
That therefore only are reputed wiſe,
For ſaying nothing.
Merchant of Venice, act. 1. *ſc*. 2.

Again:

"Gratiano ſpeaks an infinite deal of nothing, more than any man in all Venice: his reaſons are two grains of wheat hid in two buſhels of chaff; you ſhall ſeek all day ere you find them; and when you have them, they are not worth the ſearch." *Ibid.*

In the following paſſage, a character is completed by a ſingle ſtroke:

Shallow. O the mad days that I have ſpent; and to ſee how many of mine old acquaintance are dead.
Silence. We ſhall all follow, couſin.
Shallow. Certain, 'tis certain, very ſure, very ſure; Death (as the Pſalmiſt ſaith) is certain to all: all ſhall die. How good a yoke of bullocks at Stamford fair?
Slender. Truly, couſin, I was not there.
Shallow. Death is certain. Is old *Double* of your town living yet?
Silence. Dead, Sir.
Shallow. Dead! ſee, ſee; he drew a good bow: and dead. He ſhot a fine ſhoot. How a ſcore of ewes now?
Silence. Thereafter as they be. A ſcore of good ewes may be worth ten pounds.
Shallow. And is old *Double* dead?
Second Part Henry IV. *act*. 3. *ſc*. 3.

Deſcribing a jealous huſband:

"Neither preſs, coffer, cheſt, trunk, well, vault, but he hath an abſtract for the remembrance of ſuch places, and goes to them by his note. There is no hiding you in the houſe." *Merry Wives of Windſor, act*. 4. *ſc*. 3.

Congreve has an inimitabic ſtroke of this kind in his comedy of *Love for Love:*

Ben Legend. Well, father, and how do all at home? how does brother Dick, and brother Val?
Sir Sampſon. Dick, body o' me, Dick has been dead theſe two years. I writ you word when you were at Leghorn.
Ben. Meſs, that's true; marry, I had forgot. Dick's dead, as you ſay. *Act*. 3. *ſc*. 6.

Falſtaff ſpeaking of Ancient Piſtol:

"He's no ſwaggerer, hoſteſs; a tame chearer i'faith; you may ſtroak him as gently as a puppy-greyhound; he will not ſwagger with a Barbary hen, if her feathers turn back in any ſhow of reſiſtance."
Second part Henry IV. *act*. 2. *ſc*. 9.

Oſſian among his other excellencies is eminently ſucceſsful in drawing characters; and he never fails to delight his reader with the beautiful attitudes of his heroes. Take the following inſtances:

"O Oſcar! bend the ſtrong in arm; but ſpare the feeble hand. Be thou a ſtream of many tides againſt the foes of thy people; but like the gale that moves the graſs to thoſe who aſk thine aid.—So Trenmor lived; ſuch Trathal was; and ſuch has Fingal been. My arm was the ſupport of the injured; and the weak reſted behind the lightning of my ſteel."

"We heard the voice of joy on the coaſt, and we thought that the mighty Cathmor came. Cathmor the friend of ſtrangers! the brother of red-haired Cairbar! But their ſouls were not the ſame; for the light of heaven was in the boſom of Cathmor. His towers roſe on the banks of Atha: ſeven paths led to his hills: ſeven chiefs ſtood on theſe paths, and called the ſtranger to the feaſt. But Cathmor dwelt in the wood to avoid the voice of praiſe."

"Dermid and Oſcar were one: they reaped the battle together. Their friendſhip was ſtrong as their

Narration.

steel; and death walked between them to the field. They rush on the foe like two rocks falling from the brow of Ardven. Their swords are stained with the blood of the valiant: warriors faint at their name. Who is equal to Oscar but Dermid? who to Dermid but Oscar?"

"Son of Comhal, replied the chief, the strength of Morni's arm has failed; I attempted to draw the sword of my youth, but it remains in its place: I throw the spear but it falls short of the mark: and I feel the weight of my shield. We decay like the grass of the mountain, and our strength returns no more. I have a son, O Fingal! his soul has delighted in the actions of Morni's youth; but his sword has not been fitted against the foe, neither has his fame begun. I come with him to battle, to direct his arm. His renown will be a sun to my soul, in the dark hour of my departure. O that the name of *Morni* were forgot among the people! that the heroes would only say, *Behold the father of Gaul.*"

Some writers, through heat of imagination, fall into contradiction; some are guilty of downright absurdities; and some even rave like madmen. Against such capital errors one cannot be more effectually warned than by collecting instances; and the first shall be of a contradiction, the most venial of all. Virgil speaking of Neptune.

Interea magno misceri murmure pontum,
Emissamque hyemem sensit Neptunis, et imis
Stagna refusa vadis: *graviter commotus*, et alto
Prospiciens, summâ *placidum* caput extulit undâ

Æneid. i. 128.

Again:

When first young Maro, in his boundless mind,
A work t'outlast *immertal* Rome design'd.

Essay on Criticism, l. 30.

The following examples are absurdities.

"Alii pulsis e tormento catenis discerpti sectique, dimidiato corpore pugnabant sibi superstites, ac peremptæ partis ultores." *Strada, dec.* 2. *l.* 2.

Il povér huomo, che non sen' era accorto,
Andava combattendo, ed era morto *Berni*

He fled, but flying, left his life behind.

Iliad, xi. 443.

Full through his neck the weighty falchion sped:
Along the pavement roll'd the mutt'ring head.

Odyssey, xxii. 365.

The last article is of raving like one mad. Cleopatra speaking to the aspic,

——————Welcome, thou kind deceiver,
Thou best of thieves; who with an easy key,
Dost open life, and unperceiv'd by us
Ev'n steal us from ourselves; discharging so
Death's dreadful office, better than himself;
Touching our limbs so gently into slumber,
That Death stands by, deceiv'd by his own image,
And thinks himself but sleep.

Dryden, All for Love, act 5.

Having discussed what observations occurred upon the thoughts or things expressed, we proceed to what more peculiarly concerns the laguage or verbal dress.

As words are intimately connected with the ideas they represent, the emotions raised by the sound and by the sense ought to be concordant. An elevated subject requires an elevated style; what is familiar, ought to be familiarly expressed: a subject that is serious and important, ought to be clothed in plain nervous language: a description, on the other hand, addressed to the Imagination, is susceptible of the highest ornaments that sounding words and figurative expression can bestow upon it.

We shall give a few examples of the foregoing rules. A poet of any genius is not apt to dress a high subject in low words: and yet blemishes of that kind are found even in classical works. Horace observing that men are satisfied with themselves, but seldom with their condition, introduces Jupiter indulging to each his own choice:

Jam faciam quod vultis; eris tu, qui modo miles,
Mercator; tu, consultus modo, rusticus: hinc vos,
Vos hinc mutatis discedite partibus: eia,
Quid statis? nolint: atqui licet esse beatis.
Quid causæ est, merito quin illis *Jupiter ambas*
Iratus buccas inflet? neque se fore posthac
Tam facilem dicat, votis ut præbeat aurem?

Sat. lib. 1. *sat.* 1. *l.* 16.

Jupiter in wrath puffing up both cheeks, is a low and even ludicrous expression, far from suitable to the gravity and importance of the subject: every one must feel the discordance. The following couplet, sinking far below the subject, is no less ludicrous:

Not one looks backward, onward still he goes.
Yet ne'er looks forward farther than his nose.

Essay on man, ep. iv. 223.

On the other hand, to raise the expression above the tone of the subject, is a fault than which none is more common. Take the following instances:

Orcan le plus fidele á server ses desseins,
Ne sous le ciel brûlant des plus noirs Affricains.

Bajacet act 3. *sc.* 8.

Les ombres par trois fois ont obscurci les cieux
Depuis que le sommeil n'est entré dans vos yeux;
Et le jour a trois fois chassé la nuit obscure
Depuis que votre corps languit sans nourriture.

Phedra, act 1. *sc.* 3.

Assueris. Ce mortel, qui montra tant de zele pour moi, Vit-il encore?

Asaph.———Il voit l'astre qui vous eclaire.

Esther, act 2. *sc.* 3.

Oui, c'est Agamemnon c'est ton roi qui t'eville;
Viens, reconnois la voix qui frappe ton oreille.

Iphigenie.

No jocund health that Denmark drinks to-day,
But the great cannon to the clouds shall tell;
And the king's rowse the heav'n shall bruit again,
Respeaking earthly thunder.

Hamlet, act 1. *sc.* 2.

————————In the inner room
I spy a winking lamp, that weakly strikes
The ambient air, scarce kindling into light.

Southerne, Fate of Capua, act 5.

In the funeral orations of the bishop of Meaux, the following passages are raised far above the tone of the subject:

"L'Occean ettonné de se voir traversé tant de fois, en des

 des appareils si divers, et pour des causes si differentes, &c." *p.* 6.

"Grande reine, je satisfais à vos plus tendres desirs, quand je célébre ce monarque; et son cœur qui n'a jamais vêcu qui pour lui, se eveille, tout poudre qu'il est, et devient sensible, même sous ce drap mortuaire, au nom d'un epoux si cher" *p.* 32.

The following passage, intended, one would imagine, as a receipt to boil water, is altogether burlesque by the laboured elevation of the diction:

A massy caldron of stupendous frame
They brought, and plac'd it o'er the rising flame:
Then heap the lighted wood; the flame divides
Beneath the vase, and climbs around the sides:
In its wide womb they pour the rushing stream:
The boiling water bubbles to the brim.
Iliad. xviii. 405.

In a passage at the beginning of the 4th book of Telemachus, one feels a sudden bound upward without preparation, which accords not with the subject:

"Calypso, qui avoit été jusqu' à ce moment immobile et transportée de plaisir en écoutant les avantures de Télémaque, l'interrompit pour lui faira prendre quelque repôs. Il est tems, lui dit-elle, que vous alliez goûter la douceur du sommeil apprés tant de travaux. Vous n'avez rien à craindre ici; tout vous est favorable. Abandonnez vous donc à la joye. Goutez la paix, et tous les autres dons des dieux dont vous allez être comblè. Demain, *quand l'Aurore avec ses doigts de rôses entr'ouvira les portes dorées de l'Orient, et que le chevaux du soleil sortras de l'onde amère répandront les flames du jour, pour chasser devant eux toutes les etoiles du ciel*, nous reprendrons, mon cher Télémaque, l'histoire de vos malheurs."

This obviously is copied from a similar passage in the Æneid, which ought not to have been copied, because it lies open to the same censure; but the force of authority is great:

At regina gravi jamdudum saucia cura
Vulnus alit venis, et cæco carpitur igni.
Multa viri virtus animo, multusque recursat
Gentis honos: hærent infixi pectore vultus,
Verbaque: nec placidam membris dat cura quietem.
Postera Phœbea lustrabat lampade terras,
Humentemque Aurora polo dimoverat umbram;
Cum sic unanimem alloquitur malesana sororem.
Lib. iv. 1.

The language of Homer is suited to his subject, not less accurately than the actions and sentiments of his heroes are to their characters. Virgil, in that particular, falls short of perfection: his language is stately throughout: and though he descends at times to the simplest branches of cookery, roasting and boiling for example, yet he never relaxes a moment from the high tone.---In adjusting his languge to his subject, no writer equals Swift. We can recollect but one exception, which at the same time is far from being gross: The Journal of a modern Lady is composed in a style blending sprightliness with familiarity, perfectly suited to the subject: in one passage, however, the poet, deviating from that style, takes a tone above his subject. The passage we have in view begins *l.* 116. But *let me now a while survey, &c.* and ends at *l.* 135.

It is proper to be observed upon this head, that writers of inferior rank are continually upon the stretch to enliven and enforce their subject by exaggeration and superlatives. This unluckily has an effect contrary to what is intended: the reader, disgusted with language that swells above the subject, is led by contrast to think more meanly of the subject than it may possibly deserve. A man of prudence, beside, will be no less careful to husband his strength in writing than in walking: a writer, too liberal of superlatives, exhausts his whole stock upon ordinary incidents, and reserves no share to express, with greater energy, matters of importance.

Many writers of that kind abound so in epithets, as if poetry consisted entirely in high-sounding words. Take the following instance:

When black-brow'd night her dusky mantle spread,
And wrapt in solemn gloom the sable sky;
When soothing sleep her opiate dews had shed,
And seal'd in silken slumbers every eye:
My waking thought admits no balmy rest,
Nor the sweet bliss of soft oblivion share:
But watchful wo distracts my aching breast,
My heart the subject of corroding care:
From haunts of men with wandring steps and slow
I solitary steal, and soothe my pensive wo.

Here every substantive is faithfully attended by some tumid epithet.

We proceed to a second remark, not less important than the former. No person of reflection but must be sensible, that an incident makes a stronger impression on an eye witness, than when heard at second-hand. Writers of genius, sensible that the eye is the best avenue to the heart, represent every thing as passing in our sight; and, from readers or hearers, transform us as it were into spectators: a skilful writer conceals himself, and presents his personages: in a word, every thing becomes dramatic as much as possible. Plutarch, *de gloria Atheniensium*, observes, that Thucydides makes his reader a spectator, and inspires him with the same passions as if he were an eye-witness.

In the fine arts, it is a rule to put the capital objects in the strongest point of view; and even to present them oftener than once, where it can be done. In history-painting, the principal figure is placed in the front, and in the best light: an equestrian statue is placed in a centre of streets, that it may be seen from many places at once. In no composition is there greater opportunity for this rule than in writing:

———Sequitur pulcherrimus Astur,
Astur equo fidens et versicoloribus armis.
Æniad. x. 180.

———Full many a lady
I've ey'd with best regard, and many a time
Th' harmony of their tongues hath into bondage
Brought my too diligent ear: for several virtues
Have I lik'd several women; never any
With so full soul, but some defect in her
Did quarrel with the noblest grace she ow'd,
And put it to the foil. But you, O you,
So perfect, and so peerless, are created
Of every creature's best. *Tempest, act* 3. *sc.* 1.

Orlando.

Orlando.———Whate'er you are
That, in the desart inacceſſible,
Under the ſhade of melancholy boughs,
Loſe and neglect the creeping hours of time;
If ever you have look'd on better days;
If ever been where bells have knoll'd to church;
If ever ſat at any good man's feaſt;
If ever from your eye-lids wip'd a tear,
And know what 'tis to pity, and be pity'd;
Let gentleneſs by ſtrong inforcement be,
In the which hope I bluſh, and hide my ſword.

Duke ſen. True is it that we have ſeen better days;
And have with holy bell been knoll'd to church;
And ſat at good mens feaſts; and wip'd our eyes
Of drops that ſacred pity had engender'd:
And therefore ſit you down in gentleneſs,
And take upon command what help we have,
That to your wanting may be miniſtred.

As you like it.

With thee converſing I forgot all time;
All ſeaſons and their change, all pleaſe alike.
Sweet is the the breath of morn, her riſing ſweet,
With charm of earlieſt birds; pleaſant the ſun
When firſt on this delightful land he ſpreads
His orient beams on herb, tree, fruit, and flow'r
Gliſtring with dew; fragrant the fertile earth
After ſoft ſhow'rs; and ſweet the coming on
Of grateful ev'ning mild, the ſilent night
With this her ſolemn bird, and this fair moon,
And theſe the gems of heav'n, her ſtarry train:
But neither breath of morn, when ſhe aſcends
With charm of earlieſt birds, nor riſing ſun
On his delightful land, nor herb, fruit, flow'r,
Gliſt'ring with dew, nor fragrance after ſhow'rs,
Nor grateful ev'ning mild, nor ſilent night,
With this her ſolemn bird, nor walk by moon,
Or glittering ſtar-light, without thee is ſweet.

Paradiſe Loſt book 4. l. 634.

"What mean ye, that ye uſe this proverb. The fathers have eaten ſour grapes, and the childrens teeth are ſet on edge? As I live, ſaith the Lord God, ye ſhall not have occaſion to uſe this proverb in Iſrael. If a man keep my judgments to deal truly, he is juſt, he ſhall ſurely live. But if he be a robber, a ſhedder of blood; if he have eaten upon the mountains, and defiled his neighbour's wife; if he have oppreſſed the poor and needy, have ſpoiled by violence, have not reſtored the pledge, have lift up his eyes to idols, have given forth upon uſury, and have taken increaſe: ſhall he live? he ſhall not live: he ſhall ſurely die; and his blood ſhall be upon him. Now, lo, if he beget a ſon, that ſeeth all his father's ſins, and conſidereth, and doeth not ſuch like; that hath not eaten upon the mountains, hath not lift up his eyes to idols, nor defiled his neighbour's wife, hath not oppreſſed any, nor withheld the pledge, neither hath ſpoiled by violence, but hath given his bread to the hungry, and covered the naked with a garment; that hath not received uſury nor increaſe, that hath executed my judgments, and walked in my ſtatutes: he ſhall not die for the iniquity of his father; he ſhall ſurely live. The ſoul that ſinneth, it ſhall die; the ſon ſhall not bear the iniquity of the father, neither ſhall the father bear the iniquity of the ſon; the righteouſneſs of the righteous ſhall be upon him, and the wickedneſs of the wicked ſhall be upon him. Have I any pleaſure that the wicked ſhould die, ſaith the Lord God; and not that he ſhould return from his ways, and live?" *Ezekiel* xvii.

A conciſe comprehenſive ſtyle is a great ornament in narration; and a ſuperfluity of unneceſſary words, not leſs than of circumſtances, a great nuiſance. A judicious ſelection of the ſtriking circumſtances, clothed in a nervous ſtyle, is delightful. In this ſtyle, Tacitus excels all writers, ancient and modern. Inſtances are numberleſs: take the following ſpecimen:

"Crebra hinc prælia, et ſæpius in modum latrocinii: per ſaltus, per paludes: ut cuique fors aut virtus: temerè, proviſo, ob iram, ob prædam, juſſu, et aliquando ignaris ducibus." *Annal. lib.* 12. § 39.

After Tacitus, Oſſian in that reſpects juſtly merits the place of diſtinction. One cannot go wrong for examples in any part of the book.

If a conciſe or nervous ſtyle be a beauty, tautology muſt be a blemiſh; and yet writers, fettered by verſe, are not ſufficiently careful to avoid this ſlovenly practice: they may be pitied, but they cannot be juſtified. Take for a ſpecimen the following inſtances, from the beſt poet, for verſification at leaſt, that England has to boaſt off:

High on his helm celeſtial lightnings play,
His beamy ſhield emits a living ray;
Th' unweary'd blaze inceſſant ſtreams ſupplies,
Like the red ſtar that fires the autumnal ſkies.

Iliad v. 5.

Strength and omnipotence inveſt thy throne.

Ibid. viii. 576.

So ſilent fountains, from a rock's tall head,
In ſable ſtreams ſoft trickling waters ſhed.

Ibid. ix. 19.

His clanging armour rung. *Ibid.* xii. 94.

Fear on their cheek, and horror in their eye.

Ibid. xv. 4.

The blaze of armour flaſh'd againſt the day.

Ibid. xvii. 736.

As when the piercing blaſts of Boreas blow.

Ibid. xix. 380.

And like the moon, the broad refulgent ſhield
Blaz'd with long rays, and gleam'd athwart the field.

Ibid. xix. 402.

No—could our ſwiftneſs o'er the winds prevail,
Or beat the pinions of the weſtern gale,
All were in vain—— *Ibid.* xix. 604.

The humid ſweat from ev'ry pore deſcends.

Ibid. xxiii. 829.

We cloſe this article with a curious inquiry. An object, however ugly to the ſight, is far from being ſo when repreſented by colours or by words. What is the cauſe of this difference? With reſpect to painting, the cauſe is obvious: a good picture, whatever the ſubject be, is agreeable by the pleaſure we take in imitation; and this pleaſure overbalancing the diſagreeableneſs of the ſubject. makes the picture upon the whole agreeable. With reſpect to the deſcription of an ugly object, the cauſe follows. To connect individuals in the ſocial ſtate, no particular contributes more than language, by the power it poſſeſſes of an expeditious communication of thought, and a lively repreſentation of tranſactions. But nature hath not been

been satisfied to recommend language by its utility merely: independent of utility, it is made susceptible of many beauties, which are directly felt, without any intervening reflection. And this unfolds the mystery; for the pleasure of language is so great, as in a lively description to overbalance the disagreeableness of the image raised by it. This, however, is no encouragement to choose a disagreeable subject; for the pleasure is incomparably greater where the subject and the description are both of them agreeable.

The following description is upon the whole agreeable, though the subject described is in itself dismal:

Nine times the space that measures day and night
To mortal men, he with his horrid crew
Lay vanquish'd, rolling in the fiery gulf,
Confounded though immortal! but his doom
Reserv'd him to more wrath; for now the thought
Both of lost happiness and lasting pain
Torments him; round he throws his baleful eyes
That witness'd huge affliction and dismay:
Mix'd with obdurate pride and stedfast hate:
At once as far as angels ken he views
The dismal situation waste and wild:
A dungeon horrible, on all sides round
As one great furnace flamed; yet from those flames
No light, but rather darkness visible
Serv'd only to discover sights of wo,
Regions of sorrow, doleful shades, where peace
And rest can never dwell, hope never comes
That comes to all; but torture without end
Still urges, and a fiery deluge, fed
With ever-burning sulphur unconsum'd!
Such place eternal justice had prepar'd
For those rebellious. *Paradise Lost, book* 1. *l.* 50.

An unmanly depression of spirits in time of danger is not an agreeable sight; and yet a fine description or representation of it will be relished:

K. Richard. What must the king do now? must he submit?
The king shall do it; must he be depos'd?
The king shall be contented: must he lose
The name of king? o' God's name let it go;
I'll give my jewels for a set of beads;
My gorgeous palace for a hermitage;
My gay apparel, for an almsman's gown;
My figur'd goblets, for a dish of wood;
My sceptre, for a palmer's walking-staff;
My subjects, for a pair of carved saints;
And my large kingdom, for a little grave;
A little, little grave,——an obscure grave.
Or I'll be bury'd in the king's highway;
Some way of common tread, where subjects feet
May hourly trample on their sovereign's head;
For on my heart they tread now, whilst I live;
And, bury'd once, why not upon my head?
Richard II. act. 3. *sc.* 6.

Objects that strike terror in a spectator, have in poetry and painting a fine effect. The picture, by raising a slight emotion of terror, agitates the mind; and in that condition every beauty makes a deep impression. May not contrast heighten the pleasure, by opposing our present security to the danger of encountering the object represented?

——————The other shape,
If shape it might be call'd that shape had none
Distinguishable in member, joint, or limb;
Or substance might be call'd that shadow seem'd,
For each seem'd either; black it stood as night,
Fierce as ten furies, terrible as hell,
And shook a dreadful dart. *Par. Lost, b.* 2. *l.* 666.

——————Now storming fury rose,
And clamour such as heard in heaven till now
Was never: arms on clamour clashing bray'd
Horrible discord, and the madding wheels
Of brazen chariots rage; dire was the noise
Of conflict; overhead the dismal hiss
Of fiery darts in flaming vollies flew,
And flying vaulted either host with fire.
So under fiery cope together rush'd
Both battles main, with ruinous assault
And inextinguishable rage: all heaven
Resounded, and had earth been then, all earth
Had to her centre shook. *Ibid. book* 6. *l.* 207.

Ghost.——————But that I am forbid
To tell the secrets of my prison-house,
I could a tale unfold, whose lightest word
Would harrow up thy soul, freeze thy young blood,
Make thy two eyes, like stars, start from their spheres,
Thy knotty and combined locks to part,
And each particular hair to stand on end,
Like quills upon the fretful porcupine:
But this eternal blazon must not be
To ears of flesh and blood. *Hamlet, act* 1. *sc.* 8.

Gratiano. Poor Desdemona! I'm glad thy father's dead:
Thy match was mortal to him; and pure grief
Shore his old thread in twain. Did he live now,
This sight would make him do a desp'rate turn:
Yea, curse his better angel from his side,
And fall to reprobation. *Othello, act* 5. *sc.* 8.

Objects of horror must be excepted from the foregoing theory; for no description, however lively, is sufficient to overbalance the disgust raised even by the idea of such objects. Every thing horrible ought therefore to be avoided in a description.

NARSES, the eunuch who rivalled Belisarius in heroism under the reign of the emperor Justinian, emerged from obscurity A. D. 538. From the domestic service of the palace, and the administration of the private revenue, he was suddenly exalted to the head of an army. He is ranked among the few eunuchs who have rescued that unhappy name from the contempt and hatred of mankind. A feeble diminutive body concealed the soul of a statesman and a warrior. His youth had been employed in the management of the loom and distaff, in the cares of the household, and the service of female luxury; but, while his hands were busy, he secretly exercised the faculties of a vigorous and discerning mind. A stranger to the schools and the camp, he studied in the palace to dissemble, to flatter, and to persuade; and as soon as he approached the person of the emperor, Justinian listened with surprise and pleasure to the manly counsels of his chamberlain and private treasurer. The talents of Narses were tried and improved in frequent embassies; he led an army into Italy, acquired a practical

tical knowledge of the war and the country, and presumed to strive with the genius of Belisarius. Twelve years after his return, the eunuch was chosen to atchieve the conquest which had been left imperfect by the first of the Roman generals. Instead of being dazzled by vanity or emulation, he seriously declared, that unless he were armed with an adequate force, he would never consent to risk his own glory and that of his sovereign. Justinian granted to the favourite what he might have denied to the hero: the Gothic war was rekindled from its ashes, and the preparations were not unworthy of the ancient majesty of the empire.

Narses defeated the Goths, the Franks, and the Alemanni: the Italian cities opened their gates to the conqueror: he entered the capital in triumph: and having established the seat of his government at Ravenna, continued 15 years to govern Italy under the title of *Exarch*.

His virtues, we are told, were stained with avarice: and in this provincial reign he accumulated a treasure of gold and silver which surpassed the modesty of a private fortune. His government was oppressive or unpopular: and the general discontent was expressed with freedom by the deputies of Rome. Before the throne of Justinian they boldly declared, that their Gothic servitude had been more tolerable than the despotism of a Greek eunuch; and that unless their tyrant were instantly removed, they would consult their own happiness in the choice of a master. Thus was his disgrace the effect of the people's disaffection; and his death, though in the extreme period of old age, was unseasonable and premature, since his genius alone could have repaired the last and fatal error of his life He died about the year 567, and, as some say, at the advanced age of 95; but this does not appear very probable. See Gibbon's Rom. Hist. vol. iv. 4to edit. p. 194. 298, &c.

NARVA, a strong town of the Russian empire, in Livonia with a castle and a harbour. It was taken by the Muscovites from the Danes in 1558, by the Swedes in 1581, and they defeated the Muscovites near it in 1700: but it was retaken by the Russians in 1704 by storm, and the inhabitants sent to Astracan. It is seated on the river Narva, 95 miles S.W. of Wiburg, and 172 N. E. of Riga. E. Long. 29. 0. N. Lat. 59. 8.

NARWAL, in ichthyology. See MONODON.

NASSAU-SIEGEN, a small principality of Germany in the Westerwalde, is in general a mountainous woody country, with some arable and pasture ground, and a good breed of cattle. Its manufactures are chiefly those of iron and steel, having an iron mine in the neighbourhood of Siegen. Count John the Younger, in 1626, embraced the Roman Catholic religion, and endeavoured to introduce it into the country: but the principality, upon the extinction of the line of Nassau-Siegen in 1743, falling to the line of Nassau-Dietz, and therein to the prince of Orange, hereditary stadtholder of the United Provinces, the Protestants were delivered from their apprehensions of Popish tyranny and bigotry. The prince, on account of these territories, has a seat and voice at the diets of the empire and circle in the college of princes. His assessment in the matricula for Nassau Siegen is 773 florins monthly; and towards the maintainance of the chamber-judicatory, 50 rix-dollars six kruitzers and a half each term, The revenue of this principality is estimated at 100,000 rix-dollars.

NASSAU-Dillenbourgh a principality of Germany, situated near the former. It has not much arable land, but plenty of wood, good quarries of stone, some silver and vitriol, copper and lead, with store of iron for the working and smelting of which there are many forges and founderies in the country; and by these, and the sale of their iron, the inhabitants chiefly subsist. Calvinism is the religion of the princ ipaliy, which contains five towns and two boroughs, and belongs entirely to William V. prince of Orange, and hereditary stadtholder of the United Provinces, whose father succeeded to a part of it in 1739 on the death of prince Christian, and to the rest in 1743 on the death of prince William Hyacynth of Siegen. The prince, on account of this principality also and Dietz, has a seat and voice in the college of princes, at the diets of the empire and circle. His assessment in the matricula, for Nassau-Dillenbourg, is 102 florins monthly; and to the chamber-judicatory, 50 rix-dollars, six and a half kruitzers, each term. His revenue from this principality is computed at above 130,000 florins.

NASSAU-Hadamar, a county of Germany, which, till the year 1711, had princes of its own; but now belongs wholly to William V. prince of Orange.

NASSAU, prince of Orange. See MAURICE.

NATES, in anatomy, a term expressing those two fleshy exterior parts of the body vulgarly called the *buttocks*, See ANATOMY.

NATES Cerebri, are two circular protuberances of the brain, situated on the back side of the medula oblongata, near the cerebellum.

NATION, a collective term, used for a considerable number of people inhabiting a certain extent of land, confined within fixed limits, and under the same government.

NATIONAL DEBT: the money owing by government.

Our limits permit us to give but a very general sketch of this subject: However as it is of considerable importance to every inhabitant of these kingdoms, we shall endeavour to give as clear and comprehensive a view of it as the bounds necessarily prescribed us will admit. In order to this, it may not be improper to refer back to the times that have gone before us, that we may the better discover the nature of public revenues, the manner of their expenditure, and the causes of public debt.

In that rude state of society which precedes the extension of commerce and the improvements of manufactures, when those expensive luxuries which commerce and manufactures can alone introduce, are altogether unknown; the person who possesses a large revenue can spend or enjoy that revenue or in no other way than by maintaining nearly as many people as it can maintain. Among our feudal ancestors, the long time during which estates used to continue in the same family sufficiently demonstrates the general disposition of people to live within their income. Though the rustic hospitality constantly exercised by the great landholders may not to us in the present times seem con-

Smith's Wealth of Nations.

National.

confiftent with that order which we are apt to confider as infeparably connected with good œconomy, yet we muft certainly allow them to have been at leaft fo far frugal as not commonly to have fpent their whole income. Some part of this money, perhaps, they fpent in purchafing the few objects of vanity and luxury with which the circumftances of the times could furnifh them; but fome part of it they feem commonly to have hoarded. They could not well indeed do any thing elfe but hoard whatever money they faved. To trade was difgraceful to a gentleman; and to lend money at intereft, which at that time was confidered as ufury and prohibited by law, would have been ftill more fo.

The fame difpofition to fave and to hoard prevailed in the fovereign as well as in the fubjects. Among nations to whom commerce and manufactures are little known, the fovereign is in a fituation which naturally difpofes him to the parfimony requifite for accumulation. In that fituation the expence even of a forereign cannot be directed by that vanity which delights in the gaudy finery of a court. The ignorance of the times affords but few of the trinkets in which that finery confifts. Standing armies are not then neceffary: fo that the expence even of a fovereign, like that of any other great lord, can be employed in fcarce any thing but bounty to his tenants and hofpitality to his retainers. But bounty and hofpitality very feldom lead to extravagance: though vanity almoft always does. All the ancient fovereigns of Europe accordingly had treafures. Every Tartar chief in the prefent times is faid to have one.

In a commercial country abounding with every fort of expenfive luxury, the fovereign, in the fame manner as almoft all the great proprietors in his dominions, naturally fpends a great part of his revenue in purchafing thofe luxuries. His own and the neighbouring countries fupply him abundantly with all the coftly trinkets which compofe the fplendid but infignificant pageantry of a court. His ordinary expence becomes equal to his ordinary revenue, and it is well if it does not frequently exceed it. The amaffing of treafure can no longer be expected; and when extraordinary exigencies require extraordinary expences, he muft neceffarily call upon his fubjects for an extraordinary aid. The late king of pruffia and his father are the only great princes of Europe who, fince the death of Henry IV. of France in 1610, are fuppofed to have amaffed any confiderable treafure. The parfimony which leads to accumulation has become almoft as rare in republican as in monarchical governments. The Italian republics, the United Provinces of the Netherland, are all in debt. The canton of Berne is the fingle republic in Europe which has amaffed any confiderable treafure. The other Swifs republics have not. The tafte for fome fort of pageantry, for fplendid buildings at leaft and other public ornaments, frequently prevails as much in the apparently fober fenatehoufe of a little republic as in the diffipated court of the greateft king.

The want of parfimony in time of peace impofes the neceffity of contracting debt in time of war. When war comes, there is no money in the treafury but what is neceffary for carrying on the ordinary expence of the peace eftablifhment. In war an eftablifhment of three or four times that expence becomes neceffary for the defence of the ftate, and confequently a revenue, three or four times greater than the peace revenue. Suppofing that the fovereign fhould have, what he fcarce ever has, the immediate means of augmenting his revenue in proportion to the augmentation of his expence; yet ftill the produce of the taxes, from which this increafe of revenue muft be drawn, will not begin to come into the treafury till perhaps ten or twelve months after they are impofed. But the moment in which war begins, or rather the moment in which it appears likely to begin, the army muft be augmented, the fleets muft be fitted out, the garifoned towns muft be put into a pofture of defence; that army, that fleet, thefe garrifoned towns, muft be furnifhed with arms ammunition, and provifions. An immediate and great expence muft be incurred in that moment of immediate danger, which will not wait for the gradual and flow returns of the new taxes. In this exigency government can have no other refources but in borrowing.

The fame commercial ftate of Society which, by the operation of moral caufes, brings government in this manner into the neceffity of borrowing, produces in the fubjects both an ability and an inclination to lend. If it commonly brings along with it the neceffity of borrowing, it likewife brings along with it the facility of doing fo.

A country abounding with merchants and manufacturers, neceffarily abounds with a fet of people thro' whofe hands not only their own capitals, but the capitals of all thofe who either lend them money or truft them with goods, pafs as frequently or more frequently than the revenue of a private man, who without trade or bufinefs lives upon his income, paffes through his hands. The revenue of fuch a man can regularly pafs through his hands only once in a year. But the whole amount of the capital and credit of a merchant who deals in a trade of which the returns are very quick, may fometimes pafs through his hands two, three, or four times in a year. A country abounding with merchants and manufacturers, therefore neceffarily abounds with a fet of people who have it at all times in their power to advance, if they choofe to do fo, a very large fum of money to government. Hence the ability in the fubjects of a commercial ftate to lend.

The progrefs of the enormous debts which at prefent opprefs, and will in the long run probably ruin, all the great nations of Europe has been pretty uniform. In England, after the Revolution, when new connections with Europe introduced a new fyftem of foreign politics, the expences of the nation, not only in fettling the new eftablifhment, but in maintaining long wars, as principals, on the continent, for the fecurity of the Dutch barrier, reducing the French monarchy, fettling the Spanifh fucceffion, fupporting the houfe of Auftria, maintaining the liberties of the Germanic body, and other purpofes, increafed to an unufual degree; infomuch that it was not thought adviseable to raife all the expences of any one year by taxes to be levied within that year, left the unaccuftomed weight of them fhould create murmurs among the people. It was therefore the policy of the times to anticipate the revenues of their pofterity, by borrowing immenfe fums

Blackft. Comment.

National.

sums for the current service of the state, and to lay no more taxes upon the subject than would suffice to pay the annual interest of the sums so borrowed; by this means converting the principal debt into a new species of property, transferrable from one man to another at any time and in any quantity. This system indeed seems to have had its original in the state of Florence, A.D. 1344; which government then owed about L. 60,000 Sterling; and being unable to pay it, formed the principal into an aggregate sum, called metaphorically a *mount* or *bank*, the shares whereof were transferable like our stocks, with interest at 5 *per cent.* the prices varying according to the exigencies of the state. This laid the foundation of what is called the *national debt:* for a few long annuities created in the reign of Charles II. will hardly deserve that name.

Nations, like private men, have generally begun to borrow upon what may be called *personal credit*, without assigning or mortgaging any particular fund for the payment of the debt; and when this resource has failed them, they have gone on to borrow upon assignments or mortgages of particular funds.

What is called the *unfunded debt of Great Britain*, is contracted in the former of those two ways. It consists partly in a debt which bears, or is supposed to bear, no interest, and which resembles the debts that a private man contracts upon account; and partly in a debt which bears interest, and which resembles what a private man contracts upon his bill or promissory note. The debts which are due either for extraordinary services, or for services either not provided for or not paid at the time when they are performed; part of the extraordinaries of the army, navy, and ordnance, the arrears of subsidies to foreign princes, those of seamens wages, &c. usually constitute a debt of the first kind. Navy and exchequer bills, which are issued sometimes in payment of a part of such debts, and sometimes for other purposes, constitute a debt of the second kind; exchequer bills bearing interest from the day on which they are issued, and navy bills six months after they are issued. The bank of England, either by voluntarily discounting those bills at their current value, or by agreeing with government for certain considerations to circulate exchequer bills, that is, to receive them at par, paying the interest which happens to be due upon them, keeps up their value, and facilitates their circulation, and thereby frequently enables government to contract a very large debt of this kind. During the great recoinage in King William's time, when the bank of England thought proper to put a stop to its usual transactions, exchequer bills and tallies are said to have sold from 25 to 60 *per cent* discount; owing partly, no doubt, to the supposed instability of the new government established by the Revolution, but partly too to the want of the support of the bank of England.

When this resource is exhausted, and it becomes necessary, in order to raise money, to assign or mortgage some particular branch of the public revenue for the payment of the debt, government has upon different occasions done this in two different ways. Sometimes it has made this assignment or mortgage for a short period of time only, a year or a few years, for example; and sometimes for perpetuity. In the one case, the fund was supposed sufficient to pay within the limited time both principal and interest of the money borrowed: In the other, it was supposed sufficient to pay the interest only, or a perpetual annuity equivalent to the interest; government being at liberty to redeem at any time this annuity upon paying back the principal sum borrowd. When money was raised in the one way, it was said to be raised *by anticipation;* when in the other, *by perpetual funding*, or, more shortly, *by funding*.

In the reign of King William, when the debt began to be amassed, and during a great part of that of Queen Anne, before we had become so familiar as we are now with the practice of perpetual funding, the greater part of the new taxes were imposed but for a short period of time (for four, five, six, or seven years only), and a great part of the grants of every year consisted in loans upon anticipation of the produce of those taxes. The produce being frequently insufficient for paying within the limited term the principal and interest of the money borrowed, deficiencies arose; to make good which it became necessary to prolong the term.

On the 31st of December 1697, the funded and unfunded debts amounted to L. 21,515,742 : 13 : 8½; at the same time, in 1714, they were L. 53,681,076, 5s. 6$\frac{1}{12}$d. In 1755, before the breaking ont of the war, they amounted to L. 72,289,673; and on the 5th of January 1763, at the conclusion of the peace, they had accumulated to L. 122,603,336 : 8 : 2¼ of funded debt, and of unfunded L. 13,027,589 : 2 : 2 more. In 1775, they were nearly 130 millions; and the last American war added upwards of 120 millions more to that enormous sum: to pay the interest of which, and the charges of management, amounting annually to nearly eight millions and an half, the extraordinary revenues elsewhere enumerated † (excepting only the land-tax and annual malt-tax) are in the first place mortgaged and made perpetual by parliament. Perpetual we say; but still redeemable by the same authority that imposed them; which, if it at any time can pay off the capital, will abolish those taxes which are raised to discharge the interest.

† See Revenue.

By this means, then, the quantity of property in the kingdom is greatly increased in idea compared with former times; yet, if we cooly consider it, not at all increased in reality. We may boast of large fortunes, and quantities of money in the funds. But where does this money exist? It exists only in name, in paper, in public faith, in parliamentary security: and that is undoubtedly sufficient for the creditors of the public to rely on. But then what is the pledge which the public faith has pawned for the security of these debts? The land, the trade, and the personal industry of the subject; from which the money must arise that supplies the several taxes. In these therefore, and these only, the property of the public creditors does really and intrinsically exist; and of course the land, the trade, and the personal industry of individuals, are diminished in their true value just so much as they are pledged to answer. If A's income amounts to L. 100 *per annum;* and he is so far indebted to B, that he pays him L. 50 *per annum* for his interest; one half of the value of A's property is transferred to B the creditor. The creditor's property exists in the demand which he has upon the debtor, and no where else; and the debtor is only a trustee to his creditor for one half of of the value of his income. In short, the property of a creditor of the public consists in a certain portion of the national taxes; by how much therefore he is the richer, by so much the nation, which pays these taxes, is the poorer.

The only advantage that can result to a nation from public debts, is the increase of circulation, by multiplying the cash of the kingdom, and creating a new species of currency, assignable at any time and in any quantity; always therefore ready to be employed in any beneficial undertaking, by means of this its transferrable quality; and yet producing some profit even when it lies idle and unemployed. A certain proportion of debt seems to be highly useful to a trading people; but what that proportion is, it is not for us to determine. This much is indisputably certain, that the present magnitude of our national incumbrances very far exceeds all calculations of commercial benefit, and is productive of the greatest inconveniences. For, first, the enormous taxes that are raised upon the necessaries of life for the payment of the interest of this debt, are a hurt both to trade and manufactures, by raising the price as well of the artificer's subsistence as of the raw material, and of course in a much greater proportion, the price of the commodity itself. Nay, the very increase of paper-circulation itself, when extended beyond what is requisite for commerce or foreign exchange, has a natural tendency to increase the price of provisions as well as of all other merchandise. For as its effect is to multiply the cash of the kingdom, and this to such an extent that much must remain unemployed, that cash (which is the universal measure of the respective values of all other commodities) must necessarily sink in its own value, and every thing grow comparatively dearer. Secondly, if part of this debt be owing to foreigners, either they draw out of the kingdom annually a considerable quantity of specie for the interest; or else it is made an argument to grant them unreasonable privileges in order to induce them to reside here. Thirdly, if the whole be owing to subjects only, it is then charging the active and industrious subject, who pays his share of the taxes to maintain the indolent and idle creditor who receives them. Lastly, and principally, it weakens the internal strength of a state, by anticipating those resources which should be reserved to defend it in case of necessity. The interest we now pay for our debts would undoubtedly be sufficient to maintain the most vigorous war that any national motives could possibly require. If indeed our ancestors in King William's time had annually paid, so long as their exigencies lasted, a far less sum than we now annually raise upon their accounts, they would not in time of war have borne so great burdens as they have bequeathed to and settled upon their posterity in time of peace; and might have been ceased the instant the exigence was over. See Funds.

On the whole, then, the national debt is undoubtedly a subject of vast importance, and as such it has been always considered; for much has been said and written upon it, and many schemes have been proposed at various times and by various persons for gradually removing it, it being considered by the most judicious as a most pernicious incumbrance to a commercial country. Some we are aware, think it of vast utility; but this opinion is too eccentric, and in our estimation too feebly supported to be convincing. The public debt is indisputably a great grievance; and every lover of his country must surely wish to see it removed: the period, however, when this blessing shall take place, if indeed it ever arrive, must at least be very distant.

It is neither our business nor intention (even if the limits prescribed to the article did not prevent it) to be minute on the subject, or to propose any schemes for alleviating the burdens of the nation. That indeed has been already done by far abler hands than we profess to be: we must therefore refer such as wish for farther information on this interesting topic to those (and they are not a few) who have treated of it at full length. Smith's Wealth of Nations, and Sir John Sinclair's History of the Revenue, go to the bottom of the matter. The writings of Dr Price likewise deserve considerable attention, especially as one of his plans for the reduction of the debt has in fact been adopted, and in consequence established, by the legislature: His three plans may be found in a late pamphlet by William Morgan, intitled, A Review of Dr Price's Writings on the Subject of the Finances of this Kingdom.

NATIVITY, or Natal day, the day of a person's birth. The word *nativity* is chiefly used in speaking of the saints; as, the nativity of St John the Baptist, &c. But when we say *the* Nativity, it is understood of that of Jesus Christ, or the feast of Christmas.

Nativity, *nativitas*, in ancient law-books, signifies bondage or servitude.

Nativity, in astrology, the theme or figure of the heavens, and particularly of the twelve houses, at the moment when a person was born; called also the *horoscope*.

Casting the nativity, or by calculation seeking to know how long the queen should live, &c. was made felony, an. 23 Eliz. c. 2.

NATIVO habendo, in law, a writ directed to the sheriff, for a lord who claimed inheritance in any villain, when a villain was run away from him, for the apprehending and restoring him to the lord.

NATIX, in natural history, a name given by some old writers to the *nerita*.

NATOLIA, the modern name of the Lesser Asia, being the most westerly part of Turkey in Asia, and consisting of a large peninsula which extends from the river Euphrates as far as the Archipelago, the seas of Marmora, the straits of Galipoli and of Constantinople, which separate it from Europe on the west. It is bounded on the north by the Black sea, and on the south by the Mediterranean.

NATRIX, in botany, the name given by Rivinius to a genus of plants nearly allied to the anonis, and comprehended with it in one genus by Linnæus, under the name of anonis. See *Rest-harrow*

Natrix, in zoology, the name of the common or water-snake, called also *torquata*, from the ring about its neck. It is not a water animal, properly speaking, but a land one, which being able to swim very well, often takes the water to hunt about for frogs, which are its principal food. It grows to be much longer and larger than the viper, and does not bring forth live young ones, but great numbers of eggs, which it lays in dung-

dunghills to be hatched by the warmth of the place, or by the heat of the sun.

NATRUM, the nitre of the ancients, in natural history, is a genuine, pure and native salt, extremely different from our nitre, and indeed from all the other native salts, it being a fixed alkali, plainly of the nature of those made by fire from vegetables, yet capable of a regular crystallization, which those salts are not. It is found on the surface of the earth, or at very small depths within it; and is naturally formed into thin and flat cakes or crusts, which are of a spungy or cavernous substance, very light and friable, and, when pure, of a pale brownish white; but as its spungy texture renders it very subject to be fouled by earth received into its pores, it is often met with of a deep dirty brown, and not unfrequently reddish.

Natrum, whether native or purified, dissolves in a very small quantity of water; and this solution is, in many parts of Asia, used for washing; where it is also made into soap, by mixing it with oil. Natrum reduced to powder, and mixed with sand or flints, or with any other stone of which crystal is the basis, makes them readily run into glass. Gold heated red-hot, and sprinkled with a small quantity of this salt, melts in the same manner; as does also iron, copper, and the regulus of antimony: which melt much more easily than they otherwise would do. Mercury cannot be mixed with it by any art, and indeed will not amalgamate with metals if only a little of this salt be added. It is found in great abundance in many parts of Asia, where the natives sweep it up from the surface of the ground, and call it *soap-earth*. The earliest account we have of it is in the scriptures, where we find that the salt called *nitre* in those times would ferment with vinegar, and had an abstersive quality, so that it was used in baths and in washing things. Solomon compares the singing of songs with a heavy heart, to the contrariety of vinegar and nitre; and Jeremiah says, that if the sinner wash himself with nitre, his sin is not cleansed off. These are properties that perfectly agree with this salt, but not at all with our saltpetre.

NATTER-JACK, in zoology, a species of RANA.

NATURAL, in general, something that relates to nature. See NATURE.

NATURAL Children, are those born out of lawful wedlock. See BASTARD.

NATURAL Functions, are those actions whereby the aliments are changed and assimilated so as to become a part of the body.

NATURAL, in heraldry, is used where animals, fruits, flowers, &c. are blazoned with the colours they naturally have, though different from the common colours of heraldry: and this is to prevent their armories being accused of falsity, when blazoned with the names of colours unknown in heraldry.

NATURAL Note, in music, is used in opposition to flat and sharp notes, which are call *artificial notes*. See NOTE, SCALE, &c

NATURAL is also used for something coming immediately out of the hands of nature: in which sense it stands opposed to *factitious* or artificial, which signifies something wrought by art. See ARTIFICIAL.

Bishop Wilkins observes, that there appears a world of difference between natural and artificial things, when viewed with microscopes. The first ever appear adorned with all imaginable elegance and beauty; the latter, though the most curious in their kind, infinitely rude and unhewn; the finest needle appears a rough bar of iron; and the most accurate engraving or embossment, as if done with a mattock or a trowel.

NATURAL Beauty, or the beauty of natural objects, is that quality or those qualities in the works of nature, or more properly of God, which are calculated to excite pleasing sensations in the mind of all such persons of true taste as attentively observe them. It will not, we trust, be deemed improper or impertinent, therefore, to introduce a few observations on this subject, previous to our treating of natural history.—To many, it is hoped, it will appear to be a very proper introduction to that important article. "That sensibility to beauty, which when cultivated and improved, we term taste, is universally diffused through the human species†; and it is most uniform with respect to those objects, which being out of our power are not liable to variation from accident, caprice, or fashion. The verdant lawn, the shady grove, the variegated landscape, the boundless ocean, and the starry firmament, are contemplated with pleasure by every attentive beholder. But the emotions of different spectators, though similar in kind, differ widely in degree; and to relish with full delight the enchanting scenes of nature, the mind must be uncorrupted by avarice, sensuality, or ambition; quick in her sensibilities; elevated in her sentiments; and devout in her affections. He who possesses such exalted powers of perception and enjoyment, may almost say, with the poet,

† Dr Percival's Moral and Literary dissertations.

I care not, Fortune! what you me deny;
You cannot rob me of free Nature's grace;
You cannot shut the windows of the sky,
Through which Aurora shows her bright'ning face;
You cannot bar my constant feet to trace
The woods and lawns, by living stream, at eve:
Let health my nerves and finer fibres brace,
And I their toys to the great children leave:
Of fancy, reason, virtue, naught can me bereave.

"Perhaps such ardent enthusiasm may not be compatible with the necessary toils and active offices which Providence has assigned to the generality of men. But there are none to whom some portion of it may not prove advantageous; and if it were cherished by each individual, in that degree which is consistent with the indispensable duties of his station, the felicity of human life would be considerably augmented. From this source, the refined and vivid pleasures of the imagination are almost entirely derived: and the elegant arts owe their choicest beauties to a taste for the contemplation of nature. Painting and sculpture are express imitations of visible objects; and where would be the charms of poetry, if divested of the imagery and embellishments which she borrows from rural scenes? Painters, statuaries, and poets, therefore, are always ambitious to acknowledge themseves the pupils of nature! and as their skill increases, they grow more and more delighted with every view of the animal and vegetable world. But the pleasure resulting from admiration is transient; and to cultivate taste, without regard

regard to its influence on the paſſions and affection, ' is to rear a tree for its bloſſoms, which is capable of yielding the richeſt and moſt valuable fruit.' Phyſical and moral beauty bear ſo intimate a relation to each other, that they may be conſidered as different gradations in the ſcale of excellence: and the knowledge and reliſh of the former ſhould be deemed only a ſtep to the nobler and more permanent enjoyments of the latter.

" Whoever has viſited the Leaſowes, in Warwickſhire, muſt have felt the force and propriety of an inſcription which meets the eye at the entrance into thoſe delightful grounds.

Would you then taſte the tranquil ſcene?
Be ſure your boſoms be ſerene:
Devoid of hate, devoid of ſtrife,
Devoid of all that poiſons life:
And much it 'vails you, in their place,
To graft the love of human race.

" Now ſuch ſcenes contribute powerfully to inſpire that ſerenity which is neceſſary to enjoy and to heighten their beauties. By a ſecret contagion, the ſoul catches the harmony which he contemplates; and the frame within aſſimilates itſelf to that which is without. For,

Who can forbear to ſmile with Nature? Can
The ſtormy paſſions in the boſom roll,
While every gale is peace, and every grove
Is melody?

" In this ſtate of ſweet compoſure, we become ſuſceptible of virtuous impreſſions, from almoſt every ſurrounding object. The patient ox is viewed with generous complacency; the guileleſs ſheep with pity; and the playful lamb raiſes emotions of tenderneſs and love. We rejoice with the horſe, in his liberty and exemption from toil, while he ranges at large through enamelled paſtures; and the frolics of the colt would afford unmixed delight, did we not recollect the bondage which he is ſoon to undergo. We are charmed with the ſong of birds, ſoothed with the buz of inſects, and pleaſed with the ſportive motions of fiſhes, becauſe theſe are expreſſions of enjoyment; and we exult in the felicity of the whole animated creation. Thus an equal and extenſive benevolence is called forth into exertion; and having felt a common intereſt in the gratifications of inferior beings, we ſhall be no longer indifferent to their ſufferings, or became wantonly inſtrumental in producing them.

" It ſeems to be the intention of Providence, that the lower order of animals ſhould be ſubſervient to the comfort, convenience, and ſuſtenance of man. But his right of dominion extends no farther; and if this right be exerciſed with mildneſs, humanity, and juſtice, the ſubjects of his power will be no leſs benefited than himſelf. For various ſpecies of living creatures are annually multiplied by human art, improved in their perceptive powers by human culture, and plentifully fed by human induſtry. The relation, therefore, is reciprocal between ſuch animals and man: and he may ſupply his own wants by the uſe of their labour, the produce of their bodies, and even the ſacrifice of their lives, whilſt he co-operates with all-gracious Heaven in promoting happineſs, the great end of exiſtence.

" But though it be true, that partial evil, with reſpect to different orders of ſenſitive beings, may be univerſal good; and that it is a wiſe and benevolent inſtitution of nature, to make deſtruction itſelf, within certain limitations, the cauſe of an increaſe of life and enjoyment: yet a generous perſon will extend his compaſſionate regards to every individual that ſuffers for his ſake; and, whilſt he ſighs

Even for the kid or lamb that parts its life
Beneath the bloody knife,

he will naturally be ſolicitous to mitigate pain, both in duration and degree, by the gentleſt modes of inflicting it.

" We are inclinedt o believe, however, that this ſenſe of humanity would ſoon be obliterated, and that the heart would grow callous to every ſoft impreſſion, were it not for the benignant influence of the ſmiling face of nature. The count de Lauzun, when impriſoned by Louis XIV. in the caſtle of Pignerol, amuſed himſelf, during a long period of time with catching flies, and delivering them to be devoured by a rapacious ſpider. Such an entertainment was equally ſingular and cruel, and inconſiſtent, we believe, with his former character, and his ſubſequent turn of mind. But his cell had no window, and received only a glimmering light from an aperture in the roof. In leſs unfavourable circumſtances, may we not preſume, that inſtead of ſporting with miſery, he would have releaſed the agoniſing flies, and bid them enjoy that freedom of which he himſelf was breaved?

" But the taſte for natural beauty is ſubſervient to higher purpoſes than thoſe which have been enumerated: and the cultivation of it not only refines and humaniſes but dignifies and exalts the affections. It elevates them to the admiration and love of that Being who is the author of all that is fair, ſublime, and good in the creation. Scepticiſm and irreligion are hardly compatible with the ſenſibility of heart which ariſes from a juſt and lively reliſh of the wiſdom, harmony, and order ſubſiſting in the world around us: and emotions of piety muſt ſpring up ſpontaneouſly in the boſom that is in uniſon with all animated nature. Actuated by this divine inſpiration, man finds a fane in every grove: and, glowing with devout fervour, he joins his ſong to the univerſal chorus, or muſes the praiſe of the Almighty, in more expreſſive ſilence. Thus they

Whom Nature's works can charm, with God himſelf
Hold converſe; grow familiar, day by day,
With his conceptions; act upon his plan;
And form to his the reliſh of their ſouls."

On the whole then, it certainly appears, that the advantages reſulting from a taſte for natural beauties are great and important: it is equally certain, that as it is uſeful, ſo it is a continual ſource of real enjoyment; for a more rational pleaſure cannot poſſibly occupy the attention or captivate the affections of mankind, than that which ariſes from a due conſideration of the works of nature. Pleaſure, we know, is a neceſſary ingredient in human life, in order in ſome meaſure to counterbalance the pains, the evils, and liſtleſſneſſes, which are at times perhaps unavoidable, and in order to render life tolerable. It is the part then of the

the moralist, and it has been frequently his business, to point out and recommend such pleasures as are highly gratifying, and are yet perfectly innocent. The Spectator, whose works will be admired as long as the lauguage in which they are written is understood, recommends strongly and elegantly the pleasure of a garden; and a later writer*, of no common degree of merit, and of a very considerable fame, has an essay on the same subject, from which we shall select a few observations, and so conclude the article. "Not he alone (says this elegant writer) is to be esteemed a benefactor to mankind, who makes an useful discovery; but he also who can point out and recommend an innocent pleasure. Of this kind are the pleasures arising from the observation of nature; and they are highly agreeable to every taste uncorrupted by vicious indulgence. Rural scenes of almost every kind are delightful to the mind of man. But the misfortune is, that the greater part are hurried on in the career of life with too great rapidity to be able to give attention to that which solicits no passion. The darkest habitation in the dirtiest street of the metropolis, where money can be earned, has greater charms with many than the groves of Hagley.

Dr Knox.

"The patron of refined pleasure, the elegant Epicurus, fixed the seat of his enjoyment in a garden. He was of opinion, that a tranquil spot, furnished with the united sweets of art and nature, was the best adapted to delicate repose. And even the severer philosophers of antiquity were wont to discourse in the shade of a spreading tree, in some cultivated plantation. It is obvious, on intuition, that nature often intended solely to please the eye in her vegetable productions. She decorates the flowret that springs beneath our feet in all the perfections of external beauty. She has clothed the garden with a constant succession of various hues. Even the leaves of the tree undergo a pleasing vicissitude. The fresh verdure which they exhibit in the spring, the various shades which they assume in summer, the yellow and russet tinge of autumn, and the nakedness of winter, afford a constant pleasure to a lively imagination. From the snow-drop to the moss-rose, the flower garden displays an infinite variety of shape and colour. The taste of the florist has been ridiculed as trifling; yet surely without reason. Did nature bring forth the tulip and the lily, the rose and the honeysuckle, to be neglected by the haughty pretender to superior reason? To omit a single social duty for the cultivation of a polyanthus were ridiculous as well as criminal; but to pass by the beauties lavished before us, without observing them, is no less ingratitude than stupidity. A bad heart finds little amusement but in a communication with the active world, where scope is given for the indulgence of malignant passions; but an amiable disposition is commonly known by a taste for the beauties of the animal and the vegetable creation." In short, since the world was made for our use, since the beauties of nature are alike displayed before all men, and since they are unquestionably an inexhaustible fund of innocent amusement; that subject must be of vast importance which enables us to relish them properly.

NATURAL HISTORY.

NATURAL HISTORY, in its most extensive signification, denotes a knowledge and description of the whole universe. Matters of fact respecting the heavens, meteors, the atmosphere, the earth, respecting all the phenomena, indeed, which occur in the world, and even of the external parts and actions of man himself, as far as reason can discover them, belong to the province of natural history; but when we leave the simple recital of effects, and endeavour to investigate the causes of such and such phenomena, we then leave natural history, and enter on philosophy. The object of our article, therefore, in the sense we have here given it, is as extensive as nature itself. But, in its more appropriated sense, it is well known that its province only extends to the surface of the earth, the works on it, and the inhabitants of it. It treats of those substances of which, as far as our researches have led us, the earth is composed, and of those organized bodies, whether vegetable or animal, which adorn its surface, which rise into the air, or live in the bosom of the waters.—But as a science so various and comprehensive could neither with propriety nor advantage be completely discussed under the general title, we have to refer the reader to the article KINGDOMS *(in Natural History)*, where he will be directed to the different articles which constitute either the branches or the objects of the science, and which are all treated under their respective names. In the present article it is proposed to give a general and philosophical view of the subject: To set forth, in a summary way, whatever curious, worthy to be known, or not obvious to every observer, occurs in the three kingdoms of nature: with their constitution, laws, and œconomy; or, in other words, that all-wise disposition of the Creator in relation to natural things, by which they are fitted to produce general ends and reciprocal uses.

SECT. I. *Of the Terraqueous Globe in general, and its changes.*

THE world, or the terraqueous globe, which we inhabit, is every-where surrounded with elements, and contains in its superficies the three KINGDOMS *of Nature*, as they are called: the fossil, which constitutes the crust of the earth; the vegetable, which adorns the face of it, and draws the greatest part of its nourishment from the fossil kingdom; and the animal, which is sustained by the vegetable kingdom. Thus, then, these three grand divisions, or, as they are commonly called, kingdoms; cover, adorn, and vary, the surface of the earth.

As to the STRATA of the EARTH and MOUNTAINS, as far as we have hitherto been able to discover, the upper parts consist of rag-stone; the next of slate; the third of marble filled with petrifactions; the fourth again, of slate; and lastly, the lowest of free stone.—The

Of the Terraqueous Globe.

The habitable part of the earth, though it is ſcooped into various inequalities, yet is every-where high in compariſon with the water; and the farther it is from the ſea it is generally higher. Thus the waters in the lower places are not at reſt, unleſs ſome obſtacle confines them, and by that means form lakes and marſhes.

The SEA ſurrounds the continent, and takes up the greateſt part of the earth's ſurface, as geographers inform us. Nay, that it once ſpread over much the greateſt part, we may be convinced by its yearly decreaſe, by the rubbiſh left by the tides, by ſhells, ſtrata, and other circumſtances.

The ſea-ſhores are uſually full of dead teſtacious animals, wreck, and ſuch like bodies, which are yearly thrown out of the ſea. They are alſo covered with ſand of various kinds, ſtones, &c. It happens, moreover, that while the more rapid rivers ruſh through narrow valleys, they wear away the ſides; and thus the friable and ſoft earth falls in, and its ruins are carried to diſtant and winding ſhores; whence it is certain, that the continent gains no ſmall increaſe, as the ſea ſubſides.

The CLOUDS collected from exhalations, chiefly from the ſea, but likewiſe from other waters, and moiſt grounds, and condenſed in the lower regions of the ATMOSPHERE, ſupply the earth with RAIN; but ſince they are attracted by the mountainous parts of the earth, it neceſſarily follows, that thoſe parts muſt have, as is fit, a larger ſhare of water than the reſt. SPRINGS, which generally ruſh out at the foot of mountains, take their riſe from this very rain-water, and vapours condenſed, that trickle through the holes and interſtices of looſe bodies, and are received into caverns.

Theſe afford a pure WATER purged by ſtraining: and rarely dry up in ſummer, or freeze in winter, ſo that animals never want a wholeſome and refreſhing liquor.

The chief ſources of RIVERS are fountains and rills growing by gradual ſupplies into ſtill larger and larger ſtreams: till at laſt, after the conflux of a vaſt number of them, they find no ſtop, but falling into the ſea with much rapidity, they there depoſit the united ſtores they have gathered, along with foreign matter, and ſuch earthy ſubſtances as they tore off in their way. Thus the water returns in a circle whence it firſt drew its origin, that it may act over the ſame ſcene in continued ſucceſſion.

Marſhes ariſing from water retained in low grounds, are filled with moſſy tumps, which are brought down by the water from the higher parts, or are produced by putrefied plants.

We often ſee new meadows ariſe from marſhes dried up. This happens ſooner when the *ſphagnum* (a kind of moſs) has laid a foundation; for this in proceſs of time changes into a very porous mould, till almoſt the whole marſh is filled with it. After that the ruſh ſtrikes root, and along with the cotton-graſſes conſtitutes a turf, raiſed in ſuch a manner that the roots get continually higher, and thus lay a more firm foundation for other plants, till the whole marſh is changed into a fine and delightful meadow; eſpecially if the water happens to work itſelf a new paſſage.

Hillocks, that abound in low grounds, occaſion the earth to increaſe yearly, more than the countryman would wiſh, and ſeem to do hurt: but in this the great induſtry of nature deſerves to be taken notice of. For by this means the barren ſpots become ſooner rich meadow and paſture-land. Theſe hillocks are formed by the ant, by ſtones and roots, and the trampling of cattle: but the principal cauſe is the force of the winter-cold, which in the ſpring raiſes the roots of plants ſo high above the ground, that being expoſed to the air, they grow, and periſh; after which the golden maidenhairs fill the vacant places.

Mountains, hills, valleys, and all the inequalities of the earth, though ſome think they take away much from its beauty, are ſo far from producing ſuch an effect, that on the contrary they give a more pleaſing aſpect, and confer great advantages. For thus the terreſtrial ſuperficies is larger; different kinds of plants thrive better, and are more eaſily watered; and the rain-waters run in continual ſtreams into the ſea; not to mention many other uſes in relation to winds, heat, and cold. Alps are the higheſt mountains, that reach to the ſecond region of the air, where trees cannot grow erect. The higher theſe Alps are, the colder they are *cæteris paribus*. Hence the Alps in Sweden, Siberia, Swiſſerland, Peru, Braſil, Armenia, Aſia, Africa, are perpetually covered with ſnow, which becomes almoſt as hard as ice. But if by chance the ſummer heats be greater than ordinary, ſome part of theſe ſtores melts, and runs through rivers into the lower regions, which by this means are much refreſhed.

It is ſcarcely to be doubted, but that the rocks and ſtones diſperſed over the globe were formed originally in, and from, the earth; but when torrents of rain have ſoftened, as they eaſily do, the ſoluble earth, and carried it down into the lower parts, we imagine it happens, that theſe ſolid and heavy bodies, being laid bare, ſtick out above the ſurface. We might alſo take notice of the wonderful effect of the tide, ſuch as we ſee happen from time to time on the ſea-ſhore, which being daily and nightly aſſaulted with repeated blows, at length gives way, and breaks off. Hence we ſee in moſt places the rubbiſh of the ſea, and ſhores.

The winter by its froſt prepares the earth and mould, which thence are broken into very minute particles, and thus, being put into a mouldering ſtate, become more fit for the nouriſhment of plants; nay, by its ſnow it covers the ſeeds and roots of plants, and thus by *cold* defends them from the *force of cold*. We muſt add alſo, that the piercing froſt of the winter purifies the atmoſphere and putrid waters, and makes them more wholeſome for animals.

The perpetual ſucceſſion of heat and cold with us renders the ſummers more pleaſing: and tho' the winter deprives us of many plants and animals, yet the perpetual ſummer within the tropics is not much more agreeable, as it often deſtroys men and other animals by its immoderate heat; though it muſt be confeſſed, that thoſe regions abound with exquiſite fruits. Our winters though very troubleſome to a great part of the globe on account of their vehement and intenſe cold, yet are leſs hurtful to the inhabitants of the northern parts, as experience teſtifies. Hence it happens, Of the Seasons.

pens, that we may live very conveniently on every part of the earth, as every different country has different advantages from nature.

The seasons, like every thing else, have their vicissitudes; their beginnings, their progress, and their end.

The age of man begins from the cradle; pleasing childhood succeeds; then active, youth; afterwards manhood, firm, severe, and intent upon self preservation; lastly, old age creeps on, debilitates, and at length totally destroys our tottering bodies.

The seasons of the year proceed in the same way. Spring, the jovial, playful infancy of all living creatures, represents childhood and youth; for then plants spread forth their luxuriant flowers, fishes exult, birds sing, every part of nature is intent upon generation. The summer, like middle age, exhibits plants, and trees every where cloathed with green; it gives vigour, to animals, and plumps them up; fruits then ripen, meadows look cheerful, every thing is full of life. On the contrary, autumn is gloomy; for then the leaves of trees begin to fall, plants to wither, insects to grow torpid, and many animals to retire to their winter-quarters.

The day proceeds with just such steps as the year. The morning makes every thing alert, and fit for business; the sun pours forth his ruddy rays; the flowers, which had as it were slept all night, awake and expand themselves again; the birds with their sonorous voices and various notes make the woods ring, meet together in flocks, and sacrifice to Venus. Noon tempts animals into the fields and pastures; the heat puts them upon indulging their ease, and even necessity obliges them to it. Evening follows, and makes every thing more sluggish; flowers shut up*, and animals retire to their lurking places. Thus the spring, the morning, and youth are proper for generation; the summer, noon, and manhood, are proper for preservation; and autumn, evening, and old age, are not unfitly likened to destruction.

* See Vigil's of Plants.

In order to perpetuate the established course of nature in a continued series, the Divine Wisdom has thought fit that all living creatures should constantly be employed in *producing* individuals: that all natural things should contribute and lend a helping hand towards *preserving* every species: and lastly, that the *death* and *destruction* of one thing should always be subservient to the production of another. Hence the objects of our present inquiry fall to be considered in a threefold view, that of *propagation*, *preservation*, and *death* or *destruction*.

Sect. II. *The Fossil Kingdom.*

I. Propagation.

It is agreed on all hands, that stones are not organical bodies, like plants and animals; and therefore it is as clear that they are not produced from an egg, like the tribes of the other kingdoms. Hence the variety of fossils is proportionate to the different combinations of coalescent particles; and hence the species in the fossil kingdom are not so distinct as in the other two. Hence also the laws of generation in relation to fossils have been in all ages extremely difficult to explain; and lastly, hence have risen so many different opinions about them, that it would be endless to enumerate them all. We therefore, for the present, shall content ourselves with giving a very few observations on this subject.

Fossil Kingdom.

Some people suppose that clay is the sediment of the sea; and observation so far seems to go along with this opinion, for great plenty of it is generally found along the coasts. Seamen who have been so accurate as to keep journals, have observed, that a very minute sand covers the bottom of the ocean; and seem to think that it is daily crystallized from the water. It is now, generally acknowledged, that testacious bodies and petrifactions resembling animals were once real animals or vegetables. It has been supposed indeed, that shells being of a calcareous nature, changed the adjacent clay, sand, or mould, into the same kind of substance. Hence it appears certain, that marbles may be generated from petrifactions; and therefore it is often full of them. Rag-stone, the common matter of our rocks, appears to be formed from a sandy kind of clay; most frequently, however, this appears to happen where the earth is impregnated with iron. Free-stone seems to be the product of sand: and, the deeper the bed where it is found, the more compact it becomes; and the more dense the sand, the more easily it concretes. But if an alkaline clay chances to be mixed with the sand, the freestone is generated more readily, as in that called *cos friatilis particulis argilloglarensis*. The flint is almost the only kind of stone, certainly the most common, in chalky mountains.—It would appear therefore from this to be produced from chalk: but whether it can be reduced to chalk again, is left for others to enquire.

Stalactites, or drop-stone, is composed of calcareous particles, adhering to a dry, and generally a vegetable body, and is deposited by dropping water; from which circumstance it seems to have derived its vulgar name.

Incrustrations (Syst. Nat. 32. 5. 6. 7. 8.), are, in general, it appears, generated where a vitriolic water connects clayey and earthy particles together.

Slate, by the vegetables that are often enclosed in it seems to take its origin from a marshy mould.

Metals vary according to the nature of the matrix in which they adhere; *e. g.* the pyrites cupri Fahlumenus contains frequently sulphur, arsenic, iron, copper, a little gold, vitriol, alum, sometimes lead ore, silver and zinc. Thus gold, copper, iron, zinc, arsenic, pyrites, vitriol, come out of the same vein. That very rich iron ore, at Normark in Vermilandia, where it was cut transversely by a vein of clay, was changed into pure silver. The number therefore of species and varieties of fossils, each serving different purposes according to their different natures, will be in proportion as the different kinds of earths and stones are variously combined,

II. Preservation.

As fossils are destitute of life and organization, are hard, and not obnoxious to putrefaction; so they last longer than any other kind of bodies. How far the air contributes to this duration, it is easy to perceive; since air hardens many stones upon the surface

face of the earth, and makes them more solid, compact, and able to resist the injuries of time. Thus it is known from vulgar observation, that lime that has been long exposed to the air becomes hardened. The chalky marl which they use in Flanders and about Bath for building houses, as long as it continues in the quarry is friable; but when dug up and exposed to the air it grows gradually harder.

However ignorant we may be of the cause why large rocks are every where to be seen split, whence vast fragments are frequently torn off; yet we may observe, that fissures are closed up by water, which gets between them, and is detained there; forming crystal and spar. Hence we scarcely ever find any crystal, but in those stones which have retained for some time in its chinks, water loaded with stony particles. In the same manner crystal fills the cavities in mines, and concrete into quartz or a debased crystal.

It is manifest that stones are not only generated, augmented, and changed perpetually, from incrustations brought upon moss, but are also increased by crystal and spar. Not to mention that the adjacent earth, especially if it be impregnated with iron particles, is commonly changed into a solid stone.

It is said, that the marble quarries in Italy, from whence fragments are cut, grow up again. Ores grow by little and little, whenever the mineral particles conveyed by the means of water through the clefts of mountains, are retained there; so that, adhering to the homogeneous matter a long while, at last they take its nature, and are changed into a similar substance.

III. Destruction.

Fossils, although they are the hardest of bodies, yet are found subject to the laws of destruction, as well as all other created substances. For they are dissolved in various ways by the elements exerting their force upon them; as by water, air, and the solar rays; as also by the rapidity of rivers, violence of cataracts, and eddies, which continually beat upon, and at last reduce to powder the hardest rocks. The agitations of the sea and lakes, and the vehemence of the waves, excited by turbulent winds, pulverise stones, as evidently appears by their roundness along the shore. Nay, as the poet says.

The hardest stone insensibly gives way
To the soft drops that frequent on it play.

So that we ought not to wonder that these very hard bodies moulder away into powder, and are obnoxious like others to the consuming tooth of time.

Sand is formed of free-stone, which is destroyed partly by frost, making it friable; partly by the agitation of water and waves, which easily wear away, dissolve, and reduce into minute particles what the frost had made friable.

Chalk is in general supposed to be formed of rough marble, which the air, the sun, and the winds have dissolved. Tho slate earth, or humus schisti, (Syst. Nat. 512.) owes its origin to slate, showers, air, and snow melted.

Ochre is formed of metals dissolved, and presents the very same colours which we always find the ore tinged with when exposed to the air. Vitriol in the same manner mixes with water from ore destroyed.

The muria saxatilis (Syst. Nat. 14. 6.), a kind of talky stone, yielding salt in the parts that are turned to the sun, is dissolved into sand, which falls by little and little upon the earth till the whole is consumed; not to mention other kinds of fossils. Lastly, from these there arise new fossils, as we mentioned before; so that the destruction of one thing serves for the generation of another.

Testaceous worms ought not to be passed over on this occasion, for they eat away the hardest rocks. That species of shell-fish called the *razor-shell* bores through stones in Italy, and hides itself within them so that the people who eat them are obliged to break the stones before they can come at them. The cochlea, (*Faun. Suec.* 1299.), a kind of snail that lives on craggy rocks, eats and bores through the chalky hills, as worms do through wood. This is made evident by the observations of the celebrated de Geer. It ought to be observed here, that there are often found dead insects in the hearts of the hardest rocks, without any visible trace of the manner of their getting there; from whence many have supposed that stones were originally fluid. Concerning such matters, about which we have but little data, there will always be a great diversity of opinions. It is not our business, at least in this place, to give an opinion on a doubtful subject: the fact is so; of the cause let others judge.

Sect. III. *The Vegetable Kingdom.*

I. Propagation.

Anatomy abundantly proves, that all plants are organic and living bodies; and that all organic bodies are propagated from an egg has been sufficiently demonstrated by the industry of modern writers. We therefore the rather, according to the opinion of the skilful, reject the equivocal generation of plants; and the more so, as it is certain that every living thing is produced from an egg. Now the seeds of vegetables are called *eggs*; these are different in every different plant, that the means being the same, each may multiply its species, and produce an offspring like its parent. We do not deny, that very many plants push forth from their roots fresh offsets for two or more years. Nay, not a few plants may be propagated by branches, buds suckers, and leaves, fixed in the ground, as likewise many trees. Hence their stems being divided into branches, may be looked on as roots above ground for in the same way the roots creep under ground, and divide into branches. And there is the more reason for thinking so, because we know that a tree will grow in an inverted situation, *viz.* the roots being placed upwards, and the head downwards, and buried in the ground; for then the branches will become roots, and the roots will produce leaves and flowers. The lime-tree will serve for an example, on which gardeners have chiefly made an experiment. Yet this by no means overturns the doctrine, that all vegetables are propagated by seeds; since it is clear, that in each of the foregoing instances nothing vegetates but what was

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was the part of a plant, formerly produced from seed; so that accurately speaking, without seed no new plant is produced.

Thus again plants produce seeds; but they are entirely unfit for propagation, unless fecundation precedes, which is performed by an intercourse between different sexes, as experience testifies. Plants therefore must be provided with organs of generation; in which respect they are analagous to animals.— Since in every plant the flower always precedes the fruit, and the fecundated seeds visibly arise from the fruit; it is evident that the organs of generation are contained in the flower, which organs are called *antheræ* and *stigmata*, and that the impregnation is accomplished within the flower. This impregnation is performed by means of the dust of the antheræ falling upon the moist stigmata, where the dust adheres, is burst, and sends forth a very subtle matter, which is absorbed by the style, and is conveyed down to the rudiments of the seed, and thus renders it fertile. When this operation is over, the organs of generation wither and fall, nay a change in the whole flower ensues. We must, however, observe, that in the vegetable kingdom one and the same flower does not always contain the organs of generation of both sexes, but oftentimes the male organs are on one plant and the female on another. But that the business of impregnation may go on successfully, and that no plant may be deprived of the necessary dust, the whole most elegant apparatus of the antheræ and stigmata in every flower is contrived with wonderful wisdom.

For in most flowers the stamina surround the pistils, and are of about the same height: but there are many plants in which the pistil is longer than the stamina; and in these it is wonderful to observe, that the Creator has made the flowers recline, in order that the dust may the more easily fall into the stigma, *e. g.* in the campanula, cowslip, &c. This curious phenomenon did not escape the poetical eye of Milton, who describes it in the following enlivened imagery:

With cowslips wan, that hang the pensive head.

But when the fecundation is completed, the flowers rise again, that the ripe seeds may not fall out before they are dispersed by the winds. In other flowers, on the contrary, the pistil is shorter, and there the flowers preserve an erect situation; nay, when the flowering comes on, they become erect, though before they were drooping, or immersed under water. Lastly, whenever the male flowers are placed below the female ones, the leaves are exceedingly small and narrow, that they may not hinder the dust from flying upwards like smoke; as we see in the pine, fir, yew, sea-grape, juniper, cypress, &c. And when in one and the same species one plant is male and the other female, and consequently may be far from one another, there the dust, without which there is no impregnation, is carried in abundance by the help of the wind from the male to the female; as in the whole diœcious class. Again, a more difficult impregnation is compensated by the longevity of the individuals, and the continuation of life by buds, suckers, and roots; so that we may observe every thing most wisely disposed in this affair. Moreover, we cannot without admiration observe, that most flowers expand themselves when the sun shines forth; whereas when clouds, rain, or the evening comes on, they close up, lest the genial dust should be coagulated or rendered useless, so that it cannot be conveyed to the stigmata. But what is still more remarkable and wonderful, when the fecundation is over, the flowers, neither in rain, nor on the approach of night close themselves up. Hence when rain falls in the flowering time, the husbandman and gardener foretel a scarcity of fruits. To mention only one particular more: The organs of generation, which in the animal kingdom are by nature generally removed from sight, in the vegetable are exposed to the eyes of all; and that when their nuptials are celebrated, it is wonderful what delight they afford to the spectator by their most beautiful colours and delicious odours. At this time bees, flies, and other insects, suck honey out of their nectaries, not to mention the humming bird; and that from their effête dust the bees gather wax. All the experiments that have hitherto been made seem to confirm the hypothesis above unfolded; although it has lately been controverted by the author of the *Philosophy of Natural History*.

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Vid. a treatise published in Amœn. Acad. vol. i. intitled Sponsalia plantarum.

As to the dissemination of seeds after they come to maturity, it being absolutely necessary, since without it no crop could follow, the Author of nature has wisely provided for this affair in numberless ways. The stalks and stems favour this purpose; for these raise the fruit above the ground, that the winds shaking them to and fro, may disperse far off the ripe seeds. Most of the pericarpies are shut at top, that the seeds may not fall before they are shaken out by stormy winds. Wings are given to many seeds, by the help of which they fly far from the mother-plant, and oftentimes spread over a whole country. These wings consist either of a down, as in most of the composite-flowered plants; or of a membrane, as in the birch, alder, ash, &c. Hence woods, which happen to be consumed by fire or any other accident, will soon be restored again by new plants disseminated by this means. Many kinds of fruits are endued with a remarkable elasticity, by the force of which the ripe pericarpies throw the seeds to a great distance; as the wood-sorrel, the spurge, the phyllanthus, the dittany. Other seeds or pericarpies are rough, or provided with hooks; so that they are apt to stick to animals that pass by them, and by this means are carried to their holes, where they are both sown and manured by nature's wonderful care: and therefore the plants of these seeds grow where others will not; as hound's-tongue, agrimony, &c.

Berries and other pericarpies are by nature allotted for aliment to animals; but with this condition, that while they eat the pulp they shall sow the seed: for when they feed upon it, they either disperse them at the same time; or, if they swallow them, they are returned with interest, for they always come out unhurt. It is not therefore surprising, that if a field be manured with recent mud or dung, not quite rotten, various other plants, injurious to the farmer, should come up along with the grain that is sowed. Many have believed that barley or rye has been changed into oats, although all such kinds of metamorphoses are repugnant to the laws of generation; not considering, that there is another cause of this phenomenon, *viz.* that the ground perhaps has been manured with horse-dung, in which the seeds of oats, coming entire from the horse,

horse, lie hid and produce that grain. The misletoe always grows upon other trees, because the thrush that eats the seeds of it, casts them forth with its dung; and as bird-catchers make their bird-lime of this same plant, and daub the branches of trees with it, in order to catch the thrush, the proverb hence took its rise:

The thrush, when he befouls the bough,
Sows for himself the seeds of wo.

It is not to be doubted, but that the greatest part of the junipers also that fill our woods, are sown by thrushes, and other birds, in the same manner; as the berries, being heavy, cannot be dispersed far by the winds. The cross-bill that lives on the fir-cones, and the haw-finch that feeds on the pine-cones, at the same time sow many of their seeds; especially when they carry the cone to a stone, or trunk of a tree, that they may more easily strip it of its scales. Swine likewise, by turning up the earth, and moles by throwing up hillocks, prepare the ground for seeds in the same manner as the ploughman does.

We pass over many other things which might be mentioned concerning the sea, lakes, and rivers, by the help of which oftentimes seeds are conveyed unhurt to distant countries. A variety of other ways in which nature provides for the dissemination of plants, has been pointed out by Linnæus in an *Oration concerning the augmentation of the habitable earth*. As there is something very ingenious and quite new in the treatise here referred to, we shall, for the sake of those who cannot read the original, add a short abstract of it. His design is to show, that there was only one pair of all living things, created at the beginning. According to the account of Moses, says the author, we are sure that this was the case in the human species; and by by the same account we are informed that this first pair was placed in Eden, and that Adam gave names to all the animals. In order therefore that Adam might be enabled to do this, it was necessary that all the species of animals should be in paradise; which could not happen unless also all the species of vegetables had been there likewise. This he proves from the nature of their food; particularly in relation to insects, most of which live upon one plant only. Now had the world been formed in its present state, it could not have happened that all the species of animals should have been there. They must have been dispersed over all the globe, as we find they are at present; which he thinks improbable for other reasons which we shall pass over for sake of brevity. To solve all the phenomena, then, he lays down as a principle, That at the beginning all the earth was covered with the sea, unless one island large enough to contain all animals and vegetables. This principle he endeavours to establish by several phenomena, which makes it probable that the earth has been and is still gaining upon the sea, and does not forget to mention fossil shells and plants every where found, which he says cannot be accounted for by the deluge. He then undertakes to show how all vegetables and animals might in Britain have a soil and climate proper for each, only by supposing it to be placed under the equator, and crowned with a very high mountain. For it is well known that the same plants are found on the Swiss, the Pyrenean, the Scots Alps, on Olympus, Lebanon, Ida, as on the Lapland and Greenland Alps. And Tournefort found at the bottom of Mount Ararat the common plants of Armenia, a little way up those of Italy, higher those which grow about Paris, afterwards the Swedish plants, and lastly on the top the Lapland Alpine plants; and I myself, adds the author, from the plants growing on the Dalecarlian Alps could collect how much lower they were than the Alps of Lapland. He then proceeds to show how from one plant of each species, the immense number of individuals now existing might arise. He gives some instances of the surprising fertility of certain plants; *v. g.* the elecampane, one plant of which produced 3000 seeds; of spelt, 2000; of the sun-flower, 4000; of the poppy, 3200; of tobacco, 40,320. But supposing any annual plant producing yearly only two seeds, even of this, after 20 years, there would be 1,048,576 individuals. For they would increase yearly in a duple proportion, viz. 2, 4, 8, 16, 32, &c. He then gives some instances of plants brought from America, that are now become common over many parts of Europe. Lastly, he enters upon a detail of the several methods which nature has taken to propagate vegetables, which is extremely curious, but too long to insert in this place.

II. Preservation.

1. The great Author and Parent of all things decreed, that the whole earth should be covered with plants, and that no place should be void, none barren. But since all countries have not the same changes of seasons, and every soil is not equally fit for every plant; he therefore, that no place should be without some, gave to every one of them such a nature, as might be chiefly adapted to the climate; so that some of them can bear an intense cold, others an equal degree of heat; some delight in dry ground, others in moist, &c. Hence the same plants grow only where there are the same seasons of the year, and the same soil.

The Alpine plants live only in high and cold situations; and therefore often on the Alps of Armenia, Switzerland, the Pyreneans, &c. whose tops are equally covered with eternal snows as those of the Lapland Alps, plants of the same kind are found, and it would be in vain to seek for them any where else. It is remarkable, in relation to the Alpine plants, that they blow, and ripen their seeds very early, lest the winter, should steal upon them on a sudden, and destroy them.

Our northern plants, although they are extremely rare every where else, yet are found in Siberia, and about Hudson's Bay; as the arbutus, bramble, wintergreen, &c.

Plants impatient of cold live within the torrid zones; hence both the Indies, though at such a distance from one another, have plants in common. The Cape of Good Hope, we know not from what cause, produces plants peculiar to itself; as all the mesembryanthema, and almost all the species of aloes. Grasses, the most common of all plants, can bear almost any temperature of air: in which the good providence of the Creator particularly appears; for all over the globe, they above all plants are necessary for the nourishment of cattle; and the same thing is seen in relation to our most common grains.

Thus neither the scorching sun, nor the pinching cold, hinders any country from having its vegetables.

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Nor is there any soil which does not bring forth many kinds of plants. The pond-weeds, the water-lily, lobelia, inhabit the waters. The fluviales, fuci, conservæ, cover the bottoms of rivers, and sea. The sphagna * fill the marshes. The brya † clothe the plains. The driest woods, and places scarce ever illuminated by the rays of the sun, are adorned with the hypna. Nay, stones and the trunks of trees are not excepted, for these are covered with various kinds of liverwort.

* A kind of moss.

† Another kind of moss.

The desart and most sandy places have their peculiar trees and plants; and as rivers or brooks are very seldom found there, we cannot without wonder observe that many of them distil water, and by that means afford the greatest comfort both to man and beast that travel there. Thus the tillandsia ‡, which is a parasitical plant, and grows on the tops of trees in the desarts of Africa, has its leaves turned at the base into the shape of a pitcher with the extremity expanded: in these the rain is collected, and preserved for thirsty men, birds, and beasts.

‡ A kind of misletoe.

The water-tree in Ceylon produces cylindrical bladders, covered with a lid; into these is secreted a most pure and refreshing water, having the taste of nectar. There is a kind of cuckow-pint in New France, that if you break a branch of it will afford you a pint of excellent water. How wise, how beautiful, is the agreement between the plants of every country, and its inhabitants, and other circumstances!

2. Plants oftentimes by their very structure contribute remarkably both to their own preservation and that of others. But the wisdom of the Creator appears no where more than in the manner of the growth of trees. For as their roots descend deeper than those of other plants, provision is thereby made, that they shall not rob them too much of nourishment; and what is still more, a stem not above a span in diameter often shoots up its branches very high; these bear perhaps many thousand buds, each of which is a plant, with its leaves, flowers, and stipulæ. Now if all these grew upon the plain, they would take up a thousand times as much space as the tree does; and in this case there would scarcely be room in all the earth for so many plants as at present the trees alone afford. Besides, plants that shoot up in this way are more easily preserved from cattle by a natural defence; and farther, their leaves falling in autumn cover the plants growing about against the rigour of the winter; and in the summer they afford a pleasing shade, not only to animals, but to plants, against the intense heat of the sun. We may add, that trees, like all other vegetables, imbibe the water from the earth; which water does not circulate again to the root, as the ancients imigined, but being dispersed, like small rain, by the transpiration of the leaves, moistens the plants that grow around. Again, many trees bear fleshy fruits of the berry or apple kind, which, being secure from the attack of cattle, grow ripe for the use of man and other animals, while their seeds are dispersed up and down after digestion. Lastly, the particular structure of trees contributes very much to the propagation of insects; for these chiefly lay their eggs upon the leaves, where they are secure from the reach of cattle.

Ever-green trees and shrubs in the northern parts are chiefly found in the most barren woods, that they may be a shelter to animals in the winter. They lose their leaves only every third year, as their seeds are sufficiently guarded by the mosses, and do not want any other covering. The palms in the hot countries perpetually keep their leaves, for there the seeds stand in no need of any shelter whatever.

Many plants and shrubs are armed with thorns, *e. g.* the buckthorn, sloe, carduus, cotton-thistle, &c. that they may keep off the animals which otherwise would destroy their fruit. These at the same time cover many other plants, especially of the annual kind, under their branches. Nay it has frequently been observed upon commons where furze grows, that wherever there was a bush left untouched for years by the commoners, some tree has sprung up being secured by the prickles of that shrub from the bite of cattle. So that while the adjacent grounds are robbed of all plants by the voracity of animals, some may be preserved to ripen flowers and fruit, and stock the parts about with seeds, which otherwise would be quite extirpated.

All herbs cover the ground with their leaves, and by their shade hinder it from being totally deprived of that moisture which is necessary to their nourishment. They are moreover an ornament to the earth, especially as leaves have a more agreeable verdure on the upper than on the under side.

The mosses which adorn the most barren places, at the same time, preserve the lesser plants when they begin to shoot, from cold and drought; as we find by experience in our gardens, that plants are preserved in the same way. They also hinder the fermenting earth from forcing the roots of plants upwards in the spring, as we see happen annually to trunks of trees, and other things put into the ground. Hence very few mosses grow in the warmer climates, as not being so necessary to that end in those places.

The English sea mat-weed, or marran, will bear no soil but pure sand, which nature has alloted to it. Sand, the produce of the sea, is blown by winds oftentimes to very remote parts, and deluges, as it were, woods and fields. But where this grass grows, it frequently fixes the sand, gathers it into hillocks, and thrives so much, that by means of this alone at last an entire hill of sand is raised. Thus the sand is kept in bounds, other plants are preserved free from it, the ground is increased, and the sea is repelled by this wonderful disposition of nature. This seems to be the same plant which is called in Scotland *lent*, and is particularly useful for the purpose above-mentioned, and only grows among sand along the sea-coast.

How solicitous nature is about the preservation of grasses is abundantly evident from hence, that the more the leaves of the perennial grasses are eat, the more they creep by the roots, and sends forth offsets. For the Author of nature intended that vegetables of this kind, which have very slender and erect leaves should be copious, and very thick set, covering the ground like a carpet; and thus afford food sufficient for so vast a quantity of grazing animals. But what chiefly increases our wonder is, that although the grasses are the principal food of such animals, yet they are forbid as it were to touch the flower and seed-bearing stems, that so the seeds may ripen and be sown.

The caterpillar or grub of the moth, although it feeds upon grasses, to the great destruction of them in

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in meadows yet it seems to be formed in order to keep a due proportion between these and other plants; for grasses, when left to grow freely, increase to that degree, that they exclude all other plants; which would consequently be extirpated, unless this insect sometimes prepared a place for them. Hence always more species of plants appear in those places where this caterpillar has laid waste the pastures the preceding year than at any other time.

III. Destruction.

Daily experience teaches us, that all plants, as well as other created things, must submit to death.

They spring up, they grow, they flourish they ripen their fruit, they wither, and at last, having finished their course they die, and return to the dust again, from whence they first took their rise. Thus all black mould, which every where covers the earth, for the greatest part is owing to dead vegetables. For all roots descend into the sand by their branches, and after a plant has lost its stem the root remains; but this too rots at last; and changes into mould. By this means this kind of earth is mixed with sand, by the contrivance of nature, nearly in the same way as dung thrown upon fields is wrought into the earth by the industry of the husbandman. The earth thus prepared offers again to plants from its bosom what it has received from them. For when seeds are committed to the earth, they draw to themselves, accomodate to their nature, and turn into plants, the more subtile parts of this mould by the co-operation of the sun air, and rains; so that the tallest tree is, properly speaking, nothing but mould wonderfully compounded with air and water, and modified by a virtue communicated to a small seed by the Creator. From these plants when they die, just the same kind of mould is formed as gave birth to them originally; whence fertility remains continually uninterrupted. Whereas the earth could not make good its annual consumption, unless it were constantly recruited by new supplies.

The crustaceous liverworts are the first foundation of vegetation; and therefore are plants of the utmost consequence in the œconomy of nature, though so despised by us. When rocks first immerge out of the sea, they are so polished by the force of the waves, that scarce any herb can find a fixed habitation upon them; as we may observe every where near the sea. But the very minute crustaceous liverworts begin soon to cover these dry rocks, although they have no other nourishment but that small quantity of mould and imperceptible particles which the rain and the air bring thither.

These liverworts dying at last turn into a very fine earth; on this earth the imbricated liverworts find a bed to strike their roots in. These also die after a time and turn to mould; and then the various kinds of mosses, *e. g.* the hypna, the brya, polytricha, find a proper place and nourishment. Lastly these dying in their turn, and rotting, afford such plenty of new-formed mould, that herbs and shrubs easily root and live upon it.

That trees, when they are dry or are cut down, may not remain useless to the world, and lie as it were melancholy spectacles, nature hastens on their destruction in a singular way: first, the liverworts begin to strike root in them; afterwards the moisture is drawn out of them: whence putrefaction follows. Then the mushroom kinds find a fit place for nourishment on them and corrupt them still more. The beetle called *dermestes* next makes himself a way between the bark and the wood. The musk-beetle, the copper tale-beetle, and the caterpillar or cossua 812 *(S.N.)* bores an infinite number of holes through the trunk. Lastly, the woodpeckers come, and, while they are seeking for insects, wear away the tree already corrupted: till the whole passes into earth. Such industry does nature use to destroy the trunk of a tree! Nay, trees immersed in water would scarcely ever be destroyed, were it not for the worm which eats ships, which performs this work; as the sailor knows by sad experience.

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Thistles, as the most useful of plants, are armed and guarded by nature herself. Suppose there were a heap of clay, on which for many years no plant has sprung up; let the seeds of the thistle blow there, and grow, the thistles by their leaves attract the moisture out of the air, send it into the clay by means of their roots, will thrive themselves, and afford a shade. Let now other plants come hither, and they will soon cover the ground.

All succulent plants make ground fine, of a good quality, and in great plenty; as sedum, crassula, aloe, algæ. But dry plants make it more barren, as heath, pines, moss; and therefore nature has placed the succulent plants on rocks and the driest hills.

Sect. IV. *The Animal Kingdom.*

I. Propagation.

1. The generation of animals holds the first place among all things that raise our admiration when we consider the works of the Creator; and chiefly that appointment by which he has regulated the conception of the fœtus, and its exclusion, that it should be adapted to the disposition and way of living of each animal, is most worthy of our attention.

We find no species of animals exempt from the stings of love, which is put into them to the end that the Creator's mandate may be executed, *Increase and multiply:* and that thus the egg, in which is contained the rudiment of the fœtus, may be fecundated: for without fecundation all eggs are unfit to produce an offspring.

Foxes and wolves, struck with these stings, every where howl in the woods; crowds of dogs follow the female; bulls show a terrible countenance, and very different from that of oxen. Stags every year have new horns, which they lose after rutting time. Birds look more beautiful than ordinary, and warble all day long through lasciviousness. Thus small birds labour to outsing one another, and cocks to outcrow. Peacocks spread forth again their gay and glorious trains. Fishes gather together, and exult in the water; and grasshoppers chirp, and pipe, as it were, amongst the herbs. The ants gather again into colonies, and repair to their citadels. We pass over many other particulars which this subject affords, to avoid prolixity.

2. The fecundated egg requires a certain and proportionate degree of heat for the expansion of the stamina

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stamina of the embryo. That this may be obtained, nature operates in different manners; and therefore we find in different classes of animals a different way of excluding the fœtus.

The females of quadrupeds have an uterus, contrived for easy gestation, temperate and cherishing warmth, and proper nourishment of the fœtus, as most of them live upon the earth, and are there fed.

Birds, in order to get subsistence, and for other reasons, are under a necessity of shifting place; and that not upon their feet, but wings. Gestation therefore would be burthensome to them. For this reason they lay eggs, covered with a hard shell. These they sit upon by a natural instinct, and cherish till the young one comes forth.

The ostrich and cassowary are almost the only birds that do not observe this law; these commit their eggs to the sand, where the intense heat of the sun excludes the fœtus.

Fishes inhabit cold waters, and most of them have cold blood; whence it happens that they have not heat sufficient to produce the fœtus. The all-wise Creator therefore has ordained, that most of them should lay their eggs near the shore; where, by means of the solar rays, the water is warmer, and also fitter for that purpose; and also because water-insects abound more there, which afford the young fry nourishment.

Salmon, when they are about to lay their eggs, are led by instinct to go up the stream, where the water is fresh and more pure.

The butterfly-fish is an exception, for that brings forth its fœtus alive.

The fish of the ocean, which cannot reach the shores by reason of the distance, are also exempt from this law. The Author of nature has given to this kind eggs that swim; so that they are hatched amidst the swimming fucus, called *sargazo**.

* Flor. Zeyl. 389.

The cetaceous fish have warm blood; and therefore they bring forth their young alive, and suckle them with with their teats.

Many amphibious animals bring forth live fœtuses, as the viper and the toad, &c. But the species that lay eggs, lay them in places where the heat of the sun supplies the warmth of the parent.

Thus the rest of the frog kind, and the lizard kind, lay their eggs in warm waters; the common snake, in dunghills, and such like warm places; and give them up to nature, as a provident nurse, to take care of them. The crocodile and sea-tortoises go ashore to lay their eggs under the sand, where the heat of the sun hatches them.

Most of the insect kind neither bear young nor hatch eggs: yet their tribes are the most numerous of all living creatures; insomuch, that if the bulk of their bodies were proportionate to their quantity, they would scarce leave room for any other kinds of animals. Let us see therefore with what wisdom the Creator has managed about the propagation of these minute creatures. The females by natural instinct meet and copulate with the males; and afterwards lay their eggs: but not indiscriminately in every place. For they all know how to choose such places as may supply their offspring in its tender age with nourishment, and other things necessary to satisfy their natural wants: for the mother, soon after she has laid her eggs, dies; and were she to live, she would not have it in her power to take care of her young.

Butterflies, moths, some beetles, weevils, bugs, cuckow-spit insects, gall-insects, tree-bugs, &c. lay their eggs on the leaves of plants, and every different tribe chooses its own species of plant. Nay, there is scarce any plant which does not afford nourishment to some insect; and still more, there is scarcely any part of a plant which is not preferred by some of them. Thus one insect feeds upon the flower; another upon the trunk; another upon the root; and another upon the leaves. But we cannot help wondering particularly, when we see how the leaves of some trees and plants, after eggs have been let into them, grow into galls; and form dwellings, as it were, for the young ones. Thus when the gall-insect has fixed her eggs in the leaves of an oak, the wound of the leaf swells, and a knob like an apple arises, which includes and nourishes the embryo.

When the tree-bug has deposited its eggs in the boughs of the fir-tree, excrescences arise shaped like pearls. When another species of the tree-bug has deposited its eggs in the mouse-ear chickweed or the speedwell, the leaves contract in a wonderful manner into the shape of a head. The water-spider excludes eggs either on the extremities of the juniper, which from thence forms a lodging, that looks like the arrow-headed grass; or on the leaves of the poplar, from whence a red globe is produced. The tree-louse lays its eggs on the leaves of the black poplar, which turn into a kind of inflated bag; and so in other instances. Nor is it upon plants only that insects live and lay their eggs. The gnats commit theirs to stagnating waters. The water-insect called *monoculus* often increases so immensely on pools, that the red legions of them have the apearance of blood. Others lay their eggs in other places: *e. g.* the beetle, in dunghills; the dermestes, in skins; the flesh fly, in putrified flesh: the cheese-maggot, in the cracks of cheese, from whence the caterpillars issuing forth, ofentimes consume the whole cheese, and deceive many people, who fancy the worms are produced from the particles of the cheese itself, by a generation called *equivocal*, which is extremely absurd. Others exclude their eggs upon certain animals. The mill-beetle lays its eggs between the scales of fishes: the species of gad-fly, on the back of cattle; the species 1025 *(S. N.)* on the back of the rein-deer; the species 1026, in the noses of sheep. The species 1028 lodges during the winter in the intestinal tube, or the throat of horses, nor can it be driven out till the summer comes on. Nay, insects themselves are often surrounded with the eggs of other insects, insomuch that there is scarcely an animal to be found which does not afford food for other animals. Almost all the eggs of insects, when laid, are ordained to undergo, by a wonderful law of nature, various metamorphoses, *e. g.* the egg of the butterfly, being laid in the cabbage, first of all becomes a caterpillar, that feeds on the herb, crawls, and has 16 feet. This afterwards changes into a nymph, that has no feet, is smooth, and eats nothing; and lastly, this bursts into a butterfly that flies, has variety of colours, is hairy, and lives upon honey. What can be more worthy of admiration than that one and the same animal should appear on the stage of life under so many characters, as if it were three distinct animals. Linnæus (*Amæn. Academ.* tom. ii.) in a treatise on the wonders relating to insects, says, "As surprising as these transformations may seem, yet much the same happens when a chicken is hatched; the only difference is, that this chicken breaks all three coats at once, the butterfly one after another."

The laws of generation of worms are still very obscure; as we find they are sometimes produced by eggs, sometimes by offsets, just in the same manner as happens to trees. It has been observed with the greatest admiration, that the polypus or hydra (*S. N.* 221.) lets down shoots and live branches, by which it is multiplied. Nay more, if it be cut into many parts, each segment, put into the water, grows into a perfect animal; so that the parts which were torn off are restored, and form a complete and perfect animal like that from which it was torn.

3. The multiplication of animals is not tied down to the same rules in all; for some have a remarkable power of propagating, others are confined within narrow limits in this respect. Yet in general we find, that nature observes this order, that the least animals, and those which are useful and serve for nourishment to the greatest number of other animals, are endued with a greater power of propagating than others.

Mites, and many other insects, will multiply to a thousand within the compass of a very few days; while the elephant scarcely produces one young in two years.

The hawk-kind generally lay not above two eggs, at most four; while the poultry kind produce from 50 to 100.

The diver, or loon, which is eaten by few animals, lays also two eggs; but the duck kind, the moorgame, partridges, &c. and small birds, lay a very large number.

If you suppose two pigeons to hatch nine times a-year, they may produce in four years 14,760 young. They are endued with this remarkable fertility, that they may serve for food, not only for man, but for hawks and other birds of prey. Nature has made harmless and esculent animals fruitful. She has forbid the bird kinds to fall short of the number of eggs allotted to each species: and therefore, if the eggs which they intend to sit upon be taken away a certain number of times, they presently lay others in their room, as may be seen in the swallow, duck, and small birds.

II. Preservation.

1. Preservation follows generation: this appears chiefly in the tender age, while the young are unable to provide for their own support. For then their parents, though otherwise ever so fierce in their disposition, are affected with a wonderful tenderness or sense of love towards their progeny, and spare no pains to provide for, guard, and preserve them; and that not by an imaginary law, but one given by the Lord of nature himself.

Quadrupeds give suck to their tender young, and support them by a liquor perfectly easy of digestion, till nature enables them to digest what is more solid. Nay, their love toward them is so great, that they endeavour to repel with the utmost force every thing which threatens danger or destruction to them. The ewe, which brings forth two lambs at a time, will not admit one to her teats unless the other be present and suck also; lest one should famish, while the other grows fat.

Birds build their nests in the most artificial manner, and line them as soft as possible, for fear the eggs should get any damage. Nor do they build promiscuously in any place, but there only where they may quietly lie concealed and be safe from the attacks of their enemies.

The hanging bird makes its nest of the fibres of withered plants, and the down of the poplar seeds, and fixes it upon the bough of some tree hanging over the water, that it may be out of reach.

The diver places its swimming nest upon the water itself, amongst the rushes. We designedly pass over many instances of the like kind.

Again, birds sit on their eggs with so much patience, that many of them choose to perish with hunger, rather than expose the eggs to danger by going to seek for food.

The male rooks and crows, at the time of incubation, bring food to the females.

Pigeons, small birds, and other birds which pair, sit by turns; but where polygamy prevails, the males scarcely take any care of the young.

Most of the duck kind pluck off their feathers in great quantity, and cover their eggs with them, lest they should be damaged by the cold when they quit their nests for the sake of food; and when the young are hatched, who knows not how solicitous they are in providing for them till they are able to fly and shift for themselves?

Young pigeons would not be able to make use of hard seeds for nourishment, unless the parents were to prepare them in their crops, and thence feed them.

The owl called the *eagle-owl* makes its nest on the highest precipices of mountains, and in the warmest spot, facing the sun; that the dead bodies brought there may by the heat melt into a soft pulp, and become fit nourishment for the young.

As an exception indeed to this fostering care of animals, may be mentioned the cuckow, which lays its eggs in the nest of other small birds, generally the wag-tail, yellow hammer, or white-throat, and leaves the incubation or preservation of the young to them. This custom of the cuckow is so extraordinary, and out of the common course of nature, that it would not be credible were it not for the testimony of the most knowing and curious natural-historians, such as Ray, Willoughby, Gesner, Aldrovandus, Aristotle, &c. But this seeming want of instinct is accounted for from the structure and situation of its stomach, which disqualifies it for incubation †; and its instinctive care is still conspicuous in providing a proper, though a foreign, nidus for its eggs.

† See the article Cucubus.

Amphibious animals, fishes, and insects, which cannot come under the care of their parents, yet owe this to them, that they are put in places where they easily find nourishment.

2. As soon as animals come to maturity, and want no longer the care of their parents, they attend with the utmost labour and industry, according to the law and œconomy appointed for every species, to the preservation

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servation of their lives. But that so great a number of them, which occur every-where, may be supported, and a certain and fixed order may be kept up amongst them, behold the wonderful disposition of the Creator, in assigning to each species certain kinds of food, and in putting limits to their appetites. So that some live on particular species of plants, which particular regions and soils only produce; some on particular animalcula; others on carcases; and some even on mud and dung. For this reason, Providence has ordained that some should swim in certain regions of the watery element; others should fly: some should inhabit the torrid, the frigid, or the temperate zones; and others should frequent desarts, mountains, woods, pools, or meadows, according as the food proper to their nature is found in sufficient quantity. By this means there is no terrestrial tract, no sea, no river, no country, but what contains and nourishes various kinds of animals. Hence also an animal of one kind cannot rob those of another kind of its aliment; which, if it happened, would endanger their lives or health: and thus the world at all times affords nourishment to so many and so large inhabitants, at the same time that nothing which it produces is useless or superfluous.

It will not be here amiss to produce some instances by which it will appear how providentially the Creator has furnished every animal with such cloathing as is proper for the country where they live, and also how excellently the structure of their bodies is adapted to their particular way of life; so that they seem to be destined solely to the places where they are found.

Monkeys, elephants, and rhinoceroses, feed upon vegetables that grow in hot countries, and therefore therein they have their allotted places. When the sun darts forth its most fervid rays, these animals are of such a nature and disposition, that it does them no manner of hurt; nay, with the rest of the inhabitants of those parts, they go naked; whereas, were they covered with hairy skins, they must perish with heat.

On the contrary, the place of rein-deer is fixed in the coldest part of Lapland, because their chief food is the liverwort, which grows no-where so abundantly as there; and where, as the cold is most intense, the rein-deer are clothed, like the other northern animals, with skins filled with the densest hair, by the help of which they easily defy the keeness of the winter. In like manner the rough-legged partridge passes its life in the very Lapland Alps, feeding upon the seeds of the dwarf birch; and, that they may run up and down safely amidst the snow, their feet are feathered.

The camel frequents the sandy and burning desarts, in order to get the barren camel's-hay. How wisely has the Creator contrived for him! he is obliged to go through the desarts, where oftentimes no water is found for many miles about. All other animals would perish with thirst in such a journey: but the camel can undergo it without suffering; for his belly is full of cells, where he reserves water for many days. It is reported by travellers, that the Arabians, when in travelling they want water, are forced to kill their camels, and take water out of their bellies that is perfectly good to drink, and not at all corrupted.

The pelican likewise lives in desart and dry places; and is obliged to build her nest far from the sea, in order to procure a greater share of heat to her eggs. She is therefore forced to bring water from afar for herself and her young; for which reason providence has furnished her with an instrument most adapted to this purpose: She has a very large bag under her throat, which she fills with a quantity of water sufficient for many days; and this she pours into the nest, to refresh her young, and teach them to swim.

The wild beasts, lions, and tygers, come to this nest to quench their thirst, but do no hurt to the young.

Oxen delight in low grounds, because there the food most palatable to them grows.

Sheep prefer naked hills, where they find a particular kind of grass called the *festuca*, which they love above all things.

Goats climb up the precipices of mountains, that they may browse on the tender shrubs; and in order to fit them for it, they have feet made for jumping.

Horses chiefly resort to woods, and feed upon leafy plants.

Nay, so various is the appetite of animals, that there is scarcely any plant which is not chosen by some, and left untouched by others. The horse gives up the water-hemlock to the goat. The cow gives up the long-leaved water-hemlock to the sheep. The goat gives up the monks-head to the horse, &c.; for that which certain animals grow fat upon, others abhor as poison. Hence no plant is absolutely poisonous, but only respectively. Thus the spurge, that is noxious to man, is a most wholesome nourishment to the caterpillar. That animals may not destroy themselves for want of knowing this law, each of them is guarded by such a delicacy of taste and smell, that they can easily distinguish what is pernicious from what is wholesome; and when it happens that different animals live upon the same plants, still one kind always leaves something for the other, as the mouths of all are not equally adapted to lay hold of the grass; by which means there is sufficient food for all. To this may be referred an œconomical experiment well known to the Dutch, that when eight cows have been in a pasture, and can no longer get nourishment, two horses will do very well there for some days; and when nothing is left for the horses, four sheep will live upon it.

Swine get provision by turning up the earth: for there they find the succulent roots, which to them are very delicious.

The leaves and fruits of trees are intended as food for some animals, as the sloth, the squirrel; and these last have feet given them fit for climbing.

Besides myriads of fishes, the castor, the sea-calf, and others, inhabit the water, that they may there be fed; and their hinder-feet are fit for swimming, and perfectly adapted to their manner of life.

The whole order of the goose-kind, as ducks, merganser, &c. pass their lives in water, as feeding upon water-insects, fishes, and their eggs Who does not see, that attends ever so little, how exactly the wonderful formation of their beaks, their necks, their feet, and their feathers, suit their kind of life; which obser-

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observation ought to be extended to all other birds.

The way of living of the sea-swallow deserves to be particularly taken notice of; for, as he cannot so commodiously plunge into the water, and catch fish, as other aquatic birds, the Creator has appointed the sea-gull to be his caterer, in the following manner: When this last is pursued by the former, he is forced to throw up part of his prey, which the other catches; but in the autumn, when the fishes hide themselves in deep places, the merganser supplies the gull with food, as being able to plunge deeper into the sea.

The chief granary of small birds is the knot grass, that bears heavy seeds, like those of the black-bindweed. It is a very common plant, not easily destroyed, either by the road-side by trampling upon it, or any where else; and is extremely plentiful after harvest in fields, to which it gives a reddish hue by its numerous seeds. These fall upon the ground, and are gathered all the year round by the small birds. To which we may add, that many small birds feed upon the seeds of plantain, particularly linnets. It is generally known that the goldfinch lives upon the seed of thistles, from which he has its name in Latin and French. Thus bountiful nature feeds the *fowls of the air*.

The Creator has taken no less care of some amphibious animals, as the snake and frog kind; which, as they have neither wings to fly, nor feet to run swiftly and commodiously, would scarcely have any means of taking their prey, were it not that some animals run, as it were, of their own accord, into their mouths. When the rattle-snake, a native of America, with open jaws fixes his eyes upon a bird, fly, or squirrel, sitting on a tree, they fly down his throat, being rendered stupid, and giving themselves up as destitute of all refuge. How dreadful this serpent is to other animals will appear by an account we have in a treatise entitled, *Radix Senega*. Where the author (*Amœn. Academ.* tom. 2.) says, one of these terrible serpents got clandestinely into the house of governor Blake at Carolina; where it would have long lain concealed, had it not been that all the domestic animals, as dogs, hogs, turkeys, and fowls, admonished the family by their unusual cries, equally showing their horror and consternation, their hair, bristles, and crests, standing up on end. On the other hand, we cannot but adore the Creator's great goodness towards man, when we consider the rattle which terminates this serpent's tail; for by means of that we have an opportunity of guarding against this dreadful enemy; the sound warning us to fly; which if we were not to do, and we should be wounded by him, the whole body would be turned into a putrid corruption in six hours, nay sometimes in half an hour.

The limits of this article will not permit us to produce more examples of this kind. But whoever will be at the pains to take ever so slight a view of the wonderful works of the Author of nature, will readily see how wisely the plan, order, and fitness of things with divine ends, are disposed.

3. We cannot without the utmost admiration behold how providentially the Creator has acted as to the preservation of those animals which, at a certain time of the year, are by the rigour of the season excluded from the necessaries of life. Thus the bear in the autumn creeps into the moss which he has gathered, and there lies all winter; subsisting upon no other nourishment but his fat, collected during the summer in the cellulous membrance, and which without doubt, during his fast, circulates through his vessels, and supplies the place of food; to which perhaps is added that fat juice which he sucks out of the bottom of his feet.

The hedge-hog, badger, and mole, in the same manner fill their winter-quarters with vegetables, and sleep during the frosts. The bat seems cold and quite dead all the winter. Most of the amphibious animals get into dens, or to the bottom of lakes and pools.

In the autumn, as the cold approaches, and insects disappear, swallows migrate into other climes in search of food and a temperature of air more friendly to their constitution: though the latter hatches, or those young birds which are incapable of distant flights, seek for an asylum against the violence of the cold in the bottom of lakes amongst the reeds and rushes; from whence, by the wonderful appointment of nature, they come forth again. See the article Hirundo. The peristaltic motion of the bowels ceases in all these animals while they are obliged to fast; whence the appetite is diminished, and so they suffer the less from hunger. To this head may be referred the observation of the celebrated Lister concerning those animals. That their blood, when let into a vessel, does not coagulate, as that of all other animals; and so is no less fit for circulation than before.

The moor-fowls work themselves out walks under the very snow. They moult in the summer; so that about the month of August they cannot fly, and are therefore obliged to run into the woods; but then the moor-berries and bilberries are ripe, from whence they are abundantly supplied with food. Whereas the young do not moult the first summer; and therefore, though they cannot run so well, are able to escape danger by flight.

The rest of the birds who feed upon insects migrate every year to foreign regions, in order to seek for food in a milder climate; while all the northern parts, where they live well in the summer, are covered with snow.

By these migrations, birds also become useful to many different countries, and are distributed over almost all the globe. And it must excite our admiration that all of them exactly observe the times of coming and going, and that they do not mistake their way.

Insects in the winter generally lie hid within their cases, and are nourished by the surrounding liquor like the fœtus of other animals; from whence, at the approach of spring, they awake, and fly forth, to the astonishment of every one.

However, all animals which lie hid in winter do not observe these laws of fasting. Some provide storehouses in summer and autumn, from which they take what is necessary; as mice, jays, squirrels, bees.

III. Destruction.

1. We have observed above, that all animals do not live upon vegetables, but that there are some which feed

feed upon certain animalcula. Nay, there are some which subsist only by rapine, and daily destroy numbers of the peaceable kind.

These animals are destroyed, but in such a manner that the weaker generally are infested by the stronger in a continued series. Thus the tree-louse lives upon plants. The fly called *musca aphidivora* lives upon the tree-louse; the hornet and wasp-fly, upon the musca aphidivora; the dragon fly, upon the hornet and wasp-fly; the spider, on the dragon-fly; the small birds on the spider; and lastly, the hawk kind on the small birds.

In like manner, the monoculus delights in putrid waters, the gnat eats the monoculus, the frog eats the gnat, the pike eats the frog, the sea-calf eats the pike.

The bat and goat sucker make their excursions only at night, that they may catch the moths, which at that time fly about in vast quantities.

The woodpecker pulls out the insects which lie hid in the trunks of trees.

The swallow pursues those which fly about in the open air.

The mole pursues worms. The large fishes devour the small. Nay, we scarcely know an animal which has not some enemy to contend with.

Amongst quadrupeds wild beasts are most remarkably pernicious and dangerons to others, as the hawk kind among birds. But that they may not, by too attrocious a butchery, destroy a whole species, even these are circumscribed within certain bounds. First, as to the most fierce of all, it deserves to be noted how few they are in proportion to other animals. Secondly, the number of them is not equal in all countries. Thus France and England breed no wolves, and the northern countries no tygers or lions. Thirdly, these fierce animals sometimes fall upon and destroy one another. Thus the wolf devours the fox. The dog infests both the wolf and fox; nay, wolves in a body will sometimes venture to surround a bear. The tiger often kills its own male whelps. Dogs are sometimes seized with madness, and destroy their fellows, or with the mange destroy themselves.

Lastly, wild beasts seldom arrive at so great an age as animals which live on vegetables. For they are subject, from their alkaline diet, to various diseases which bring them sooner to an end.

But although all animals are infested by their peculiar enemies, yet they are often able to elude their violence by stratagems and force. Thus the hare often confounds the dog by her windings.

When the bear attacks sheep and cattle, these draw up together for mutual defence. Horses join heads together, and fight with their heels. Oxen join tails, and fight with their horns.

Swine get together in herds, and boldly oppose themselves to any attack, so that they are not easily overcome; and it is worth while to observe, that all of them place their young, as less able to defend themselves, in the middle that they may remain safe during the battle.

Birds, by their different ways of flying, oftentimes escape the hawk. If the pigeon had the same way of flying as the hawk, she would hardly ever escape his claws.

It deserves also to be remarked, how much some animals consult their safety by night. When horses sleep in woods, one by turn remains awake, and, as it were, keeps watch. When monkeys in Brasil sleep upon trees, one of them keeps awake, in order to give the sign when the tiger creeps towards them; and in case the guard should be caught asleep, the rest tear him to peices. Hence rapacious animals are not always successful in their hunting, and are often obliged to labour for a whole day to no purpose. For this reason the Creator has given them such a nature, that they can bear fasting a long time. Thus the lion lurks in his den many days without famishing; and the wolf when he has once well satisfied his hunger, can fast many weeks without any difficulty.

If we consider the end for which it pleased the Supreme Being to constitute such an order of nature, that some animals should be, as it were, created only to be miserably butchered by others, it seems that his Providence not only aimed at sustaining, but also keeping a just proportion amongst all the species; and so prevent any one of them from increasing too much, to the detriment of men and other animals. For if it be true, as it most assuredly is, that the surface of the earth can support only a certain number of inhabitants, they must all perish if the same number were doubled or trebled.

There are some viviparous flies which brings forth 2000 young. These in a little time would fill the air, and like clouds intercept the rays of the sun, unless they were devoured by birds, spiders, and many other animals.

Storks and cranes free Egypt from frogs, which, after the inundation of the Nile, cover the whole country. Falcons clear Palestine of mice. Bellonius on this subject says as follows: "The storks come to Egypt in such abundance, that the fields and meadows are white with them. Yet the Egyptians are not displeased with this sight; as frogs are generated in such numbers there, that did not the storks devour them, they would over-run every thing. Besides, they also catch and eat serpents. Between Belba and Gaza, the fields of Palestine are often desart on account of the abundance of mice and rats; and were they not destroyed by the falcons that come here by instinct, the inhabitants could have no harvest."

The white fox is of equal advantage in the Lapland Alps; as he destroys the Norway rats, which are generated there in great abundance, and thus hinder them from increasing too much in proportion, which would be the destruction of vegetables.

It is sufficient for us, that nothing is made by Providence in vain; and that whatever is made, is made with supreme wisdom. For it does not become us to pry too boldly into all the designs of God. Let us not imagine, when these rapacious animals sometimes do us mischief, that the Creator planned the order of nature according to our private principles of œconomy: for the Laplanders have one way of living; the European husbandman another, the Hottentots and savages a third; whereas the stupendous œconomy of the Deity is one throughout the globe; and if Providence does not always calculate exactly according to our way of reckoning, we ought to consider this affair in the same light, as when different seamen

men wait for a fair wind, every one with respect to the part he is bound to, who we plainly see cannot all be satisfied.

2. The whole earth would be overwhelmed with carcases and stinking bodies, if some animals did not delight to feed upon them. Therefore, when an animal dies, bears, wolves, foxes, ravens, &c. do not lose a moment till they have taken all away. But if a horse *e.g.* dies near the public road, you will find him, after a few days, swoln, burst, and at last filled with innumerable grubs of carniverous flies, by which he is entirely consumed, and removed out of the way, that he may not become a nuisance to passengers by his poisonous stench.

When the carcases of fishes are driven upon the shore, the voracious kinds, such as the thornback, the hound-fish, the conger-eel, &c. gather about and eat them. But because the flux and reflux soon change the state of the sea, they themselves are often detained in pits, and become a prey to the wild beasts that frequent the shores. Thus the earth is not only kept clean from the putrefaction of carcases, but at the same time, by the œconomy of nature, the necessaries of life are provided for many animals. In the like manner many insects at once promote their own good, and that of other animals. Thus gnats lay their eggs in stagnant, putrid, and stinking waters, and the grubs that arise from these eggs clear away all the putrefaction: and this will easily appear, if any one will make the experiment by filling two vessels with putrid water, leaving the grubs in one, and taking them all out of the other: for then he will soon find the water that is full of grubs pure and without any stench, while the water that has no grubs will continue stinking.

Lice increase in a wonderful manner in the heads of children that are scabby; nor are they without their use, for they consume the redundant humours.

The beetle kind in summer extract all moist and glutinous matter out of the dung of cattle, so that it becomes like dust, and is spread by the wind over the ground. Were it not for this, the vegetables that lie under the dung would be so far from thriving that all that spot would be rendered barren.

As the excrements of dogs is of so filthy and sceptic a nature that no insect will touch them, and therefore they cannot be dispersed by that means, care is taken that these animals should exonerate upon stones, trunks of trees or some high place that vegetables may not be hurt by them.

Cats bury their dung. Nothing is so mean, nothing so little in which the wonderful order and wise disposition of nature do not shine forth.

Lastly, all these treasures of nature, so artfully contrived, so wonderfully propagated, so providentially supported throughout her three kingdoms, seem intended by the Creator for the sake of man. Every thing may be made subservient to his use, if not immediately, yet mediately; not so to that of other animals. By the help of reason man tames the fiercest animals; pursues and catches the swiftest; nay, he is able to reach even those which lie hid in the bottom of the sea.

By the help of reason, he increases the number of vegetables immensely, and does that by art which nature left to herself, could scarcely effect. By ingenuity he obtains from vegetables whatever is convenient or necessary for food, drink, cloathing, medicine, navigation, and a thousand other purposes.

He has found the means of going down into the abyss of the earth, and almost searching its very bowels. With what artifice has he learned to get fragments from the most rocky mountains, to make the hardest stones fluid like water, to separate the useful metal from the useless dross, and to turn the finest sand to some use! In short, when we follow the series of created things, and consider how providentially one is made for the sake of another, the matter comes to this, that all things are made for the sake of man; and for this end more especially, that he, by admiring the works of the Creator, should extol his glory, and at once enjoy all those things of which he stands in need, in order to pass his life conveniently and pleasantly.

Besides general natural histories, which we have here given a specimen of, as those of Pliny, &c. there are likewise particular ones, and those of two kinds. The first, those which only consider one kind of things; such as the History of Shells, by Dr Lister; of Fishes, by Willoughby; that of Birds, by the same; that of Plants, by Ray; those of insects, by Swammerdam and Mouffet; that of Animals, by Gesner; that of Fossils, by Agricola, Mercatus, &c.

The second, those which consider the several kinds of natural things found in particular countries or provinces: as, the Natural History of Dauphine, by Chorier; the Natural History of the Antilles. by F. Du Tertre, and M. Lonvillers De Poincy; that of Oxfordshire and Staffordshite, by Dr Plott; that of Lancashire, by Leigh; of Northamptonshire, by Morton; that of the Western Islands, by Martin, &c.

The natural history only of one particular place, is a subject very extensive in its materials, and not to be set about without great care and circumspection. Mr Boyle has favoured the world with a list of the heads under which to arrange things, and what to enquire after on such an occasion.

The general heads under which he comprehends the articles of this history are four; the things which regard to the heavens, the air, the waters and the earth.

To these general heads Mr Boyle imagines should be added, inquiries into traditions in the country, of any thing relating to it, whether peculiar to it, or only more common there than elsewhere; and where these require learning or skill in the answerer, the utmost care is to be taken to put the people in a way to give their accounts in a satisfactory manner; for a false or bad account of any thing is always much worse than no account at all.

This subject concerning the works of nature, a very small part of which we have been able to touch upon, is of such importance and dignity that if it were to be properly treated in all its parts, men would find wherewithal to employ almost all the powers of the mind: nay, time itself would fail before, with the most acute human sagacity, we should be able to discover the amazing œconomy, laws, and exquisite structure, even of the least insect, since, as Pliny observes, nature nowhere appears more herself than in her most minute works.

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Summary as it is, however, the preceding view, as it were in a map, of the several parts of nature, their connections and dependencies, may at least, perhaps, convey an useful lesson, and such an one as the best of us often need to have inculcated.

From a partial consideration of things, we are very apt to criticise what we ought to admire; to look upon as useless what perhaps we should own to be of infinite advantage to us, did we see a little farther; to be peevish where we ought to give thanks; and at the same time to ridicule those who employ their time and thoughts in examining what we were (*i. e.* some of us most assuredly were) created and appointed to study. In short, we are too apt to treat the Almighty worse than a rational man would treat a good mechanic, whose works he would either thoroughly examine or be ashamed to find any fault with. This is the effect of a partial consideration of nature; but he who has the candour of mind and leisure to look farther, will be inclined to wonder and adore, and even to cry out with the poet,

How wond'rous is this scene! where all is form'd
With number, weight, and measure! all design'd
For some great end! where not alone the plant
Of stately growth; the herb of glorious hue,
Or food-full substance: not the labouring steed;
The herd, and flock, that feed us; not the mine
That yields us stores for elegance and use;
The sea that loads our table; and conveys
The wanderer man from clime to clime; with all
Those rolling spheres, that from on high shed down
Their kindly influence; not these alone,
Which strike ev'n eyes incurious; but each moss,
Each shell, each crawling insect, holds a rank
Important in the plan of Him who fram'd
This scale of beings; holds a rank, which lost
Would break the chain and leave behind a gap
Which nature's self would rue. Almighty Being,
Cause and support of all things, can I view
These objects of my wonder, can I feel
These fine sensations, and not think of thee?
Thou who dost thro' th' eternal round of time,
Dost thro' th' immensity of space exist
Alone, shalt thou alone excluded be
From this thy universe? shall feeble man
Think it beneath his proud philosophy
To call for thy assistance, and pretend
To frame a world, who cannot frame a clod;—
Not to know thee, is not to know ourselves——
Is to know nothing—nothing worth the care
Of man's exalted spirit—All becomes,
Without thy ray divine, one dreary gloom,
Where lurk the monsters of fantastic brains,
Order bereft of thought, uncaus'd effects,
Fate freely acting, and unerring Chance.
Where meanless matter to a chaos sinks,
Or something lower still: for without thee
It crumbles into atoms void of force,
Void of resistance—It eludes our thought.
Where laws eternal to the varying code
Of self love dwindle. Interest, passion, whim,
Take place of right and wrong: the golden chain
Of being melts away, and the mind's eye
Sees nothing but the present. All beyond
Is visionary guess—is dream—is death.

THOMSON

We shall add to this article the following description of a museum: The windows ought to be in the two longest sides of the building, that it may be equally lighted during the whole day.

On one wing of the museum must be placed eleven presses, with shelves supported on wooden brackets. These presses are intended for containing the eleven following classes of the *mineral kingdom* (a kingdom which forms the original basis of every thing pertaining to this globe: minerals have neither organization nor life), *viz.*

1. Waters.	7. Semimetals.
2. Earths.	8. Metals.
3. Sands.	9. Bitumens and sulphurs.
4. Stones.	10. Volcanic productions.
5. Salts.	11. Petrifactions, fossils, and *lusus naturæ*.
6. Pyrites	

We at once perceive the advantage of such an arrangement, where every thing is distinct and distributed in the manner most advantageous for the inspection of the student. The presses must be provided with a wire grate, or covered with glass: and each of them must have a title on the cornice, indicating the class which it contains. Besides this, each shelf in the press ought to have a small title on the edge, specifying the kind of substances which are placed on it; and these should be kept in clear glass-bottles, well sealed and furnished with proper titles also. In them are to be seen earths, clays, turfs, ochres, chalks, marls, lapis ollaris, and micaceous stones, calcareous or limestones, spars, congelations, stony residua, stalactites, alabaster, gypsum or plaster-stone, flints, rock-stones, rock and mineral crystals, salts, and pyrites subject to efflorescence, coals, and other bituminous bodies, lava, and the dross of volcanoes. In the bottom of each press two spaces may be reserved and furnished with a considerable number of small semicircular shelves, where pieces much esteemed, and in complete preservation, may be placed by themselves or on very small pedestals; such as transparent mineral salt. collections of coloured pyrites, the stone called the *Inca's* stone, beautiful specimens of cobalt, bismuth, zinc, antimony, ore of fluid quicksilver, and cinnabar in crystals; the whole properly titled and arranged according to their classes.

The press for *metals* ought to present us in the same order with select and rare specimens of the ores of white, green, &c. lead, the ore of nickel, collections of crystallised tin, the *flos-ferri*, beautiful needles of hematite, a powerful rough loadstone, with some platina, the silky copper of China, and a collection of malachite; likewise virgin silver, in vegetation and red silver, together with a collection of golden ore. These substances form a spectacle equally varied and instructive: in this department of her works nature is as rich and brilliant as in the various kinds of stones.

The press for *bitumens* may in like manner contain specimens of jet polished on one side; amber of different colours (which when it is transparent, and contains insects, ought to be polished on the two opposite surfaces); a beautiful specimen of ambergris, together with pieces of transparent red and yellow sulphur.

In the press for *petrifactions* or for *fossils*, we must likewise place, on semicircular shelves, the rarest and the

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the best preserved pieces? such as lilium lapideum non lrepores, transparent belemnites, fossil urchins, the articulated nautilus, cornua ammonis sawed and polished, hysterolite, lapis lenticularis, gryphites calculi or bezoars, turquoises, loadstones, glossopetræ; in short all kinds of figured stones, and also petrified wood.

In the press for *stones*, which has a similar apparatus of shelves, we see different kinds of crystals, and all the precious stones in their matrix. Those which are detached and uncut are placed in cases or watch-glasses: but those which have been cut and set are to be put in a jewel-box or open case for rings. The same is to be observed with regard to pieces, cups, cisterns or polished plates of agate, cornelian, jade, sardonyx, onyx, chalcedony, jasper, porphyry, granite, lapis lazuli, marble, alabaster, and Iceland crystal. Here likewise are to be placed the Bologna stone, the Labrador stone, the serpentine stone, talc, amianthus, zeolite, basaltes, touch-stone, together with Egyptian and English flints. With regard to impressed petrifactions, large arborizations, and Florence stones, if they are in good preservation: they should be framed and suspended by hooks on the pilasters which connect the presses of the mineral kingdom. These presses are of an uniform height; but their breadth is proportioned to the size or number of the materials composing the class which it contains, and they are supported as well as those which are placed all around, on a chest of drawers breast high. These drawers must correspond to the presses above them, and contain substances of the same class. This methodical arrangement is a great help to the memory: because it occasionally supplies the place of a numbered catalogue, and because in a great multitude of objects it is the only means of finding at once what we want.

In the mineral kingdom, these drawers are very useful for containing earths, belemnites, entroches, astroites, and other polymorphus fossils, univalve, bivalve, and multivalve shells, polished petrifactions of bones and pieces of wood, collections of marbles and polished flints, collections of silex, sands, and amber, together with pieces procured from the melting of ores, such as regulus, dross, &c. Some parts of the mineral kingdom, such as the earths and certain stones, make not a brilliant figure in a museum; they are notwithstanding the most scientific parts of it, and the most interesting to those who prefer the solid satisfaction of tracing nature in her most important productions, and her fundamental operations, to the empty spectacle of gaudy colours and agreeable figures.

Minerals in general require to be kept with great care, and so as not to be intermixed. Some of them, such as the salts, easily dissolve: and others, as the pyrites, are subject to efflorescence. Vegetables and animals are likewise more or less liable to corruption; and to prevent this inconvenience, great pains must be taken in preserving certain pieces which are subject to speedy decay.

On the *second* wing of the cabinet are to be placed ten presses, distributed like those of the mineral kingdom, and intended for containing the ten following divisions of the *vegetable kingdom*. Vegetables are organised bodies, but they possess not, like animals spontaneous motion or feeling.

1. Roots.
2. Barks.
3. Woods and stalks.
4. Leaves.
5. Flowers.
6. Fruits and seeds.
7. Parasite plants, also agarics and mushrooms.
8. The juices of vegetables; such as balsams and solid resins, resinous, gums, and gums properly so called.
9. Extracted juices, sugars, and dregs.
10. Marine plants, and plants growing on the shores of the sea.

In this kingdom, the same order of presses, the same symmetry and arrangement, are to be observed as in the mineral kingdom. The semicircular shelves in the bottom of the presses are here very useful for containing in small square phials China varnish, essential oils, and other peculiar aromatics, whether of Arabia or India; together with the roots of cumbou, mandragora, certain fruits either monstrous or natural, which grow in the East Indies, and which the natives ripen in large bottles with narrow necks, preserved in spirits, such as the cashew-nut, &c. Here likewise are placed a number of fruits, remarkable for their rarity or great size; as cocoa nuts, gourds, the fruit of the bastard locust-tree, the fruit of the sand-box-tree, banana figs, pine-apples, coloquintida apple, dogsbane, vegetable tumors or wens, and a branch of *lois de dentelle*, in which the three parts of the bark, especially the *liber*, are distinctly separated.

As the number of vegetables greatly exceeds that of minerals, we seldom put any thing in bottles but the dried parts of exotic plants, which are used either in medicine or in the arts, and those likewise which we cultivate merely from curiosity. With regard to indigenous plants, an *herbal* is formed of land and sea plants, pasted or laid between leaves of paper collected into the shape of a book, and arranged according to the system of the best botanists. To make this herbal as convenient as possible, it is proper to put the dried plants between two folds of dry paper, and, arranging them according to their families, genera, and species, to pile them one one above another, either openly on the shelves or in large band-boxes. On the back of the band-boxes must be a title indicating the family, at the extremity another with the name of the genus, and on each leaf the name of the species which it contains: the paper must be loose, that they may be changed at pleasure. The drawers are useful partly for holding different kinds of woods with the bark, cut in such a manner as that the grain and contexture of it may easily be distinguished, and for containing a collection of the woods of both Indies in small polished pieces with proper titles. One part of the drawers has several divisions within for the purpose of holding seeds; and a small title is inscribed on each of these divisions.

Sea-weeds, and small marine plants of an elegant shape, which from their colour and variety form agreeable pictures, may be framed and suspended by hooks to the pilasters of the presses. In the animal kingdom, particularly insects, it is well known, are attended with irreparable devastations. Butterflies, still

ſtill more than the moſt beautiful birds, are not only ſubject to deſtruction in this way, but are alſo expoſed to great danger from the rays of the ſun, either direct or reflected, which alter their colour, make them loſe all their ſplendor, and, in ſome ſpecies, render it impoſſible to diſtinguiſh them. In general, we cannot prevent the deſtruction of vegetables and animals, but by drying them as much as poſſible, or by putting them in prepared liquors, which muſt not be allowed to evaporate. But dried animals and vegetables require ſtill a greater care: a great multitude of inſects which are bred in the month of April feed upon them and deſtroy them internally before they are perceived: they ought to be carefully watched during the continuance of this plague, which is about five months. In like manner, the moiſture of winter and the heat of ſummer make it neceſſary that the preſſes of muſæums ſhould be kept carefully ſhut, except perhaps thoſe which front to the north. Beſides, the vapour of ſulphur in combuſtion will kill theſe deſtructive inſects either before or after they become perfect ones: the fumigations muſt be carefully performed during dry weather, and in a box made on purpoſe, into which only the ſpecimens attacked are introduced.

On the third wing of the cabinet are placed preſſes for containing the ten following diviſions of the *animal kingdom* (a kingdom which derived the ſubſtance neceſſary to its exiſtence either mediately or immediately from the vegetable kingdom.——Animals poſſeſs feeling and ſpontaneous motion.)

1. Lythophytes
2. Zoophytes.
3. Teſtaceous animals.
4. Cruſtaceous animals.
5. Inſects.
6. fiſhes.
7. Amphibious animals. reptiles, and oviparous quadrupeds.
8. Birds, with their neſts and eggs.
9. Viviparous quadrupeds.
10. Man.

In theſe preſſes the ſame external decoration and diſtribution may be obſerved as in the preceding ones.

The preſs for the *lythophytes* muſt be arranged in ſuch a manner as to preſent at one view the hiſtory of lithophytes, madreporæ, and coral either rough or ſtript of its covering; the whole placed on ſmall wooden pedeſtals, blackened or gilded. Corallines, as well as fuci, may be paſted on a bit of paper, and put into a frame: ſuch pictures, when ſuſpended by hooks to the outſide of the pilaſters, always attract the attention of the ſpectators. If we have a conſiderable collection of them, it will be neceſſary to make a kind of herbal of them.

The preſs for *zoophytes* contains ſponges, the marine jet d' eau, the penna marina, holothuriæ, and all thoſe ſubſtances which are called *animal plants*, molluſcæ, worms, &c. Theſe productions muſt be preſerved in rectified ſpirit of wine, which will be ſufficiently weakened by the water contained in them. Upon the ſides are ſea-ſtars, both prickly and ſmooth, with ſeveral rays, a Meduſa's head, &c.

The *teſtaceous* animals are preſerved in bottles among ſpirits. On the ſemicircular ſhelves at the bottom of the preſs are placed large ſhells, and ſmall ones with their marine covering.

The preſs for *cruſtaceous* animals conſiſts almoſt entirely of ſemicircular ſhelves; and contains crabs, cray-fiſh, &c. Small lobſters, ſquillæ, and all ſmall cruſtaceous animals, excepting the hermit crab, are put in frames.

Two kinds of inſects are found in the preſs deſtined for them. The firſt kind, after being dried, are put in ſmall wooden frames, which are varniſhed and glazed on two ſides, that we may have it in our power to examine the inſect on both ſides: of this kind are flies, mantes, beetles, butterflies with their nymphæ or chryſalides, &c. (Theſe animals form the moſt brilliant part of the cabinet, while the preſs for birds is the moſt ſtriking; but great pains muſt be uſed in their preſervation.) Other inſects, ſuch as graſhoppers, ſcolopendræ, ſcorpions, ſalamanders, ſpiders, tarantulas, caterpillars, and eſpecially all ſoft inſects, muſt be preſerved in ſpirits, and placed on ſemicircular ſhelves at the bottom of the preſs. Here alſo are depoſited honey-combs, waſps neſts, and branches furniſhed with the neſts of thoſe inſects which produce the gum-lac.

In the preſs for *fiſhes* are to be ſeen bottles containing foreign fiſhes, which are always ſent home in ſpirits. The ſoft fiſhes of our own country are preſerved in the ſame manner. The ſkin of large fiſhes, whether found in ſalt or freſh water, is taken off and paſted on a bit of paper: the two parts are ſometimes ſewed together, and the colours are renewed by means of varniſh. The flying fiſh muſt be ſuſpended about the top of the preſs; and armed fiſhes, with oſtracia, on the ſhelves below,

The preſs for *amphibious* animals contains, in bottles full of ſpirit of wine diluted with alum water, ſerpents, vipers, adders, frogs, toads, lizards, ſmall land or water turtles, and a ſmall tortoiſe with its ſhell. The lower ſhelves are furniſhed with a ſmall rattle-ſnake, a cameleon, a crocodile, a beaver, a ſea-lion, a ſea calf, &c.

The preſs for *birds* is filled with animals of that claſs both foreign and natives, ſtuffed and provided with glaſs eyes. The ſkin covered with the feathers may be preſerved perfect and dry by being fitted to a mould of tree moſs, or filled with cotton and ſprinkled on the inſide with pepper, camphire, and corroſive ſublimate, to defend it from the attack of moths, grubs, wood lice, and dermeſtes. The ſpring and autumn are the beſt ſeaſons for this operation; the moulting-time is very improper, becauſe it is unfavourable to the beautiful colour and the preſervation of the feathers, which moreover are then full of blood. The birds, when thus prepared, and when the brain has been taken out, are then placed on their ſupports.—Some females may be placed in their neſts in the attitude of incubation; thoſe which are accuſtomed to perch may be placed on artificial trees: a wooden ſupporter covered with moſs, turf, or artificial reeds, may be given to thoſe which live among ſuch plants.—Swimming birds are placed on the lowermoſt ſhelves, which muſt be covered with pieces of mirrors or ſilver gauze, in imitation of water. We muſt be careful to give each animal the moſt pictureſque attitude: to preſerve the proportions, together with the natural poſition of the legs, wings, head, body, and feathers; to obſerve an equilibrium in thoſe which are at reſt, and to avoid it in thoſe which have a fighting attitude.—We muſt characterize the animal, repreſent his genius,

 diſpoſitions,

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dispositions, graces, boldness, or timidity. In short, we must endeavour to express that beautiful *tout ensemble* which gives the appearance of life and motion to the whole. The deception ought to be such, that those who examine the particulars of the collection may apply to each what was said on another occasion—*Nature is dead, but Art is alive.* These observations on birds are equally applicable to the other animals; but all of them must be arranged in a methodical order, which possesses the advantage necessary in such collections of uniting pleasure with instruction.

The lower shelves contain the eggs and nests of birds; and a collection of feathers is made in a book in the same manner as an *herbal.*

The press for *quadrupeds* contains, preserved in bottles, small animals, such as mice, rats, the opossum, &c. Other animals are stuffed, such as the cat, the squirrel, the hedge hog, the porcupine, the armadillo, the Guinea pig, the wolf, the fox, the roe-buck, the hare, the dog, &c.

The press containing the *history of man* consists of a complete myology, of a head separately injected, of a brain and the organs of generation in both sexes, of a neurology, an osteology, embryos of all different ages, with their after births, monstrous fœtuses, and an Egyptian mummy. Here likewise are put beautiful anatomical pieces in wax or wood, and stony concretions extracted from the human body.

The preservation of subjects in bottles with spirit of wine does not always succeed, because they spoil as the spirit of wine evaporates, unless particular care be taken to examine the vessels wherein they are contained, which requires time and pains, and is attended with expence. Mr Lewis Nicola, in the Philadelphia Transactions for the year 1771, recommends, after using the different methods pointed out by M. Reaumur of putting subjects intended for preservation in bottles filled with spirit of wine, to wipe well the neck of the bottle, and put a layer of putty, two lines thick, over the piece of skin or bladder which covers it. The bottle is then reversed in a wooden cup, which they fill with melted tallow, or with a mixture of tallow and wax to prevent the spirit of wine from evaporating.

The drawers under the presses of the *animal kingdom* contain small detached parts of animals, such as teeth, small horns, jaw-bones, claws, beaks, nails, vertebræ, hairs, scales, balls of hair, and a collection of bones remarkable for blows, fractures, deformities, and diseases.

To decorate a cabinet to the greatest advantage, and to make one complete whole, the walls must be furnished throughout their whole extent. For this purpose the tops of the presses are commonly ornamented with shells of a very great size, foreign wasps-hives, the horn of a rhinoceros, an elephant's trunk, the horn of an unicorn, urns and busts of alabaster, jasper, marble, porphyry, or serpentine stone. Here likewise are placed figures of antique bronze, large lythophytes, animals made of shells, bouquets made of the wings of Scarabæub gourds cut into two, painted, and made into bowls, plates, vases, and as they are used by savages: little trunks of bark, books made of the leaves of the palm-tree, globes, spheres, &c. The multiplicity and singularity of the objects never fail to arrest the attention of the spectator.

The circumference of the cabinet being furnished in the manner we have described, the floor may likewise be paved with different kinds of common stones which are susceptible of a polish.

The ceiling, which must be very white, is divided into three spaces, furnished with hook and brass wires. Here may be distributed in order different vegetable and animal productions, which are of too great a size to be contained in the presses; such as,

1. The sugar-cane, a branch of the palm-tree, together with that called the *Chinese fan*, large cocoas both simple and with a double lobe, the leaf of the banana-tree, Indian and European sticks, remarkable for the knots, tubercles, and spiral wreaths, which cover their whole length, a bamboo root divided longitudinally into two parts, and the different species of reed-canes.

2. The skins of large animals: also stuffed animals, such as lizards, whether a crocodile or caiman and scaly lizard, a shark, a sword-fish, a sea-calf, a sea-tortoise, large and long serpents, the horns of deer, wild goats, roe-bucks, and rein-deer.

3. The third space is filled with Indian rackets, hammocks, dresses, and tufts of feathers; with calumets or pipes; with quivers, bows, and arrows; with head-pieces, caps with feathers, aprons, necklaces, Chinese necessaries, fans made of the leaves of the palm tree, a gargoulette of Indostan, a Polish whip, Indian canoes, Chinese musical instruments, lances, weapons, Indian furniture and utensils; and in short, various curiosities from nations ancient and modern, if they can be found; various furniture and utensils of different nations, ancient and modern.

As the great extent of a fine collection requires that there be no empty space, stands may be placed in different parts of the room, especially at the corners, for supporting large vertebræ, the head of a sea-cow, very large madrepores, or considerable collections either of rock chrystal or of minerals.

In the middle of the room is placed a receptacle for shells, which is a large table or bureau with raised edges. The surface of this table is divided into 27 separate cases, of different sizes, and proportioned to the 27 families of marine shells to be deposited in them. These divisions are made with wood or pasteboard painted blue, and are sometimes in the form of shelves; the bottom is covered with blue cotton or green sattin, or, what is still simpler, with white linen, sufficiently rough to keep the shells in their place. In some cabinets, these shelves are covered with mirrors on all their different surfaces, which shows the objects double, and gives us an opportunity of viewing them on the two opposite sides. In other cabinets the cases for each family are distributed into a number of smaller divisions, for containing the several species separate from each other. The sea-shells, contained in the receptacle for shells, are all cleaned and present, in the variety of their figure and colours, together with their inequality, an agreeable and enchanting picture, so much the more charming that it unites a methodical distribution to a symmetrical order. The upper part of this table is shut by a net-work

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work of brass wire covered with serge, or, what is still better, by a glass frame, to defend the shells from dust. We must not omit to mention, that in the middle of the table there is a long elevated square box, containing land and river shells. From the middle of each compartment, or at each family of shells, arises a small pyramidal wooden pillar, on the top of which is an horizontal piece of pasteboard, or sort of sign, denoting the kind of shells belonging to that division. Each family is distinguished from the adjoining one by those kind of ornaments of silk called *caterpillars*. By means of the different tints, we perceive the limits and extent of each family in the same manner as the colours in a geographical map enable us to distinguish the several provinces of the same empire. An exhibition of this kind was to be seen from 1768 to 1774, in a museum belonging to the prince of Condé at Chantilly.

Under the table for shells, on the side of the windows, is a glazed cage, large enough to contain the skeletons of an animal belonging to each class, to wit, a fish, an amphibious animal, a reptile, a lizard, a bird, and a quadruped. When to these we can add, for the sake of the comparative osteology, the skeletons of the intermediate individuals of these animals, together with those which make the nearest approaches to man, such as the *monkey* and the *bear*, we greatly increase both the pleasure and instruction. Below this table are likewise placed the best books connected with the different branches of natural history, especially such as have illuminated plates. The difficulty of acquiring the most valuable objects, and of preventing their destruction when once acquired, obliges us to have recourse to figures, in order to preserve a representation of them. This is an infallible method of communicating, not only to our cotemporaries, but also to posterity, the discoveries of the age in which the work was composed. Here also may be deposited the *herbal* and the collection of *feathers*, arranged in the form of books.

The space above the door is furnished with a large frame, filled with the skins of rare fishes, which are dried, varnished, and pasted on paper.

The piers of the windows are furnished with one or two presses, which are provided with shelves, and contain different kinds of instruments employed in physics, such as an air-pump, a burning mirror, a perspective glass, a magnifier, a microscope, a telescope, magnets both natural and artificial, &c.

On the semicircular shelves below are placed stones formerly used by savages for hatchets. Some curious pieces of lacker work, Indian pagodas, trinkets belonging to the savages of the north and to the Chinese, which are made of ivory or yellow amber, or of coral mounted with gold, silver, porcelain-clay, *kraicks* of Siam, and Turkish *cangiers*, which are a kind of poniards, Indian curiosities of silver, and the galians which the Turks and Persians use in smoking tobacco and aloes.

The drawers under this press contain a collection of medals, china ink, lachrymatory phials, and the most beautiful engraved stones of Europe, or an impression of them in wax or sulphur, counters, cameos, antiques, talismans, ancient weights and measures, idols, urns, lamps, instruments of sacrifice, and false jewels.

Last of all, the embrasures of the windows must be furnished with pictures of stone in connected pieces. Here likewise, as well as in the embrasures and pannels of the door, may be put tubes hermetically sealed, containing rare reptiles preserved in proper liquors.

The reader will by this time have some idea of the prodigious extent of the science of natural history; so extensive is it, indeed, that the longest life is far from being sufficient to enable us to acquire a perfect knowledge of it: it is important beyond dispute, because its business is with the works of God. In all the articles connected with the present, as forming particular parts of it, and to which we refer, we have made great use of the works of the celebrated Linnæus, who it is well known arranged the three kingdoms into regular systems, of which botany is the most complete. The world in general seems to have been most dissatisfied with the animal kingdom: he himself, in the course of a variety of editions, made many important alterations. Some men of considerable note, for example Buffon, have written on this subject without any regard to systematic arrangement. Dr Berkenhout's works on this part of science are very useful; in a a particular manner, because he translates Latin names, &c. Bomare's new edition of his Natural History, in 15 vols. octavo, a work of considerable importance, was published in 1791.

The most complete system, however, of natural history which has been yet given to the public, is undoubtedly that of Linnæus, in his *Systema Naturæ*, of which a new and improved edition is actually publishing by —— Gmeling. A short view of this elaborate work will, we presume, not be unacceptable to the reader, as it will present him, in a very small compass, an abstract of whatever is at present known in the six first classes of natural history.

Class I. *Mammalia.*

Ord.	Gen.	Sp.
Primates	4	88
Bruta	7	25
Feræ	10	186
Glires	10	129
Pecora	8	90
Belluæ	4	25
Cete	4	14
7	47	557

Class II. *Aves.*

Ord.	Gen.	Sp.
Accipitres	4	271
Picæ	23	663
Anseres	13	314
Grallæ	20	326
Gallinæ	10	129
Passeres	17	983
6	87	2686

Class III. *Amphibia.*

Ord.	Gen.	Sp.
Reptilia	4	147
Serpentes	6	219
2	10	366

Class IV.

Class IV. *Pisces.*

Ord.	Gen.	Sp.
Apodes	10	37
Jugulares	6	52
Thoracici	19	452
Abdominales	16	202
Branchiostegi	10	81
Condropterygii	5	65
6	66	889

Class V. *Insecta.*

Ord.	Gen.	Sp.
Coleoptera	55	4048
Hemyptera	14	1464
Lepidoptera	3	2600
Neuroptera	7	174
Hymenoptera	15	1239
Diptera	12	692
Aptera	15	679
7	121	10896

Class VI. *Vermes.*

Ord.	Gen.	Sp.
Intestina	21	384
Mollusca	31	438
Testacea	36	2525
Zoophita	15	498
Infusoria	15	191
5	118	4036

In the new French *Encyclopédie par ordre de Matieres*, the editors promised to give a description of more than 18,000 plants. Dr Berkenhout, in the last edition of his Synopsis, says, that in Great Britain and Ireland there are about 54 species of the mammalia, 250 of birds, 50 of the amphibia, 600 of insects, 150 of fishes, and 1600 species of plants: but in every class he is probably much within the number.

NAT

Natural Philosophy, is commonly defined to be that art or science which considers the powers and properties of natural bodies, and their mutual actions on one another. The province of moral philosophy is the mind of man; its inquiries and researches are into the intellectual world. Natural philosophy, on the other hand, is only concerned with the material part of the creation. The Moralist's business is to inquire into the nature of virtue, the causes and effects of vice, to propose remedies for it, and to point out the mode of attaining happiness, which only can be the result of virtuous conduct. The Naturalist, on the contrary, has nothing to do with spirit; his business is solely about body or matter; and he ought to have a solid and accurate knowledge of all material substances, together with their affections and properties; and, if possible,, he is to investigate the reasons of such and such appearances.—Indeed, the first and principal part of this science is to collect all the manifest and sensible appearances of things, and reduce them into a body of natural history. Philosophy, it has often been said, and it is even now very generally thought, to mean an inquiry into all the causes of things; but experience informs us, that though we are acquainted with a good number of effects, we can trace but few of their causes; so that philosophy itself will really be found to be in general but a collection of facts. Still, however, it differs from natural history in its appropriated sense; the business of which is only to observe the appearances of natural bodies separately, and from these appearances to class them with other bodies: natural philosophy goes farther, and recites the action of two or more bodies of the same or different kinds upon one another; and though it can never investigate nor point out the causes of those effects, whatever they are, yet, from mathematical reasoning combined with experience, it can be demonstrated, that in such circumstances such effects must always take place. There are evidently two ways of making observations on the material world: the first is, when we view things nearly as they happen to turn up, without any design or intervention of our own; in which way, indeed, no great improvements can be expected in the art, because chance having the direction, only exhibits occasional or extemporary properties. The other method is, when, after a thorough acquaintance with bodies, we apply them to other bodies equally known, diligently attending to the result, and observing whether any thing new arises. Such seems to be in general the nature of our article; nor is it our intention to be much more particular at present. We must therefore refer our readers respectively to those parts of the subject, respecting which they wish for more satisfaction and minuter details. The ancient and modern definitions of the word *Philosophy*, together with its origin, as well as the manner of philosophising in former times as well as at present, with the gradual improvemement of science, particularly natural, we shall introduce, we think, more properly under the words Philosophy and Physics. We need only add under the present article, what however is well known, that natural philosophy was till lately divided only into four parts, commonly called the *four branches*, viz. 1. Mechanics; 2. Hydrostatics; 3, Optics; and 4. Astronomy; and these again are subdivided into various parts. Modern discoveries have added, however, two more parts to the number, viz. magnetism and electricity, whose properties and effects, &c. have been wonderfully unfolded of late years.—It is remarkable, that in the English universities these two latter branches are never taken notice of in lecturing on natural philosophy, the old division being still retained, without any mention of these two important articles. The reason may be, that they are only subject to experiment, and not yet reduced to mathematical reasoning; which is the method of teaching philosophy in one of those celebrated seminaries. Of these branches of this extensive science, it is not our intention to take even a general view in this place. We must

must therefore refer our readers to each particular article, where they will find them treated at considerable length—See *Experimental Philosophy*.

NATURALIZATION, in the English law, the act of naturalizing an alien, or putting him into the condition of a natural born subject, and intitling him to the rights and privileges thereof. But none can be naturalized unless they have received the sacrament within one month before the bringing in of the bill, and taken the oaths of allegiance and supremacy in the presence of the parliament. A person who is naturalized may have lands by descent, as heir at law, as well as obtain them by purchase; but he is disabled from being a member of the privy council or parliament; or from holding offices, 7 Jac. I. cap. 2. 12 Will. III. cap. 2. All children born out of the king's dominions, whose fathers were or are subjects of this kingdom at the time of their birth, are adjudged to be natural born subjects of this realm, except children of parents attainted of treason, or that are in the actual service of a foreign prince at enmity with us, 4 Geo. II. cap. 21. Every foreign seaman, who in time of war serves two years on board an English ship, is *ipso facto* naturalized, 13 Geo. II. cap. 3. And all foreign Protestants and Jews upon their residing seven years in any of the British colonies, without being absent above two months at a time, or serving two years in a military capacity there, are upon taking the oaths naturalized to all intents and purposes, as if they had been born in this kingdom; and therefore are admissible to all such privileges, and no other as Protestants or Jews born in this kingdom are intitled to. See Alien and Denizen.

In France, before the Revolution, naturalization was the king's prerogative; in England it is only done by act of parliament. In the former of those places, before their government was overturned, Swiss, Savoyards, and Scots, did not require naturalization, being reputed regnicoles, or natives.

NATURALS, among physicians, whatever naturally belongs to an animal, in opposition to non-naturals. See Non-naturals.

NATURE, according to Mr Boyle, has eight different significations; it being used, 1. For the Author of nature, whom the schoolmen call *Natura Naturans*, being the same with God. 2. By the nature of a thing, we sometimes mean its essence; that is, the attributes which make it what it is, whether the thing be corporeal or not; as when we attempt to define the nature of a fluid, of a triangle, &c. 3. Sometimes we confound that which a man has by nature with what accrues to him by birth; as when we say, that such a man is noble by nature. 4. Sometimes we take nature for an internal principle of motion; as when we say, that a stone by nature falls to the earth. 5. Sometimes we understand, by nature, the established course of things. 6. Sometimes we take nature for an aggregate of powers belonging to a body, especially a living one; in which sense physicians say, that nature is strong, weak, or spent; or that, in such or such diseases, nature left to herself will perform the cure. 7. Sometimes we use the term *nature* for the universe, or whole system of the corporeal works of God; as when it is said of a phœnix, or chimera, that there is no such thing in nature.

8. Sometimes too, and that most commonly, we express by the word *nature* a kind of semi-deity, or other strange kind of being.

If, says the same philosopher, I were to propose a notion of nature less ambiguous than those already mentioned, and with regard to which many axioms relating to that word may be conveniently understood, I should first distinguish between the universal and the particular nature of things. Universal nature I would define to be the aggregate of the bodies that make up the world in its present state, considered as a principle; by virtue whereof they act and suffer, according to the laws of motion prescribed by the Author of all things. And this makes way for the other subordinate notion; since the particular nature of an individual consists in the general nature applied to a distinct portion of the universe; or, which is the same thing, it is a particular assemblage of the mechanical properties of matter, as figure, motion, &c.

Kingdoms of Nature. See Kingdoms.

Conduct or operations of Nature. See *Natural History*.

NAVA (anc. geog.) Tacitus; a river of Belgica, which runs north-east into the left or west side of the Rhine. Now the *Nahe*, rising at the village of Naheweiler, on the borders of the bishopric of Triers, running through the Lower Palatinate, the duchy of Simmeren, by the small town of Bing, into the Rhine.

NAVAL, something relating to a ship; whence,

Naval Architecture. See *Ship-Building*.

Naval-Camp, in antiquity, a fortification, consisting of a ditch and parapet on the land side, or a wall built in the form of a semicircle, and extended from one point of the sea to another. This was sometimes defended with towers, and beautified with gates, through which they issued forth to attack their enemies. Homer has left us a remarkable description of the Grecian fortifications of this sort, in the Trojan war, beginning at v. 436. Iliad η.

Then, to secure the camp and naval powers,
They rais'd embattled walls with lofty tow'rs:
From space to space were ample gates around,
For passing chariots; and a trench profound,
Of large extent, and deep in earth below
Strong piles infix'd stood adverse to the foe.

Pope's *Transl.*

Towards the sea, or within it, they fixed great pales of wood, like those in their artificial harbours; before these the vessels of burden were placed in such order, as that they might be instead of a wall, and give protection to those within; in which manner Nicias is reported by Thucydides to have encamped himself: but this seems only to have been practised when the enemy was thought superior in strength, and raised great apprehensions of danger in them. When their fortifications were thought strong enough to defend them from the assaults of enemies, it was frequent to drag their ships to shore, which the Greeks called νεωλκεῖν, the Romans *subducere*. Around the ships the soldiers disposed their tents, as appears every where in Homer: but this seems only to have been practised in winter, when their enemy's fleet was laid up and could not assault them; or in long sieges, and when they lay in no danger from their enemies by sea;

as

as in the Trojan war, where the defenders of Troy never once attempted to encounter the Grecians in a sea-fight.

The adjacent places were usually filled with inns and stews well stocked with females, that prostituted themselves to the mariners, merchants, and artificers of all sorts who flocked thither in great numbers; this, however, appears to have happened only in times of peace.

Naval Crown, among the ancient Romans, a crown adorned with figures of prows of ships, conferred on persons who in sea-engagements first boarded the enemy's vessel. See Crown.

Naval Engagement. See Tactics *(Naval)*.

Naval Stores, comprehend all those particulars made use of, not only in the navy, but in every other kind of navigation; as timber and iron for shipping, pitch, tar, hemp, cordage, sail-cloth, gunpowder, ordnance, and fire-arms of every sort, ship-chandlery wares, &c.

Naval-Tactics, the military operations of fleets. See Tactics *(Naval.)*.

NAVAN, a borough, post, and fair town of Ireland, in the county of Meath and province of Leinster; situated about 23 miles north-west of Dublin, on the river Boyne. It consists of two chief streets, which intersect each other at right angles.—The Tholsel, or town-house, is a handsome stone building. This place was formerly in great repute, and walled in by Hugh de Lacy. An abbey for regular canons, dedicated to the Virgin Mary, was erected here; but whether antecedent to the end of the 12th century is not certain: about that period, however, it was either founded or re-edified by Joceline de Angulo or Nangle. In the burial-ground are the remains of many ancient tombs, with figures in alto relievo; and the present barrack for one troop of horse is built on the site of the abbey. Navan sends two members to parliament; patronage in the Preston family. Here are four fairs held.

NAVARRE, a province of Spain, part of the ancient kingdom of Navarre, erected soon after the invasion of the Moors; and is otherwise called *Upper Navarre*, to distinguish it from Lower Navarre belonging to the French. It is bounded on the south and east by Arragon, on the north by the Pyrenees, and on the west by Old Castile and Biscay; extending from south to north about 80 miles, and from east to west about 75. It abounds in sheep and cattle; game of all kinds, as boars, stags, and roebucks; and in wild-fowl, horses, and honey; yielding also some grain, wine, oil, and a variety of minerals, medicinal waters, and hot baths. Some of the ancient chiefs of this country were called *Solrarbores*, from the custom, as it is supposed which prevailed among some of those free nations of choosing and swearing their princes under some particular tree. The name of the province is supposed to be a contraction of *Nava Errea*, signifying, in the language of the Vascones, its ancient inhabitants, "a land of valleys." —For the particulars of its history, see the article Spain.

Navarre (Peter), an officer of eminence in the 16th century, and particularly celebrated for his dexterity in the directing and springing of mines. He was a native of Biscay, and of low extraction. According to Paul Jove, who affirms that he had an account of the matter from his own mouth, he was first a sailor; but being disgusted with that employment, he sought his fortune in Italy, when poverty compelled him to become footman to the cardinal of Arragon. He afterwards inlisted himself a soldier in the Houstine army; and having served there for some time, went to sea again, and distinguished himself by his courage. The reputation of his valour having reached the ears of Gonsalvo de Cordoue, this general employed him in the war against Naples, and raised him to the rank of a captain. Having contributed greatly to the taking of that city by very opportunely springing a mine, the emperor rewarded him for this signal service with the earldom of Alveto, situated in that kingdom, and gave him the title of *count of Navarre*. Having the command of a naval expedition against the Moors in Africa, he was at first very successful, and took possession of Oran, Tripoli, and some other places; but being afterwards shipwrecked on the island of Gerbes, the great heats and the Moorish cavalry destroyed a part of his army. Our hero was equally unfortunate in Italy: He was made prisoner at the famous battle of Ravenna, in 1512, and languished in France for the space of two years. When finding that the king of Spain, who had been prejudiced against him by his courtiers, would do nothing towards his ransom, he went into the service of Francis I. who gave him the command of twenty companies of infantry, consisting of Gascons, Biscayans, and the inhabitants of the Pyrenee mountains. He distinguished himself in several successful expeditions, until the year 1522, when having been sent to the relief of the Genoese, he was taken by the Imperialists. They conducted him to Naples, where he remained a prisoner for three years in the castle of Œuf. From this confinement he was released by the treaty of Madrid, and afterwards fought at the siege of Naples under Laulric in 1528: but being again made prisoner at the unfortunate retreat from Aversa, he was conducted a second time to the castle of Œuf. Here the prince of Orange having, by order of the emperor, caused several persons of the *Angevine* faction to be beheaded, our hero would undoubtedly have suffered the same fate, if the governor, seeing his distressed situation, and feeling for the misfortunes of so great a man, had not saved him the shame of this last punishment by allowing him to die a natural death. Others pretend that he was strangled in his bed, having arrived at a very advanced age. Paul Jove and Philip Thomasini have written his life. This last informs us, that he was of a tall size, had a swarthy countenance, black eyes, beard, and hair. A duke of Sessa, in the last century being desirous to honour his memory and that of the marshal de Lautree, caused a monument to be erected to each of them in the church of Sainte-Marie-le-Neuve at Naples, where they had been interred without any funeral honours.

Navarre (surnamed Martin Azpilcucta), because he was born in the kingdom which bears that name, successively professor of jurisprudence at Toulouse, Salamanca, and Coimbra, was consulted from all quarters as the oracle of law. For a part of his knowledge he was indebted to the schools of Cahors and Toulouse, in in which he had ſtudied. His friend Barthelimi Carewza, a Dominican, and archbiſhop of Toledo, having been charged with hereſy by the court of inquiſition at Rome, Navarre ſet out at the age of 80 years to defend him. Pius V. appointed him aſſeſſor to cardinal Francis Alciat, vice-penetentiary. Gregory XIII. never paſſed his gate without ſending for him; and ſometimes would converſe with him for an hour together on the ſtreet: he even deigned to viſit him, accompanied by ſeveral cardinals. Theſe honours did not render him more haughty. His character became ſo eminent, that even in his own time the greateſt encomium that could be paid to a man of learning was to ſay that he was a *Navarre:* this name thus included the idea of erudition, as that of Roſcius formerly marked an accompliſhed comedian. Azpilcucta was the oracle of the city of Rome, and of the whole Chriſtian world. For the influence which he had acquired, he was indebted not only to his knowledge, but alſo to his probity and virtue. Faithful to the duties which the church preſcribed, his temperance and frugality preſerved to him a vigorous conſtitution; and at a very advanced age his genius was equal to the ſevereſt ſtudy. His ſavings enabled him to give liberal aſſiſtance to the poor. His charities, indeed, were ſo great, that his mule, it is ſaid, would ſtop as ſoon as ſhe perceived a beggar. He died at Rome in 1586, at the age of 92. His works were collected and printed in 6 vols folio at Lyons in 1597, and at Venice in 1602. They diſplay more learning than judgement, and are now very ſeldom conſulted. Navarre was uncle by the mother's ſide to St Francis of Sales. See SALES.

NAUCLERUS (John), deſcended of a noble family of Suabia, was provoſt of the church of Suringia, and profeſſor of law in the univerſity of that city.—His original name was *Vergeau;* but this name, which in German ſignifies "ſailor," he changed into Nauclerus, a word of the ſame ſignification in Greek.—He was alive in 1501. We have from him a Latin Chronicle from Adam to the year 1500, of which Baſelius wrote a continuation down to 1514, and Surius to 1564. It poſſeſſes greater accuracy than any hiſtorical compilation which had appeared prior to his time; but ſtill it is only a compilation. It is chiefly valued for what regards the occurrences of the 15th century. It was printed at Cologne in folio in 1564 and 1579.

NAUCRARI, among the Athenians, was the name given to the chief magiſtrates of the Δημοι, "boroughs or townſhips," called Ναυκραριαι; becauſe each was obliged, beſides two horſemen, to furniſh out one ſhip for the public ſervice.

NAUCRATES, a Greek poet, who was employed by Artemiſia to write a panegyric upon Mauſolus.—An orator who endeavoured to alienate the cities of Lycia from the intereſt of Brutus.

NAUCRATIS, a city of Egypt on the left ſide of the Canopic mouth of the Nile. It was celebrated for its commerce, and no ſhip was permitted to land at any other place, but was obliged to ſail directly to the city there to depoſit its cargo. It gave birth to Athenæus.

NAUCRATITES NOMOS (anc. geog.), Pliny; a diviſion of the Delta, ſo called from the town *Naucratis;* though Ptolemy compriſes it under the Nomos Saites.

NAUCYDES, a ſtatuary who lived about four centuries before the Chriſtian era.

NAUDE (Gabriel), was deſcended of a reputable family, and born at Paris, February 12th. 1600.—His parents obſerving his fondneſs for reading and inclination to letters, reſolved to breed him in that way; and accordingly ſent him to a religious community, to learn the firſt rudiments of grammar and the principles of Chriſtianity. Thence he was removed to the univerſity; where he applied himſelf with great ſucceſs to claſſical learning; and having learned philoſophy, was created maſter of arts very young.—As ſoon as he had finiſhed his courſe in philoſophy, he remained ſome time at a ſtand what profeſſion to chooſe, being adviſed by his friends to divinity; but his inclination being more turned to phyſic, he fixed at length upon that faculty. However, this choice did not prevent him from indulging his genius in other branches of learning: in reality, the plan of his ſtudies was very extenſive, ſuited to his comprehenſive talents and indefatigable induſtry: and he ſoon diſtinguiſhed himſelf therein ſo much, that Henry de Meſmes, preſident à mortier, hearing his character, made him keeper of his library, and took him into his family. Naude was the more pleaſed with this poſt, as it gave him an opportunity of gratifying his bookiſh taſte in general, and at the ſame time furniſhed him both with means and leiſure to improve himſelf as he could wiſh, in the ſcience which he had embraced in particular. He quitted it in 1626, in order to go to Padua to perfect himſelf therein: but he did not continue long in that univerſity, the death of his father and his domeſtic affairs calling him back to Paris before the expiration of the year.

In 1628 the faculty of phyſic appointed him to make the cuſtomary diſcourſe on the reception of licentiates; which performance entirely anſwered their expectations from him, and was made public. In 1631, Cardinal Bagni made him his librarian and Latin ſecretary, and carried him with him to Rome in the ſpring of that year. Naude continued in this ſervice till the death of the cardinal, which happened July 24. 1641; and in the interim made an excurſion to Padua, to take his doctor of phyſic's degree, in order to ſupport with a better grace the quality with which he had been honoured by Louis XIII. who had made him his phyſician. The ceremony of this appointment was performed March 25. 1633, and we have the ſpeech he pronounced on the occaſion. After the death of his patron, he had thoughts of returning to France; but was detained in Italy by ſeveral advantageous offers made to him by perſons of conſideration in that country. Among theſe he preferred thoſe of Cardinal Barberini, and cloſed with his eminence. However, as ſoon as Cardinal Richelieu ſent for him to be his librarian, he immediately returned to Paris; but he happened not to be long in the ſervice of the prime miniſter, if it be true that he arrived at Paris in march 1642, ſince Cardinal Richelie died in December following; notwithſtanding, he ſucceeded to the like poſt under Mazarine, for whom he formed

formed a moſt rich library, which he raiſed from the firſt volume in the ſpace of ſeven years to the number of 40,000.

His deſign was nearly completed before the Cardinal gave him two ſmall benefices, a canonry of Verdun and the priory of Artige in the Limoſin: and we know how much this ungeneroſity affected him, from a letter of Patin to Charles Spon, dated March 22. 1648, where he writes thus of our librarian: "I have ſeen one thing in him which I am very ſorry for; eſpecially as I have known him along hitherto at a great diſtance from ſuch a diſpoſition: it is, that he begins to complain of his fortune, and of his maſter's avarice, from whom he had never received any more than 1200 livres a year in benefices; not forbearing to declare, that his life was ſacrificed for too ſmall a matter. I think (continues Patin) what grieves him is, the apprehenſion of dying before he has raiſed ſomething for his brothers and his nephews, of whom he has a great number." However that be, Naude had the grief to ſee this library, which he had collected with ſo much pains and care, totally diſperſed. Upon the diſgrace of Mazarine it was ſold: and Patin, in a letter of March 5. 1651, obſerves, that Naude had bought all the books in phyſic for 3500 livres. Chriſtina queen of Sweden, who ſet herſelf to draw into her dominions all the literati of Europe, procured a propoſal to be made to Naude of being her library keeper: and as he was then out of all employ, he accepted the propoſal, and went to Cop.—But he ſoon grew out of humour with his reſidence in Sweden: the manners of the people, ſo very different from his, gave him great diſguſt; and ſeeing France become more quiet than it had been, he reſolved to return. Accordingly he quitted Sweden loaded with preſents from the queen, and ſeveral perſons of diſtinction: but the fatigue of the journey threw him into a fever, which obliged him to ſtop at Abbeville; and he died there July 29. 1653.

As to his character, he was very prudent and regular in his conduct, ſober, never drinking any thing but water. Study was his principal occupation, and he was indeed a true *Helluo librorum;* ſo that he underſtood them perfectly well. He ſpoke his mind with great freedom, and that freedom ſometimes ſhowed itſelf upon religious ſubjects, in ſuch a manner as might have occaſioned ſome diſadvantageous thoughts of him; but the Chriſtian ſentiments in which he died left room to believe that his heart was never corrupted, and had no ſhare in the free expreſſions which ſometimes eſcaped from him; eſpecially in the philoſophical railleries which paſſed ſometimes between him, Guy Patin, and Gaſſendi. He wrote a great number of books, a catalouge of which may be ſeen in Niceron's Memoires, tom. ix. Voltaire ſays, that "of all his books, the *Apologie des grands Homes accuſes de Magie* is almoſt the only one which continues to be read."

NAVE, in architecture, the body of a church, where the people are diſpoſed, reaching from the balluſter, or rail of the door, to the chief choir. Some derive the word from the Greek ναός, "a temple;" and others from ναυς, "a ſhip," by reaſon the vault or roof of a church bears ſome reſemblance to a ſhip.

NAVEL, in anatomy, the centre of the lower part of the abdomen; being that part where the umbilical veſſels paſſed out of the placenta of the mother. See Anatomy, p. 725.

Navel-Wort in botany. See Cotyledon.

NAVEW, in botany. See Brassica, of which it is a ſpecies.

NAVIGATION.

IS the art of conducting or carrying a ſhip from one port to another.

HISTORY.

The poets refer the invention of the art of navigation to Neptune, ſome to Bacchus, others to Hercules, others to Jaſon, and others to Janus, who is ſaid to have made the firſt ſhip. Hiſtorians aſcribe it to the Æginets, the Phœnicians, Tyrians, and the ancient inhabitants of Britain. Some will have it, the firſt hint was taken from the flight of the kite; others, as Oppian, *De piſcibus*, lib. 1.) from the fiſh called *nautilus:* others aſcribe it to accident.—Scripture refers the origin of ſo uſeful an invention to God himſelf, who gave the firſt ſpecimen thereof in the ark built by Noah under his direction. For the raillery the good man underwent on account of his enterpriſe ſhows evidently enough the world was then ignorant of any thing like navigation, and that they even thought it impoſſible.

However, profane hiſtory repreſents the Phœnicians, eſpecially thoſe of their capital Tyre, as the firſt navigators; being urged to ſeek a foreign commerce by the narrowneſs and poverty of a ſlip of ground they poſſeſſed along the coaſts; as well as by the conveniency of two or three good ports, and by their natural genius to traffic. Accordingly, Lebanon, and the other neighbouring mountains, furniſhing them with excellent wood for ſhip-building, in a ſhort time they were maſters of a numerous fleet; and conſtantly hazarding new navigations, and ſettling new trades, they ſoon arrived at an incredible pitch of opulency and populouſneſs: inſomuch as to be in a condition to ſend out colonies, the principal of which was that of Carthage; which keeping up their Phœnician ſpirit of commerce, in time not only equalled Tyre itſelf, but vaſtly ſurpaſſed it; ſending its merchant-fleets through Hercules's pillars, now the ſtraits of Gibraltar, along the weſtern coaſts of Africa and Europe; and even, if we believe ſome authors, to America itſelf.

Tyre, whoſe immenſe riches and power are repreſented in ſuch lofty terms both in ſacred and profane authors, being deſtroyed by Alexander the Great, its navigation and commerce were transferred by the conqueror to Alexandria, a new city, admirably ſituated for thoſe purpoſes; propoſed for the capital of the empire of Aſia, which Alexander then meditated.

And

And thus arose the navigation of the Egyptians; which was afterwards so cultivated by the Ptolemies, that Tyre and Carthage were quite forgotten.

Egypt being reduced into a Roman province after the battle of Actium, its trade and navigation fell into the hand of Augustus; in whose time Alexandria was only inferior to Rome: and the magazines of the capital of the world were wholly supplied with merchandizes from the capital of Egypt.

At length, Alexandria itself underwent the fate of Tyre and Carthage; being surprised by the Saracens, who, in spite of the emperor Heraclius, overspread the northern coasts of Africa, &c. whence the merchants being driven, Alexandria has ever since been in a languishing state, though it still has a considerable part of the commerce of the Christian merchants trading to the Levant.

The fall of Rome and its empire drew along with it not only that of learning and the polite arts, but that of navigation; the barbarians, into whose hands it fell, contenting themselves with the spoils of the industry of their predecessors.

But no sooner were the more brave among those nations well settled in their new provinces; some in Gaul, as the Franks; others in Spain, as the Goths; and others in Italy, as the Lombards; but they began to learn the advantages of navigation and commerce, and the methods of managing them, from the people they subdued; and this with so much success, that in a little time some of them became able to give new lessons, and set on foot new institutions for its advantage. Thus it is to the Lombards we usually ascribe the invention and use of banks, book-keeping, exchanges, rechanges, &c.

It does not appear which of the European people, after the settlement of their new masters, first betook themselves to navigation and commerce.—Some think it began with the French; though the Italians seem to have the justest title to it; and are accordingly ordinarily looked on as the restorers thereof, as well as of the polite arts, which had been banished together from the time the empire was torn asunder. It is the people of Italy then, and particularly those of Venice and Genoa, who have the glory of this restoration; and it is to their advantageous situation for navigation they in great measure owe their glory. In the bottom of the Adriatic were a great number of marshy islands, only separated by narrow channels, but those well screened, and almost inaccessible, the residence of some fishermen, who here supported themselves by a little trade of fish and salt, which they found in some of these islands. Thither the Veneti, a people inhabiting that part of Italy along the coasts of the Gulph, retired, when Alaric king of the Goths, and afterwards Attila king of the Huns, ravaged Italy.

These new islanders, little imagining that this was to be their fixed residence, did not think of composing any body politic; but each of the 72 islands of this little Archipelago continued a long time under its several masters, and each made a distinct commonwealth, When their commerce was become considerable enough to give jealousy to their neighbours, they began to think of uniting into a body. And it was this union first begun in the sixth century, but not completed till the eighth, that laid the sure foundation of the future grandeur of the state of Venice. From the time of this union, their fleets of merchantmen were sent to all the parts of the Mediterranean; and at last to those of Egypt, particularly Cairo, a new city, built by the Saracen princes on the eastern banks of the Nile, where they traded for their spices and other products of the Indies. Thus they flourished, increased their commerce, their navigation, and their conquests on the terra firma, till the league of Cambray in 1508, when a number of jealous princes conspired to their ruin; which was the more easily effected by the diminution of their East India commerce, of which the Portuguese had got one part and the French another. Genoa, which had applied itself to navigation at the same time with Venice, and that with equal success, was a long time its dangerous rival, disputed with it the empire of the sea, and shared with it the trade of Egypt and other parts both of the east and west.

Jealousy soon began to break out; and the two republics coming to blows, there was almost continual war for three centuries before the superiority was ascertained; when, towards the end of the 14th century, the battle of Chioza ended the strife; the Genoese, who till then had usually the advantage, having now lost all; and the Venetians, almost become desperate, at one happy blow, beyond all expectation, secured to themselves the empire of the sea, and superiority in commerce.

About the same time that navigation was retrieved in the southern parts of Europe, a new society of merchants was formed in the north, which not only carried commerce to the greatest perfection it was capable of till the discovery of the East and West Indies, but also formed a new scheme of laws for the regulation thereof, which still obtain under the names of *Uses and Customs of the Sea*. This society is that famous league of the Hanse-towns, commonly supposed to have begun about the year 1164. See *Hanse-Towns*.

For the modern state of navigation in England, Holland, France, Spain, Portugal, &c. See Commerce, Company, &c.

We shall only add, that, in examining the reasons of commerce's passing successively from the Venetians, Genoese and Hanse towns, to the Portuguese and Spaniards, and from these again to the English and Dutch, it may be established as a maxim, that the relation between commerce and navigation, or, if we may be allowed to say it, their union is so intimate, that the fall of the one inevitably draws after it that of the other; and that they will always either flourish or dwindle together. Hence so many laws, ordinances statutes, &c. for its regulation; and hence particularly that celebrated act of navigation, which an eminent foreign author calls the *palladium* or *tutelar deity of the commerce of England*; which is the standing rule, not only of the British among themselves, but also of other nations with whom they traffic.

The art of navigation hath been exceedingly improved in modern times, both with regard to the form of the vessels themselves, and with regard to the methods of working them. The use of rowers is now entirely superseded by the improvements made in the formation of the sails, rigging, &c. by which means the

the ships can not only sail much faster than formerly, but can tack in any direction with the greatest facility. It is also very probable that the ancients were neither so well skilled in finding the latitudes, nor in steering their vessels in places of difficult navigation, as the moderns. But the greatest advantage which the moderns have over the ancients is from the mariner's compass, by which they are enabled to find their way with as great facility in the midst of an immeasurable ocean, as the ancients could have done by creeping along the coast, and never going out of sight of land. Some people indeed contend, that this is no new invention, but the ancients were acquainted with it. They say, that it was impossible for Solomon to have sent ships to Ophir, Tarshish, and Parvaim, which last they will have to be *Peru*, without this useful instrument. They insist that it was impossible for the ancients to be acquainted with the attractive virtue of the magnet, and to be ignorant of its polarity. Nay, they affirm, that this property of the magnet is plainly mentioned in the book of Job, when the load stone is mentioned by the name of *topaz*, or *the stone that turns itself*: But it is certain, that the Romans, who conquered Judea, were ignorant of this instrument, and it is very improbable, that such an useful invention, if once it had been commonly known to any nation, would have been forgot, or perfectly concealed from such a prudent people as the Romans, who were so much interested in the discovery of it.

Among those who do agree that the mariner's compass is a modern invention, it hath been much disputed who was the inventor. Some give the honour of it to Flavio Gioia of Amalfi in Campania*, who lived about the beginning of the 14th century; while others say that it came from the east, and was earlier known in Europe. But, at whatever time it was invented, it is certain, that the mariner's compass was not commonly used in navigation before the year 1420, In that year the science was considerably improved under the auspices of Henry duke of Visco, brother to the king of Portugal. In the year 1485, Roderic and Joseph, physicians to John II. king of Portugal, together with one Martin de Bohemia, a Portuguese, native of the island of Fayal, and scholar to Regiomontanus, calculated tables of the sun's declination for the use of sailors, and recommended the astrolabe for taking observations at sea. Of the instructions of Martin, the celebrated Christopher Columbus is said to have availed himself, and to have improved the Spaniards in the knowledge of the art; for the further progress of which a lecture was afterwards founded at Seville by the emperor Charles V.

* See Mariner's Compass.

The discovery of the variation is claimed by Columbus, and by Sebastian Cabot. The former certainly did observe this variation without having heard of it from any other person, on the 14th of September 1492, and it is very probable that Cabot might do the same. At that time it was found that there was no variation at the Azores, where some geographers have thought proper to place the first meridian; though it hath since been observed that the variation alters in time.—The use of the cross-staff now began to be introduced among sailors. This ancient instrument is described by John Werner of Nuremberg, in his annotations on the first book of Ptolemy's Geography, printed in 1514. He recommends it for observing the distance between the moon and some star, in order thence to determine the longitude.

At this time the art of navigation was very imperfect on account of the inaccuracies of the plane chart, which was the only one then known, and which, by its gross errors, must have greatly misled the mariner, especially in voyages far distant from the equator. Its precepts were probably at first only set down on the sea-charts, as is the custom at this day: but at length there were two Spanish treatises published in 1545; one by Pedro de Medina; the other by Martin Cortes, which contained a complete system of the art, as far as it was then known. These seem to have been the oldest writers who fully handled the art; for Medina, in his dedication to Philip prince of Spain, laments that multitudes of ships daily perished at sea, because there were neither teachers of the art nor books by which it might be learned; and Cortes, in his dedication, boasts to the emperor, that he was the first who had reduced navigation into a compendium, valuing himself much on what he had performed. Medina defended the plane chart; but he was opposed by Cortes, who showed its errors, and endeavoured to account for the variation of the compass, by supposing the needle to be influenced by a magnetic pole (which he called the *point attractive*) different from that of the world; which notion hath been farther prosecuted by others. Medina's book was soon translated into Italian, French, and Flemish, and served for a long time as a guide to foreign navigators. However, Cortes was the favourite author of the English nation, and was translated in 1561; while medina's work was entirely neglected, though translated also within a short time of the other. At that time the system of navigation consisted of the following particulars, and others similar: an account of the Ptolemaic hypothesis, and the circles of the sphere; of the roundness of the earth, the longitudes, latitudes, climates, &c. and eclipses of the luminaries: a kalendar; the method of finding the prime, epact, moon's age, and tides; a description of the compass, an account of its variation, for the discovering of which Cortes said an instrument might easily be contrived; tables of the sun's declination for four years, in order to find the latitude from his meridian altitude; directions to find the same by certain stars; of the course of the sun and moon; the length of the days; of time and its divisions; the method of finding the hour of the day and night; and lastly, a description of the sea-chart, on which to discover where the ship is, they made use of a small table, that showed, upon an alteration of one degree of the latitude, how many leagues were run in each rhumb, together with the departure from the meridian. Besides, some instruments were described, especially by Cortes; such as one to find the place and declination of the sun, with the days, and place of the moon; certain dials, the astrolabe, and cross-staff; with a complex machine to discover the hour and latitude at once.

About the same time were made proposals for finding the longitude by observations of the moon.—In 1530, Gemma Frisius advised the keeping of the time by means of small clocks or watches, then, as he says, newly invented. He also contrived a new sort

of

of cross staff and an instrument called the *nautical quadrant;* which last was much praised by William Cunningham, in his *Astronomical Glass,* printed in the year 1559.

In 1537 Pedro Nunez, or Nonius, published a book in the Portuguese language, to explain a difficulty in navigation proposed to him by the commander Don Martin Alphonso de Susa. In this he exposes the errors of the plane chart, and likewise gives the solution of several curious astronomical problems; amongst which is that of determining the latitude from two observations of the sun's altitude and intermediate azimuth being given. He observed, that though the rhumbs are spiral lines, yet the direct course of a ship will always be in the arch of a great circle, whereby the angle with the meridians will continually change: all that the steersman can here do for the preserving of the original rhumb, is to correct these deviations as soon as they appear sensible. But thus the ship will in reality describe a course without the rhumb-line intended; and therefore his calculations for assigning the latitude, where any rhumb line crosses the several meridians, will be in some measure erroneous. He invented a method of dividing a quadrant by means of concentric circles, which, after being much improved by Dr Halley, is used at present, and is called a *nonius.*

In 1577, Mr William Bourne published a treatise, in which, by considering the irregularities in the moon's motion, he shows the errors of the sailors in finding her age by the epact, and also in determining the hour from observing on what point of the compass the sun and moon appeared. He advises, in sailing towards the high latitudes, to keep the reckoning by the globe, as there the plane chart is most erroneous. He despairs of our ever being able to find the longitude, unless the variation of the compass should be occasioned by some such attractive point, as Cortes had imagined; of which, however, he doubts: but as he had shown how to find the variation at all times, he advises to keep an account of the observations, as useful for finding the place of the ship; which advice was prosecuted at large by Simon Stevin, in a treatise published at Leyden in 1599: the substance of which was the same year printed at London in English by Mr Edward Wright, intitled the *Haven finding Art.* In this ancient tract also is described the way by which our sailors estimate the rate of a ship in her course, by an instrument called the *log.* This was so named from the piece of wood or log that floats in the water while the time is reckoned during which the line that is fastened to it is veering out. The author of this contrivance is not known; neither was it taken notice of till 1607, in an East India voyage published by Purchas: but from this time it became famous, and was much taken notice of by almost all writers on navigation in every country: and it still continues to be used as at first, though many attempts have been made to improve it, and contrivances proposed to supply its place; many of which have succeeded in quiet water but proved useless in a stormy sea.

In 1581 Michael Coignet, a native of Antwerp, published a treatise, in which he animadverted on Medina. In this he showed that as the rhumbs are spirals, making endless revolutions about the poles, numerous errors must arise from their being represented by straight lines on the sea-charts; but though he hoped to find a remedy for these errors, he was of opinion that the proposals of Nonius were scarcely practicable, and therefore in a great measure useless. In treating of the sun's declination, he took notice of the gradual decrease in the obliquity of the ecliptic; he also described the cross-staff with three transverse pieces, as it is at present made, and which he owned to have been then in common use among the sailors. He likewise gave some instruments of his own invention; but all of them are now laid aside, excepting perhaps his nocturnal. He constructed a sea-table to be used by such as sailed beyond the 60th degree of latitude; and at the end of the book is delivered a method of sailing on a parallel of latitude by means of a ring dial and a 24 hour-glass. The same year the discovery of the dipping-needle was made by Mr Robert Norman *. In his publication on that art he maintains in opposition to Cortes, that the variation of the compass was caused by some point on the surface of the earth, and not in the heavens: he also made considerable improvements in the construction of compasses themselves; showing especially the danger of not fixing, on account of the variation, the wire directly under the *flower-de-luce;* as compasses made in different countries have it placed differently. To this performance of Norman's is always prefixed a discourse on the variation of the magnetical needle by Mr William Burrough, in which he shows how to determine the variation in many different ways. He also points out many errors in the practice of navigation at that time, and speaks in very severe terms concerning those who had published upon it.

* See dipping needle.

All this time the Spaniards continued to publish treatises on the art. In 1585 an excellent compendium was published by Roderico Zamorano; which contributed greatly towards the improvement of the art, particularly in the sea charts. Globes of an improved kind, and of a much larger size than those formerly used, were now constructed, and many improvements were made in other instruments; however the plane chart continued still be followed, though its errors were frequently complained of. Methods of removing these errors had indeed been sought after; and Gerard Mercator seems to have been the first who found the true method of doing this so as to answer the purposes of seamen. His method was to represent the parallels both of latitude and longitude by parallel straight lines, but gradually to augment the former as they approached the pole. Thus the rhumbs, which otherwise ought to have been curves, were now also extended into straight lines: and thus a straight line drawn between any two places marked upon the chart would make an angle with the meridians, expressing the rhumb leading from the one to the other. But though, in 1569, Mercator published an universal map constructed in this manner, it doth not appear that he was acquainted with the principles on which this proceeded: and it is now generally believed, that the true principles on which the construction of what is called *Mercator's chart* depends, were first discovered by an Englishman, Mr Edward Wright.

Mr Wright supposes, but, according to the general opinion, without sufficient grounds, that this enlargement of the degrees of latitude was known and mentioned by Ptolemy, and that the same thing had also been spoken of by Cortes. The expressions of Ptolemy

lemy alluded to, relate indeed to the proportion between the distances of the parallels and meridians; but instead of proposing any gradual enlargement of the parallels of latitude, in a general chart, he speaks only of particular maps; and advises not to confine a system of such maps to one and the same scale, but to plan them out by a different measure, as occasion might require: only with this precaution, that the degrees of longitude in each should bear some proportion to those of latitude; and this proportion is to be deduced from that which the magnitude of the respective parallels bear to a great circle of the sphere. He adds that in particular maps, if this proportion be observed with regard to the middle parallel, the inconvenience will not be great though the meridians should be straight lines parallel to each other. Here he is said only to mean, that the maps should in some measure represent the figures of the countries for which they are drawn. In this sense Mercator, who drew maps for Ptolemy's tables, understood him; thinking it, however, an improvement not to regulate the meridians by one parallel, but by two; one distant from the northern, the other from the southern extremity of the map by a fourth part of the whole depth: by which means, in his maps, though the meridians are straight lines, yet they are generally drawn inclining to each other towards the poles. With regard to Cortes, he speaks only of the number of degrees of latitude, and not of the extent of them; nay, he gives express directions that they should all be laid down by equal measurement on scale of leagues adapted to the map.

For some time after the apearance of Mercator's map, it was not rightly understood, and it was even thought to be entirely useless, if not detrimental.—However, about the year 1592, its utility began to be perceived: and seven years after, Mr Wright printed his famous treatise entitled, *The Correction of certain Errors in Navigation*, where he fully explained the reason of extending the length of the parallels of latitude, and the uses of it to navigators. In 1610, a second edition of Mr Wright's book was published with improvements. An excellent method was proposed of determining the magnitude of the earth; at the same time it was judiciously proposed to make our common measures in some proportion to a degree on its surface, that they might not depend on the uncertain length of a barley-corn. Some of his other improvements were, "The Table of latitudes for dividing the meridian computed to minutes;" whereas it had only been divided to every tenth minute. He also published a description of an instrument which he calls the *sea-rings;* and by which the variation of the compass, altitude of the sun and time of the day, may be determined readily at once in any place, provided the latitude is known. He showed also how to correct the errors arising from the eccentricity of the eye in observing by the cross-staff. He made a total amendment in the tables of the declinations and places of the sun and stars from his own observations made with a six-foot quadrant in the years 1594, 95, 96, and 97. A sea quadrant to take altitudes by a forward or backward observation; and likewise with a contrivance for the ready finding the latitude by the height of the pole-star, when not upon the meridian. To this edition was subjoined a translation of Zamorano's Compendium above mentioned, in which he correected some mistakes in the original; adding a large table of the variation of the compass observed in very different parts of the world, to show that it was not occasioned by any magnetical pole.

These improvements soon became known abroad.—In 1608, a treatise intitled, *Hypomnemata Mathematica*, was published by Simon Stevin, for the use of Prince Maurice. In that part relating to navigation, the author having treated of sailing on a great circle, and shown how to draw the rhumbs on a globe mechanically, sets down Wright's two tables of latitudes and of rhumbs, in order to describe these lines more accurately, pretending even to have discovered an error in Wright's table. But all Stevin's objections were fully answered by the author himself, who showed that they arose from the gross way of calculating made use of by the former.

In 1624, the learned Wellebrordus Snellius, professor of mathematics at Leyden, published a treatise of navigation on Wright's plan, but somewhat obscurely; and as he did not particularly mention all the discoveries of Wright, the latter was thought by some to have taken the hint of all his discoveries from Snellius. But this supposition is long ago refuted; and Wright enjoys the honour of those discoveries which is justly his due.

Mr Wright having shown how to find the place of the ship on his chart, observed that the same might be performed more accurately by calculation: but considering, as he says, that the latitudes, and especially, the courses at sea, could not be determined so precisely, he forbore setting down particular examples: as the mariner may be allowed to save himself this trouble, and only mark out upon his chart the ship's way, after the manner then usually practised. However, in 1614, Mr Raphe Handson, among his nautical questions subjoined to a translation of Pitiscus's trigonometry, solved very distinctly every case of navigation by applying arithmetical calculations to Wright's table of latitudes, or of meridional parts, as it hath since been called. Though the method discovered by Wright for finding the change of longitude by a ship sailing on a rhumb is the proper way of performing it Handson also proposes two ways of approximation to it without the assistance of Wright's division of the meridian line. The first was computed by the arithmetical mean between the cosines of both latitudes; the other by the same mean between the secants as an alternative, when Wright's book was not at hand; though this latter is wider from the truth than the first. By the same calculations also he showed how much each of these compendiums deviates from the truth, and also how widely the computations on the erroneous principles of the plane chart differ from them all. The method, however, commonly used by our sailors is commonly called the *middle-latitude;* which, though it errs more than by the arithmetical mean between the two co-sines, is preferred on account of its being less operose: yet in high latitudes it is more eligible to use that of the arithmetical mean between the logarithmic co-sines equivalent to the geometrical mean between the co-sines themselves; a method since proposed by Mr John Bassat. The computation by the middle latitude will always fall short of the true change of longitude; that by the geometrical mean will always

ways exceed; but that by the arithmetical mean falls short in latitudes above 45 degrees, and exceeds in lesser latitudes. However, none of these methods will differ much from the truth when the change of latitude is sufficiently small.

About this time logarithms were invented by John Napier, baron of Merchiston in Scotland, and proved of the utmost service to the art of navigation. From which Mr Edmund Gunter constructed a table of logarithmic sines and tangents to every minute of the quadrant, which he published in 1620. In this work he applied to navigation, and other branches of mathematics, his admirable ruler known by the name of Gunter's scale *; on which are described lines of logarithms, of logarithmic sines and tangents, of meridional parts, &c. He greatly improved the sector for the same purposes. He showed also how to take a back-observation by the cross-staff, whereby the error arising from the eccentricity of the eye is avoided. He described likewise another instrument, of his own invention, called the *cross bow*, for taking altitudes of the sun or stars, with some contrivances for the more ready collecting the latitude from the observation. The discoveries concerning logarithms were carried to France in 1624 by Mr Edmund Wingate, who published two small tracts in that year at Paris. In one of these he taught the use of Gunter's scale; and in the other, of the tables of artificial sines and tangents, as modelled according to Napier's last form, erroneously attributed by Wingate to Briggs.

* See Gunter's Scale.

Gunter's rule was projected into a circular arch by the Reverend Mr William Oughtred in 1633, and its uses fully shown in a pamphlet intitled, *The Circles of Proportion*, where, in an appendix, are well treated several important points in navigation. It has also been made in the form of a sliding ruler.

The logarithmic tables were first applied to the different cases of sailing by Mr Thomas Addison, in his treatise intitled, *Arithmetical navigation*, printed in 1625. He also gives two traverse tables, with their uses; the one to quarter points of the compass, the other to degrees. Mr Henry Gellibrand published his discovery of the changes of the variation of the compass, in a small quarto pamphlet, intitled, *A discourse mathematical on the variation of the magnetical needle*, printed in 1635. This extraordinary phenomenon he found out by comparing the observations made at different times near the same place by Mr Burrough, Mr Gunter, and himself, all persons of great skill and experience in these matters. This discovery was likewise soon known abroad; For Father Athanasius Kircher, in his treatise intitled, *Magnes*, first printed at Rome in 1641, informs us, that he had been told it by Mr John Greaves; and then gives a letter of the famous Marinus Mersennus, containing a very distinct account of the same.

As altitudes of the sun are taken on shipboard by observing his elevation above the visible horizon, to obtain from thence the sun's true altitude with correctness, Wright observes it to be necessary that the dip of the visible horizon below the horizontal plane passing through the observer's eye should be brought into the account, which cannot be calculated without knowing the magnitude of the earth. Hence he was induced to propose different methods for finding this; but complains that the most effectual was out of his power to execute; and therefore contented himself with a rude attempt, in some measure sufficient for his purpose: and the dimensions of the earth deduced by him corresponded very well with the usual divisions of the log-line; however, as he wrote not an express treatise on navigation, but only for the correcting such errors as prevailed in general practice, the log-line did not fall under his notice. Mr Richard Norwood, however, put in execution the method recommended by Mr Wright as the most perfect for measuring the dimensions of the earth, with the true length of the degrees of a great circle upon it; and, in 1635, he actually measured the distance between London and York; from whence, and the summer solstitial altitudes of the sun observed on the meridian at both places, he found a degree on a great circle of the earth to contain 367,196 English feet, equal to 57,300 French fathoms or tortoises: which is very exact, as appears from many measures that have been made since that time. Of all this Mr Norwood gave a full account in his treatise called *The Seaman's Practice*, published in 1637. He there shows the reason why Snellius had failed in his attempt: he points out also various uses of his discovery, particularly for correcting the gross errors hitherto committed in the divisions of the log-line. But necessary amendments have been little attended to by sailors, whose obstinacy in adhering to established errors has been complained of by the best writers on navigation. This improvement has at length, however, made its way into practice, and few navigators of reputation now make use of the old measure of 42 feet to a knot. In that treatise also Mr Norwood describes his own excellent method of setting down and perfecting a sea-reckoning, by using a traverse table; which method he had followed and taught for many years. He shows also how to rectify the course by the variation of the compass being considered; as also how to discover currents, and to make proper allowance on their account. This treatise, and another on trignometry, were continually reprinted, as the principal books for learning scientifically the art of navigation. What he had delivered, especially in the latter of them, concerning this subject, was contracted as a manual for sailors, in a very small piece called his *Epitome*; which useful performance has gone through a great number of editions. No alterations were ever made in the Seaman's Practice till the 12th edition in 1676, when the following paragraph was inserted in a smaller character: "About the year 1672, Monsieur Picart has published an account in French, concerning the measure of the earth, a breviate whereof may be seen in the Philosophical Transactions, N° 112. wherein he concludes one degree to contain 365,184 English feet, nearly agreeing with Mr Norwood's experiment;" and this advertisement is continued through the subsequent editions as late as the year 1732.

About the year 1645, Mr Bond published in Norwood's epitome a very great improvement in Wright's method by a property in his meridian line, whereby its divisions are more scientifically assigned than the author himself was able to effect; which was from this theorem, that these divisions are analogous to the excesses of the logarithmic tangents of half the respective latitudes augmented by 45 degrees above the logarithm of the radius.

dius. This he afterwards explained more fully in the third edition of Gunter's works, printed in 1653; where, after observing that the logarithmic tangents from 45° upwards increase in the same manner that the secants added together do, if every half degree be accounted as a whole degree of Mercator's meridional line. His rule for computing the meridional parts belonging to any two latitudes, supposed on the same side of the equator, is to the following effect: "Take the logarithmic tangent, rejecting the radius, of half each latitude, augmented by 45 degrees; divide the difference of those numbers by the logarithmic tangent of 45° 30′, the radius being likewise rejected; and the quotient will be the meridional parts required, expressed in degrees." This rule is the immediate consequence from the general theorem, That the degrees of latitude bear to one degree (or 60 minutes, which in Wright's table stands for the meridional parts of one degree), the same proportion as the logarithmic tangent of half any latitude augmented by 45 degrees, and the radius neglected, to the like tangent of half a degree augmented by 45 degrees, with the radius likewise rejected. But here was farther wanting the demonstration of this general theorem, which was at length supplied by Mr James Gregory of Aberdeen in his *Exercitationes Geometricæ*, printed at London in 1668; and afterwards more concisely demonstrated, together with a scientific determination of the divisor, by Dr Halley in the Philosophical Transactions for 1695, N° 219. from the consideration of the spirals into which the rhumbs are transformed in the sterengraphic projection of the sphere upon the plane of the equinoctial; and which is rendered still more simple by Mr Roger Cotes, in his Logometria, first published in the Philosophical Transactions for 1714, N° 388. It is moreover added in Gunter's book, that if $\frac{1}{20}$th of this division, which does not sensibly differ from the logarithmic tangent of 45° 1′ 30″ (with the radius subtracted from it), be used, the quotient will exhibit the meridional parts expressed in leagues: and this is the divisor set down in Norwood's Epitome. After the same manner the meridional parts will be found in minutes, if the like logarithmic tangent of 45° 1′ 30″, diminished by the radius, be taken; that is, the number used by others being 12633, when the logarithmic tables consist of eight places of figures besides the index.

In an edition of the Seamen's Kalendar, Mr Bond declared, that he had discovered the longitude by having found out the true theory of the magnetic variation; and to gain credit to his assertion, he foretold, that at London in 1657 there would be no variation of the compass, and from that time it would gradually increase the other way; which happened accordingly. Again, in the Philisophical Transactions for 1668, N° 40. he published a table of the variation for 49 years to come. Thus he acquired such reputation, that his treatise, intitled, *The Longitude Found*, was in 1676 published by the special command of Charles II. and approved by many celebrated mathematicians. It was not long, however, before it met with opposition; and in 1678 another treatise, intitled, *The Longitude not Found*, made its appearance; and as Mr Bond's hypothesis did not in any manner answer its author's sanguine expectations, the affair was undertaken by Dr Halley. The result of his speculation was, that the magnetic needle is influenced by four poles; but this wonderful phenomenon seems hitherto to have eluded all our researches. In 1700, however, Dr Halley published a general map, with curve lines expressing the paths where the magnetic needle had the same variation; which was received with universal applause. But as the positions of these curves vary from time to time, they should frequently be corrected by skilful persons; as was done in 1744 and 1756, by Mr William Mountaine, and Mr James Dodson, F. R. S. In the Philosophical Transactions for 1690, Dr Halley also gave a dissertation on the monsoons; containing many very useful observations for such as sail to places subject to these winds.

After the true principles of the art were settled by Wright, Bond, and Norwood, the authors on navigation became so numerous, that it would be impossible to enumerate them. New improvements were daily made, and every thing relative to it was settled with an accuracy not only unknown to former ages, but which would have been reckoned utterly impossible. The earth being found to be a spheriod, and not a perfect sphere, with the shortest diameter passing thro' the poles, a tract was published in 1741 by the Rev. Doctor Patrick Murdoch, wherein he accommodated Wright's sailing to such a figure; and Mr Colin Maclaurin, the same year, in the Philosophical Transactions, N° 461. gave a rule for determining the meridonal parts of a spheroid; which speculation is farther treated of in his book of Fluxions, printed at Edinburgh in 1742.

Among the later discoveries in navigation, that of finding the longitude both by lunar observations and by time keepers is the principal. It is owing chiefly to the rewards offered by the British parliament that this has attained the present degree of perfection. We are indebted to Dr Maskelyne for putting the first of these methods in practice, and for other important improvements in navigation. The time keepers, constructed by Harrison for this express purpose, were found to answer so well, that he obtained the parliamentary reward.

THEORY of NAVIGATION.

THE motion of a ship in the water is well known to depend on the action of the wind upon its sails, regulated by the direction of the helm. As the water is a resisting medium, and the bulk of the ship very considerable, it thence follows, that there is always a great resistance on her fore-part; and when this resistance becomes sufficient to balance the moving force of the wind upon the sails, the ship attains her utmost degree of velocity, and her motion is no longer accelerated. This velocity is different according to the different strength of the wind; but the stronger the wind, the greater resistance is made to the ship's passage through the water: and hence, though the wind should blow ever so strong, there is also a limit to the velocity of the ſhip: for the ſails and ropes can bear but a certain force of air; and when the reſiſtance on the fore-part becomes more than equivalent to their ſtrength, the velocity can be no longer increaſed, and the rigging gives way.

The direction of a ſhip's motion depends on the poſition of her ſails with regard to the wind, combined with the action of the rudder. The moſt natural direction of the ſhip is, when ſhe runs directly before the wind, the ſails are then diſpoſed, ſo as to be at right angles thereto. But this is not always the caſe, both on account of the variable nature of the winds, and the ſituation of the intended port, or of intermediate headlands or iſlands. When the wind therefore happens not to be favourable, the ſails are placed ſo as to make an oblique angle both with the direction of the ſhip and with the wind and the ſails, together with the rudder, muſt be managed in ſuch a manner, that the direction of the ſhip may make an acute angle with that of the wind, and the ſhip making boards on different tacks, will by this means arrive at the intended port.

The reaſon of the ſhip's motion in this caſe is, that the water reſiſts the ſide more than the fore-part, and that in the ſame proportion as her length exceeds her breadth. This proportion is ſo conſiderable, that the ſhip continually flies off where the reſiſtance is leaſt, and that ſometimes with great ſwiftneſs. In this way of ſailing, however, there is a great limitation: for if the angle made by the keel with the direction of the wind be too acute, the ſhip cannot be kept in that poſition; neither is it poſſible for a large ſhip to make a more acute angle with the wind than about 6 points; though ſmall ſloops, it is ſaid, may make an angle of about five points with it. In all theſe caſes, however, the velocity of the ſhip is greatly retarded; and that not only on account of the obliquity of her motion, but by reaſon of what is called her *lee-way*. This is occaſioned by the yielding of the water on the lee ſide of the ſhip, by which means the veſſel acquires a compound motion, partly in the direction of the wind, and partly in that which is neceſſary for attaining the deſired port.

It is perhaps impoſſible to lay down any mathematical principles on which the lee-way of a ſhip could be properly calculated; only we may ſee in general that it depends on the ſtrength of the wind, the roughneſs of the ſea, and the velocity of the ſhip. When the wind is not very ſtrong, the reſiſtance of the water on the lee-ſide bears a very great proportion to that of the current of air: and therefore it will yield but very little: however, ſuppoſing the ſhip to remain in the ſame place, it is evident, that the water having once begun to yield, will continue to do ſo for ſome time, even though no additional force was applied to it; but as the wind continually applies the ſame force as at firſt, the lee-way of the ſhip muſt go on conſtantly increaſing till the reſiſtance of the water on the lee-ſide balances the force applied on the other, when it will become uniform, as doth the motion of a ſhip ſailing before the wind. If ſhe changes her place with any degree of velocity, then every time ſhe moves her own length a new quantity of water is to be put in motion, which hath not yet received any momentum, and which of conſequence will make a reater reſiſtance than it can do when the ſhip remains in the ſame place. In proportion to the ſwiftneſs of the ſhip, then the lee-way will be the leſs: but if the wind is very ſtrong, the velocity of the ſhip bears but a ſmall proportion to that of the current of air; and the ſame effects muſt follow as though the ſhip moved ſlowly, and the wind was gentle; that is, the ſhip muſt make a great deal of lee-way.—The ſame thing happens when the ſea riſes high, whether the wind is ſtrong or not; for then the whole water of the ocean, as far as the ſwell reaches, hath acquired a motion in a certain direction, and that to a very conſiderable depth. The mountainous waves will not fail to carry the ſhip very much out of her courſe; and this deviation will certainly be according to their velocity and magnitude. In all caſes of a rough ſea, therefore, a great deal of lee way is made.—Another circumſtance alſo makes a variation in the quantity of the lee-way; namely, the lightneſs or heavineſs of the ſhip; it being evident, that when the ſhip ſinks deep in the water, a much greater quantity of that element is to be put in motion before ſhe can make any lee-way, than when ſhe ſwims on the ſurface. As therefore it is impoſſible to calculate all theſe things with mathematical exactneſs, it is plain that the real courſe of a ſhip is exceedingly difficult to be found, and frequent errors muſt be made, which only can be corrected by celeſtial obſervations.

In many places of the ocean there are *currents*, or places where the water, inſtead of remaining at reſt, runs with a very conſiderable velocity for a great way in ſome particular direction, and which will certainly carry the ſhip greatly out of her courſe. This occaſions an error of the ſame nature with the lee-way; and therefore, whenever a current is perceived, its velocity ought to be determined, and the proper allowances made.

Another ſource of error in reckoning the courſe of a ſhip proceeds from the variation of the compaſs. There are few parts of the world where the needle points exactly north; and in thoſe where the variation is known, it is ſubject to very conſiderable alterations. By theſe means the courſe of the ſhip is miſtaken; for as the ſailors have no other ſtandard to direct them than the compaſs, if the needle, inſtead of pointing due north, ſhould point north-eaſt, a prodigious error would be occaſioned during the courſe of the voyage, and the ſhip would not come near the port to which ſhe was bound. To avoid errors of this kind the only method is, to obſerve the ſun's amplitude and azimuth as frequently as poſſible, by which the variation of the compaſs will be perceived, and the proper allowances can then be made for errors in the courſe which this may have occaſioned.

Errors will ariſe in the reckoning of a ſhip, eſpecially when ſhe ſails in high latitudes, from the ſpheroidal figure of the earth; for as the polar diameter of our globe is found to be conſiderably ſhorter than the equatorial one, it thence follows, that the farther we remove from the equator, the longer are the degrees of latitude. Of conſequence, if a navigator aſſigns any certain number of miles for the length of a degree of latitude near the equator, he muſt vary that meaſure as he approaches towards the poles, otherwiſe he will imagine that he hath not ſailed ſo far as he actually hath done. It would therefore be neceſſary to to have a table containing the length of a degree of latitude in every different parallel from the equator to either pole; as without this a troublesome calculation must be made at every time the navigator makes a reckoning of his course. Such a table, however, hath not yet appeared; neither indeed does it seem to be an easy matter to make it, on account of the difficulty of measuring the length even of one or two degrees of latitude in different parts of the world. Sir Isaac Newton first discovered this spheroidal figure of the earth; and showed from experiments on pendulums, that the polar diameter was to the equatorial one as 229 to 230. This proportion, however, hath not been admitted by succeeding calculators. The French mathematicians, who measured a degree on the meridian in Lapland, made the proportion between the equatorial and polar diameters to be as 1 to 0.9891. Those who measured a degree at Quito in Peru, made the proportion 1 to 0.99624, or 266 to 265. M. Bouquer makes the proportion to be as 179 to 178; and M. Buffon, in one part of his theory of the earth, makes the equatorial diameter exceed the polar one by $\frac{1}{187}$ of the whole. According to M. du Sejour, this proportion is as 321 to 320; and M. de la Place, in his Memoir upon the Figure of Spheroids has deduced the same proportion. From these variations it appears that the point is not exactly determined, and consequently that any corrections which can be made with regard to the spheroidal figure of the earth must be very uncertain.

It is of consequence to navigators in a long voyage to take the nearest way to their port; but this can seldom be done without considerable difficulty. The shortest distance between any two points on the surface of a sphere is measured by an arch of a great circle intercepted between them; and therefore it is advisable to direct the ship along a great circle of the earth's surface. But this is a matter of considerable difficulty, because there are no fixed marks by which it can be readily known whether the ship sails in the direction of a great circle or not. For this reason the sailors commonly choose to direct their course by the rhumbs, or the bearing of the place by the compass. These bearings do not point out the shortest distance between places; because, on a globe, the rhumbs are spirals, and not arches of great circles. However, when the places lie directly under the equator, or exactly under the same meridian, the rhumb then coincides with the arch of a great circle, and of consequence shows the nearest way. The sailing on the arch of a great circle is called *great circle sailing;* and the cases of it depend all on the solution of problems in spherical trigonometry.

PRACTICE of NAVIGATION.

BOOK I.

Containing the various Methods of Sailing.

Introduction.

The art of navigation depends upon astronomical and mathematical principles. The places of the sun and fixed stars are deduced from observation and calculation, and arranged in tables, the use of which is absolutely necessary in reducing observations taken at sea, for the purpose of ascertaining the latitude and longitude of the ship, and the variation of the compass. The problems in the various sailings are resolved either by trigonometrical calculation, or by tables or rules formed by the assistance of trigonometry. By mathematics, the necessary tables are constructed, and rules investigated for performing the more difficult parts of navigation. For these several branches of science, and for logarithmic tables, the reader is referred to the respective articles in this work. A few tables are given at the end of this article; but as the other tables necessary for the practice of navigation are to be found in almost every treatise on that subject, it therefore seems unnecessary to insert them in this place.

Chap. I. *Preliminary Principles.*

Sect. I. *Of the Latitude and Longitude of a Place.*

The situation of a place on the surface of the earth is estimated by its distance from two imaginary lines intersecting each other at right angles: The one of these is called the *equator*, and the other the *first meridian*. The situation of the equator is fixed, but that of the first meridian is arbitrary, and therefore different nations assume different first meridians. In Britain, that which passes through the royal observatory at Greenwich is esteemed to be the first meridian.

The equator divides the earth into two equal parts, called the *northern* and *southern hemispheres;* and the latitude of a place is its distance from the equator, reckoned on a meridian in degrees and parts of a degree; and is either north or south, according as it is in the northern or southern hemisphere.

The first meridian being continued round the globe, divides it into two equal parts, called the *eastern* and *western hemispheres;* and the longitude of a place is that portion of the equator contained between the first meridian and the meridian of the given place, and is either east or west; according as it is in the eastern or western hemisphere, respectively to the first meridian.

Prob. I. The latitudes of two places being given, to find the difference of latitude.

Rule. Subtract the less latitude from the greater, if the latitudes be of the same name, but add them if of contrary; and the remainder or sum will be the difference of latitude.

Example I. Required the difference of Latitude between the Lizard, in latitude 49° 57′ N. and Cape St Vincent, in latitude 37° 2′ N?

Latitude of the Lizard	49° 57′ N.
Latitude of Cape St Vincent	37 2 N.
Difference of latitude	12 55=775 miles.

Example II. What is the difference of latitude between Funchal, in latitude 32° 38′ N. and the Cape of Good Hope, in latitude 34° 29′ S?

Latitude

Latitude and Longitude.

Latitude of Funchal	32° 38′N.
Lat. of Cape of Good Hope	34 29 S.
Difference of latitude	67 7 = 4027 miles.

Prob. II. Given the latitude of one place, and the difference of latitude between it and another place, to find the latitude of that place.

Rule. If the given latitude and the difference of latitude be of the same name, add them; but if of different names, subtract them, and the sum or remainder will be the latitude required of the same name with the greater.

Example I. A ship from latitude 39° 22′ N. sailed due north 560 miles—Required the latitude come to?

Latitude sailed from	-	39° 22′ N.
Difference of latitude 560′	-	= 9 20 N.
Latitude come to	- -	48 42 N.

Example II. A ship from latitude 7° 19′ N. sailed 854 miles south—Required the latitude come to?

Latitude sailed from	- -	7° 19′ N.
Difference of latitude 854′	-	= 14 14 S.
Latitude come to	- -	6 55 S.

Prob. III. The longitudes of two places being given, to find their difference of longitude.

Rule. If the longitudes of the given places are of the same name, subtract the less from the greater, and the remainder is the difference of longitude: but if the longitudes are of contrary names, their sum is the difference of longitude. If this exceeds 180°, subtract it from 360°, and the remainder is the difference of longitude.

Example I. Required the difference of longitude between Edinburgh and New York, their longitude being 3° 14′ W. and 74° 10′ W. respectively?

Longitude of New York	- -	74° 10′ W.
Longitude of Edinburgh	- -	3 14 W.
Difference of longitude	- -	70 56

Example II. What is the difference of longitude between Maskelyne's Isles, in longitude 167° 59′ E. and Olinde, in longitude 35° 5′ W?

Longitude of Maskelyne's Isles		167° 59′ E.
Longitude of Olinde	-	35 5 W.
Sum	- - - - -	203 4
Subtract from	- -	360 0
Difference of longitude	-	156 56

Prob. IV. Given the longitude of a place, and the difference of longitude between it and another place, to find the longitude of that place.

Rule. If the given longitude and the difference of longitude be of a contrary name, subtract the less from the greater, and the remainder is the longitude required of the same name with the greater quantity; but if they are of different names, add them, and the sum is the longitude sought, of the same name with that given. If this sum exceeds 180°, subtract it from 360°, the remainder is the required longitude of a contrary name to that given.

Example I. A ship from longitude 9° 54′ E. sailed westerly till the difference of longitude was 23° 18′—Required the longitude come to?

Tides.

Longitude sailed from	- -	9° 54′ E.
Difference of longitude	- .	23 18 W.
Longitude come to	- -	13 24 W.

Example II. The longitude sailed from is 25° 9′ W. and difference of longitude 18° 46′ W.—Required the longitude come to?

Longitude left	- -	25° 9′ W.
Difference of longitude	-	18 46 W.
Longitude in	- -	43 55 W.

Sect. II. *Of the Tides.*

The theory of the tides has been explained under the article Astronomy, and will again be further illustrated under that of Tides. In this place, therefore, it remains only to explain the method of calculating the time of high water at a given place.

As the tides depend upon the joint actions of the sun and moon, and therefore upon the distance of these objects from the earth and from each other; and as, in the method generally employed to find the time of high water, whether by the mean time of new moon or by the epacts, or tables deduced therefrom, the moon is supposed to be the sole agent, and to have an uniform motion in the periphery of a circle, whose centre is that of the earth; it is hence obvious that method cannot be accurate, and by observation the error is sometimes found to exceed two hours. That method is therefore rejected, and another given, in which the error will seldom exceed a few minutes, unless the tides are greatly influenced by the winds.

Prob. I. To reduce the time of the moon's phases as given in the Nautical Almanac to the meridian of a known place.

Rule. To the time of the proposed phase, as given in the Nautical Almanac, apply the longitude of the place in time, by addition or subtraction, according as it is east or west, and it will give the time of the phase at the given place.

Example I. Required the time of new moon at Salonique in May 1793?

Time of new moon per Naut. Alm.	9d 15h 31′
Longitude of Salonique in time	0 1 33 E.
Time of new moon required in May	9 17 4

Example II. What is the time of the last quarter of the moon at Resolution Bay in October 1793?

Time of last quarter per Naut. Alm.	26d 5h 47′
Longitude in time - -	0 9 17 W
Time at Resolution Bay of last quarter, October - - -	25 20 30

Prob. II. To find the time of high water at a known place.

Rule. In the Nautical Almanac seek in the given month, or in that immediately preceeding or following it, for the time of that phase which happens nearest to the given day; reduce the time of this phase to the meridian of the given place by Prob. I. and take the difference between the reduced time and the noon of the given day.

Find the equation answering to this difference in Table VII. which applied to the time of high water on the day of new or full moon at the given place, according as the table directs, will give the approximate time of high water in the afternoon.

Now take the interval between the reduced time of the phase and the approximate time of high water; find the corresponding equation, which applied as before to the syzigy time of high water, will give the time of the afternoon high water.

If the time of the morning high water is required, increase the last interval by 12 hours, if the given day falls before the phase, or diminish it by 12 hours when after that phase; and the equation to this time, applied to the syzigy time, gives the morning time of high water.

Example I. Required the morning and afternoon times of high water at Leith, 11th December 1793?

Nearest phase to 11th Dec. is 1st quart.	9d	20h	29′
Longitude of Leith in time	—0	0	13
Time at Leith of 1st quarter	9	20	16
Given day - -	11	0	0
Difference - -	1	3	44
Time of H. W. at Leith-pier on syz.	0	2	20
Equat. from Tab. to 1d 3h 44′	+0	6	32
Approximate time of high water	11	8	52
Reduced time of 1st quarter -	9	20	16
Interval - - - -	1	12	36
Time of high water at Leith on syz.	0	2	20
Equat. from the Tab. to 1d 12h 36′	0	7	0
Time of high water at Leith		9	20P.M.
Time of H. W. at Leith at full & change		2	20
Equat. to 1d 12h 36—12h=1d 0h 36′		6	22
High water at Leith, Dec. 11th, at		8	42A.M.

The time of high water found by the common method is about an hour and a half sooner.

Example II. Required the time of high water at Funchal, 15th November 1793?

The nearest phase to 15th November is that of full moon, - - - -	17d	8h	46′
Longitude of Funchal in time,	0	1	8 W.
Time of full moon at Funchal, -	17d	7	38
Given day, November -	15	0	0
Difference, - -	2	7	38
Time of high water at Funchal at full and change, - -	0	12	4
Equation from the Table to 2d 7h 38′ before full moon -	—0	1	35
Approx. time of high water, Nov. 15.	0	10	29
Reduced time of full moon -	17	7	38
Interval, - -	1	11	9
Time of high water at full and change,	0	12	4
Equation to 1d 11h before full moon,	0	0	56
Time of high water, - -	0	11	8PM.

Equation to 1 d. 11 h.+12 h.=1 d. 23 h. is 1 h, 15′, and 12 h. 4′—1 h. 15′=10 h. 49′=time of high water in the forenoon.

Example III. Required the time of high water at Duskey Bay, 24th of October 1793?

The nearest phase to the 24th October is the last quarter -	26d	5h	47′
Longitude of Duskey Bay in time,	+0	11	5 E.
Reduced time of first quarter of moon,	26	16	52
Given day, - -	24	0	0
Difference, - -	2	16	52
Time of high water at full and change,		10h	67′
Equation to 2d 16h 52′ before last quarter, - -	+	2	52
Approximate time of high water,		1	49
Change of equation to app. time 1h 49′			3
Time of high water in the afternoon,		1	52
Change of equation to 12 hours, -			20
Time of high water in the morning,		1	32

Sect. III. *Of measuring a Ship's Run in a given time.*

The method commonly used at sea to find the distance sailed in a given time, is by means of a log-line and half minute-glass. A description of these is given under the articles Log and Log-line, which see.

It has been already observed, that the interval between each knot on the line ought to be 50 feet, in order to adapt it to a glass that runs 30 seconds. But although the line and glass be at any time perfectly adjusted to each other, yet as the line shrinks after being wet, and as the weather has a considerable effect upon the glass, it will therefore be necessary to examine them from time to time; and the distance given by them must be corrected accordingly. The distance sailed may therefore be affected by an error in the glass, or in the line, or in both. The true distance may, however, be found as follows.

Prob. I. The distance sailed by the log, and the seconds run by the glass, being given, to find the true distance, the line being supposed right.

Rule.—Multiply the distance given by the log by 30, and divide the product by the seconds run by the glass, the quotient will be the true distance.

Example I. The hourly rate of sailing by the log is nine knots, and the glass is found to run out in 35 seconds. Required the true rate of sailing?

9
30

35)270(7.7=true rate of sailing.

Example II. The distance sailed by the log is 73 miles, and the glass runs out in 26 seconds. Sought the true distance?

73
30

26)2190(84.2 the true distance.

Prob. II. Given the distance sailed by the log, and the measured interval between two adjacent knots on

Plane Sailing. the line, to find the true diſtance, the glaſs running exactly 30 ſeconds.

Rule. Multiply twice the diſtance ſailed by the meaſured length of a knot, point off two figures to the right, and the remainder will be the true diſtance.

Example I. The hourly rate of ſailing by the log is five knots, and the interval between knot and knot meaſures 53 feet. Required the true rate of ſailing?

Meaſured interval	=	53
Twice hourly rate	=	10
True rate of ſailing,	=	5.30

Example II. The diſtance ſailed is 64 miles, by a log-line which meaſures 42 feet to a knot. Required the true diſtance?

Twice given diſtance,	=	128
Meaſured interval,		42
		256
		512
True diſtance,		53.76

Prob. III. Given the length of a knot, the number of ſeconds run by the glaſs in half a minute, and the diſtance ſailed by the log; to find the true diſtance.

Rule. Multiply the diſtance ſailed by the log by ſix times the meaſured length of a knot, and divide the product by the ſeconds run by the glaſs, the quotient, pointing off one figure to the right, will be the true diſtance.

Example. The diſtance ſailed by the log is 159 miles, the meaſured length of a knot is 42 feet, and the glaſs runs 33 ſeconds in half a minute. Required the true diſtance?

Diſtance by the log,		159
Six times length of a knot=42×6=		252
		318
		795
		318
Second run by the glaſs	=	33)40068(121.4= true diſtance.

Chap. II. *Of Plane Sailing.*

Plane ſailing is the art of navigating a ſhip upon principles deduced from the notion of the earth's being an extended plane. On this ſuppoſition the meridians are eſteemed as parallel right lines. The parallels of latitude are at right angles to the meridians; the lengths of the degrees on the meridians, equator, and parallels of latitude, are every where equal; and the degrees of longitude are reckoned on the parallels of latitude, as well as on the equator.—In this ſailing four things are principally concerned, namely, the *courſe*, *diſtance*, *difference of latitude*, and *departure*.

The courſe is the angle contained between the meridian and the line deſcribed by the ſhip, and is uſually expreſſed in points of the compaſs.

The diſtance is the number of miles a ſhip has ſailed on a direct courſe in a given time.

The difference of latitude is the portion of a meridian contained between the parallels of latitude ſailed from and come to; and is reckoned either north or ſouth, according as the courſe is in the northern or ſouthern hemiſphere. Plane Sailing.

The departure is the diſtance of the ſhip from the meridian of the place ſhe left, reckoned on a parallel of latitude. In this ſailing, the departure and difference of longitude are eſteemed equal.

In order to illuſtrate the above, let A (fig. 1.) repreſent the poſition of any given place, and AB the meridian paſſing through that place; alſo let AC repreſent the line deſcribed by a ſhip, and C the point arrived at. From C draw CB perpendicular to AB. Now in the triangle ABC, the angle BAC repreſents the courſe, the ſide AC the diſtance, AB the difference of latitude, and BC the departure. Plate CCCXXXVII.

In conſtructing a figure relating to a ſhip's courſe, let the upper part of what the figure is to be drawn on repreſent the *north*, then the lower part will be *ſouth*, the right-hand ſide *eaſt*, and the left-hand ſide *weſt*.

A north and ſouth line is to be drawn to repreſent the meridian of the place from which the ſhip ſailed; and the upper or lower part of this line, according as the courſe is ſoutherly or northerly, is to be marked as the poſition of that place. From this point as a centre, with the chord of 60°, an arch is to be deſcribed from the meridian towards the right or left, according as the courſe is eaſterly or weſterly; and the courſe, taken from the line of chords if given in degrees, but from the line of rhumbs, if expreſſed in points of the compaſs, is to be laid upon this arch, beginning at the meridian. A line drawn through this point and that ſailed from, will repreſent the diſtance, which if given muſt be laid thereon, beginning at the point ſailed from. A line is to be drawn from the extremity of the diſtance perpendicular to the meridian: and hence the difference of latitude and departure will be obtained.

If the difference of latitude is given, it is to be laid upon the meridian, beginning at the point repreſenting the place the ſhip left; and a line drawn from the extremity of the difference of latitude perpendicular to the meridian, till it meets the diſtance produced, will limit the figure.

If the departure is given, it is to be laid off on a parallel, and a line drawn through its extremity will limit the diſtance. When either the diſtance and difference of latitude, diſtance and departure, or difference of latitude and departure, are given, the meaſure of each is to be taken from a ſcale of equal parts, is to be laid off on its reſpective line, and the extremities connected. Hence the figure will be formed.

Prob. I. Given the courſe and diſtance, to find the difference of latitude and departure.

Example. A ſhip from St Helena, in latitude 15° 55′ S. ſailed S. W. by S. 158 miles. Required the latitude come to, and departure?

By Conſtruction.

Draw the meridian AB (fig. 2.), and with the chord of 60° deſcribe the arch *m n*, and make it equal to the rhumb of 3 points, and through *e* draw AC equal to 158 miles; from C draw CB perpendicular to AB; then AB applied to the ſcale from which AC was taken, will be found to meaſure 131.4 and BC 87.8.

By

Plane Sailing.

By Calculation.

To find the difference of latitude.

As radius	- - -		10.00000
is to the co-sine of the course		3 points	9.91985
so is the distance	-	158	2.19866
to the difference of latitude		131.4	2.11851

To find the departure.

As radius	- - -		10.00000
is to the sine of the course		3 points	9.74474
so is the distance	-	158	2.19866
to the departure	-	87.8	1.94340

By Inspection.

In the traverse table, the difference of latitude answering to the course 3 points, and distance 158 miles, in a distance column is 131.4, and departure 87.8.

By Gunter's Scale.

The extent from 8 points to 5 points, the complement of the course on the line of sine rhumbs (marked SR.) will reach from the distance 158 to 131.4, the difference of latitude on the line of numbers; and the extent from 8 points to 3 points on sine rhumbs, will reach from 158 to 87.8, the departure on numbers.

Latitude St Helena	=	15° 55′ S.
Difference of latitude	-	2 11 S.
Latitude come to	-	18 6 S.

Prob. II. Given the course and difference of latitude, to find the distance and departure.

Example. A ship from St George's, in latitude 38° 45′ north, sailed SE½S; and the latitude by observation was 35° 7′ N. Required the distance, run, and departure?

Latitude St George's	-	38° 45′ N.
Latitude come to	-	35 7 N.
Difference of latitude		3 38 = 218 miles.

By Construction.

Plate CCCXXXVII. Draw the portion of the meridian AB (fig. 3.) equal to 218 m. from the centre A with the chord of 60° describe the arch *m n*, which make equal to the rhumb of 3½ points: through A*e* draw the line AC, and from B draw BC perpendicular to AB, and let it be produced till it meets AC in C. Then the distance AC being applied to the scale will measure 282 m. and the departure BC 179 miles.

By Calculation.

To find the distance.

As radius	- -		10.00000
is to the secant of the course		3½ points	10.11181
so is the difference of latitude		218 m.	2.33846
to the distance	-	282	2.45027

To find the departure.

As radius	- -		10.00000
is to the tangent of the course		3½ pts.	9.91417
so is the difference of latitude		218	2.33846
to the departure	-	178.9	2.25253

By Inspection.

Find the given difference of latitude 218 m. in a latitude column, under the course 3½ points; opposite to which, in a distance column, is 282 miles; and in a departure column is 178.9 m.

By Gunter's Scale.

Plane Sailing.

Extend the compass from 4½ points, the complement of the course to 8 points on sine rhumbs, that extent will reach from the difference of latitude 218 miles to the distance 282 miles in numbers; and the extent from 4 points to the course 3½ points on the line of tangent rhumbs (marked T. R.) will reach from 218 miles to 178.9, the departure on numbers.

Prob. III. Given course and departure, to find the distance and difference of latitude?

Example. A ship from Palma, in latitude 28° 37′ N sailed NW by W, and made 192 miles of departure: Required the distance, run, and latitude come to?

By Construction.

Make the departure BC (fig. 4.) equal to 192 miles, draw BA perpendicular to BC, and from the centre C, with the chord of 60°, describe the arch *m n*, which make equal to the rhumb of 3 points, the complement of the course; draw a line through C*e*, which produce till it meets BA in A: then the distance AC being measured, will be equal to 231 m. and the difference of latitude AB will be 128.3 miles.

By Calculation.

To find the distance.

As the sine of the course		5 points	9.91985
is to radius	- - -		10.00000
so is the departure	-	192 -	2.28330
to the distance	-	230.9	2.36345

To find the difference of latitude.

As the tangent of the course		5 points	10.17511
is to radius	- - -		10.00000
so is the departure	-	192	2.28330
to the difference of latitude		128.3	2.10819

By Inspection.

Find the departure 192 m. in its proper column above the given course 5 points; and opposite thereto is the distance 231 miles, and difference of latitude 138.3, in their respective columns.

By Gunter's Scale.

The extent from 5 points to 8 points on the line of sine rhumbs being laid from the departure 192 on numbers, will reach to the distance 231 on the same line; and the extent from 5 points to 4 points on the line of tangent rhumbs will reach from the departure 192 to the difference of latitude 128.3 on numbers.

Latitude of Palma	-	28° 37′ N
Difference of latitude	-	2 8 N
Latitude come to	- - -	30 45 N

Prob. IV. Given the distance and difference of latitude, to find the course and departure.

Example. A ship from a place in latitude 43° 13′ N, sails between the north and east 285 miles; and is then by observation found to be in latitude 46° 31′ N: Required the course and departure?

Latitude sailed from	-	43° 13′ N
Latitude by observation		46 31 N
Difference of latitude	-	3 18 = 198 miles.

By Construction.

Draw the portion of the meridian AB (fig. 5.) equal to 198 miles; from B draw BC perpendicular to

Plane Sailing.

to AB: then take the diſtance 285 miles from the ſcale, and with one foot of the compaſs in A deſcribe an arch interſecting BC in C, and join AC. With the chord of 60° deſcribe the arch *m n*, the portion of which, contained between the diſtance and difference of latitude, applied to the line of chords, will meaſure 46°, the courſe; and the departure BC being meaſured on the line of equal parts, will be found equal to 205 miles.

By Calculation.

To find the courſe.

As the diſtance -	285	2.45484
is to the difference of latitude	198	2.29660
ſo is the radius -		10.00000
to the coſine of the courſe	46° 0′	9.84176

To find the departure.

As radius - -		10.00000
is to the ſine of the courſe	46° 0′	9.85693
ſo is the diſtance -	285	2.45484
to the departure -	205	2.31177

By Inſpection.

Find the given diſtance in the table in its proper column; and if the difference of latitude anſwering thereto is the ſame as that given, namely 198, then the departure will be found in its proper column, and the courſe at the top or bottom of the page, according as the difference of latitude is found in a column marked *lat.* at top or bottom. If the difference of latitude thus found does not agree with that given, turn over till the neareſt thereto is found to anſwer to the given diſtance. This is in the page marked 46 degrees at the bottom, which is the courſe, and the correſponding departure is 205 miles.

By Gunter's Scale.

The extent from the diſtance 285 to the difference of latitude 198 on numbers, will reach from 90° to 44°, the complement of the courſe on ſines; and the extent from 90° to the courſe 46° on the line of ſines being laid from the diſtance 285, will reach to the departure 205 on the line of numbers.

Prob. V. Given the diſtance and departure, to find the courſe and difference of latitude.

Example. A ſhip from Fort-Royal in the iſland of Grenada, in latitude 12° 9′ N, ſailed 260 miles between the ſouth and weſt, and made 190 miles of departure: Required the courſe and latitude come to?

By Conſtruction.

Plate CCXXXVII.

Draw BC (fig 6.) perpendicular to AB, and equal to the given departure 190 miles: then from the centre C, with the diſtance 260 miles, ſweep an arch interſecting AB in it, and join AC. Now deſcribe an arch from the centre A with the chord of 60°, and the portion *m n* of this arch, contained between the diſtance and difference of latitude, meaſured on the line of chords, will be 47° the courſe; and the difference of latitude AB applied to the ſcale of equal parts, meaſures 177 miles.

By Calculation.

To find the courſe.

As the diſtance -	260	-	2.41497
is to the departure	190	-	2.27875
ſo is radius -		-	10.00000
to the ſine of the courſe	46° 57′		9.86378

Plane Sailing.

To find the difference of latitude.

As radius - - -		10.00000
is to the coſine of the courſe	46° 57′	9.83419
ſo is the diſtance -	260	2.41497
to the difference of latitude	177.5	2.24916

By Inſpection.

Seek in the traverſe table until the neareſt to the given departure is found in the ſame line with the given diſtance 260. This is found to be in the page marked 47° at the bottom, which is the courſe; and the correſponding difference of latitude is 177.3.

By Gunter's ſcale.

The extent of the compaſs, from the diſtance 260 to the departure 190 on the line of numbers, will reach from 90° to 47°, the courſe on the line of ſines: and the extent from 90 to 43°, the complement of the courſe on ſines, will reach from the diſtance 260 to the difference of latitude 177½ on the line of numbers.

Latitude Fort-Royal	- -	-	12	9 N
difference of latitude -	177	-	=2	57 S
Latitude in	-	-	9	12 N

Prob. VI. Given difference of latitude and departure, ſought courſe and diſtance.

Example. A ſhip from a port in latitude 7° 56′ S, ſailed between the ſouth and eaſt, till her departure is 132 miles; and is then by obſervation found to be in latitude 12° 3′ S. Required the courſe and diſtance?

Latitude ſailed from -		7°	56′ S.
Latitude in by obſervation		12	3 S.
Difference of latitude	-	4	7=247.

By Conſtruction.

Draw the portion of the meridian AB (fig. 7.) equal to the difference of latitude 247 miles; from B draw BC perpendicular to AB, and equal to the given departure 132 miles, and join AC: then with the chord of 60° deſcribe an arch from the centre A; and the portion *m n* of this arch being applied to the line of chords, will meaſure about 28°; and the diſtance AC, meaſured on the line of equal parts, will be 280 miles.

By Calculation.

To find the courſe.

As the difference of latitude -	247	2.39270
is to the departure - -	132	2.12057
ſo is radius - -		10.00000
to the tangent of the courſe -	28° 7′	9.72787

To find the diſtance.

As radius - -		10.00000
is to the ſecant of the courſe	28° 7′	10.05454
ſo is the difference of latitude	247	2.39270
to the diſtance -	280	2.44724

By Inſpection.

Seek in the table till the given difference of latitude and departure, or the neareſt thereto, are found together in their reſpective columns, which will be under 28°, the required courſe; and the diſtance anſwering thereto is 280 miles.

By Gunter's Scale.

The extent from the given difference of latitude 247 to to the departure 132 on the line of numbers, will reach from 45° to 28°, the course on the line of tangents; and the extent from 62°, the complement of the course, to 90° on sines, will reach from the difference of latitude 247 to the distance 280 on numbers.

Chap. III. *Of Traverse Sailing.*

If a ship sails upon two or more courses in a given time, the irregular track she describes is called a *traverse*; and to resolve a traverse is the method of reducing these several courses, and the distances run, into a single course and distance. The method chiefly used for this purpose at sea is by inspection, which shall therefore be principally adhered to; and is as follows.

Make a table of a breadth and depth sufficient to contain the several courses, &c. This table is to be divided into six columns; the several courses are to be put in the first, and the corresponding distances in the second column; the third and fourth columns are to contain the differences of latitude, and the two last the departures.

Now, the several courses and their corresponding distances being properly arranged in the table, find the difference of latitude and departure answering to each in the traverse table; remembering that the difference of latitude is to be put in a north or south column, according as the course is in the northern or southern hemisphere; and that the departure is to be put in an east column if the course is easterly, but in a west column if the course is westerly: Observing also, that the departure is less than the difference of latitude when the course is less than 4 points or 45°; otherwise greater.

Add up the columns of northing, southing, easting, and westing, and set down the sum of each at its bottom; then the difference between the sums of the north and south columns will be the difference of latitude made good, of the same name with the greater; and the difference between the sums of the east and west columns, is the departure made good, of the same name with the greater sum.

Now seek in the traverse table, till a difference of latitude and departure are found to agree as nearly as possible with those above; then the distance will be found on the same line, and the course at the top or bottom of the page according as the difference of latitude is greater or less than the departure.

In order to resolve a traverse by construction, describe a circle with the chord of 60°, in which draw two diameters at right angles to each other, at whose extremities are to be marked the initials of the cardinal points, north being uppermost.

Lay off each course on the circumference, reckoned from its proper meridian; and from the centre to each point draw lines, which are to be marked with the proper number of the course.

On the first radius lay off the first distance from the centre; and through its extremity, and parallel to the second radius, draw the second distance of its proper length; through the extremity of the second distance, and parallel to the the third radius, draw the third distance of its proper length; and thus proceed until all the distances are drawn.

A line drawn from the extremity of the last distance to the centre of the circle will represent the distance made good: and a line drawn from the same point perpendicular to the meridian, produced, if necessary, will represent the departure; and the portion of the meridian intercepted between the centre and departure will be the difference of latitude made good.

Examples.

I. A ship from Fyal, in latitude 38° 32′ N, sailed as follows: ESE 163 miles, SW ½ W 110 miles, SE ¾ S 180 miles, and N by E 68 miles. Required the latitude come to, the course, and distance made good?

By Inspection.

Course.	Dist.	Diff. of Latitude. N	Diff. of Latitude. S	Departure. E	Departure. W
ESE	163	—	62.4	150.6	—
SW½W	110	—	69.8	—	85.0
SE¾S	180	—	144.5	107.2	—
N*b*E	68	66.7	—	13.3	—
		66.7	276.7	271.1	
			66.7	85.0	
S41½E	281		210.0	186.1	

Latitude left,	-	38° 32′ N.
Difference of latitude,		3 21 S.
Latitude come to	-	35 11 N.

By Construction.

With the chord of 60° describe the circle NE,SW (fig. 8), the centre of which represents the place the ship sailed from: draw two diameters NS, EW at right angles to each other; the one representing the meridian, and the other the parallel of latitude of the place sailed from. Take each course from the line of rhumbs, lay it off on the circumference from its proper meridian, and number it in order 1, 2, 3, 4. Upon the first rhumb C1, lay of the first distance from C to A; through it draw the second distance AB parallel to C2, and equal to 110 miles; through B draw BD equal to 180 miles, and parallel to C3; and draw DE parallel to C4, and equal to 68 miles. Now CE being joined, will represent the distance made good; which applied to the scale will measure 281 miles. The arch S*n*, which represents the course, being measured on the line of chords, will be found equal to 41½°. From E draw EF perpendicular to CS produced; then CF will be the difference of latitude, and FE the departure made good; which applied to the scale will be found to measure 210 and 186 respectively.

Plate CCCXXXVII.

As the method by construction is scarcely ever practised at sea, it therefore seems unnecessary to apply it to the solution of the following examples.

II. A

II. A ship from latitude 1° 38′ S sailed as under. Required her present latitude, course, and distance made good?

Course.	Dist.	Diff. of Latitude N	Diff. of Latitude S	Departure E	Departure W
NW*b*N	43	35.8	—	—	23.9
WNW	78	29.9	—	—	72.1
SE*b*E	56	—	31.1	46.6	—
WSW½W	62	—	18.0	—	59.3
N¾E	85	84.1	—	12.5	—
		149.8	49.1	59.1	155.3
		49.1			59 1
N 44° W	139	100.7=1° 41′			96.2
Latitude left	-	1 38 S.			
Latitude come to		0 3 N			

III. Yesterday at noon we were in latitude 13° 12′ N, and since then have run as follows: SSE 36 miles, S 12 miles, NW ½ W 28 miles, W 30 miles, SW 42 miles, W*b*N 39 miles, and N 20 miles. Required our present latitude, departure, and direct course and distance?

Courses.	Dist.	Diff. of Latitude. N	Diff. of Latitude. S	Departure. E	Departure. W
SSE	36	—	33.3	13.8	—
S	12	—	12.0	—	—
NW½W	28	17.8	—	—	21 6
W	30	—	—	—	30.0
SW	42	—	29.7	—	29.7
W*b*N	39	7.6	—	—	38.2
N	20	20.0	—	—	—
		45.4	75 0	13.8	119.5
			45.4		13.8
S 74° W	110		29.6=0° 30′		105.7
Yesterday's latitude	-		13 12 N		
Present latitude	-		12 42 N		

IV. The course per compass from Greigsness to the May is SW ¼ S. distance 58 miles: from the May to the Staples S*b*E ¾ E. 44 miles; and from the Staples to Flamborough Head S*b*E, 110 miles. Required the course per compass, and distance from Greigsness to Flamborough Head?

Courses.	Dist.	Diff. of Latitude. N	Diff. of Latitude. S	Departure. E	Departure. W
SW ¼ S	58	—	43 0	—	38.9
S*b*E ¾ E	44	—	41.4	14.8	—
S*b*E	110	—	107.9	21.5	—
			192.3	36.3	38.9
					36.3
					2.6

Hence the course per compass is S 1° E, and distance 110 miles.

Chap. IV. *Of Parallel Sailing.*

The figure of the earth is spherical. and the meridians gradually approach each other, and meet at the poles. The difference of longitude between any two places is the angle at the pole contained between the meridians of those places; or it is the arch of the equator intercepted between the meridians of the given places; and the meridian distance between two places in the same parallel, is the arch thereof contained between their meridians. It hence follows, that the meridian distance, answering to the same difference of longitude, will be variable with the latitude of the parallel upon which it is reckoned; and the same difference of longitude will not answer to a given meridian distance when reckoned upon different parallels.

Parallel sailing is therefore the method of finding the distance between two places lying in the same parallel whose longitudes are known; or, to find the difference of longitude answering to a given distance, run in an east or west direction. This sailing is particularly useful in making low or small islands.

In order to illustrate the principles of parallel sailing, let CABP (fig. 9.) represent a section of one fourth part of the earth, the arch ABP being part of a meridian; CA the equatorial; and CP the polar semiaxis. Also let B be the situation of any given place on the earth; and join BC, which will be equal to CA or CP (A). The arch AB, or angle ACB, is the measure of the latitude of the place B; and the arch BP, or angle BCP, is that of its complement. If BD be drawn from B perpendicular to CP, it will represent the cosine of latitude to the radius BC or CA. Plate CCCXXXVII.

Now since circles and similar portions of circles are in the direct ratio of their radii; therefore,

As radius
Is to the cosine of latitude;
So is any given portion of the equator
To a similar portion of the given parallel.

But

(A) This is not strictly true, as the figure of the earth is that of an oblate spheroid; and therefore the radius of curvature is variable with the latitude. The difference between CA and CP, according to Sir Isaac Newton's hypothesis, is about 17 miles.

But the difference of longitude is an arch of the equator; and the distance between any two places under the same parallel, is a similar portion of that parallel.

Hence R : cosine latitude :: Diff. longitude : Distance.

And by inversion,

Cosine latitude : R :: Distance : Diff. of longitude.

Also,

Diff. of longitude : Distance :: R : cos. latitude.

Prob. I. Given the latitude of a parallel, and the number of miles contained in a portion of the equator, to find the miles contained in a similar portion of that parallel.

Example I. Required the number of miles contained in a degree of longitude in latitude 55° 58′?

By Construction.

Plate CCCXXXVII.

Draw the indefinite right line AB (fig. 10.); make the angle BAC equal to the given latitude 55° 58′, and AC equal to the number of miles contained in a degree of longitude at the equator, namely 60: from C draw CB perpendicular to AB; and AB being measured on the line of equal parts, will be found equal to 33. 5, the miles required.

By Calculation.

As radius - - -		10.00000
is to the cosine of latitude,	55° 58′	9.74794
so is miles in a deg. of long. at eq.	60	1.77815
to the miles in deg. in the given par.	33.58	1.52609

By Inspection.

To 56°, the nearest degree to the given latitude, and distance 60 miles, the corresponding difference of latitude is 33.6, which is the miles required.

By Gunter's Scale.

The extent from 90° to 34°, the complement of the given latitude on the line of sines, will reach from 60 to 33.6 on the line of numbers.

There are two lines on the other side of the scale, with respect to Gunter's line, adapted to this particular purpose; one of which is entitled *chords*, and contains the several degrees of latitude: The other, marked M. L. signifying *miles of longitude*, is the *line of longitude*, and shows the number of miles in a degree of longitude in each parallel. The use of these lines is therefore obvious.

Example II. Required the distance between Treguier in France, in longitude 3° 14′ W. and Gaspey Bay, in longitude 64° 27′ W. the common latitude being 48° 47′ N?

Longitude Treguier -	3° 14′ W	
Longitude Gaspey Bay	64 27 W	
Difference of longitude	61 13=3673′	
As radius -		10.00000
is to the cosine of latitude,	48 47	9.81882
so is the difference of longitude	3673	3.56502
to the distance -	2420	3.38384

Prob. II. Given the number of miles contained in a portion of a known parallel, to find the number of miles in a similar portion of the equator.

Example. A ship from cape Finisterre, in latitude 42° 52′ N, and longitude 9° 17′ W, sailed due west 342 miles. Required the longitude come to?

By Construction.

Draw the straight line AB (fig. 11.) equal to the given distance 342 miles, and make the angle BAC equal 42° 52′, the given latitude: from B draw BC perpendicular to AB, meeting AC in C; then AC applied to the scale will measure 466½, the difference of longitude required.

By Calculation.

As radius - -		10.00000
is to the secant of latitude	42° 52′	10.13493
so is the distance -	342	2.53403
to the difference of longitude	466.6	2.66896

By Inspection.

The nearest degree to the given latitude is 43°; under which, and opposite to 171, half the given distance in a latitude column, is 234 in a distance column, which doubled gives 468, the difference of longitude.

If the proportional part answering to the difference between the given alitude and that used be applied to the above, the same result with that found by calculation will be obtained.

By Gunter's Scale.

The extent from 47° 8′, the complement of latitude to 90° on the line of sines, being laid the same way from the distance 342, will reach to the difference of longitude 466½ on the line of numbers.

Longitude Cape Finisterre -	9° 17′W
Difference of longitude -	7 47 W
Longitude come to -	17 4 W

Prob. III. Given the number of miles contained in any portion of the equator, and the miles in a similar portion of a parallel, to find the latitude of that parallel.

Example. A ship sailed due east 358 miles, and was found by observation to have differed her longitude 8° 42′. Required the latitude of the parallel?

By Construction.

Make the line AB (fig. 12.) equal to the given distance; to which let BC be drawn perpendicular, with an extent equal to 522′, the difference of longitude; describe an arch from the centre A cutting BC in C; then the angle BAC being measured by means of the line of chords, will be found equal to 46°⅔, the required latitude.

By Calculation.

As the distance -	358	2.55388
is to the difference of longitude,	522	2.71767
so is radius - - -		10.00000
to the secant of the latitude	46° 42′	10.16379

By Inspection.

As the difference of longitude and distance exceed the limits of the table, let therefore the half of each be taken; these are 261 and 179 respectively. Now, by entering the table with these quantities, the latitude will be found to be between 46 and 47 degrees. Therefore, to latitude 46°, and distance 261 miles, the corresponding difference of latitude is 181′.3, which exceeds the half of the given distance by 2′.3. Again, to latitude 47°, and distance 261, the difference of latitude is 178′.0, being 1′.0 less than the half of that given: therefore the change of distance answering to a change of 1° of latitude is 3′.3.

Now, as 3′.3 : 2′.3 :: 1° : 42′

Hence the latitude required is 46° 42′.

Parallel Sailing.

By Gunter's Scale.

The extent from 522 to 358 on the line of numbers, will reach from 90° to about $43^{\circ}\frac{2}{3}$, the complement of which $46\frac{1}{3}$ is the latitude required?

Prob. IV. Given the number of miles contained in the portion of a known parallel, to find the length of a similar portion of another known parallel.

Example. From two parts in latitude 33° 58′ N, distance 348 miles, two ships sail directly north till they are in latitude 48° 23′ N. Required their distance?

By Construction.

Plate CCCXXXVII.

Draw the lines CB, CE (fig. 13.), making angles with CP equal to the complements of the given latitudes, namely, 56° 2′ and 41° 37′ respectively: make BD equal to the given distance 348 miles, and perpendicular to CP; now from the centre C, with the radius CB, describe an arch intersecting CE in E; then EF drawn from the point E, perpendicular to CP, will represent the distance required; and which being applied to the scale, will measure $278\frac{1}{2}$ miles.

By Calculation.

As the cosine of the latitude left	33° 58′	9.91874
is to the cosine of the latitude come to	48 23	9.82226
so is the given distance	348	2.54158
to the distance required	278.6	2.44510

By Inspection

Under 34°, and opposite to 174, half the given distance in a latitude column is 210 in a distance column; being half the difference of longitude answering thereto. Now, find the difference of latitude to distance 210 miles over 48° of latitude, which is 140′.5; from which 1′.1 (the proportional part answering to 23 minutes of latitude) being subtracted, gives 139′.4, which doubled is 278′.8, the distance required.

By Gunter's Scale.

The extent from 56° 2′, the complement of the latitude left, to 41° 37′, the complement of that come to on the line of sines, being laid the same way from 348, will reach to $278\frac{1}{2}$, the distance sought on the line of numbers.

Prob. V. Given a certain portion of a known parallel, together with a similar portion of an unknown parallel, to find the latitude of that parallel.

Example. Two ships, in latitude 56° 0′ N, distant 180 miles, sail due south; and having come to the same parallel, are now 232 miles distant. The latitude of that parallel is required?

By Construction.

Make DB (fig. 14.) equal to the first distance 180 miles, DM equal to the second 232, and the angle DBC equal to the given latitude 56°; from the centre C, with the radius CB, describe the arch BE; and through M draw ME parallel to CD, intersecting the arch BE in E, join EC and draw EF perpendicular to CD: then the angle FEC will be the latitude required; which being measured, will be found equal to 43° 53′.

By Calculation.

As the distance on the known parallel	180	2.25527
is to the distance on that required	232	2.36549
so is the cosine of the latitude left	56° 0′	9.74756
to the cosine of the latitude come to	43 53	9.85778

Middle Latitude Sailing.

By Inspection.

To latitude 56°, and half the first distance 90 in a latitude column, the corresponding distance is 161, which is half the difference of longitude. Now 161, and 116 half the second distance, are found to agree between 43 and 44 degrees; therefore, to latitude 43° and distance 161, the corresponding difference of latitude is 117′.7; the excess of which above 116′ is 1′.7: and to latitude 44°, and distance 161, the difference of latitude is 115′.8: hence 117.7—115.8 =1′.9, the change answering to a change of 1° of latitude.

There 1′.9 : 1′.7 :: 1° : 53′

Hence the latitude is 43° 53′.

By Gunter's Scale.

The extent from 180 to 232 on the line of numbers, being laid in the same direction on the line of sines, from 34°, the complement of the latitude sailed from, will reach to 46° 7′, the complement of the latitude come to.

Chap. V. *Of Middle Latitude Sailing.*

The earth is a sphere, and the meridians meet at the poles; and since a rhumb-line makes equal angles with every meridian, the line a ship describes is therefore that kind of a curve called a *spiral*.

Let AB (fig. 15.) be any given distance sailed upon an oblique rhumb, PBN, PAM the extreme meridians, MN a portion of the equator, and PCK, PEL two meridians intersecting the distance AB in the points CE infinitely near each other. If the arches BS, CD, and AR, be described parallel to the equator, it is hence evident, that AS is the difference of latitude, and the arch MN of the equator the difference of longitude, answering to the given distance AB and course PAB.

Now, since CE represents a very small portion of the distance AB, DE will be the correspondent portion of a meridian: hence the triangle EDC may be considered as rectilineal. If the distance be supposed to be divided into an infinite number of parts, each equal to CE, and upon these, triangles be constructed whose sides are portions of a meridian and parallel, it is evident these triangles will be equal and similar; for, besides the right angle, and hypothenuse which is the same in each, the course or angle CED is also the same. Hence, by the 12th of V. Euc. the sum of all the hypothenuses CE, or the distance AB, is to the sum of all the sides DE, or the difference of latitude AS, as one of the hypothenuses CE is to the corresponding side DE. Now, let the triangle GIH (fig. 16.) be constructed similar to the triangle CDE, having the angle G equal to the course: then as GH : GI :: CE : DC :: AB : AS.

Hence, if GH be made equal to the given distance AB, then GI will be the corresponding difference of latitude.

In like manner, the sum of all the hypothenuses CE, or the distance AB, is to the sum of all the sides CD,

Middle Latitude Sailing.

CD, as CE is to CD, or as GH to HI, because of the similar triangles.

The several parts of the same rectilineal triangle will therefore represent the course, distance, difference of latitude, and departure.

Although the parts HG, GI, and angle G of the rectilineal triangle GIH, are equal to the corresponding parts AB, AS, and angle A, of the triangle ASB upon the surface of the sphere; yet HI is not equal to BS, for HI is the sum of all the arcs CD; but CD is greater than OQ, and less than ZX: therefore HI is greater than BS, and less than AR. Hence the difference of longitude MN cannot be inferred from the departure reckoned either upon the parallel sailed from or on that come to, but on some intermediate parallel TV, such that the arch TV is exactly equal to the departure: and in this case the difference of longitude would be easily obtained. For TV is to MN as the sine PT to the sine PM; that is, as the cosine of latitude is to the radius.

The latitude of the parallel TV is not, however, easily determined with accuracy; various methods have therefore been taken in order to obtain it nearly, with as little trouble as possible: first, by taking the arithmetical mean of the two latitudes for that of the mean parallel: secondly, by using the arithmetical mean of the cosines of the latitudes: thirdly, by using the geometrical mean of the cosines of the latitudes: and lastly, by employing the parallel deduced from the mean of the meridional parts of the two latitudes. The first of these methods is that which is generally used.

Plate cccxxxvii.

In order to illustrate the computations in middle latitude sailing, let the triangle ABC (fig. 17.) represent a figure in plain sailing, wherein AB is the difference of latitude, AC the distance, BC the departure, and the angle BAC the course. Also let the triangle DBC be a figure in parallel sailing, in which DC is the difference of longitude, BC the meridian distance, and the angle DCB the middle latitude. In these triangles there is therefore one side BC common to both; and that triangle is to be first resolved in which two parts are given, and there the unknown parts of the other triangle will be easily obtained.

Prob. I. Given the latitudes and the longitudes of two places, to find the course and distance between them.

Example. Required the course and distance from the island of May, in latitude 56° 12′ N, and longitude 2° 37′ W, to the Naze of Norway, in latitude 57° 50′ N, and longitude 7° 27′ E?

Latitude Isle of May	56° 12′ N	-	56° 12′
Latitude Naze of Norway	57 50 N	-	57 50
Difference of latitude	1. 38=98′		114. 2
Middle latitude	-	-	57. 1

Longitude Isle of May	-	2 37 W
Longitude Naze of Norway	-	7 27 E
Difference of longitude	-	10 7 = 604′

By Construction.

Draw the right line AD (fig. 18.) to represent the meridian of the May; with the chord of 60° describe the arch *m n*, upon which lay off the chord of 32° 59′, the complement of the middle latitude from *m* to *n*: from D through *n* draw the line DC equal to 604′, the difference of longitude, and from C draw CB perpendicular to AC: make BA equal to 98′, the difference of latitude, and join AC; which applied to the scale will measure 343 miles, the distance sought: and the angle A being measured by means of the line of chords, will be found equal to 73° 24′, the required course.

By Calculation.

To find the course (B).

As the difference of latitude -	98′ -	1.99123
is to the difference of longitude	604	2.78104
so is the cosine of middle latitude - -	57° 1′	9.73591
to the tangent of the cosine	73 24	10.52572

To find the distance.

As radius - - -		10.00000
is to the secant of the course	73° 24′	10.54411
so is the difference of latitude	98′	1.99123
to the distance - -	343	2.53534

By Inspection.

To middle latitude 57°, and 151 one-fourth of the difference of longitude in a distance column, the corresponding difference of latitude is 82.2.

Now 24.5, one-fourth of the difference of latitude, and 82.2, taken in a departure column, are found to agree nearest on table marked 6½ points at the bottom, which is the cosine; and the corresponding distance 85¾ multiplied by 4 gives 343 miles, the distance.

By Gunter's Scale.

The extent from 98 the difference of latitude, to 604 the difference of longitude on numbers, being laid the same way from 33°, the complement of the middle latitude on sines, will reach to a certain point beyond the termination of the lines on the scale. Now the extent between this point and 90° on sines, will reach from 45° to 73° 24′, the course on the line of tangents. And the extent from 73° 24′ the course, to 33° the complement of the middle latitude on the line of sines, being laid the same way from 604 the difference of longitude, will reach to 343 the distance on the line of numbers.

The true course, therefore, from the island of May to the Naze of Norway is N 73° 24 E, or ENE¼E nearly; but as the variation at the May is 2¼ points west,

(B) For R. : cosine Mid. lat. : : Diff. of long. : Departure;
And diff. of lat. : Dep. : : R. : Tangent course.
Hence diff. of lat. : cosine mid. lat. : : diff. of long. : tang. course
Or diff. of lat. : diff. of long. : : cosine mid. lat. : tang. course.

Middle Latitude Sailing.

west, therefore the course *per* compass from the May is E¾S.

Prob. II. Given one latitude, course, and distance failed, to find the other latitude and difference of longitude.

Example. A ship from Brest, in latitude 48° 23′ N. and longitude 4° 30′ W. failed SW¾W 238 miles. Required the latitude and longitude come to?

By Construction.

With the course and distance construct the triangle ABC (fig. 17.), and the difference of latitude AB being measured, will be found equal to 142 miles: hence the latitude come to is 46° 1′ N, and the middle latitude 47° 12′. Now make the angle DCB equal to 47° 12′; and DC being measured, will be 281, the difference of longitude: hence the longitude come to is 9° 11′ W.

Plate CCCXXVII.

By Calculation.

To find the difference of latitude,

As radius - - -		10.00000
is to the co-sine of the course,	4¾	9.77503
so is the distance, -	238	2.37658
to the difference of latitude	141.8	2.15161
Latitude of Brest, 48° 23′ N.		48° 23′ N.
Difference of Lat. 2 22 S.	half	1 11 S.
Lat. come to 46° 1′ N.	Mid. Lat.	47 12

To find the difference of longitude (D).

As the co-sine of Mid. Lat.	47° 12′	9.83215
is to the sine of the course	4¾ points	9.90483
so is the distance	238	2.37658
to the difference of longitude	281.3	2.44926
Longitude of Brest -	-	4° 30′ W.
Difference of longitude -	-	4 41 W.
Longitude come to -	-	9 11 W.

By Inspection.

To the course 4¾ points, and distance 238 miles, the difference of latitude is 141.8, and the departure 191.1. Hence the latitude come to is 46° 1′ N, and middle latitude 47° 12′. Then to middle latitude 47° 12′, and departure 191.1 in a latitude column, the corresponding distance is 281′, which is the difference of longitude.

By Gunter's Scale.

The extent from 8 points to 3¼ points, the complement of the course on sine rhumbs, being laid the same way from the distance 238, will reach to the difference of latitude 142 on the line of numbers; and the extent from 42° 48′ the complement of the middle latitude, to 53° 26′, the course on the line of sines will reach from the distance 238 to the difference of longitude 281 on numbers.

Prob. III. Given both latitudes and course, required the distance and difference of longitude?

Example. A ship from St Antonio, in latitude 17° 0′ N, and longitude 24° 25′ W, failed NW, ¾ N, till by observation her latitude is found to be 28° 34′ N. Required the distance failed, and longitude come to?

Latitude St Antonio	17° 0 N.	17° 0′ N.
Latitude by observation	28 34 N.	28 34 N.
Difference of lat.	11 34=694m	45 34
	Middle lat.	22 47

By Construction.

Construct the triangle ABC (fig. 19), with the given course and difference of latitude, and make the angle BCD equal to the middle latitude. Now the distance AC and difference of longitude DC being measured, will be found equal to 864 and 558 respectively.

By Calculation.

To find the distance.

As radius, -	-	10.00000
Is to the secant of the course	3¼ points	10.09517
So is the difference of lat.	694	2.84136
To the distance -	864	2.93653

To find the difference of longitude.

As the cosine of middle latitude	22° 47′	9.96472
Is to the tangent of the course	3¼ points	9.87020
So is the difference of latitude	694	2.84136
To the difference of longitude	558.3	2.74684
Longitude of St Antonio	-	24° 25′ W.
Difference of longitude,	-	9 18 W.
Longitude come to -	-	33 43 W.

By Inspection.

To course 3¼ points, and difference of latitude 231.3 one third of that given, the departure is 171.6, and distance 288, which multiplied by 3 is 864 miles.

Again to the middle latitude 22° 47′, or 23°, and departure 171.6 in a latitude column, the distance is 186, which multiplied by 3 is 558, the difference of longitude.

By Gunter's Scale.

The extent from 4¾ points, the complement of the course, to 8 points on the line of sine rumbs, will reach from the difference of latitude 694 to the distance 864 on numbers; and the extent from the course 36° 34′ to 67° 13′, the complement of middle latitude on sines, will reach from the distance 864 to the difference of longitude 558 on numbers.

Prob. IV. Given one latitude, course, and departure, to find the other latitude, distance, and difference of longitude.

Example. A ship from latitude 26° 30′ N. and longitude 45° 30′ W. failed NE¾N. till her departure is 216 miles. Required the distance run, and latitude and longitude come to?

By Construction.

With the course and departure construct the triangle ABC (fig. 20.), and the distance and difference of latitude being measured, will be found equal to 340 and 263 respectively. Hence the latitude come to is 30° 53′ and middle latitude 28° 42′. Now make the angle BCD equal to the middle latitude, and the difference of longitude DC applied to the scale will measure 246′.

By

(D) This proportion is obvious, by considering the whole figure as an oblique angled triangle.

By Calculation.

To find the distance.

As the sine of the course	3½ points	9.80236
Is to radius		10.00000
So is the departure	216	2.33445
To the distance	340.5	2.53209

To find the difference of latitude.

As the tangent of the course	3½ points	9.91417
is to radius		10.00000
so is the departure	216	2.33445
to the difference of lat.	263.2	2.42028
Latitude sailed from	26° 30′ N.	26° 30′ N.
Difference of latitude	4 23 N. half	2 12 N.
Latitude come to	30 53 N. Mid. lat.	28 42

To find the difference of longitude.

As radius		10.00000
is to the secant of the mid. lat. 28° 42′		10.05693
so is the departure	216	2.33445
to the difference of longitude	246.2	2.39138
Longitude left,		45° 30′ W.
Difference of longitude		4 6 E.
Longitude come to		41 24 W.

By Inspection.

Under the course 3½ points, and opposite to 108 half the departure, the distance is 170, and difference of latitude 131½; which doubled, give 340 and 263 for the distance and difference of latitude respectively.

Again, to middle latitude 28° 42′, and departure 108, the distance is 123: which doubled is 246 the difference of longitude.

By Gunter's Scale.

The extent from the course 3½ points, on sine rhumbs, to the departure 216 on numbers, will reach from 8 points on sine rhumbs to about 340, the distance on numbers; and the same extent will reach from 4½ points, the complement of the course, to 263, the difference of latitude on numbers; and the extent from 61° 18′ the complement of the middle latitude, to 90° on sines, will reach from the departure 216 to the difference of longitude 246 on numbers.

Prob. V. Given both latitudes and distance; to find the course and difference of longitude.

Example. From Cape Sable, in latitude 43° 24′ N. and longitude 65° 39′ W. a ship sailed 246 miles on a direct course between the south and east, and is then by observation in latitude 40° 48′ N. Required the course and longitude in?

Latitude Cape Sable,	43 48 N.	43° 24′ N.
Latitude by observation,	40 48 N.	40 48 N.
Difference of latitude,	2 36 = 156′	24 12
	Middle latitude	42 6

By Construction.

Plate cccxxxvii. Make AB (fig. 21.) equal to 156 miles; draw BC perpendicular to AB, and make AC equal to 246 miles. Draw CD, making with CB an angle of 42° 6′ the middle latitude. Now DC will be found to measure 256, and the course or angle A will measure 50° 39′.

By Calculation.

To find the course.

As the distance	246	2.39093
is to the difference of latitude	156	2.19312
so is radius,		10.00000
to the cosine of the course	50° 39′	9.80219

To find the difference of longitude.

As the cosine of middle latitude	42° 6′	9.87039
is to the sine of the course	50 39	9.88834
so is the distance	246	2.39093
to the difference of longitude	256.4	2.40888
Longitude Cape Sable,		65° 39′ W.
Difference of longitude		4 16 E.
Longitude come to		61 23 W.

By Inspection.

The distance 246, and difference of latitude 156, are found to correspond above 4½ points, and the departure is 193.1. Now, to the middle latitude 42°, and departure 190.1 in a latitude column, the corresponding distance is 256, which is the difference of longitude required.

By Gunter's scale.

The extent from 246 miles, the distance to 156, the difference of latitude on numbers, will reach from 90° to about 39°⅓, the complement of the course on the line of sines: and the extent from 48°, the complement of the middle latitude, to 50°⅔, the course on sines, will reach from the distance 246m to the difference of longitude 256m on numbers.

Prob. VI. Given both latitudes and departure; sought the course, distance, and difference of longitude.

Example. A ship from Cape St Vincent, in latitude 37° 2′ N. longitude 9° 2′ W. sails between the south and west; the latitude come to is 18° 16′ N, and departure 838 miles. Required the course and distance run, and longitude come to?

Latitude Cape St Vincent,	37° 2′ N.	37° 2′
Latitude come to	18 16 N.	18 16
Difference of latitude	18 46 = 1126	55 18
	Middle latitude	27 39

By Construction.

Make AB (fig. 22.) equal to the difference of latitude 1126 miles, and BC equal to the departure 838, and join AC; draw CD so as to make an angle with CB equal to the middle latitude 27° 39′. Then the course being measured on chords is about 36°⅔, and the distance and difference of longitude, measured on the line of equal parts, are found to be 1403 and 946 respectively.

By Calculation.

To find the course.

As the difference of latitude	1126	3.05154
is to the departure	838	2.92324
so is radius		10.00000
to the tangent of the course	36° 39′	9.87170

To

Middle Latitude Sailing.

To find the distance.

As radius		10.00000
is to the secant of the course	36° 39′	10.09566
so is the difference of latitude	1126	3.05154
to the distance	1403	3.14720

To find the difference of longitude.

As radius		10.00000
is to the secant of the mid. lat.	27° 39′	10.05266
so is the departure	838	2.92324
to the difference of longitude	946	2.97590
Longitude Cape St Vincent		9° 2′W.
Difference of longitude		15 46W.
Longitude come to		24 48W.

By Inspection.

One-tenth of the difference of latitude 112.6, and of the departure 83.8, are found to agree under 3½ points, and the corresponding distance is 140, which multiplied by 10 gives 1400 miles. And to middle latitude 27°⅔, and 209.5 one-fourth of the departure in a latitude column, the distance is 236.5; which multiplied by 4 is 946, the difference of longitude.

By Gunter's Scale.

The extent from the difference of latitude 1126 to the departure 838 on numbers, will reach from 45° to 36°⅔ the course on tangents; and the extent from 53°⅓ the complement of the course to 90° on sines, will reach from 1126 to 1403 the distance on numbers. Lastly, the extent from 62°⅓ the complement of the middle latitude, to 90° on sines, will reach from the departure 838 to the difference of longitude 946 on numbers.

Prob. VII. Given one latitude, distance, and departure, to find the other latitude, course, and difference of longitude.

Example. A ship from Bourdeaux, in latitude 44° 50′ N, and longitude 0° 35′ W, sailed between the north and west 374 miles, and made 210 miles of westing. Required the course and latitude and longitude come to?

By Construction.

Plate CCCXXXVII.

With the given distance and departure make the triangle ABC (fig. 23.) Now the course being measured on the line of chords is about 34°⅙, and the difference of latitude on the line of numbers is 309 miles: hence the latitude come to, is 49° 59′ N, and middle latitude 47° 25′. Then make the angle BCD equal to 47° 25′, and DC measured will be 310 miles, the difference of longitude.

By Calculation.

To find the course.

As the distance	374	2.57287
is to the departure	210	2.32222
so is radius		10.00000
to the sine of the course	34° 10′	9.74935

To find the difference of latitude.

As radius		10.00000
is to the cosine of the course	34° 10′	9.91772
so is the distance	374	2.57287
to the difference of latitude	309.4	2.49059

Latitude Bourdeax	44° 50′ N			44° 50′
Difference of latitude	5 9 N	half		2 35
Latitude come to	49 59 N	Mid. lat.		47 25

To find the difference of longitude.

As radius		10.00000
is to the secant of middle latitude	47° 25′	10.16963
so is the departure	210	2.32222
to the difference of longitude	310.3	2.49185
Longitude of Bourdeax		0° 35′ W
Difference of longitude		5 10 W
Longitude in		5 45 W

By Inspection.

The half of the distance 187, and of the departure 105, are found to agree nearest under 34°, and the difference of latitude answering thereto is 155; which doubled is 310 miles.

Again, to middle latitude 47° 25′, and departure 105 in a latitude column, the corresponding distance is 155 miles, which doubled is 310 miles, the difference of longitude.

By Gunter's Scale.

The extent from the distance 374 miles to the departure 210 miles on the line of numbers, will reach from 90° to 34° 10′, the course on the line of sines; and the extent from 90° to 55° 50′, the complement of the course on sines, will reach from the distance 374 to the difference of latitude 309 miles on numbers.

Again, the extent from 42° 35′, the complement of the middle latitude, to 90° on sines, will reach from the departure 210 to the difference of longitude 310 on numbers.

Prob. VIII. Given one latitude, departure, and difference of longitude, to find the other latitude, course, and distance.

Example. A ship from latitude 54° 56′ N, longitude 1° 10 W, sailed between the north and east, till by observation she is found to be in longitude 5° 26′ E, and has made 220 miles of easting. Required the latitude come to, course, and distance run?

Longitude left	1° 10′ W
Longitude come to	5 26 E
Difference of longitude	6 36 = 396

By Construction.

Make BC (fig. 24.) equal to the departure 220, and CD equal to the difference of longitude 396:—then the middle latitude BCD being measured, will be found equal to 56° 15′: hence the latitude come to is 57° 34′, and difference of latitude 158°. Now make AB equal to 158, and join AC, which applied to the scale, will measure 271 miles. Also the course BAC being measured on chords will be found equal 54⅓.

By Calculation.

To find the middle latitude.

As the departure	220	2.34242
is to the difference of longitude	396	2.59769
so is radius		10.00000

to

Middle Latitude Sailing.

to the secant of the middle latitude	56° 15′	-	10.25527
Double the middle latitude	112 30		
Latitude left	54 56		
Latitude come to	57 34		
Difference of latitude	2 38 = 158		

To find the course.

As the difference of latitude	158	-	2.19866
is to the departure	220	-	2.34242
so is radius	-		10.00000
to the tangent of the course	54° 19′		10.14376

To find the distance.

As radius	-		10.00000
is to the secant of the course	54° 19′		10.23410
so is the difference of latitude	158	-	2.19866
to the distance	270.9	-	2.43276

By Inspection.

As the difference of longitude and departure exceed the limits of the tables, let therefore their halves be taken; these are 198 and 110 respectively. Now these are found to agree exactly in the page marked 5 points at the bottom. Whence the middle latitude is 56° 15′, and difference of latitude 158 miles.

Again the difference of latitude 158 and departure 220 will be found to agree nearly above 54° the course, and the distance on the same line is 271 miles.

By Gunter's Scale.

The extent from the difference of longitude 396 to the departure 220 on numbers, will reach from 90° to 33° 45′, the complement of the middle latitude on sines; and hence the difference of latitude is 158 miles. Now the extent from 158 to 220 on numbers, will reach from 45° to 54°⅓ on tangents; and the extent from the complement of the course 35°⅔ to 90° on sines, will reach from the difference of latitude 158 to the distance 271 on numbers.

Prob. IX. Given the course and distance sailed, and difference of longitude; to find both latitudes.

Example. A ship from a port in north latitude, sailed SE¾S 438 miles, and differed her longitude 7° 28′. Required the latitude sailed from, and that come to?

By Construction.

Plate CCCXXXVII.

With the course and distance construct the triangle ABC (fig. 25.) and make DC equal to 448 the given difference of longitude. Now the middle latitude BCD will measure 48° 58′, and the difference of latitude AB 324 miles; hence the latitude left is 51° 40′, and that come to 46° 16′.

By Calculation.

To find the difference of latitude.

As radius	-	-	10.00000
is to the cosine of the course	3¾ pts.	-	9.86979
so is the distance	438	-	2.64147
to the difference of latitude	324 05	-	2.51126

To find the middle latitude.

As the difference of longitude	448	-	2.65128
is to the distance	438	-	2.64147
so is the sine of the course	3¾ pts.		9.82708
to the cosine of the middle latitude	48° 58′		9.81727
half difference of latitude	2 42		
Latitude sailed from	51 40		
Latitude come to	46 16		

Middle Latitude Sailing.

By Inspection.

To the course 3¾ points, and half the distance 219 miles, the departure is 147.0, and difference of latitude 162.2; which doubled is 324.4. Again, to half the difference of longitude 224 in a distance column, the difference of latitude is 149.9 above 48°, and 146,9 over 49°.

Now, as 30 : 29 : : 60′ : 58

Hence the middle latitude is 48° 58′: the latitude sailed from is therefore 51° 40′, and latitude come to 46° 16′.

By Gunter's Scale.

The extent from 8 points to 4¼ points, the complement of the course on sine rhumbs, will reach from the distance 438 miles to the difference of latitude 3245 on numbers. And the extent from the difference of longitude 448, to the distance 438 on numbers, will reach from the course 42° 11′ to the complement of the middle latitude 41° 2′ on sines. Hence the latitude left is 51° 40′, and that come to 46° 16′.

Prob. X. Given the course, difference of latitude, and difference of longitude; to find both latitudes and distance.

Example. From a port in south latitude a ship sailed SW¼W, and has made 690 miles of difference of latitude, and 20° 38′ of difference of longitude.—Required both latitudes and distance?

By Construction.

Construct the triangle ABC (fig 26.) with the given course and difference of latitude, and make CD equal to 1228 the difference of longitude. Then AC applied to the scale will measure 1088 miles; and the middle latitude BCD will measure 46° 47′. Hence the latitude left is 41° 2′, and the latitude come to 52° 32′.

By Calculation.

To find the distance.

As radius	-		10.00000
is to the secant of the course	4¼ pts.		10.19764
so is the difference of latitude	690	-	2.83885
to the distance	1088	-	3.03649

To find the middle latitude.

As the difference of longitude	1228	-	3.08920
is to the distance	1088	-	3.03649
so is the sine of the course	4¼ pts.		9.88819
to the cosine of the middle latitude	46° 47′		9.83548
Half difference of latitude	5 45		
Latitude sailed from	41 2		
Latitude come to	52 32		

By Inspection.

To the course 4¼ points, and one-fourth of the given difference of latitude 172.5 the departure is 210.2

Fig. 1.

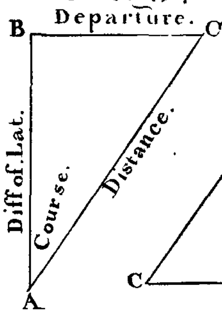


Fig. 2.

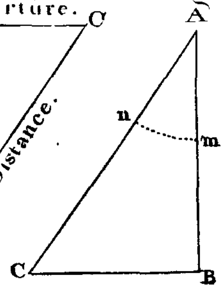


Fig. 3.

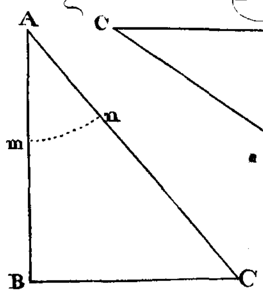


Fig. 4.

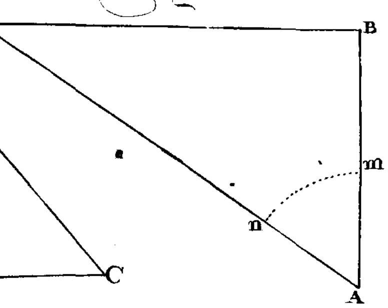


Fig. 5.

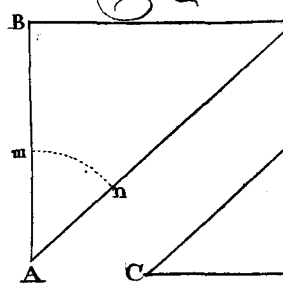


Fig. 6.

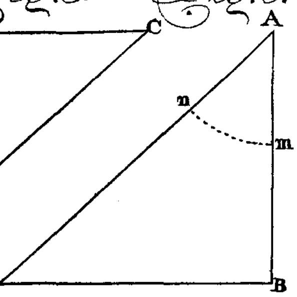


Fig. 7.

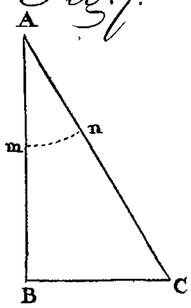


Fig. 8.

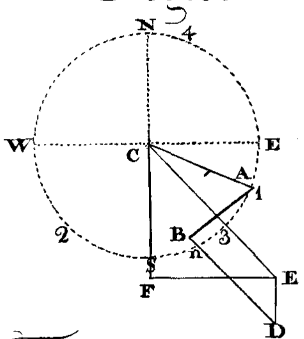


Fig. 9.

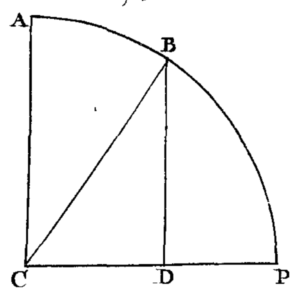


Fig. 10.

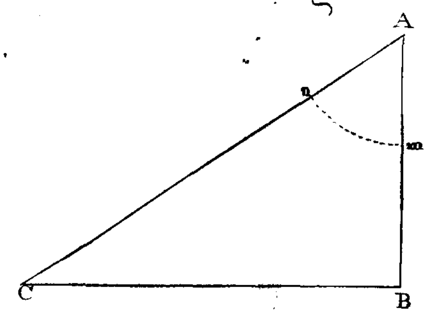


Fig. 11.

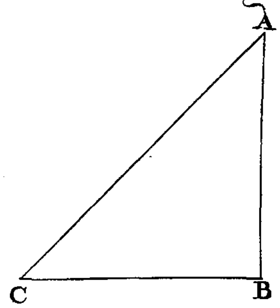


Fig. 12.

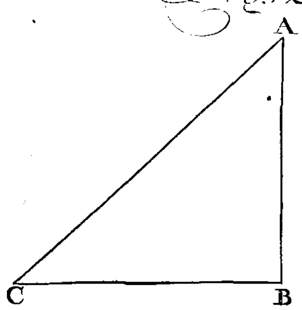


Fig. 13.

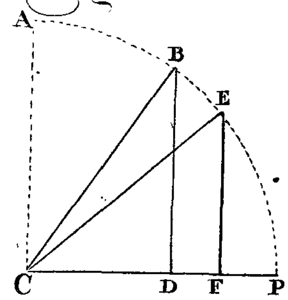
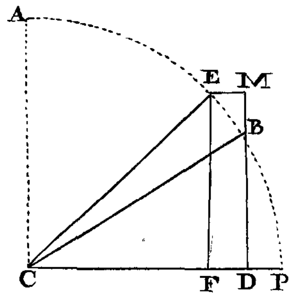


Fig. 14.



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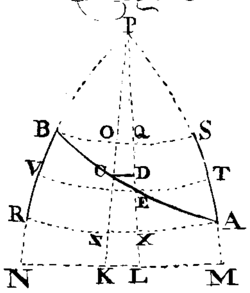

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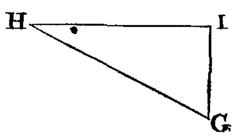

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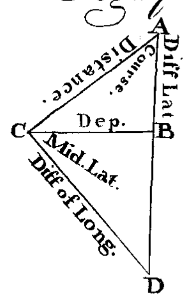

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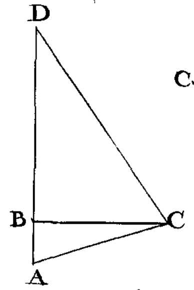
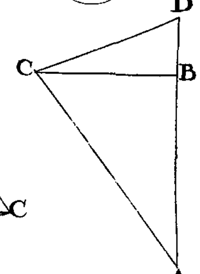


Fig. 19.



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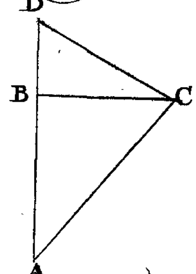

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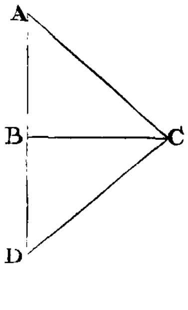


Fig. 22.

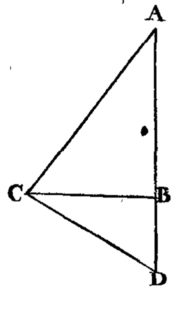


Fig. 23.

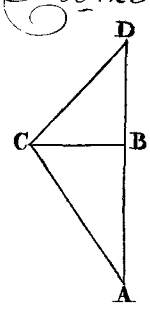


Fig. 24.

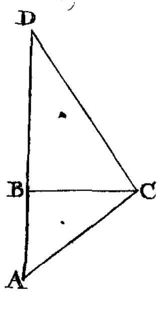


Fig. 25.

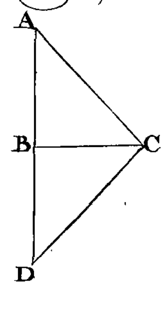


Fig. 26.

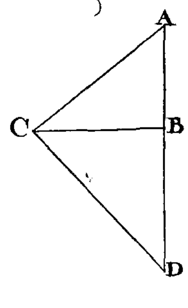
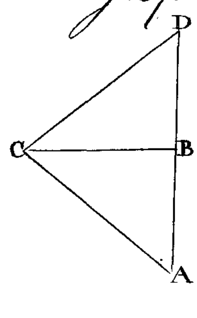


Fig. 27.



Middle Latitude Sailing.

210.2, and distance 272, which multiplied by 4 is 1088.

Now the middle latitude answering to the difference of longitude 1228, and the departure 840.8, or their aliquot parts, will be found as in last problem to be 46° 47'. Hence the latitudes are 41° 2' and 52° 32' respectively.

By Gunter's Scale.

The extent from the complement of the course $3\frac{1}{2}$ points to 8 points on sine rhumbs, will reach from the difference of latitude 690 to the distance 1088 miles on numbers; and the extent from the difference of longitude 1228 to the distance 1088 on numbers, will reach from the course 50° 38' to the complement of the middle latitude 43° 13' on the line of sines.—Hence both latitudes are found as before.

Prob. XI. Given the distance sailed, difference of latitude, and difference of longitude, to find both latitudes and course.

Example. In north latitude, a ship sailed 458 miles on a direct course between the north and west; and then was found to have differed her latitude 296 miles, and longitude 7° 17'. Required both latitudes and course?

By Construction.

Plate CCCXXXVII. With the distance and difference of latitude construct the triangle ABC (fig. 27.) and make CD equal to the difference of longitude 437; then the course BAC will be found to measure 49° 44', and the middle latitude BCD 36° 54': Hence the latitude left is 34° 26', and that come to 39° 22'.

By Calculation.

To find the course.

As the difference of latitude	296	-	2.47129
is to the distance -	458	-	2.66086
so is radius - - -			10.00000
to the secant of the course	49° 44'		10.18957

To find the middle latitude.

As the difference of longitude	437	-	2.64048
is to the distance -	458	-	2.66086
so is the sine of the course	49 44	-	9.88255
to the cosine of the middle latitude -	36 54	-	9.90293
Half difference of latitude	2 28		
Latitude left - -	34 26		
Latitude come to -	39 22		

By Inspection.

To half the distance 229 the difference of latitude is 150.2 at 49°, and 147.2 at 50°.

Then, as 3.0 : 2.2 :: 60' : 44'

Therefore the course is 49° 44'

Also the departure is 172.8 at 49°, and 175.4 at 50°,

Hence, as 3.0 : 2.2 :: 2.6 : 1.9

And $172.8 + 1.9 = 174.7 =$ half the departure.

Now to half the difference of longitude 218.5 in a distance column, the difference of latitude is 176.8 at 36°, and 174.5 at 37°.

Then, as 2.3 : 2.1 :: 60' : 54'.

Hence the middle latitude 36° 54'; and therefore the latitude sailed from is 34° 26', and that come to 39° 22'.

By Gunter's Scale.

The extent from the distance 458 to the difference of latitude 296 on numbers, will reach from 90° to 40° 16' the complement of the course on sines: and the extent from the difference of longitude 437 to the distance 458 on numbers, will reach from the course 49° 44', to the complement of the middle latitude 53° 6' on the line of sines: Hence the latitudes are 34° 26' and 39° 22' respectively.

Prob. XII. Given the distance, middle latitude, and difference of longitude, to find both latitudes and course.

Example. The distance is 384 miles between the south and east, the middle latitude 54° 6, and difference of longitude 6° 36'. Required both latitude and course?

By Construction.

With the middle latitude 54° 6', and difference of longitude 396, construct the triangle BCD (fig. 28.) and make AC equal to the given distance 384 miles. Then the course BAC will be found to measure 37° 12', and the difference of latitude AB 306 miles.—Hence the latitude sailed from is 56° 39', and that come to 51° 33'. Plate CCCXXXVIII.

By Calculation.

To find the course.

As the distance -	384	-	2.58433
is to the difference of longitude -	396	-	2.59769
so is the cosine of middle latitude -	54° 6'	-	9.76817
to the sine of the course	37 12	-	9.78153

To find the difference of latitude.

As radius - - -			10.00000
is to the cosine of the course	37° 12'	-	9.90120
so is the distanee -	384	-	2.58433
to the difference of latitude	305.9	-	2.48553
Middle latitude -	54° 6'		
Half difference of latitude	2 33		
Latitude sailed from -	56 39 N		
Latitude come to -	51 33 N		

By Inspection.

To the middle latitude 54°, and half the difference of longitude 198 in a distance column, the number in a latitude column is 116.4. Now half the distance 192 and 116.4 in a departure column, are found to agree nearly under the course 37°, and the corresponding difference of latitude 153; which doubled is 306 miles. Hence the latitude left is 56° 39' N, and latitude come to 51° 33' N.

By Gunter's Scale.

The extent from the distance 384 to the difference of longitude 396 on the line of numbers, will reach from 35° 54', the complement of the middle latitude, to 37° 12', the course on the line of sines: And the extent from 90° to 52° 48' the complement of the course on sines, will reach from the distance 384 to the difference of latitude 306 on numbers. Hence the latitudes are known.

Prob. XIII. To determine the difference of longitude made good upon compound courses, by middle latitude sailing.

Middle Latitude Sailing.

Rule. I. With the feveral courfes and diftances find the difference of latitude and departure made good, and the fhip's prefent latitude, as in traverfe failing.

Now enter the traverfe table with the given middle latitude, and the departure in a latitude column, the correfponding diftance will be the difference of longitude, of the fame name with the departure.

Example. A fhip from Cape Clear, in latitude 51° 18′ N, longitude 9° 46′ W, failed as follows:— SW*b*S 34 miles, W*b*N 63 miles, NNW 48 miles, and NE½E 85 miles. Required the latitude and longitude come to?

Courfes.	Dift.	Diff. of Latitude. N	Diff. of Latitude. S	Departure. E	Departure. W
SW*b*S	54	—	44.9	—	30.0
W*b*N	63	12.3	—	—	61.8
NNW	48	44.4	—	—	18.4
NE½E	85	53.9	—	65.7	—
		110.6	44.9	65.7	110.2
		44.9	—	—	65.7
N 34° W	79	65.7= 1 6N			44.5

Latititude of Cape Clear 51 18N

Latitude come to - 52 24N
Sum - - 103 42
Middle latitude - 51 51

Now, to middle latitude 51° 51′ or 52°, and departure 44.5 in a latitude column, the difference of longitude is 72 in a diftance column.

Longitude of Cape Clear - 9 46 W
Difference of longitude - 1 12 W

Longitude come to - 10° 58′ W

The above method is that always practifed to find the difference of longitude made good in the courfe of a day's run; and will, no doubt, give the difference of longitude tolerably exact in any probable run a fhip may make in that time, efpecially near the equator. But in a high latitude, when the diftances are confiderable, this method is not to be depended on.—To illuftrate this, let a fhip be fuppofed to fail from latitude 57° N, as follows: E 240 miles, N 240 miles, W 240 miles, and S 240 miles: then, by the above method, the fhip will be come to the fame place fhe left. It will, however, appear evident from the following confideration, that this is by no means the cafe; for let two fhips, from latitude 61° N, and diftant 240 miles, fail directly fouth till they are in latitude 57° N; now their diftance being computed by Problem IV. of Parallel Sailing, will be 269.6 miles; and, therefore, if the fhip failed as above, fhe will be 29.6 miles weft of the place failed from; and the error in longitude will be equal to 240 × fecant 61—fecant 57° = 29.6 × fecant 57°.

Theorems might be inveftigated for computing the errors to which the above method is liable. Thefe corrections may, however, be avoided, by ufing the following method.

Rule II. Complete the traverfe table as before, to which annex five columns: the firft column is to contain the feveral latitudes the fhip is in at the end of each courfe and diftance; the fecond, the fums of each following pair of latitude; the third, half the fums, or middle latitudes; and the fourth and fifth columns are to contain the differences of longitude.

Now find the difference of longitude anfwering to each middle latitude and its correfponding departure, and put them in the eaft or weft difference of longitude columns, according to the name of the departure. Then the difference of the fums of the eaft and weft columns will be the difference of longitude made good, of the fame name with the greater.

Ex. A fhip from Halliford in Iceland, in lat. 64° 30′ N, long. 27° 15′ W, failed as follows: SSW 46 miles, SW 61 miles, S*b*W 59 miles, SE*b*E 86 miles, S*b*E½E 76 miles. Required the lat. and long. come to?

Traverse Table.

Courfes.	Dift.	Diff. of Lat. N	Diff. of Lat. S	Departure. E	Departure. W
SSW	46	—	42.5	—	17.6
SW	61	—	43.1	—	43.1
S*b*W	59	—	57.9	—	11.5
S*b*E	86	—	47.8	71.5	—
SE*b*½E	76	—	72.7	22.0	—
			264.0	93.5	72.2
				72.2	
				21.3	

By Rule I.

Latitude Halliford - - 64° 30′ N
Difference of latitude - 4 24 S
Latitude in - - 60 6 N
Sum - - - 124 36
Middle latitude - 62 18

Now, to middle lat. 62 18, and departure 21.3, the difference of long. is 46 E.

Longitude Halliford - 27 15 W
Longitude in - - 16 29

The Error of comm. method, in this Ex. is 12′.

Longitude Table.

Succeffive Latitudes.	Sums.	Middle Latitude.	Diff. of Longitude. E	Diff. of Longitude. W
64° 30′	—	—	—	—
63 48	128° 18′	64° 9′	—	40.4
63 5	126 53	63 27	—	96.4
62 7	125 12	62 36	—	25.0
61 19	123 26	61 43	150.9	—
60 6	121 25	60 43	45.0	—
			195.9	161.8
			161.8	

Difference of longitude - 34.1
Longitude Halliford - 27.15 W
Longitude in - - 26,41 W

Mercator's Sailing.

Chap. VI. *Of Mercator's Sailing.*

It was observed in Middle Latitude Sailing, that the difference of longitude made upon an oblique rhumb could not be exactly determined by using the middle latitude. In Mercator's sailing, the difference of longitude is very easily found, and the several problems of sailing resolved with the utmost accuracy, by the assistance of Mercator's chart or equivalent tables.

In Mercator's chart the meridians are straight lines parallel to each other; and the degrees of latitude, which at the equator are equal to those of longitude, encrease with the distance of the parallel from the equator. The parts of the meridian thus encreased are called *meridional parts*. A table of these parts was first constructed by Mr Edward Wright, by the continual addition of the secants of each minute of latitude.

For by parallel sailing,

R : cos. of lat. : : part of equat. : similar part of parallel.

And because the equator and meridian on the globe are equal, therefore,

R : cos. lat. : : part of meridian : similar part of parallel.

Or sec. lat. : R : : part of merid. : similar part of parallel.

Hence, $\frac{\text{secant latitude}}{\text{part of meridian,}} = \frac{R}{\text{part of parallel.}}$

But in Mercator's chart the parallels of latitude are equal, and radius is a constant quantity. If therefore the latitude be assumed successively equal to 1′, 2′, 3′, &c. and the corresponding parts of the enlarged meridian be represented by a, b, c, &c.; then,

$$\frac{\text{secant } 1'}{\text{part of mer. } a} = \frac{\text{secant } 2'}{\text{part of mer. } b} = \frac{\text{secant } 3'}{\text{part of mer. } c.} \text{ \&c.}$$

Hence secant 1′ : part of mer. a : : secant 2′ : part of mer. b : : secant 3′ : part of mer. c, &c.

Therefore by 12th V. Euclid,

Secant 1′ : part of mer. a : : secant 1′ + secant 2′ + secant 3′, &c. : parts of mer. $a+b+c$, &c.

That is, the meridional parts of any given latitude is equal to the sum of the secants of the minutes in that latitude (D).

Since CD : LK : : R : secant LD, fig. 15.

And in the triangle CED,

ED : CD : : R : tangent CED;

Therefore, ED : LK. : R² : secant LD × tangent CED

$$\text{Hence LK} = \frac{\text{ED} \times \text{sec. LD} \times \text{tang. CED}}{R^2} = \frac{\text{ED} \times \text{sec. LD}}{R} \times \frac{\text{tang CED.}}{R}$$

But $\frac{\text{ED} \times \text{sec. LD}}{R}$ is the enlarged portion of the meridian answering to ED. Now the sum of all the quantities $\frac{\text{ED} \times \text{secant LD}}{R}$ corresponding to the sum of all the ED's contained in AS will be the meridional parts answering to the difference of latitude AS; and MN is the sum of all the corresponding portions of the equator LK.

$$\text{Whence MN} = \text{mer. diff. of lat.} \times \text{tangent } \frac{\text{CED}}{\text{R.}}$$

That is, the difference of longitude is equal to the meridional difference of latitude multiplied by the tangent of the course, and divided by the radius.

This equation answers to a right-angled rectilineal triangle, having an angle equal to the course; the adjacent side equal to the meridional difference of latitude, and the opposite side the difference of longitude. This triangle is therefore similar to a triangle constructed, with the course and difference of latitude, according to the principles of plane sailing, and the homologous sides will be proportional. Hence if, in fig. 29. the angle A represents the course AB the difference of latitude, and if AD be made equal to the meridional difference of latitude: then DE, drawn perpendicular to AD, meeting the distance produced to E, will be the difference of longitude. Plate CCCXXVIII

It is scarce necessary to observe, that the meridional difference of latitude is found by the same rules as the proper difference of latitude; that is, if the given latitudes be of the same name, the difference of the corresponding meridional parts will be the meridional difference of latitude; but if the latitudes are of a contrary denomination, the sum of these parts will be the meridional difference of latitude.

Prob. I. Given the latitudes and longitudes of two places, to find the course and distance between them.

Example. Required the course and distance between Cape Finisterre, in latitude 42° 52′ N, longitude 9° 17′ W, and Port Praya in the island of St Jago, in latitude 14° 54′ N, and longitude 23° 29′ W?

Lat. Cape Finisterre	42° 52′	Mer. parts	2852
Latitude Port Praya	14 54	Mer. parts	904
Difference of lat. =	27 58	Mer. diff. lat.	1948
	1678		

Longitude Cape Finisterre	-	9° 17′ W
Longitude Port Praya	-	23 29 W
Diff. longitude	-	14 12 = 852.

By Construction.

Draw the straight line AD (fig. 29.) to represent the meridian of Cape Finisterre, upon which lay off AB, AD equal to 1678 and 1948, the proper and meridional differences of latitude; from D draw DE perpendicular to AD, and equal to the difference of longitude 852 join AE, and draw BC parallel to DE; then the distance AC will measure 1831 miles, and the course BAC 23° 37′.

By Calculation.

To find the course.

As the meridian difference of lat.	1948	3.28959
is to the difference of longitude	852	2.93044
so is radius - - -		10.00000
to the tangent of the course	23° 37′	9.64085

To find the distance.

As radius - - -		10.00000
is to the secant of the course,	23° 37′	10.03798
so is the difference of latitude	1678	3.22479
to the distance -	1831	3.26277

4 T 2 By

(D) This is not strictly true; for instead of taking the sum of the secants of every minute in the distance of the given parallel from the equator, the sum of the secants of every point of latitude should be taken.

By Inspection.

As the meridian difference of latitude and difference of longitude are too large to be found in the tables, let the tenth of each be taken; these are 194.8 and 85.2 respectively. Now these are found to agree nearest under 24°; and to 167.8, one-tenth of the proper difference of latitude, the distance is about 183 miles, which multiplied by 10 is 1830 miles.

By Gunter's Scale.

The extent 1948, the meridional difference of latitude, to 852, the difference of longitude on the line of numbers, will reach from 45° to 23° 37', the course on the line of tangents. And the extent from 66° 23', the complement of the course to 90° on sines, will reach from 1678, the proper difference of latitude, to 1831, the distance on the line of numbers.

Prob. II. Given the course and distance sailed from a place whose situation is known, to find the latitude and longitude of the place come to.

Example. A ship from Cape Hinlopen in Virginia, in latitude 38° 47' N, longitude 75° 4' W, sailed 267 miles NE*b*N. Required the ship's present place?

By Construction.

Plate CCCXXXVIII With the course and distance sailed construct the triangle ABC (fig. 30.); and the difference of latitude AB being measured, is 222 miles: hence the latitude come to is 42° 29' N, and the meridional difference of latitude 293. Make AD equal to 293; and draw DE perpendicular to AD, and meeting AC produced in E: then the difference of longitude DE being applied to the scale of equal parts will measure 196; the longitude come to is therefore 71° 48' W.

By *Calculation.*

To find the difference of latitude.

As radius - - -		10.00000
is to the cosine of the course,	3 points	9.91985
so is the distance -	267	2.42651
to the difference of latitude	222	2.34636

Lat. Cape Hinlopen =	38° 47' N.	Mer. parts	2528
Difference of lat.	3 42 N.		
Latitude come to	42 29 N.	Mer. parts	2821
		Meridional difference of lat.	293

To find the difference of longitude.

As radius - -		10.00000
is to the tangent of the course,	3 points	9.82489
so is the mer. diff. of latitude	293	2.46687
to the difference of longitude	195.8	2.29176

Longitude Cape Hinlopen	75° 4' W
Difference of longitude -	3 16 E
Longitude come to -	71 48 W

By *Inspection.*

To the course 3 points, and distance 267 miles, the difference of latitude is 222 miles: hence the latitude in, is 42° 29', and the meridional difference of latitude 293. Again, to course 3 points, and 146.5 half the mer. difference of latitude, the departure is 97.9, which doubled is 195.8, the difference of longitude.

By Gunter's Scale.

The extent from 8 points to the complement of the course 5 points on sine rhumbs, will reach from the distance 267 to the difference of latitude 222 on numbers; and the extent from 4 points to 3 points on tangent rhumbs, will reach from the meridional difference of latitude 293 to the difference of longitude 196 on numbers.

Prob. III. Given the latitudes and bearing of two places, to find their distance and difference of longitude.

Example. A ship from Port Canso in Nova Scotia, in latitude 45° 20' N, longitude 60° 55' W, sailed SE ¾S, by observation is found to be in latitude 41° 14' N. Required the distance sailed, and longitude come to?

Lat. Port Canso -	45° 20' N	Mer. parts	3058
Lat. in by observation	41 14 N	Mer. parts	2720
Difference of lat. -	4 6	Mer. diff. lat.	338
	246		

By *Construction.*

Make AB (fig. 31.) equal to 246, and AD equal to 338; draw AE, making an angle with AD equal to 3¾ points, and draw BC, DE perpendicular to AD. Now AC being applied to the scale, will measure 332, and DE 306.

By Calculation.

To find the distance.

As radius - -		10.00000
is to the secant of the course,	3¾ points	10.13021
so is the difference of latitude	246	2.39093
to the distance -	332	2.52114

To find the difference of longitude.

As radius - -		10.00000
is to the tangent of the course,	3¾ points	9.95729
so is the mer. diff. of latitude	338	2.52892
to the difference of longitude	306.3	2.48621

Longitude Port Canso -	60° 55' W
Difference of longitude -	5 6 E
Longitude in - -	55 49 W

By Inspection.

Under the course 3¾ points, and opposite to half the difference of latitude, 123 in a latitude column is 166 in a distance column, which doubled is 332 the distance; and opposite to 169, half the meridional difference of latitude in a latitude column, is 153 in a departure column, which doubled is 306, the difference of longitude.

By Gunter's Scale.

The extent from the complement of the course 4¼ points to 8 points on sine rhumbs, will reach from the difference of latitude 246 m. to the distance 332 on numbers; and the extent from 4 points, to the course 3¾ points on tangent rhumbs, will reach from the meridional difference of latitude 338 to the difference of longitude 306 on numbers.

Prob. IV. Given the latitude and longitude of the place sailed from, the course, and departure; to find the distance, and the latitude and longitude of the place come to.

Example. A ship sailed from Sallee in Latitude 33° 58' N, longitude 6° 20' W, the corrected course was NW*b*W¾W, and departure 420 miles. Required the

Mercator's Sailing.

the distance run, and the latitude and longitude come to?

By Construction.

With the course and departure construct the triangle ABC (fig. 32.): now AC and AB being measured, will be found equal to 476 and 224 respectively: hence the latitude come to is 37° 42′ N, and meridional difference of latitude 276. Make AD equal to 276; and draw DE perpendicular thereto, meeting the distance produced in E; then DE applied to the scale will be found to measure 516′. The longitude in therefore is 14° 56′ W.

Plate CCCXXXVIII

By Calculation.

To find the distance.

As radius - - -		10.00000
is to to the cosecant of the course,	5¼ pts	10.05457
so is the departure - -	420	2.62325
to the distance - -	576.2	2.67782

To find the difference of latitude.

As radius - -		10.00000
is to the co-tangent of the course,	5¼ pts	9.72796
so is the departure -	420	2.62325
to the difference of latitude -	224.5	2.35121

Lat. of Sallee	33° 58′ N	Mer. parts 2169
Diff. of lat.	3 44 N	
Latitude in	37 42 N	Mer. parts 2445

Mer. difference of latitude 276

To find the difference of longitude.

As radius - - -		10.00000
is to the tangent of the course	5¼ pts	10.27204
so is the mer. diff. of latitude	276	2.44091
to the difference of longitude	516.3	2.71295

Longitude of Sallee -	6° 20′ W
Difference of longitude -	8 36 W
Longitude in - -	14 56 W

By Inspection.

Above 5¼ points the course, and opposite to 210 half the departure, are 238 and 112; which doubled, we have 476 and 224, the distance and difference of latitude respectively. And to the same course, and opposite to 138, half the meridional difference of latitude, in a latitude column, is 258 in a departure column; which being doubled is 516, the difference of longitude.

By Gunter's Scale.

The extent from 5¼ points, the course on sine rhumbs, to the departure 420 on numbers, will reach from 8 points on sine rhumbs to the distance 476 on numbers; and from the complement of the course 2¾ points on sine rhumbs to the difference of latitude 224 on numbers.

Again, the extent from difference of latitude 224 to the meridional difference of latitude 276 on numbers, will reach from the departure 420 to the difference of longitude 516 on the same line.

Prob. V. Given the latitudes of two places, and their distance, to find the course and difference of longitude.

Example. A ship from St Mary's, in latitude 36° 57′ N, longitude 25° 9′ W, sailed on a direct course between the north and east 1162 miles, and is then by observation in latitude 49° 57′ N. Required the course and longitude come to?

Mercator's Sailing.

Lat. of St Mary's -	36° 57′ N	Mer. parts	3470
Lat. come to -	49 57 N	Mer. parts	2389
Difference of lat.	13 0	Mer. diff. lat.	1081
	780		

By Construction.

Make AB (fig. 33.) equal to 780, and AD equal to 1081; draw BC, DE perpendicular to AD; make AC equal to 1162 m. and through AC draw ACE. Then the course or angle A being measured, will be found equal to 47° 50′, and the difference of longitude DE will be 1194.

By Calculation.

To find the course.

As the distance - -	1162	3.06521
is to the difference of latitude,	780	2.89209
so is radius - - -		10.00000
to the cosine of the course -	47° 50′	9.82688

To find the difference of longitude.

As radius - - -		10 00000
is to the tangent of the course,	47° 50′	10.04302
so is the mer. diff. of latitude	1081	3.03383
to the difference of longitude	1194	3.07685

Longitude of St Mary's -	25° 9′ W
Difference of longitude -	19 54 E
Longitude in -	5 15 W

By Inspection.

Because the distance and difference of latitude exceed the limits of the table, take the tenth of each; these are 116.2 and 78.0: Now these are found to agree nearest above 4½ points, which is therefore the course; and to this course, and opposite to 108.1, one tenth of the meridional difference of latitude, in a latitude column, is 119.3 in a departure column, which multiplied by 10 is 1193, the difference of longitude.

By Gunter's Scale.

The extent from the distance 1162 m. to the difference of latitude 780 m. on numbers, will reach from 90° to 42° 10′ in the line of sines. And the extent 45°, to the course 47° 50′ on the line of tangents, will reach from the meridional difference of latitude 1081 to the difference of longitude 1194 on numbers.

Prob. VI. Given the latitudes of two places, and the departure; to find the course, distance, and difference of longitude.

Example. From Aberdeen, in latitude 57° 9′ N, longitude 2° 9′ W. a ship sailed between the south and east till her departure is 146 miles, and latitude come to 53° 32′ N. Required the course and distance run, and longitude come to?

Latitude Aberdeen	57° 9′ N.	mer. parts 4199
Latitude come to	53 32 N.	mer. parts 3817
Difference of latitude	3 37	mer. diff. of lat. 382.
	217.	

By

Plate CCCXXXVIII.

By Construction.

With the difference of latitude 217m. and departure 146m. construct the triangle ABC (fig. 34.), make AD equal to 382, draw DE parallel to BC, and produce AC to E: Then the course BAC will measure 33° 56′, the distance AC 261, and the difference of longitude DE 257.

By Calculation.

To find the course.

As the difference of latitude	217	2.33646
is to the departure	146	2.16435
so is radius - - -		10.00000
to the tangent of the course	33° 56′	9.82789

To find the distance.

As radius - - -		10.00000
is to the secant of the course	33° 56′	10.08109
so is the difference of latitude	217	2.33646
to the distance	261.5	2.41755

To find the difference of longitude.

As the difference of latitude	217	2.33646
is to the mer. diff. of latitude	382	2.58206
so is the departure	146	2.16435
to the difference of longitude	257	2.40995
Longitude of Aberdeen		2° 9′ W
Difference of longitude		4 17 E
Longitude come to - -		2 8 E

By Inspection

The difference of latitude 217, and departure 146, are found to agree nearest under 34°, and the corresponding distance is 262 miles. To the same course, and opposite to 190.7, the nearest to 191 half the meridional difference of latitude, is 128.6 in a departure column, which doubled is 257, the difference of longitude.

By Gunter's Scale.

The extent from the difference of latitude 217, to the departure 146 on numbers, will reach from 45° to about 34°, the course on the line of tangents; and the same extent will reach from the meridional difference of latitude 382 to 257, the difference of longitude on numbers.—Again, the extent from the course 34° to 90 on sines, will reach from the departure 146 to the distance 261 on numbers.

Prob. VII. Given one latitude, distance, and departure; to find the other latitude, course, and difference of longitude.

Example. A ship from Naples, in latitude 40° 51′ N, longitude 14° 14′ E, sailed 252 miles on a direct course between the south and west, and made 173 miles of westing. Required the course made good, and the latitude and longitude come to?

By Construction.

With the distance and departure make the triangle ABC (fig. 35.) as formerly.—Now the course BAC being measured by means of a line of chords will be found equal to 43° 21′, and the difference of latitude applied to the scale of equal parts will measure 183′: hence the latitude come to is 37° 48′ N, and meridional difference of latitude 237.—Make AD equal to 237, and complete the figure, and the difference of longitude will measure 224′: hence the longitude in is 10° 30′ E.

By Calculation.

To find the course.

As the distance	252	2.40140
is to the departure	173	2.23805
so is radius - - -		10.00000
to the sine of the course	43° 21′	9.83665

To find the difference of latitude.

As radius - - -		10.00000
is to the cosine of the course	43° 21′	9.86164
so is the distance	252	2.40140
to the difference of latitude	183.2	2.26304

Latitude of Naples	40° 51′ N. Mer. parts	2690
Difference of latitude	3 3 S	
Latitude come to	37 48 N. Mer. parts	2453
Meridional difference of latitude		237

To find the difference of longitude.

As radius - - -		10.00000
is to the tangent of the course	43° 21′	9.97497
so is the mer. diff. of latitude	237	2.37475
to the difference of longitude	223.7	2.34972
Longitude of Naples		14° 14′ E
Difference of longitude		3 44 W
Longitude in - -		10 30 E.

By Inspection.

Under 43° and opposite to the distance 252 m. the departure is 171.8, and under 44°, and opposite to the same distance, the departure is 175.0.

Then as 3.2 : 1.2 :: 60′ : 22′

Hence the course is 43° 22′

Again, under 43° and opposite to 118.5, half the meridional difference of latitude in a latitude column, is 110.5 in a departure column; also under 44° and opposite to 118.5 is 114.4.

Then as 3.2 : 1.2 :: 3.9 : 1.5

And 110.5 + 1.5 = 112, which doubled is 224, the difference of longitude.

By Gunter's Scale.

The extent from the distance 252 on numbers to 90° on sines will reach from the departure 173 on numbers to the course 43°⅓ on sines; and the same extent that will reach from the complement of the course 46°⅔ on sines will reach to the difference of latitude on numbers.—Again, the extent from 45° to 43°⅓ on tangents will reach from the meridional difference of latitude 237 to the difference of longitude 224 on numbers.

Prob. VIII. Given one latitude, course and difference of longitude; to find the other latitude and distance.

Example. A ship from Tercera, in latitude 38° 45′ N, longitude 27° 6′ W, sailed on a direct course, which, when corrected, was N 32° E, and is found by observation to be in longitude 18° 24′ W. Required the latitude come to, and distance sailed?

Longitude of Tercera		27° 6′ W
Longitude in		18 24 W
Difference of longitude	-	8 42 = 522

By

Plate CCCXXXVIII.

By Construction.

Make the right angled triangle ADE (fig. 36.) having the angle A equal to the course 32°, and the side DE equal to the difference of longitude 522: then AD will measure 835, which added to the meridional parts of the latitude left, will give these of the latitude come to 48° 46'; hence the difference of latitude is 601: make AB equal thereto, to which let BC be drawn perpendicular; then AC applied to the scale will measure 708 miles.

By Calculation.

To find the meridional difference of latitude.

As radius, - -		10.00000
is to the co-tangent of the course	32° 0'	10.20421
so is the difference of longitude	5 22	2.71767
to the mer. difference of latitude	8352	2.92188

Latitude of Tercera	38° 45' N	Mer. parts	2526
		Mer. diff. of lat.	835
Latitude come to	48 46 N.	Mer. parts.	3361

Difference of latitude 10 1 = 601 miles.

To find the distance.

As radius - - -		10.00000
is to the secant of the course	32° 0'	10.07158
so is the difference of latitude	601	2.77887
to the distance	707.7	2.85045

By Inspection.

To course 32°, and opposite to 130.5, one fourth of the given difference of latitude in a departure column, the difference of latitude is 208.8, which multiplied by 4 is 835, the meridional difference of latitude; hence the latitude in is 48° 46' N, and difference of latitude 601.

Again, to the same course, and opposite to 200, one third of the difference of latitude, the distance is 236, which multiplied by 3 gives 708 miles.

By Gunter's Scale.

The extent from the course 32° to 45° on tangents will reach from the difference of longitude 522 to the meridional difference of latitude 835 on numbers.—And the extent from the complement of the course 58° to 90° on sines, will reach from the difference of latitude 601 to the distance 708 miles on numbers.

Prob. IX. To find the difference of longitude made good upon compound courses.

Rule. With the several courses and distances, complete the Traverse Table, and find the difference of latitude, departure, and course made good, and the latitude come to as in Traverse Sailing. Find also the meridional difference of latitude.

Now, to the course and meridional difference of latitude in a latitude column, the corresponding departure will be the difference of longitude, which applied to the longitude left will give the ship's present longitude.

Example. A ship from Port St Julian, in latitude 49° 10' S, longitude 68° 44' W, sailed as follows, ESE 53 miles, SE*b*S 74 miles, E by N 68 m. SE*b*E½E 47 miles, and E 84 miles. Required the ship's present place?

Courses.	Dist.	Diff. of Lat.		Departure.	
		N	S	E	W
ESE	53		20.3	49.0	
SE*by*S	74		61.5	41.1	
E*by*N	68	13.3		66.7	
SE*by*E½E	47		22.1	41.5	
E	84			84.0	
		13.3	103.9	282.3	
			13.3		
S 72° E	297		90.6 = 1° 31'		

Latitude left.	49 10 S	m. pt. 3397
Latitude come to	50 41 S	m. pt. 3539
Mer. difference of latitude		142

Now to course 72°, and opposite to 71, half the mer. difference of latitude in a latitude column, is 218.7 in a departure column, which doubled is 437, the difference of longitude.

Longitude of Port St Julian	68° 44' W
Difference of longitude	7 17 E
Longitude come to	61 27 W

Although the above method is that usually employed at sea to find the difference of longitude, yet as it has been already observed, it is not to be depended on, especially in high latitudes; in which case the following method becomes necessary.

Rule II. Complete the Traverse Table as before, to which annex five columns. Now with the latitude left, and the several differences of latitude, find the successive latitudes, which are to be placed in the first of the annexed columns; in the second the meridional parts corresponding to each latitude is to be put; and in the third, the meridional differences of latitude.

Then to each course, and corresponding meridional difference of latitude, find the difference of longitude, which place in the fourth or fifth columns, according as the course is easterly or westerly; and the difference between the sums of these columns will be the difference of longitude made good upon the whole of the same name with the greater.

Remarks.

1. When the course is north or south, there is no difference of longitude.

2. When the course is east or west, the difference of longitude cannot be found by Mercator's Sailing; in this case the following rule is to be used.

To the nearest degree to the given latitude taken as a course, find the distance answering to the departure in a latitude column: this distance will be the difference of longitude.

Example I. Four days ago we took our departure from Faro-head, in latitude 58° 40' N. and longitude 4° 50' W, and since have sailed as follows: NW 22 miles, W 69 miles, WNW 93 miles, W*b*S 77 miles, SW 58 miles, and W¾S 49 miles—Required our present latitude and longitude?

Traverse Table.					
Courses.	Dist.	Diff. of Lat N	Diff. of Lat S	Departure E	Departure W
NW	32	22.6			22.6
W	69				69.0
WNW	93	35.6			85.9
W*b*S	77		15.0		75.5
SW	58		41.0		41.0
W¾S	49		7.2		48.5
		58.2	63.2		342.5
			58.2		
W 1° S	343		5.0		

Longitude Table.				
Successive Latitudes.	Merid. Parts.	Merid. Diff. Lat.	Diff. of Longitude. E	Diff. of Longitude. W
58° 40′	4370			
59 3	4415	45		45.0
59 3	4415	0		134.0
59 38	4484	69		166.5
59 23	4454	30		151.0
58 42	4374	80		80.0
58 35	4361	13		88.0
				664.5

Longitude of Faro-head - 4° 50′ W.
Difference of longitude - 11 4 W.

Longitude in - - 15 54 W.

Example II. A ship from latitude 78° 15′ N, longitude 28° 84′ E. sailed the following courses and distances. The latitude come to is required, and the longitude, by both methods: the bearing and distance of Hacluit's head-land, in latitude 79° 55′ N. longitude 11° 55′ E. is also required?

Traverse Table.					
Courses.	Dist.	Diff. of Latitude. N	Diff. of Latitude. S	Departure. E	Departure. W
WNW	154	58.9	—	—	142.3
SW	96	—	67.9	—	67.9
NW½W	89	56.4	—	—	68.8
N*b*E	110	107.9	—	21.5	—
NW¾N	56	45.0	—	—	33.4
S*b*E¾E	78	—	73.4	26.3	—
		268.2	141.3	47.8	312.4
		141.3			47.8
		126.9			264.6

By Rule 1st.

Latitude left 78° 15′ N. Mer. pts = 7817
Diff. of latitude 2 7 N.

Lat. come to 80 22 N. Mer. pts = 8504

Meridional diff. of latitude - 687
As difference of lat. 126.9 2.10346
is to mer. diff. of latit. 687 - 2.83696
so is the departure 264.6 - 2.42256

to difference of longit. 1432 - 3.15606

23° 52′ W.
Longitude left 28 14 E.

Longitude in 4 22 E.

The error of this method in the present example, is therefore 1° 23′.

Longitude Table.				
Successive Latitudes.	Merid. Parts.	Merid. Diff. Lat.	Diff. of Longitude. E	Diff. of Longitude. W
78° 15′	7817		—	
79 14	8120	303	—	731.7
78 6	7774	346	—	346.0
79 2	8056	282	—	343.6
80 50	8676	620	123.6	—
81 35	8970	294	—	218.0
80 22	8504	466	166.7	—
			290.3	1639.3
				290.3
				1349.0

Longitude left - - 28° 14′ E.
Difference of longitude - 22 29 W.

Longitude in - - 5 45 E.

To find the bearing and distance of Hacluit's head-land.

Lat. H H. = 79° 55′ N. M. P. 8347 Lon. 11° 55′ E.
Lat. ship = 80 22 N. M. P. 8504 Lon. 5 45 E.

Diff. lat. 0 27 M. D. L. 157 D. L. 6 10

370

Now to 78.5 half the meridional difference of latitude, and 185.0 half the difference of longitude, the course 67°, and opposite to the difference of latitude 27, the distance is 69 miles.—Hence Hacluit's head-land bears S 67° E. distant 69 miles.

Method of resolving the Problems of Mercator's Sailing.

CHAP. VII. *Containing the Method of resolving the several Problems of Mercator's Sailing, by the Assistance of a Table of Logarithmic Tangents.*

PROB. The constant quantity 12.633114 (G) is to the difference or sum of the logarithmic tangents of half the co-latitudes of two places, according as these latitudes are of the same, or a contrary denomination; as the tantgent of the course is to the difference of longitude.

Demonst. Let CABP, Plate CCCXXXVIII. fig. 37. be a section of one fourth of the earth in the plane of the meridian; and let AC be the radius of the equator, and B any given place whose latitude is therefore AB. Draw BD perpendicular to AC, and BE parallel to it; and let B*b* be a very small portion of the meridian, as one minute.——Now put CA $= r$, DB $= y$, BE $= x$, and $z =$ meridional parts answering to the arch AB.

Then, $x : r :: bn : \frac{r}{x} \times bn$

but, $x : r :: \frac{r}{x} \times bn : \frac{r^2}{x^2} \times bn =$ correspondent portion of the enlarged meridian. Now these being put into fluxions, we have,

$$\dot{z} = \frac{r^2}{x^2} \times \dot{} = \frac{\dot{y}}{r^2 - y^2}$$

Of which the fluent is,

$$z = \frac{2.302585 \times r}{2} \times \log. \frac{r+y}{r-y}$$

$$= 2.302585 \times r \times \log. \sqrt{\frac{r+y}{r-y}}$$

Now as the meridional parts are expressed in parts of the equator, this equation becomes,

$$z = \frac{2.302585 \times 180^\circ \times 60'}{3.15149} \times \log. \sqrt{\frac{r+y}{r-y}} = \frac{1}{.0001263314} \times \log. \sqrt{\frac{r+y}{r-y}},$$

But $\log. \sqrt{\frac{r+y}{r-y}} = \log. \sqrt{\frac{r + \text{sine AB})}{r - \text{sine AB})}} = \log. \sqrt{\frac{\tan.\ (45 + \frac{1}{2}\text{AB})}{\tan.\ (45 - \frac{1}{2}\text{AB})}}$

And the tang. $(45 - \frac{1}{2}\text{AB}) = \frac{1}{\tan.\ (45 + \frac{1}{2}\text{AB})}$

Therefore $z = \frac{1}{.00012633114} \times \log. \sqrt{\tan.\ (45 + \frac{1}{2}\text{AB})^2} =$

$$= \frac{\log.\ \text{tang.}\ (45 + \frac{1}{2}\text{AB})}{.00012633114.} = \frac{\log.\ \text{tang. half co-latitude.}}{.00012633114,\ \&c.}$$

Hence the meridional parts answering to any given latitude, is found by dividing the difference between the log. of the radius and the log. tangent of half the complement of latitude, by the constant quantity .00012633114, &c.; and the meridional difference of latitude is obtained by dividing the difference or sum of the logarithmic tangents of half the co-latitudes, according as they are of the same or a contrary name, by the above quantity.

And the meridional difference of latitude multiplied by the tangent of the course, is equal to the difference of longitude. Hence the proposition is manifest.

This method shall be illustrated with examples performed by calculation: the other methods of solution are purposely omitted.

PROB. I. Given the latitudes and longitudes of two places, to find the course and distance between them.

EXAMPLE. Required the bearing and distance of Ostend, in lat. 51° 14′ N.; long. 2° 56′ E. from Aberdeen, in latitude 57° 9′ N. and longitude 2° 9′ W.?

Long. Aberdeen,	2° 9′ W.	Lat. 57°	9′	comp. 32°	51′	half 16°	25½′	tangent 9.46951
Long. Ostend,	2 56 E.	Lat. 51	14	comp. 38	46	half 19	23	tangent 9.54633
Diff. longitude	5 5=305	Diff. Lat. 5	55=355					Difference 7682

To find the course.

As the difference of the log. tang. 7682		3.88547
is to the constant logarithm	-	11.10151
so is the diff. of longitude	305	2.48430
to the tangent of the course	26° 38′	9.70034

To find the distance.

As radius	- - -	10.00000
is to the secant of the course	26° 38′	10.04871
so is the difference of latitude	355	2.55023
to the distance -	397.1	2.59894

PROB. II. Given the latitudes and bearing of two places; to find the distance and differ. of longitude.

EXAMPLE. Two days ago we were in latitude 23° 18′ S. longitude 16° 54′ W.; and having run upon a direct course, which corrected was S. 53° E. we were found to be in latitude 26° 26′ S. Required the distance sailed, and longitude come to?

Lat. left,	23° 18′	comp. 66° 42′	half 33° 21′	tang. 9.81831
Lat. come to,	26 26	comp. 63 34	half 31 47	tang. 9.79213
Diff. of Lat.	3 8=188m.			Difference 2618

G) In this case the tangent is to consist of five figures besides the index; but if the table extends to 6 or 7 figures, the above number will be 126.33, &c. or 1263.3, &c.

Method of resolving the Problems of Mercator's Sailing.

To find the distance.

As radius - - -		10.00000
is to the secant of the course	53°	10.22054
so is the difference of latitude	188	2.27416
to the distance	312.4	2.49470

To find the difference of longitude.

As the constant logarithm -		11.10151
is to the tangent of the course	53°	10.12289
so is the diff. of log. tangents	2618	3.41797
to the difference of longitude	275	2.43935
Longitude left, - -		16° 54' W.
Difference of longitude, -		4 35 E.
Longitude in - -		12 19 W.

Prob. III. Given the latitudes of two places, and the distance between them; to find the course and difference of longitude.

Example. A ship from latitude 48° 10' N. longitude 15° 12' W. failed on a direct course between the south and west 284 miles, and is then in latitude 44° 52' N. Required the course and longitude come to?

Lat. left, 48° 10' N.	comp. 41° 50'	half 20° 55'	tang. 9.58229
Lat. in, 44 52 N.	comp. 45 8	half 22 34	tang. 9.61865
Diff of lat. 3 18=198m.			Difference 3636

To find the course.

As the distance -	284	2.45332
is to the difference of latitude	198	2.29666
so is radius - - -		10.00000
to the cosine of the course	45° 48'	9.84334

To find the difference of longitude.

As the constant logarithm -		11.10151
is to the tangent of the course	45° 48'	10.01213
so is the diff. of logarithm tangents	3636	3.36062
to the difference of longitude	186.7	2.27124
Longitude left, - -		15° 12' W.
Difference of longitude - -		3 7 W.
Longitude come to - -		18 19 W.

Prob. IV. Given both latitudes and departure, to find the course, distance, and difference of longitude.

Example. A ship from latitude 18° 24' S. longitude 3° 25' E. failed between the north and west upon a direct course, till by observation she is in latitude 12° 42' N. and has made 970 miles of departure.—Required the course, distance, and longitude come to?

Lat. left, 18° 24' S.	comp. 71° 36'	half 35° 48'	cotan. 0.14193
Lat. come to, 12 42 N.	comp. 77 18	half 38 39	cotan. 0.09706
Diff. of lat. 31 6=1866			Sum 0.23899

To find the course.

As the difference of latitude	1866	3.27091
is to the departure -	970	2.98677
so is radius - - -		10.00000
to the tangent of the course,	27° 28'	9.71586

To find the distance.

As radius - -		10.00000
is to the secant of the course	27° 28'	10.05194
so is the difference of latitude	1866	3.27091
to the distance -	2103	3.32285

To find the difference of longitude.

As the constant logarithm - -		11.10151
is to the tangent of the course	27° 28'	9.71586
so is the sum of the log. tangents	23899	4.37838
to the difference of longitude	983.4	2.99273
Longitude left - -		3° 25' E.
Difference of longitude -		16 23 W.
Longitude come to -		12 58 W.

Prob. V. Given one latitude course and distance; to find the other latitude and difference of longitude.

Example. From Scarborough, in latitude 54° 20' N. longitude 0° 10' W. ship failed NE ¾ E 210 miles. Required the latitude and longitude come to?

To find the difference of latitude.

As radius - - -		10.00000
is to the cosine of the course	4¾ points	9.77503
so is the distance -	210	2.32222
to the difference of latitude	125	2.09725

Lat. left, 54° 20' N.	comp. 35° 40'	half 17° 50'	tang. 9.50746
Diff. of lat. 2 5 N.			
Lat. in, 56 25 N.	comp. 33 35	half. 16 47½	tang. 9.47964
			Difference 2782

To find the difference of longitude.

As the constant logarithm -		11.10151
is to the tangent of the course	4¾ pts.	10.12980
so is the difference of log. tang.	2782	3.44436
to the difference of longitude	296.9	2.47265
Longitude of Scarborough -		0 10 W.
Difference of longitude -		4 57 E.
Longitude come to, - -		4 47 E.

Prob. VI. Given one latitude, course, and departure, to find the other latitude, distance, and difference of longitude.

Example. A ship from latitude 32° 58' N. longitude 16° 28' W. failed SE½S, and made 164 miles of departure. Required the distance run, and latitude and longitude come to?

To find the distance.

As the sine of the course	3½ pts.	9.80236
is to radius - -		10.00000
so is the departure -	164	2.21484
to the distance -	285.5	2.41248

To find the difference of latitude.

As the tangent of the course	3½ pts.	9.91417
is to radius - -		10.00000
so is the departure	164	2.21484
to the difference of latitude	199.8	2.30067

Lat. left, - 32° 58' N.	comp. 57° 2'	half 28° 31'	tang. 9.73507
Diff. of lat. 3 20 S.			
Lat. come to, 29 38 N.	comp. 60 22	half 30 11	tang. 9.76464
			Difference 2957

To find the difference of longitude.

As the constant logarithm -		11.10151
is to the tangent of the course	3½ pts.	9.91417
so is the difference of log. tangents	2957	3.47085
to the difference of longitude	192.1	2.28351

Longitude

Longitude left,	- -	16° 28′W.
Difference of longitude,	-	3 12 E.
Longitude in,	- - - -	13 16 W.

Prob. VII. Given one latitude, distance, and departure; to find the other latitude, course, and difference of longitude.

Example. A ship from Cape Voltas, in latitude 28° 55′S. longitude 15° 53′E. sailed 286 miles between the south and west, and made 238 miles of departure. Required the course, the latitude and longitude come to?

To find the course.

As the distance -	286	2.45637
is to departure -	238	2.37658
so is radius - - - -		10.00000
to the sine of the course	56° 19′	9.92021

To find the difference of latitude.

As radius . - -		10.00000
is to the cosine of the course	56° 19′	9.74398
so is the distance -	286	2.45637
to the difference of latitude	158.6	2.20035

Lat. Cape Voltas, 28° 55′S. comp. 61° 5′ half 30° 32½′ tang. 9 77087
Diff. of Lat. 2 39 S.

Latitude in, 31 34 S, comp. 58 26 half 29 13 tang. 9.74762

Difference 2325

To find the difference of longitude.

As the constant logarithm	-	11.10151
is to the tangent of the course	56° 19′	10.17620
so is the diff. of log. tangents	2325	3.36642
to the difference of longitude	276.1	2.44111
Longitude Cape Voltas,	-	15° 53′E.
Difference of longitude,	-	4 36 W.
Longitude come to,	-	11 17 E.

Prob. VIII. Given one latitude, course, and difference of longitude, to find the other latitude and distance.

Example. A ship from latitude 16° 54′N. longitude 62° 16′W. sailed upon a NW. by N. course, until her longitude by observation is 68° 10′W. Required the distance run, and latitude come to?

Longitude left,	-	62° 16′W.
Longitude come to,	-	68 10 W.
Difference of longitude,	-	5 54=354

To find the latitude come to.

As the tangent of the course	3 pts.	9.82489
is to the constant logarithm,	-	11.10151
so is the difference of longitude	354	2.54900
to the difference of log. tangents.	6693	3.82562

Lat. left, 16° 54′ comp. 73° 6′ half 36° 33′ tang. 9.87000
Diff. log. tang. 6693

Lat. in, 25 8 64 52 32 20 tang. 9.80307

Diff. of lat. 8 14=494m.

To find the distance.

As radius - - -		10.0000
is to the secant of the course	3 points,	10.08015
so is the difference of latitude	494	2.69373
to the distance -	594.1	2.77388

Prob. IX. Given one latitude, distance, and difference of longitude, to find the course, and other latitude.

Rule. To the arithmetical complement of the logarithm of the distance, add the logarithm of the difference of longitude in minutes, and the log. cosine of the given latitude, the sum rejecting radius will be the log. sine of the approximate course.

To the given latitude taken as a course in the traverse table, and half the difference of longitude in a distance column, the corresponding departure will be the first correction of the course, which is subtractive if the given latitude is the least of the two; otherwise, additive.

In Table A, under the complement of the course, and opposite to the first correction in the side column, is the second correction. In the same table find the number answering to the course at the top, and difference of longitude in the side column; and such part of this number being taken as is found in table B opposite to the given latitude, will be the third correction. Now these two corrections, subtracted from the course corrected by the first correction, will give the true course.

Now the course and distance being known, the difference of latitude is found as formerly.

	Table A.									Table B.	
Arc.	10°	20°	30°	40°	50°	60°	70°	80°	90°	Lat.	
										0°	
1°	3′	1′	1′	1′	0′	0′	0′	0	0	10	$\frac{1}{3}$
2	12	6	4	2	2	1	1	0	0	20	$\frac{1}{3}$
3	27	13	8	6	4	3	2	1	0	30	$\frac{1}{6}+\frac{1}{7}$
4	47	23	14	10	7	5	3	1	0	40	$\frac{1}{6}+\frac{1}{8}$
5	74	36	23	16	11	8	5	2	0	50	$\frac{1}{6}+\frac{1}{10}$
6	107	52	33	22	16	11	7	3	0	60	$\frac{1}{4}$
7	145	70	44	30	21	15	9	4	0	70	$\frac{1}{5}$
8	190	92	58	40	28	19	12	6	0	80, &c.	$\frac{1}{6}+\frac{1}{36}$
											$\frac{1}{6}$

Example. From latitude 50° N, a ship sailed 290 miles between the south and west, and differed her longitude 5°. Required the course, and latitude come to?

Distance - -	290	ar. co. log.	7.53760
Diff. of longitude	300	log.	2.47712
Latitude -	50°	cosine	9.80807
Approximate course	41 41′	sine	9.82279

To lat. 50°, and half diff. long. 150, the 1st Corr. in a dep. column is 115 +1 55

In

Method of resolving the Problems of Mercator's Sailing.

In table A to co. course 48° and 1st corr. 1° 55, the second correction is	—0	2
To course 41° and diff. long. 5°, the number is 6', of which ⅓ (Tab. B) being taken gives	—0	1
True course	S. 43 33 W	

To find the difference of latitude.

As radius		10 00000
is to the cosine of the course	43° 33'	9.86020
so is the distance	290	2.46240
to the difference of latitude	210.2	2.32260
Latitude left		50° 0' N
Difference of latitude		3 30 S
Latitude come to		46 30 N

It was intended in this place to have given rules, to make allowance for the spheroidal figure of the earth: but as the ratio of the polar to the equatorial semiaxis is not as yet determined with sufficient accuracy, neither is it known if both hemispheres be similar figures; therefore these rules would be grounded on assumption only, and which might probably err more from the truth than those adapted to the spherical hypothesis. This therefore is supposed to be a sufficient apology for not inserting them.

Chap. VIII. *Of Oblique Sailing.*

Oblique sailing is the application of oblique angled plane triangles to the solution of problems at sea. This sailing will be found particularly useful in going along shore, and in surveying coasts and harbours, &c.

Example I. At 11h A. M. the Girdleness bore W NW, and at 2h P. M. it bore NW*b*N; the course during the interval S*b*W 5 knots an hour. Required the distance of the Ship from the Ness at each station?

By Construction.

Plate CCCXXVIII

Describe the circle NE.SW (fig. 38.) and draw the diameters NS. EW. at right angles to each other; from the centre C, which represents the first station, draw the WNW line CF; and from the same point draw CH, S*b*W, and equal to 15 miles the distance sailed.—From H draw HF in a NW*b*N direction, and the point F will represent the Girdleness. Now the distances CF, HF will measure 19.1 and 26.5 miles respectively.

By Calculation.

In the triangle FCH are given the distance CH 15 miles; the angle FCH equal to 9 points, the interval between the S*b*W and WNW points; and the angle CHF equal to 4 points, being the supplement of the angle contained between the S*b*W and NW*b*N points; hence CFH is 3 points; to find the distances CF, FH.

To find the distance CF.

As the sine of CFH	3 points	9.74474
is to the sine of CHF	4 points	9.84948
so is the distance CH	15 miles	1.17609
to the distance CF	19.07	1.28083

To find the distance FH.

As the sine of CFH	3 points	9.74474
is to the sine of FCH	9 points	9.99157
so is the distance CH	15 miles	1.17609
to the distance FH	26.48	1.42292

Oblique Sailing.

Example II. The distance between the SE point of the island of Jersey and the island of Brehaut is 13 leagues; and the correct bearing and distance of Cape Frehel from the island of Brehaut is SE*b*E 26 miles. It is also known that the SE point of Jersey bears NNE from Cape Frehel: from whence the distance of these two is required, together with the bearing of the said point from the island of Brehaut?

By Construction.

Describe a circle, (fig. 39.) and draw two diameters at right angles, the extremities of which will represent the cardinal points, north being uppermost.—Let the centre B represent Brehaut, from which draw the SE*b*E line BF equal to 26 miles, and the point F will represent Cape Frehel, from which draw the NNE line FI: make BI equal to 39 miles: Then FI applied to the scale will measure 34½ miles, end the inclination of BI to the meridian will be found equal to 63⅓°.

By Calculation.

In the triangle BIF are given BI and BF equal to 39 miles, and 26 miles respectively; and the angle BFI equal to 7 points to find the side FI, and angle FBI.

To find the angle BIF.

As the distance BI	39	1.59106
is to the distance BF	26	1.41497
so is the sine of BFI	78° 45'	9.99157
to the sine of BIF	40 50	9.81548
Sum	119 35	
Angle FBI	60 25	
—— EBF	33 45	
Difference, or EBI	26 40	

Bearing of Jersey from Brehaut N 63 20 E

To find the distance FI.

As the sine of BFI	78° 45'	9.99157
is to the sine of EBI	60 25	9.93934
so is the distance BI	39 miles	1.59106
to the distance FI	34.58	1.53883

Example III. At noon Dungeness bore per compass N*b*W distance 5 leagues; and having run NW*b*W 7 knots an hour, at 5 P. M. we were up with Beachy-head. Required the bearing and distance of Beachy-head from Dungeness?

By Construction.

Describe a circle (fig. 40) to represent the horizon; from the centre C draw the N*b*W line CD equal to 15 miles; and the NW*b*W line CB equal to 35 miles; join DB, which applied to the scale will measure about 26½ miles; and the inclination of DB to the meridian will be found equal to N 79°¾ W.

By Calculation.

In the triangle DBC are given the distances CD, CB equal to 15 and 35 miles respectively; and the angle BCD equal to 4 points; to find the angles B and D, and the distance BD.

To

Oblique Sailing.

To find the angles.

Distance CB =	35	sum of the ang.	16 points	
CD =	15	angle C	4	
Sum	50	angles B and D	12	
Difference	20	half sum -	6 pts. = 67°30′	
As the sum of the distances			50	1.69897
is to their difference -			20	1.30103
so is the tangent of half sum angles			67 30	10.38378
to the tangent of half their differ.			44 0	9.98484
Angle CDB - -			111 30	
Supplement - -			68 30	
Angle NCD - -			11 15	

Magnetic bearing - N 79 45 W. Or by allowing 2¼ points of westerly variation, the true bearing of Beachy-head from Dungeness will be W ¾ S nearly.

To find the distance.

As the sine of CBD -		111° 30′	9.96868
is to the sine of BCD -		45.0	9.84948
so is the distance BC -		35	1.54407
to the distance BD - -		26.6	1.42487

Example IV. Running up Channel E*b*S *per* compass at the rate of 5 knots an hour. At 11h A. M. the Eddistone light-house bore N*b*E¾E and the Start point NE*b*E¼E; and at 4 P. M. the Eddistone bore NW*b*N, and the Start N ¾ E. Required the distance and bearing of the Start from the Eddistone, the variation being 2¼ points W?

By Construction.

Plate CCCXXXVIII. Let the point C (fig. 41.) represent the first station, from which draw the N*b*E¼E line CA, the NE*b*E¼E line CB, and the E*b*S line CD, which make equal to 25 miles, the distance run in the elapsed time; then from D draw the NE*b*N line DA intersecting CA in A, which represents the Eddistone; and from the same point draw the N¾E line DB cutting CB in B, which therefore represents the Start. Now the distance AB applied to the scale will measure 22.9, and the bearing *per* compass BAF will measure 73°⅓.

By Calculation.

In the triangle CAD are given CD equal to 25 miles. the angle CAD equal to 4¼ points, the distance between N*b*E¼E and NW*b*N; and the angle ADC equal to 4 points, the distance between the NW*b*N and W*b*N points; to find the distance CA.

As the sine of	CAD	4¼ points	-	9.86979
is to the sine of	CDA	4 points	-	9.84948
so is the distance	CD -	25 miles	-	1.39794
to the distance CA	-	23.86	-	1.37763

In the triangle BCD are given the distance CD 25 miles, the angle CBD 4¼ points the interval between NE*b*E¼E and N¾E; and CDB 7¾ points, the distance between W*b*N and N¾E; to find the distance CD.

As the sine of CBD -	4¼ points	-	9.88819
is to the sine of CDB	7¾ points	-	9.99947
so is the distance CD	25 miles	-	1.39794
to the distance CB -	32.3	-	1.50922

In the triangle CAB, the distances CA, CB, are given, together with the included angle ACB, equal to 4 points, the distance between N*b*E¼E and NE*b*E¼E; to find the angle CAB and distance AB.

Distance CB	32.3	Angle ACB	= 45° 0′
Distance CA	23.86	Sum of CAB and ABC	135 0
Sum -	56.16	Half -	67 30
Difference	8.44		

As the sum of the distances	56.16	-	1.74943
is to their difference -	8.44	-	0.92634
so is the tangent of half sum angles -	67.30	-	10.38278
to the tangent of half diff. angles -	19.56	-	9.55969
Angle CAB -	87.26		
Angle CAF -	14 4		

Bearing *per* compass S 73 22 E or ESE¾E; and the variation 2¼ points being allowed to the left of ESE¾E gives E¾N, the true bearing of the Start from the Eddistone.

To find the distance.

As the sine of CAB -	87° 26′	-	9.99956
is to the sine of ACB	45 0	-	9.84948
so is the distance CB -	32.3	-	1.50922
to the distance AB -	22.86		1.35914

Example V. A ship from a port in latitude 57° 9′ N, longitude 2° 9′ W, sailed 82 miles on a direct course, and spoke a ship that had run 100 miles from a port in latitude 56° 21′ N, longitude 2° 53′ W.—Required the course of each ship, and the latitude and longitude come to?

Lat. - 57° 9′ N	Mer. parts 4199	Lon. 2° 9′W
—— 56 21 N	——— 4112	— 2 50 W
Diff. of lat. 48	Mer. diff. lat. 87	Diff. lon. 41

By Construction.

With the meridional difference of latitude, the difference of longitude, and difference of latitude, construct the triangles ADE, ABC (fig. 42.) as in Mercator's Sailing: then A will represent the northernmost, and C the southernmost port. The distance AC applied to the scale will measure 53 miles, and the bearing BCA will be 25°¼. From the points A and C, with distances equal to 82 and 100 miles respectively, describe arches intersecting each other in M, which will therefore be the place of meeting.—Now the angle ABM, the ship's course from the southermost port, will measure N 80°⅓ E; and the other ship's course, or angle BAM, will be 67°½, or ESE. From M draw the parallel MNP, and AN will be the difference of latitude made by the one ship, and CP that by the other ship: hence either of these being measured and applied to its correspondent latitude, will give 56° 38′, the latitude in. Make AF equal to 57, the meridional difference of latitude between the northermost port and latitude in: from F draw FG perpendicular to AF, and produce AM to G, then FG will be the difference of longitude, which applied to the scale will measure 139; hence the longitude in, is 0° 10′ E.

By

By Calculation.

In the triangles ADE, ABC, are given AD equal to 87, DE equal to 41, and AB equal to 48; to find the angle BAC and distance AC.

To find the bearing of the ports.

As the meridional diff. of lat.	87	-	1.93952
is to the diff. of long. -	41	-	1.61278
so is radius - -		-	10.00000
to the tangent of the bearing	25° 14'		9.67326

To find the distance of the ports.

As radius - -		-	10.00000
is to the secant of the bearing -	25° 14'	-	10.04355
so is the diff. of latitude	48	-	1.68124
to the distance -	53.06	-	1.72479

In the triangle AMC, the three sides are given to find the angles.

To find the angle ACM.

AM	-	82			
MC	-	100	ar. co. log.	-	8.00000
AC	-	53.06	ar. co. log.	-	8.27523
Sum	-	235.06			
Half	-	117.53	- log.	-	2.07015
Difference	-	35.53	- log.	-	1.55059
					19.89597
		27 29	- cosine		9.94798
Angle ACM		54 58			
Angle BAC		25 14			

Southermost ship's course } N 80 12 E

To find the angle MAC.

As AM - -	82	-	1.91381
is to MC - -	100	-	2.00000
so is the sine of ACM -	54 58	-	9.91319
to the sine of MAC -	93 3	-	9.99938
Angle BAC -	25 14		

Northernmost ship's course - } S 67 49 E, or ESE.

In the right-angled triangle AMN, given AM, and the angle MAN, to find the differences of latitude AN.

As radius - -		-	10.00000
is to the cosine of the course	67° 49'	-	9.57700
so is the distance -	82	-	1.91381
to the diff. of lat.	30.96	-	1.49081
Latitude of northernmost port	57 9	Mer. parts	4199
Latitude in -	56 38	Mer. parts	4142
Meridional difference of latitude		-	57

To find the difference of longitude FG.

As radius -		-	10.00000
is to the tangent of the course -	67° 49'	-	10.38960
so is the mer. diff. of lat.	57	-	1.75587
to the diff. of long. -	139.8		2.14547
Longitude left - - -	2° 9' W		
Difference of longitude -	2 20 E		
Longitude in - -	0 11 E		

Chap. IX. *Of Windward Sailing.*

Windward sailing is, when a ship by reason of a contrary wind is obliged to sail on different tacks in order to gain her intended port; and the object of this sailing is to find the proper course and distance to be run on each tack.

Example I. A ship is bound to a port 48 miles directly to the windward, the wind being SSW, which it is intended to reach on two boards; and the ship can lie within 6 points of the wind. Required the course and distance on each tack?

By Construction.

Draw the SSW line CB (fig. 43.) equal to 48 miles. Make the angles ACB, ABC, each equal to 6 points. Hence the first course will be W, and the second SE: also the distance CA, or AB, applied to the scale will measure $62\frac{3}{4}$ miles, the distance to be sailed on each board. Plate CCCXXXVIII.

By Calculation.

From A draw AD perpendicular to BC; then in the triangle ADC are given CD, equal to 24 miles; and the angle ACD, equal to 6 points, to find the distance AC.

As radius -	-	-	10.00000
is to the secant of C -	6 points	-	10.41716
so is CD -	24 miles	-	1.38021
to CA -	62.7	-	1.79737

Example II. The wind at NW, a ship bound to a port 64 miles to the windward, proposes to reach it on three boards; two on the starboard, and one on the larboard tack, and each within 5 points of the wind. Required the course and distance on each tack?

By Construction.

Draw the NW line CA (fig. 44.) equal to 64 miles; from C draw CB W*b*S, and from A draw AD parallel thereto, and in an opposite direction; bisect AC in E, and draw BED parallel to the N*b*E rhumb, meeting CB, AD in the points B and D: then CB=AD applied to the scale will measure $36\frac{1}{4}$ miles, and BD=2CB=$72\frac{1}{2}$ miles.

By Calculation.

From B draw BF perpendicular to AC; then in the triangle BFC are given the angle BCF equal to 5 points, and CF equal to one fourth of CA=16 m. to find CB.

As radius -	-	-	10.00000
is to the secant of BCF, -	5 points		10.25526
so is CF - -	16 m.		1.20412
to CB - -	36.25		1.55938

Example III. A ship which can lie within $5\frac{1}{2}$ points of the wind, is bound to a port 36 miles to the windward, the wind being NE*b*N, which it is intended to reach

Windward Sailing.

reach on four boards, the first being on the larboard tack. Required the course and distance on each?

By Construction.

Plate CCCXXXVIII.

Draw the NE*b*N line CA (fig. 45.) equal to 36 miles, and bisect it in B; from C and B draw lines parallel to the E½S rhumb; and from A and B draw lines parallel to the SSE½E point, meeting the former in the points D and E. Now the distances AD, BD, BE, and CE, are equal; and any one of them applied to the scale will measure 19.1 miles.

By Calculation.

From E draw EF perpendicular to AC; and in the triangle CFE are given CF=9 m. and the angle FCE =5½ points, to find CE.

As radius			10.00000
is to the secant of FCE	-	5½ points	10.32661
so is CF	-	9 miles	0.95424
to the distance CE	-	19.1 miles	1.28085

Example IV. A ship bound to a port bearing N*b*W distant 40 miles, with the wind at N*b*E ½ E, intends to reach it on two boards. Required the course and distance on each tack, the ship lying within 5½ points of the wind?

By Construction.

Draw the N*b*W line CA (fig. 46.) equal to 40 miles; and because the wind is N*b*E ½ E, and the ship can lie within 5½ points of the wind, the course on the larboard tack will be E*b*N, and on the starboard NW. Therefore, from the centre C draw the E*b*N line CB, and from it draw the NW line AB, meeting CB in B; then CB and AB applied to the scale will measure 26.7 and 48.1 m. respectively.

By Calculation.

In the triangle ACB, given AC = 40 miles, and the angles A, B, and C, equal to 3, 5, and 8 points respectively, to find AB and BC.

To find the distance CB.

As the sine of B	-	5 points	9.91985
is to the sine of A	-	3 points	9.74474
so is the distance CA	-	40 miles	1.60206
to the distance CB	-	26.73	1.42695

To find the distance AB.

As the sine of B	-	5 points	9.91985
is to the sine of C	-	8 points	10.00000
so is the distance CA	-	40 miles	1.60206
to the distance AB	-	48.11	1.68221

Example V. A ship close hauled within 5 points of the wind, and making one point of lee-way, is bound to a port bearing SSW, distant 54 miles, the wind being S*b*E: It is intended to make the port at three boards, the first of which must be on the larboard tack in order to avoid a reef of rocks. Required the course and distance on each tack?

By Construction.

Draw the SSW line CA (fig. 47.) equal to 54 m. and as the wind is S*b*E, and the ship makes her course good within 6 points of the wind, therefore the course on the larboard tack will be SW*b*W, and on the starboard E*b*S: hence from C draw the SW*b*W line CB, and from A draw AD parallel thereto; bisect CA in E. and draw BED parallel to the E*b*S line; then will CB and AD be the distances on the larboard tack, which applied to the scale, each will be found to measure 37.4; and the distance on the starboard tack BD will measure 42.4 miles.

By Calculation.

The triangles CBE, EAD are equal and similar: hence in the first of these are given CE, equal to 27 miles, half the distance between the ship and port; the angles C, B, and E, equal to 3, 4, and 9 points respectively, to find CB and BE.

To find CB, the distance on the larboard tack.

As the sine of B	-	4 points	9.84948
is to the sine of E	-	9 points	9.99157
so is the distance CE	-	27 miles	1.43136
to the distance BC	-	37.45	1.57345

To find BE half the distance on the starboard tack.

As the sine of B	-	4 points	9.84948
is to the sine of C	-	3 points	9.74474
so is the distance CE	-	27 miles	1.43136
to the distance BE	-	21.21	1.32662
Whole distance AC	-	42.42	

Example VI. A ship plying to the windward, with the wind at NNE, after sailing 51 miles on each of two tacks, found by observation to have made 36 miles of difference of latitude. How near the wind did she make her way good?

By Construction.

Make CA (fig. 48.) equal to 36 miles; draw AB perpendicular to CA, and draw the NNE line CB, meeting AB in B; make CD, BD each equal to 51 miles; and these being measured, will be found equal to 6 points.

By Calculation.

In the triangles CAB, BCD, are given AB equal to 36m. CD=BD=51, and the angle ACB equal to 2 points, to find the angle BCD.

As the distance CD	-	51	1.70757
is to the diff. of latitude CA	,	18	1.25527
so is the secant of ACB	-	2 points	10,03438
to the cosine of BCD	-	67° 32′	9.58208

Example VII. A ship that makes her way good within 6½ points of the wind, reaches her port on two boards; the first being on the larboard tack 25 miles, and the other on the starboard tack 38 miles; and the difference of latitude is 21 miles north. Required the bearing of the port, and direction of the wind?

By Construction.

With the given distances 25 and 38 miles and the included angle equal to 16—2×6½=3 points, construct the triangle BCD (fig. 49.); hence CB will be known. Draw CA equal to 21 miles, the given difference of latitude; from A draw AB perpendicular to CA, and make CB equal to what it was before determined; make DE=DC, and draw the line CE, which will represent the direction of the wind, and the angle ACB is the bearing of the port: now ACE will be found equal to 52°½, and ACB 18°.

By Calculation.

In the triangle BCD are given BC=25m. BD=38m. and the angle D=3 points, to find the angle BCD, and distance CB.

To

Windward Sailing.

To find the angle BCD.

Diſtance	BD=38	Angle BDC	33° 45'
	BC=25		
		BCD+CBD	146 15
Sum	63	$\frac{BCD+CBD}{2}$=	73 7½
Difference	13		

As the ſum of the ſides	63	1.79934
is to the difference of the ſides	13	1.11394
ſo is the tang. of half ſum angles	73° 7½'	10.51806
to the tang. of half diff. angles	34 13½	9.83266
Angle BCD	107 21	

To find the diſtance BC.

As the ſine of BCD		107° 21'	9.97978
is to the ſine of BDC		33 45	9.74474
ſo is the diſtance BD		38	1.57978
to the diſtance BC		22.12	1.34474

To find the angle ACB, the bearing of the port.

As the diſtance BC	22.12	1.34474
is to the diſtance AC	21.	1.32222
ſo is radius		10.00000
to the coſine of ACB	18° 17'	9.97748
Angle BCD	107 21	
———ACD	125 38	
———DCE	73 7	
Direction of the wind	N 52 31 E	

Chap X. *Of Current Sailing.*

The computations in the preceding chapters have been performed upon the aſſumption that the water has no motion. This may no doubt anſwer tolerably well in thoſe places where the ebbings and flowings are regular, as then the effect of the tide will be nearly counterbalanced. But in places where there is a conſtant current or ſetting of the ſea towards the ſame point, an allowance for the change of the ſhip's place ariſing therefrom muſt be made: And the method of reſolving theſe problems, in which the effect of a current, or heave of the ſea, is taken into conſideration, is called *current ſailing*.

In a calm, it is evident a ſhip will be carried in the direction and with the velocity of the current. Hence, if a ſhip ſails in a direction of the current, her rate will be augmented by the rate of the current; but in ſailing directly againſt it, the diſtance made good will be equal to the difference between the ſhip's rate as given by the log and that of the current. And the abſolute motion of the ſhip will be a-head, if her rate exceeds that of the current; but if leſs, the ſhip will make ſternway. If the ſhip's courſe be oblique to the current, the diſtance made good in a given time will be repreſented by the third ſide of a triangle, whereof the diſtance given by the log, and the drift of the current in the ſame time, are the other ſides; and the true courſe will be the angle contained between the meridian and the line actually deſcribed by the ſhip.

Example I. A ſhip ſailed NNE at the rate of 8 knots an hour, during 18 hours, in a current ſetting NW*b*W 2½ miles an hour—Required the courſe and diſtance made good?

Current Sailing.

By Conſtruction.

Plate CCCXXXIX.

Draw the NNE-line CA (fig. 50), equal to 18×8 =144 miles; and from A draw AB parallel to the NW*b*W rhumb, and equal to 18×2½=45 miles: now BC being joined will be the diſtance, and NCB the courſe. The firſt of theſe will meaſure 159 miles, and the ſecond 6° 23'.

By Calculation.

In the triangle ACB, are given AC=144 miles, AB=45 miles, and the angle CAB=9 points, to find BAC and BC.

To find the courſe made good.

Diſt. AC	144	Ang. BAC=9 pts=	101° 15'
Diſt. AB	45		
		B+C	78 45
Sum	189	$\frac{B+C}{2}$	39 22½
Diff.	99		

As the ſum of the ſides	189	2.27646
is to the difference of the ſides	99	1.99563
ſo is the tan. of half ſum angles	39 22½	9.91417
to the tan. of half diff. angles	23 15½	9.63334
Angle ACB	16 7	
Angle ACN	22 30	
Courſe made good	N 6 23 E	

To find the diſtance.

As the ſine of ACB	16° 7'	9.44341
is to the ſine of CAB	101 15	9.99157
ſo is the diſtance AB	45	1.65321
to the diſtance CB	159	2.20137

Example II. A ſhip from a port in latitude 42° 52' N, ſailed S*b*W¾W 17 miles in 7 hours, in a current ſetting between the north and weſt; and then the ſame port bore ENE, and the ſhip's latitude by obſervation was 42° 42' N. Required the ſetting and drift of the current?

By Conſtruction.

Draw the S*b*W¾W line CA (fig. 51) equal to 17 miles, and make CB equal to 10 miles, the difference of latitude: through B draw the parallel of latitude BD, and draw the WSW line CD, interſecting BD in D: AD being joined, will repreſent the drift of the current, which applied to the ſcale will meaſure 20.2, and the angle DAE will be its ſetting, and will be found equal to 72°.

By Calculation.

In the triangle CBD, given CB=10 miles, and the angle BCD=6 points; to find the diſtance CD.

As radius		10.00000
is to the ſecant of BCD	6 points	10.41710
ſo is the diff. of lat. CB	10 miles	1.00000
to the diſtance CD.	26.13	1.41710

Again, in the triangle ACD are given the diſtance AC=17 miles, CD=26.13, and the angle ACD 4¾ points; to find the remaining parts.

To

Fig. 28.

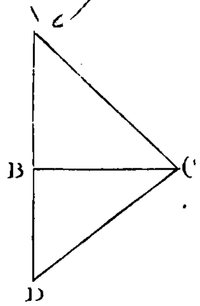


Fig. 29.

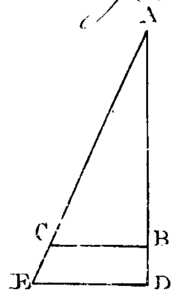


Fig. 30.

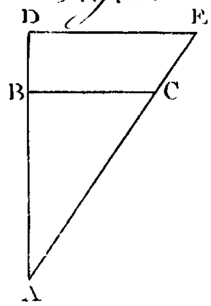


Fig. 31.

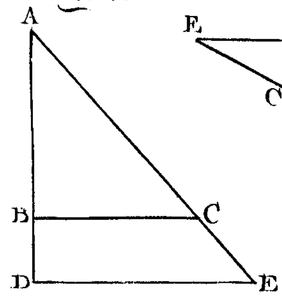


Fig. 32.

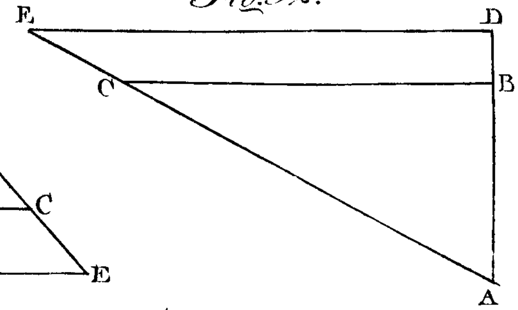


Fig. 33.

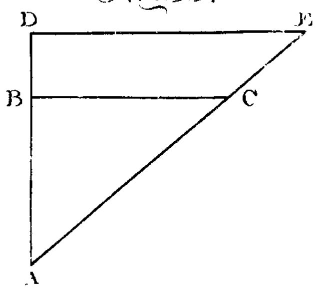


Fig. 34.

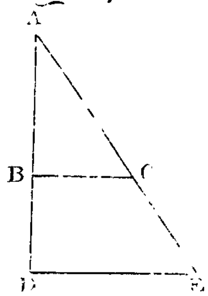


Fig. 35.

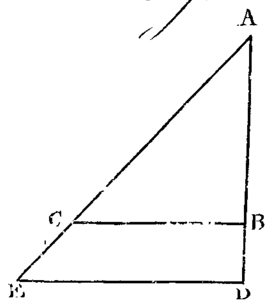


Fig. 36.

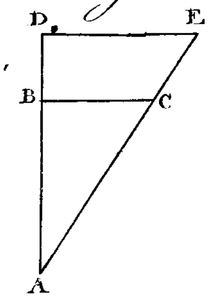


Fig. 37.

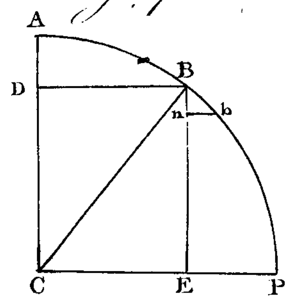


Fig. 38.

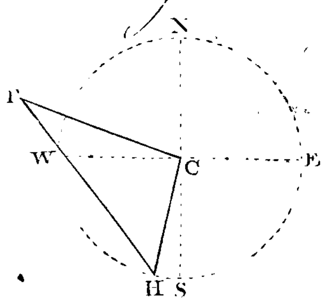


Fig. 39.

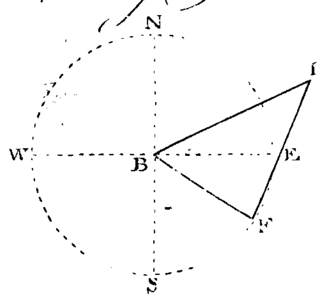


Fig. 40.

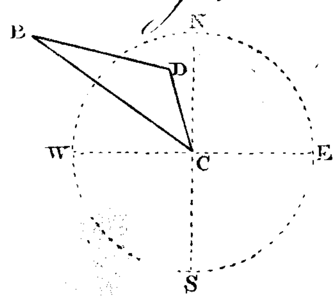


Fig. 41.

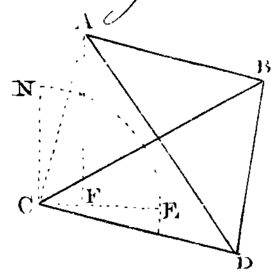


Fig. 42.

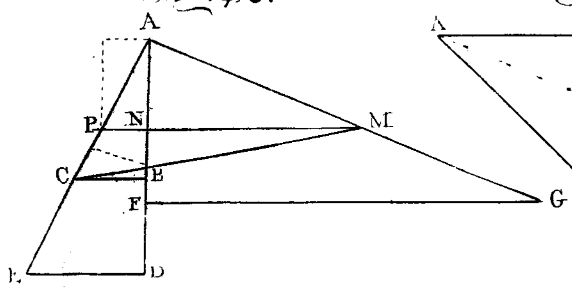


Fig. 43.

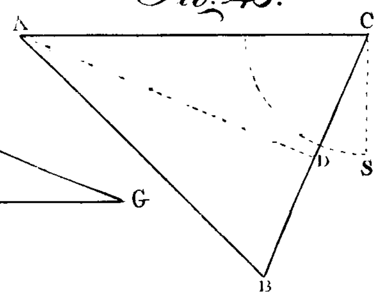


Fig. 44.

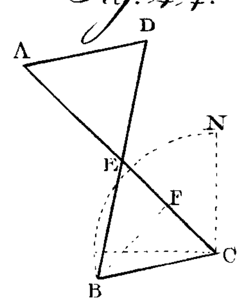


Fig. 45.

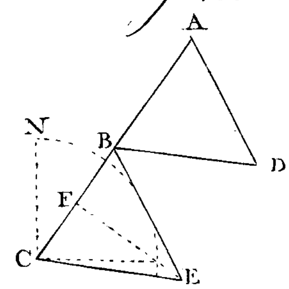


Fig. 46.

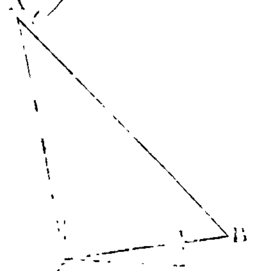


Fig. 47.

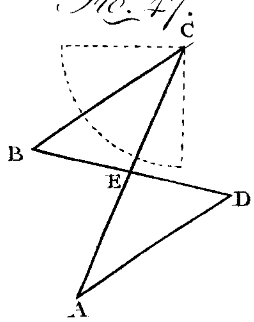


Fig. 48.

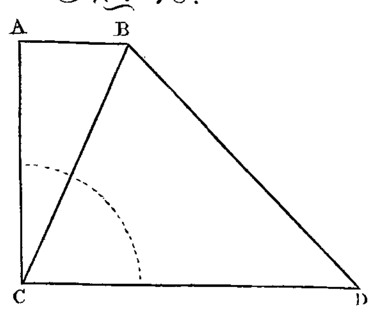
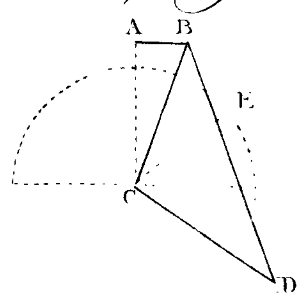


Fig. 49.



Aikin Sc.

Current Sailing.

To find the setting of the current.

Distance	DC = 26.13	Angle ACD = 4½ points.	
Distance	AC = 17. 0	CAD+CDA 11½	
Sum -	43.13	CAD+CDA / 2	5¾=64° 41′
Difference	9.13		

As the sum of the sides	43.13	-	1.63478
is to the difference of the sides -	9.13	-	0.96047
so is the tang. of half sum angles -	64° 41′	-	10.32509
to the tang. of half diff. angles -	24 6	-	9.65078
Angle CAD -	88 47		
Angle CAE=ACB=1½ pt.=	16 52		
Setting of the current EAD=	71 55		

To find the drift of the current.

As the sine of CAD -	88° 47′	-	9.99990
is to the sine of ACD	4½ points		9.88819
so is the distance CD -	26.13	-	1.41710
to the drift of currt. AD	20.2	-	1.30539

Hence the hourly rate of the current is $\frac{20.2}{7}=2.9$ knots.

Example III. A ship, from latitude 38° 20′ N, sailed 24 hours in a current setting NW*b*N, and by account is in latitude 38° 42′ N, having made 44 miles of easting; but the latitude by observation is 38° 58′ N. Required the course and distance made good, and the drift of the current?

By Construction.

Plate cccxxxix. Make CE (fig. 52.) equal to 22 miles, the difference of latitude by D R, and EA=44 miles, the departure, and join CA; make CD=38 miles, the difference of latitude by observation; draw the parallel of latitude DB, and from A draw the NW*b*N line AB, intersecting DB in B, and AB will be the drift of the current in 24 hours; CB being joined, will be the distance made good, and the angle DCB the true course. Now, AB and CB applied to the scale, will measure 19 2 and 50.5 respectively; and the angle DCB will be 41°¼.

By Calculation.

From B draw BF perpendicular to AE, then in the triangle AFB are given BF=16 miles, and the angle ABF=3 points; to find AB and AF.

To find the drift of the current AB.

As radius	-	-	10.00000
is to the secant of ABF	3 points	-	10.08015
so is BF -	16 miles		1.20412
to the drift of the current AB	19.24	-	1.28427

Hence the hourly rate $=\frac{19.24}{24}=0.8$.

To find AF.

As radius	-	-	10.00000
is to the tangent of ABF -	3 points		9.82489
so is BF - -	16	-	1.20412
to AF - -	10.69		1.02901
Departure by account EH	44.		
True departure	EF=DB=33.31		

Now, in the triangle CDB are given the difference of latitude and departure; to find the course and distance.

To find the course.

As the difference of latitude CD	38.	1.57978
is to the departure DB -	33.31	1.52257
so is radius - -		10.00000
to the tangent of the course	41° 14′	9 94279

To find the distance.

As radius - -		10.00000
is to the secant of the course	41° 14′	10 12376
so is the difference of latitude	38	1.57978
to the distance - -	50.53	1.70354

Example IV. In the Straits of Sunda, at 2 P. M. steering SE*b*S at the rate of 5 knots an hour, I passed close by the SE of the small islands off Hog point. At 6, not having changed our course, came to anchor on the Java shore. Upon setting the said island from this anchoring place, I find it bears due north, its distance by the chart being 22 miles. It follows from hence, that our course has been affected by a current. Required its velocity and direction?

By Construction.

From A (fig. 53.) draw the SE*b*S line AB=20, which will represent the ship's apparent tract through the water; draw AC equal to 22 miles south, and C will be the ship's real place; and BC being joined will be the current's drift in four hours; which applied to the scale will measure 12.3; from A draw AD parallel to BC, and the angle CAD will be the direction of the current, and will be found to measure 64°⅕

By Calculation.

In the triangle ABC, given BB=20 m. AC=22 m. and the included angle A=3 points; to find the remaining parts.

To find the setting of the current.

Distance AC=22 m. Included angle = 3 points.

AB=20		B+C=13	
Sum -	42		
Difference	2	$\frac{B+C}{2}$=6½p=73.7½	
As the sum of the sides	42	-	1.62325
is to the difference of the sides -	2	-	0.30103
so is the tangent of half sum angles	73° 7′½	-	10.51806
to the tangent of half diff. angles	8 55¼	-	9.19584

Setting of the current S 64 12 W, or SW*b*W¼W.

To find the drift of the current.

As the sine of ACB -	64° 12′	-	9.95440
is to the sine of BC	33 45	-	9.74474
so is the distance AB	20	-	1.30103
to the velocity of current BC -	12.34	-	1.09137

and $\frac{12.34}{4}=3.1$, its hourly rate.

Example V. A ship bound from Dover to Calais, lying

Current Sailing.

lying 21 miles to the SE*b*E½E, and the flood tide setting NE½E 2½ miles an hour. Required the course she must steer, and the distance run by the log at 6 knots an hour to reach her port?

By Construction.

Plate cccxxxix. In the position of the SE*b*E½E rhumb, draw DC =21 miles (fig. 54.); draw DE NE½E=2½ miles; from E with 6 miles cut DC in F; draw DB parallel to EF, meeting CB drawn parallel to DE: then the distance DB applied to the scale will measure 19.4, and the course SDB will be SE½S.

By Calculation.

In the triangle DBF, given DE=2½ miles, EF =6 miles, and the angle EDF=6 points; to find the angle DFE=CBD.

As the hourly rate of sailing	6 m.	0.77815
is to the hourly rate of the current	2½ m.	0.39794
so is the sine of EDF=6 points	67° 30′	9.96562
to the sine of DFE	22 38	9.58541
Angle - SDC=5½ points=	61 52	
Course SDB	39 14=SE½S.	

In the triangle DBC, given DC=21 miles, the angle BDC=DFE=22° 38, and the angle DCB= DEF=6 points; to find the distance DB.

As the sine of DBC	89° 52′	9.99999
is to the sine of DCB	67 30	9.96562
so is the true distance DC	21 m.	1.32222
to the distance by the log DB.	19.4 m.	1.28785

Example VI. A ship at sea in the night has sight of Scilly light, bearing NE*b*N, distant 4 leagues, it being then flood tide, setting ENE 2 miles an hour. What course and distance must the ship sail to make the Lizard, which bears from Scilly E½S, distance 17 leagues?

By Construction.

Draw the NE*b*N line AS=12 miles (fig. 55.); hence S will represent Scilly; from S draw SL=51 miles, and parallel to the E½S rhumb, then L will represent the Lizard; draw LC parallel to the ENE rhumb, and equal to 2 miles, and make CD=5 miles; from A draw AB parallel to CD, meeting LC produced in B; then AB will be the distance, and the angle SAB the course: the first of these applied to the scale will measure 41.9 miles, and the course will be S 88° E.

By Calculation.

In the triangle SAL are given the sides AS, SL =12 and 51 miles respectively, and the angle ASL =10½ points; to find the other parts.

To find the angles.

Distance SL=51 m.	Angle ASL=10½ points.	
——— AS=12 m.	SAL+SLA=5½	
Sum - 63 m.	$\frac{SAL+SLA}{2}$=2¾=30° 56′	
Difference 39 m.		
As the sum of the sides	63	1.79934
is to the diff. of the sides	39	1.59106
so is the tangent of half sum angles	30° 56′	9.77763
to the tang. of half their difference	20 21	9.56935
Angle SAL	=51 17	
NAS=3 points	33 45	
NAL	85 2	
LAE=FLA	4 58	
FLB=2 points	22 30	
ALB=DLC	17 32	

Instruments to solve Problems in Sailing, independent of Calculation.

To find the distance AL.

As the sine of SAL	51° 17′	9.89223
is to the sine of ASL	10½ points	9.94543
so is the distance SL	51 miles	1.70757
to the distance AL	57.64	1.76077

Again, in the triangle DLC, are given the side DC=5 miles, the ship's run in an hour; LC=2 miles, the current's drift in the same time; and the angle DLC=17° 32′; to find the angle LDC=LAB.

As the dist.	DC=5 miles	0.69897
is to the distance	LC=2 miles	0.30103
so is the sine of	DLC=17° 32′	9.47894
to the sine of	LDC 6 55	9.08100
Angle NAL	85 2	
NAB	91 57	
Course	S 88 3 E	

In the triangle ABL, the side AL, together with the angles, are given, to find the distance AB.

As the sine of ABL	155° 33′	9.61689
is to the sine of ALB	17 32	9.47894
so is the distance AL	57.64	1.76077
to the distance AB	41.96	1.62282

Chap. XI. *Instruments proposed to solve the various Problems in Sailing, independent of Calculation.*

Various methods, beside those already given, have been proposed to save the trouble of calculation.— One of these methods is by means of an instrument composed of rulers, so disposed as to form a right-angled triangle, having numbers in a regular progression marked on their sides. These instruments are made of different materials, such as paper, wood, brass, &c. and are differently constructed, according to the fancy of the inventor. Among instruments of this kind, that by John Cook, Esq; seems to be the best. A number of other instruments, very differently constructed, have been proposed for the same purpose; of these, however, we shall only take notice of the rectangular instrument, by And. Mackay, A. M. F. R. S. E.

I. *Of* Cooke's *Triangular Instrument.*

Description. The stock *a b c d* (fig. 56.) is a parallelopiped: The length from *a* to *b* is two feet, the breadth from *a* to *d* two inches, and the depth is one inch and a half. The stock is perforated longitudinally, so as to be capable of containing within it *e f*, a cylindrical piece of wood one inch diameter; *g h* is an aperture on the surface of the stock about a quarter of an inch wide, which discloses one-twelfth part

Instruments to solve Problems in Sailing, independent of Calculation

of the surface of the cylinder contained; the edge $d c$ is divided into twelve parts, each of these is subdivided into six parts, and each of these again into ten parts. The surface of the cylinder is divided longitudinally into twelve parts, and on each of them is engraved a portion of a line of meridional parts 22 feet long, which contains the meridional parts for every minute from the equator as far towards the pole as navigation is practicable; and the smallest division on is not less than $\frac{1}{40}$th of an inch. By rolling and sliding this cylinder, any part of any line on it may be brought into any position which may be required: the box i is engrooved into the edge of the stock $a b$, so that it may move freely from a to b; a limb from this box extends to k, which serves to mark that degree of the perpendicular $i l$ which is parallel to the centre of the semicircle m; $i l$ is two feet long, and graduated on both edges as the stock; it is perpendicular to the stock, and is fixed in the box i, by which it may be moved from a to b; $o p n$ is a semicircle of six inches radius, engraved, as appears in the plate, which slides freely from c to d in a groove in the edge of the stock $c d$; $m q$ is the index moving on the centre m, the edge of which marks the course on the semicircle; it is two feet long, and divided into 72 parts; and these are subdivided in the same manner as those on the stock and perpendicular, to which they are equal; r is a vernier attached to the index to show minutes; S is a vernier composed of concentric semicircles, which slides along the edge $q m$, to the intersection of the perpendicular and index, where it serves as a vernier to both; below x is a small piece of ivory, with a mark on it to point out the degree of the line $d c$, which is perpendicularly under the centre of the semicircle. Fig. 57. is a view of the back part of the instrument.

Plate cccxxxix.

Use. The method of working every case which occurs in navigation, is to make the instrument similar to that ideal triangle which is composed of the difference of latitude, departure, and distance; or, to that composed of the meridional difference of latitude, difference of longitude, and enlarged distance; or, to that composed of the difference of longitude, departure, and sine, of the middle latitude; which is done by means of the data procured from the compass, log-line, and quadrant: whence it follows, from the nature of similar triangles, or from the relation which exists between the sides of triangles and the sines of their opposite angles, that the parts of the instrument become proportional to those which they represent; and will ascertain the length of the lines, or the extent of the angles sought, by its graduations.

In the practice of this instrument, a small square is necessary, in order to bring the centre of the semicircle perpendicularly over the meridional degree corresponding to the latitude.

Plane Sailing.

Prob. I. The course and distance sailed being given, to find the difference of latitude and departure.

Example. A ship from latitude 24° 18′ N sailed NW b N 168 miles. Required the latitude come to, and departure?

Set the centre of the semicircle perpendicularly over the given latitude 24° 18′, and the index to the course 3 points; move the perpendicular until it cut the index at the given distance 168; then at the point of intersection on the perpendicular is 93.3 miles, the departure, and on the base, by the edge of the box, is 26° 38′, the latitude come to.

Prob. II. Both latitudes and course given, to find the distance and departure.

Example. Let the latitude sailed from be 43° 50′ N. that come to 47° 8′ N, and the course NNE. Required the distance and departure?

Move the centre of the semicircle to the latitude left 43° 50′, and the edge of the box to the latitude come to 47° 8′; fix the index at the given course 2 points: then at the point of intersection of the index and perpendicular is the distance 214 miles on the index, and the departure 82 miles on the perpendicular.

Prob. III. Given the course and departure, to find the distance and difference of latitude.

Example. Let the latitude sailed from be 32° 38′ N, the course SWbS, and the departure 200 miles. Required the distance and latitude come to?

Move the centre of the semicircle to the latitude left 32° 38′, set the index to the given course 3 points, and move the perpendicular till the given departure 200 cuts the index; at this point on the index is 360 miles, and the edge of the box will cut the latitude come to 27° 39′ N.

Prob. IV. Given the difference of latitude and distance, to find the course and departure.

Example. Let the latitude left be 17° 10′ N, the latitude come to 21° 40′ N, and the distance sailed on a direct course between the north and west 300 miles. Required the course and departure?

Move the semicircle and box to the given latitudes, and the index until the distance found thereon meets the perpendicular, then at the point of contact on the perpendicular is 130.8, the departure, and on the semicircle by the index is 25° 50′, the course.

Prob. V. The distance and departure given, to find the course and difference of latitude.

Example. The distance sailed is 246 miles between the south and east, the departure is 138 miles, and the latitude left 51° 10′ N. Required the course and latitude come to?

Set the centre of the semicircle to 51° 10′, the latitude sailed from; find the distance 246 on the index, and the departure 138 on the perpendicular; then move both till these points meet, and the course 34° 10′ will be found on the semicircle by the index, and the latitude in, 47° 47′ N, by the edge of the box.

Prob. VI. Both latitudes and departure given, to find the course and distance.

Examplle. A ship from latitude 43° 10′ N, sailed between the north and west till she is in latitude 47° 14′ N, and has made 170 miles of departure. Required the course and distance?

Move the centre of the semicircle over 43° 10′, and the edge of the box to 47° 14′; find the departure on the perpendicular, and bring the edge of the index thereto; now at the point of intersection is the distance 297.4 miles on the index, and the course 34° 52′ on the semicircle.

Traverse Sailing.

Example. A ship from latitude 46 48′ N sailed

Instrument to solve Problems in Sailing, independent of Calculation

ed SSW½W 24 miles, S*b*W 36 miles, and S½E 40 miles. Required the latitude in, together with the direct course and distance?

Set the semicircle to the latitude sailed from 46° 48′, and the index to the course SSW½W, mark the distance 24 on the index, and bring the perpendicular to meet it; then the index will cut the departure 11.3 on the perpendicular, and the perpendicular will cut the latitude 46° 27′ N on the base. For the next course and distance, bring the semicircle to the latitude marked by the perpendicular, and lay down the course S*b*W: if it be towards the first meridian, move the last marked departure until it meets the index, and the limb of the box will mark the present departure; but if the course be from the first meridian, bring the last departure 11.3 to the limb of the box, the index will mark the departure made good 18.3 on the perpendicular, and the latitude arrived at 45° 52′ will be marked on the base by the perpendicular; proceed in the same manner with all the courses of which the traverse consists, then the difference of latitude 1° 36′ will be intercepted between the latitude sailed from 46° 48′, and the latitude come to 45° 12′, last marked by the perpendicular; and also the departure made good will be intercepted between that point on the perpendicular where the first departure commenced, and that where the last terminated. Now, with the difference of latitude 1° 36′ and the departure, the course will be S 8° 30′ W, and distance 97 miles, by last problem in Plane Sailing.

Parallel Sailing.

Prob. I. The difference of longitude between two places in one parallel of latitude given, to find the distance between them.

Example. Let the common latitude be 49° 30′ N, and the difference of longitude 3° 30′. Required the distance?

Set the index to 40° 30′, the complement of the latitude on the semicircle; mark the difference of longitude in miles on the index; then move the perpendicular until it meets the termination of the difference of longitude on the index, and the part of the perpendicular intercepted between the limb of the box and the point of intersection will be the distance 136.4 miles.

Prob. II. The distance between two places in one parallel of latitude given, to find the difference of longitude between them.

Example. Let the latitude of the given parallel be 49° 30′ N, the distance sailed 136.4 E. Required the difference of longitude?

Set the index to the complement of the latitude 40° 30′, and mark the distance sailed on the perpendicular; then move it until it meets the index, and the point of intersection will show the difference of longitude 210′ or 3° 30′ on the index.

Prob. III. Given the distance sailed on a parallel, and the difference of longitude, to find the latitude of that parallel.

Example. The distance sailed due east is 136.4, and the difference of longitude 3° 30′. Required the latitude of the parallel?

Find the difference of longitude 210 on the index, and the distance 136.4 on the perpendicular, and move both until these numbers meet, and the complement of the latitude 40° 30′ will be shown by the index on the semicircle.

Instruments to solve Problems in Sailing, independent of Calculation

Mercator's and Middle Latitude Sailing.

Prob. I. The latitudes and longitudes of two places given, to find the direct course and distance between them.

Example. Required the course and distance between two places whose latitudes and longitudes are 50° 50′ N, 19° 0′ W, and 54° 30′ N, 15° 30′ W, respectively?

By Mercator's Sailing.

To find the course.

Move the centre of the semicircle perpendicularly over the meridional degree answering to latitude 50° 50′ N, then move the box until the edge of the perpendicular cuts the meridional parts of the other latitude 54° 30 N, and move the index until it cuts the difference of longitude 3° 30′ on the perpendicular, and the index will mark the course 30° 10′, or NNE¾E nearly, on the semicircle.

To find the distance.

Screw the index to this course, and move the centre of the semicircle to the latitude 50° 50′ N, and the edge of the perpendicular to the latitude 54° 30′ N. then the perpendicular will cut the distance 254.7 on the index.

By Middle Latitude Sailing.

To find the departure.

Move the centre of the semicircle to the latitude 50° 50′ and the edge of the index to the complement of the middle latitude 37° 20′ on the semicircle; then move the box until the edge of the perpendicular intersects the termination of the difference of longitude 210 miles on the index, which point of intersection will mark the departure 121 on the perpendicular.

To find the course and distance.

Move the edge of the perperdicular to the other latitude 54° 30′, and the index until it cuts the departure 128 on the perpendicular; then will the perpendicular mark the distance on the index 254.7 miles, and the index will mark the course on the semicircle 30° 10′, or NNE¾E nearly.

Prob. II. Both latitudes and course given, to find the distance and difference of longitude.

Example. A ship from latitude 50° 50′ N, longitude 19° 0′ W, sailed N 30′ 10′ E, until she is in latitude 54° 30′ N. Required the distance and difference of longitude?

By Mercator's Sailing.

To find the difference of longitude.

Move the box and semicircle as in the former problem to the meridional parts of the given latitudes, then set the index to the course, and it will mark the difference of longitude 3° 30′ on the perpendicular: Hence the longitude in is 15° 30′ W.

To find the distance.

Move the perpendicular and semicircle to the given latitudes, and put the index to the given course; then the perpendicular will cut the distance 254.7 miles on the index.

By Middle Latitude Sailing.

To find the distance and departure.

Move the semicircle and perpendicular to the given latitudes, and the index to the course; then the perpendicular will show the departure 128 miles, and the

the

Fig. 50.

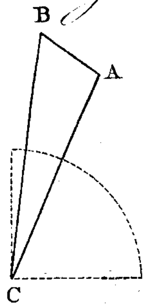


Fig. 51.

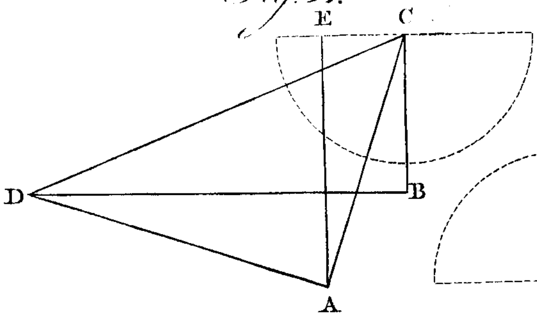


Fig. 52.

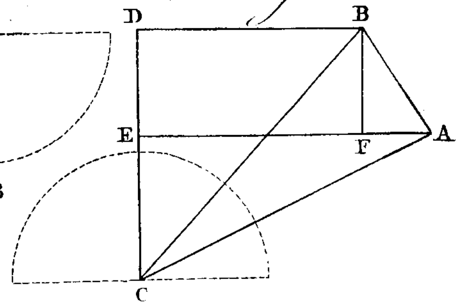


Fig. 53.

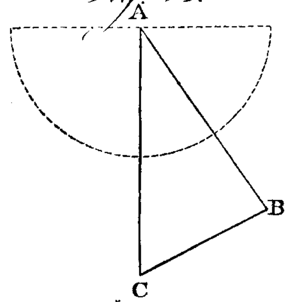


Fig. 54.

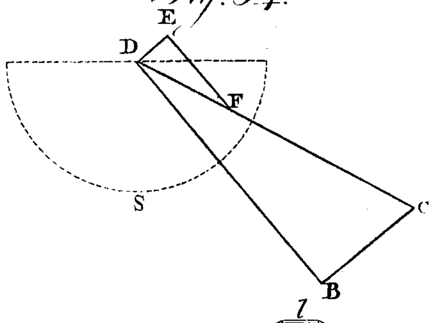


Fig. 55.

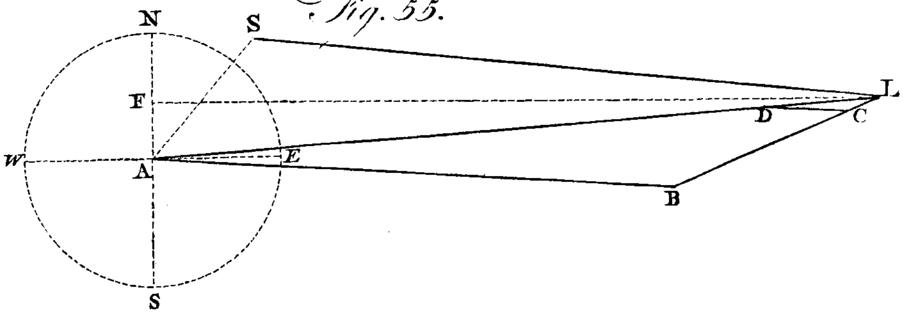


Fig. 56.

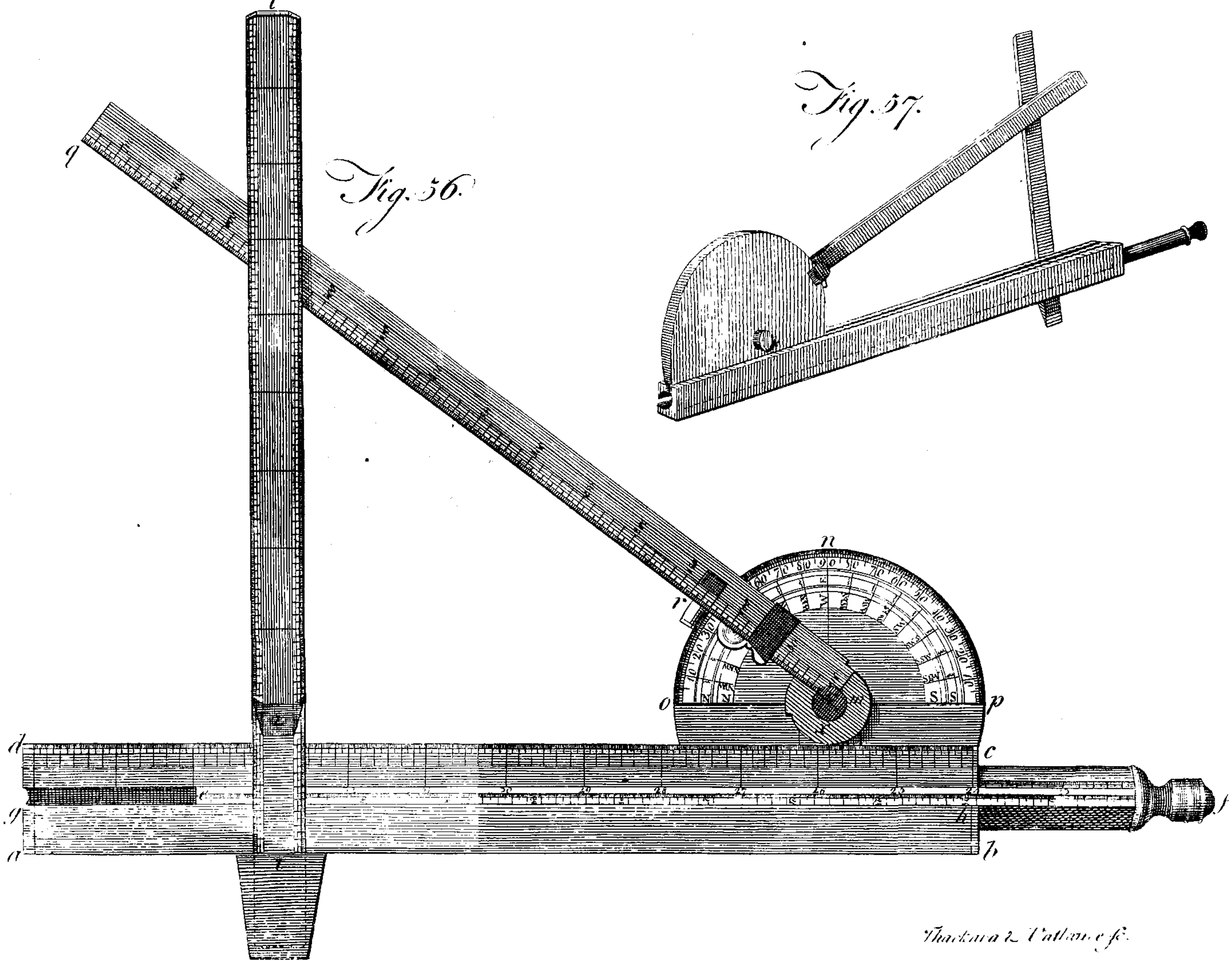


Fig. 57.

Thackara & Vallance sc.

Instruments to solve Problems in Sailing, independent of Calculation

the index the distance 254.7 miles at the point of intersection.

To find the difference of longitude.

Set the index to the complement of the middle latitude on the semicircle, and move the box until the termination of the departure on the perpendicular meets the index, which will mark the difference of longitude thereon 210 m. or 3° 30′.

PROB. III. Both latitudes and distance given, to find the course and difference of longitude.

EXAMPLE. From latitude 50° 50′ N, longitude 19° 0′ W, a ship sailed 254.7 miles between the north and east, and by observation is in latitude 54° 30′ N. Required the course and difference of longitude?

By Mercator's Sailing.

To find the course.

Move the perpendicular and semicircle to the given latitudes, and the index until the distance sailed marked on it meets the perpendicular; then the index will mark the course N. 30° 10′ E. on the semicircle.

To find the difference of longitude.

Screw the index to the course, move the perpendicular and semicircle to the meridional parts of the given latitudes, and the space intercepted between the limb of the box and the index will be the difference of longitude 3° 30′.

By Middle Latitude Sailing.

To find the departure and course.

Move the semicircle and perpendicular to the given latitudes, and the index until the distance sailed on it cuts the perpendicular; then the perpendicular will show the departure 128 miles, and the semicircle the course N 30° 10′ E.

To find the difference of longitude.

Set the index to 37° 20′, the complement of the middle latitude on the semicircle, and move the perpendicular until the termination of the departure on it cuts the index; then the point of intersection will mark the difference of longitude 210 miles on the index.

PROB. IV. Both latitudes and departure given, to find the course, distance, and difference of longitude.

EXAMPLE. Let the latitude and longitude sailed from be 56° 40′ S and 28° 55′ E respectively, the latitude come to 61° 20′ S, and departure 172 miles. Required the course, distance, and difference of longitude?

By Mercator's Sailing.

To find the course and distance.

Move the perpendicular and semicircle to the given latitudes (H); then move the index till it meets the extremity of the departure on the perpendicular; the distance will be marked on the index 329, and the course S 31° 55′ E or SSE¾E nearly on the semicircle.

To find the difference of longitude.

Move the perpendicular and semicircle to the Meridional parts of the given latitudes, and the index will cut the difference of longitude on the perpendicular 5° 35′.

By middle Latitude Sailing.

The course and distance is found as before.

To find the difference of Longitude.

Set the index to 31°, the complement of the middle latitude on the semicircle, and move the perpendicular until the departure marked on it cuts the index, and this point of intersection will mark the difference of longitude on the index 335 m. or 5° 35′.

PROB. V. One latitude, course, and distance given, to find the difference of latitude and difference of longitude.

EXAMPLE. Let the latitude left be 56° 40′ S, longitude 28° 55′ E, the course S 31° 35′ E, and distance 328 m. Required the latitude and longitude come to?

By Mercator's Sailing.

To find the latitude come to.

Set the semicircle to the latitude sailed from, and the index to the course, and bring the perpendicular to the distance, which at the same time will mark the latitude come to 61° 20′ S.

To find the difference of longitude.

Screw the index to the course, and move the semicircle and perpendicular to the meridional parts of both latitudes; then the index will cut the difference of longitude on the perpendicular 5° 35′.

By Middle Latitude Sailing.

The latitude arrived at is found as above.

To find the departure.

The semicircle and perpendicular being set to both latitudes, and the index to the course, it will show the departure 172.7 on the perpendicular.

To find the difference of longitude.

Set the index to 31°, the complement of the middle latitude on the semicircle, and move the perpendicular until the departure marked on it cuts the index, and the division on the index at the point of intersection will be the difference of longitude 335.

PROB. VI. One latitude, course, and departure, given, to find the distance, difference of latitude, and difference of longitude.

EXAMPLE. Let the latitude sailed from be 56° 40′ N, longitude 28° 35′ W, the course N 31° 35′ W, and departure 172.7 Required the distance, and the latitude and longitude come to?

By Mercator's Sailing.

To find the distance and latitude come to.

Move the semicircle to the latitude left, and the index to the course; mark the departure on the perpendicular, and move it until the termination thereof meets the index; then the point of intersection will show the distance 329 miles on the index, and the perpendicular will show the latitude arrived at 61° 20′ N on the base.

To find the difference of longitude.

Screw the index, and move the perpendicular and semicircle to the meridional parts of both latitudes, then the index will cut the difference of longitude 5° 35′ on the perpendicular.

By Middle Latitude Sailing.

Find the distance sailed and latitude in as above, and

(H) In southern latitudes, the end of the cylinder where the numbers begin must be turned towards the north, pointed out by the semicircle; and in northern latitudes, it must be reversed.

Instruments to solve Problems in Sailing, independent of Calculation

and the difference of longitude as in Problem IV. by middle latitude sailing.

Prob. VII. One latitude the distance sailed, and departure given, to find the course, difference of latitude, and difference of longitude.

Example. The latitude sailed from is 48° 30′ N, and longitude 14° 40′ W, the distance run is 345 miles between the south and east, and the departure 200 miles. Required the course, and the latitude and longitude come to?

By Mercator's Sailing.

To find the course and latitude come to.

Move the semicircle to the latitude left, mark the distance on the index, and the departure on the perpendicular, move both until these points meet; then will the index shew the course 35° 26′ E on the semicircle, and the latitude come to 43° 49′ on the base.

The difference of longitude is found as in the preceding problem.

By Middle Latitude Sailing.

The course and latitude come to are found as above, and the difference of longitude as in Problem IV. by middle latitude sailing.

Plate CCCXL.

II. *Of* Mackay's *Rectangular Instrument.*

Description. Fig. 58. is a representation of this instrument, of about one-third of the original size—The length CA is divided into 100 equal parts, and the breadth CB into 70; but in this plate every second division only is marked, in order to avoid confusion; through these divisions parallels are drawn, terminating at the opposite sides of the instrument. Upon the upper and right-hand sides are two scales; the first contains the degrees of the quadrant, and the other the points and quarters of the compass. M is an index moveable about the centre C, and divided in the same manner as the sides (1). Fig. 59. is a portion of the enlarged meridian, so constructed that the first degree is equal to three divisions on the instrument, and therefore, in the use of this line, each division on the instrument is to be accounted 20 minutes. The size of the plate would not admit of the continuation of the line.

Use. From a bare inspection of this instrument, it is evident that any triangle whatever may be formed on it. In applying it to nautical problems, the course is to be found at top, or right hand side, in the column of degrees or points, according as it is expressed; the distance is to be found on the index, the difference of latitude at either side column, and the departure at the head or foot of the instrument. The numbers in these columns may represent miles, leagues, &c.; but when used in conjunction with the enlarged meridional line, then 10 is to be accounted 100 miles, 20 is to be esteemed 200 miles, and so on, each number being increased in a tenfold ratio; and the intermediate numbers are to be reckoned accordingly.

Plane Sailing.

Prob. I. The course and distance sailed given, to find the difference of latitude and departure.

Example. Let the course be NE ½ N, distance 44 miles. Required the difference of latitude and departure?

Move the index until the graduated edge be over 3½ points, and find the given distance 44 miles on the index: this distance will be found to cut the parallel of 34 miles, the difference of latitude in the side column, and that of 28 miles, the departure at the top.

Prob. II. Given the course and difference of latitude, to find the distance and departure.

Example. Required the distance and departure answering to the course 28°, and difference of latitude 60 miles?

Lay the index over the given course 28°; find the difference of latitude 60 miles in the side column; its parallel will cut the index at 68 miles, the distance and the corresponding departure at the top is 32 miles.

Prob. III. The course and departure given, to find the distance and difference of latitude?

Example. Let the course be SSW and the departure 36 miles. Required the distance and difference of latitude?

Lay the index over two points; find the departure at the top, and its parallel will cut the index at 94 miles the distance, and the difference of latitude on the side column is 87 miles.

Prob. IV. Given the distance and difference of latitude, to find the course and departure.

Example. The distance is 35 leagues, and the difference of latitude 30 leagues. Required the course and departure?

Bring 35 leagues on the index to the parallel of 30 leagues in the side; then the departure at the top is 18 leagues and the course by the edge of the index on the line of rhumbs is 2¾ points.

Prob. V. Given the distance and departure, to find the course and difference of latitude.

Example. Let the distance be 58 miles, and the departure 15 miles. Required the course and difference of latitude?

Move the index until 58 found thereon cuts the parallel of 15 from the top: this will be found to intersect the parallel of 56 miles, the difference of latitude; and the course by the edge of the ruler is 15°.

Prob. VI. The difference of latitude and departure being given, to find the course and distance.

Example. Let the difference of latitude be 30 miles, the departure 28 miles. Required the course and distance?

Bring the index to the intersection of the parallels of 30 and 28; then the distance on the index is 41 miles, and the course by its edge is 43°.

Traverse Sailing.

Find the difference of latitude and departure answering to each course and distance by Problem I. of Plane Sailing, and from thence find the difference of latitude and departure made good; with which find the course and distance by the last problem.

An example is unnecessary.

4 *Parallel*

(1) In the original instrument are two slips, divided like the side and end of the instrument. One of these slips is moveable in a direction parallel to the side of the instrument, and the other parallel to the end.

Instruments to solve Problems in Sailing, independent of Calculation.

Parallel Sailing.

Prob. I. Given the difference of longitude between two places on the same parallel, to find the distance between them.

Example. Let the latitude of a parallel be 48°, and the difference of longitude between two places on it 3° 40, Required their distance?

Put the index to 48°, the given latitude, and find the difference of longitude 220 on the index, and the corresponding parallel from the side will be 147, the distance required.

Prob. II. The latitude of a parallel, and the distance between two places on that parallel, being given, to find the difference of longitude between them.

Example. The latitude of a parallel is 56°, and the distance between two places on it 200 miles. Required their difference of longitude?

Put the index to the given latitude, and find the distance in the side column, and the intersection of its parallel with the index will give 358, the difference of longitude sought.

Prob. III. Given the distance and difference of longitude between two places on the same parallel, to find the latitude of that parallel.

Example. The number of miles in a degree of longitude is 46.5. Required the latitude of the parallel?

Bring 60 on the index to cut the parallel of 46.5 from the side, then the edge of the index will give 39° 11′, the latitude required.

Middle Latitude and Mercator's Sailing.

Prob. I. The latitudes and longitudes of two places being given, to find the course and distance between them.

Example. Required the course and distance between Genoa, in latitude 44° 25′N, longitude 8° 36E, and Palermo, in latitude 38° 10′N, longitude 13° 38′ E.?

By Mercator's Sailing.

Take the interval between 38° 10′ and 44° 25′ on the enlarged meridian, which laid off from C upwards will reach to 500; now find the difference of longitude 302 at the top, and bring the divided edge of the index to the intersection of the corresponding parallels, and the index will show the course 31° 8′ on the line of degrees; then find the difference of latitude 375 on the side column, and its parallel will intersect the index at 438, the distance.

By Middle Latitude Sailing.

Put the index to 41° 18′, the complement of the middle latitude on degrees, and the difference of longitude 302 on the index will intersect the parallel of 227, the departure, in the side column. Now move the index to the intersection of the parallels of 375 and 227, the first being found in the side column, and the other at top or bottom; then the distance answering thereto on the index will be 438, and the course on the scale of degrees is 41° 10′.

Prob. II. Given one latitude, course, and distance, to find the other latitude and difference of longitude.

Example. Let the latitude and longitude sailed from be 39° 22′N and 12° 8′ W. respectively, the course NNW½W. and distance 500 miles. Required the latitude and longitude come to?

By Mercator's Sailing.

Put the index to the course 2½ points, and find the distance 500 miles thereon; then the corresponding difference of latitude will be 441 miles, and the departure 235½ miles: hence the latitude in is 46° 43′ N Now take the interval between the latitudes of 39° 22′ and 46° 43′ on the enlarged meridian, which laid off from C will reach to about 605, the parallel of which will intersect the vertical parallel of the difference of longitude 323 at the edge of the index: hence the longitude in is 17° 31′ W.

By Middle Latitude Sailing.

Find the difference of latitude and departure as before, and hence the latitude in is 46° 43′ N, and the middle latitude 43° 3′. Now put the index to 43° 3′, and the horizontal parallel of the departure 235½ will intersect the index at 322, the difference of longitude.

Prob. III. Both latitudes and course given, to find the distance and difference of longitude.

Example. The latitude sailed from is 22° 54′ S, and longitude 42° 40′ W, the course is SE by E, and latitude come to 26° 8′ South. Required the distance sailed, and longitude in?

By Mercator's Sailing.

Bring the index to 5 points, the given course, and the parallel of 194 the difference of latitude found in the side column will intersect the index at 349, the distance; and it will cut the vertical parallel of 290, the departure.

Take the interval between the given latitudes 22° 54′ and 26° 8′ on the enlarged meridian; lay off that extent from the centre on the side column, and it will reach to 213: the parallel of this number will intersect the vertical parallel of 319, the difference of logitude. Hence the longitude in is 37° 21′ W.

By Middle Latitude Sailing.

With the given course and difference of latitude find the distance and departure as before; then bring the index to the middle latitude 24° 31′; find the departure 290 in the side column, and its parallel will intersect the index at 319, the difference of longitude.

Prob. IV. One latitude course, and departure, given, to find the other latitude, distance, and difference of longitude.

Example. The latitude and longitude left are 20° 30′ N. and 49° 17′ W. respectively; the course is NE¾N, and departure 212 miles. Required the latitude and longitude come to, and distance sailed?

By Mercator's Sailing.

Put the index to the given course 3¼ points, and the vertical parallel of 212 will cut the index at 356, the distance, and the horizontal parallel of 286, the difference of latitude; the latitude come to is therefore 25° 16′ N.

Now take the interval between the latitudes 20° 30′, and 25° 16′ on the enlarged meridian, which laid off from the centre C will reach to 311; and this parallel will intersect the vertical parallel of the difference of longitude 230, at the edge of the index. Hence the longitude in is 45° 27′ W.

By Middle Latitude Sailing.

Find the distance and difference of latitude as directed above; then bring the index to 22° 53′, the middle latitude, and the horizontal parallel of 212, the departure,

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parture, will intersect the index at 230, the difference of longitude.

PROB. V. Both latitudes and distance given, to find the course and difference of longitude.

EXAMPLE. The distance sailed is 500 miles between the north and west; the latitude and longitude left are 40° 10 N, and 9° 20 W. respectively, and the latitude in is 46° 40 N. Required the course and longitude in?

By Mercator's Sailing.

Bring the distance 500 on the index to intersect the horizontal parallel of the difference of latitude 390; then the course 38° 44' is found on the line of degrees by the edge of the index, and the vertical parallel of the above point of intersection is that answering to 313, the departure.

Take the interval between the latitudes 40° 10', and 46° 40', which lay off from the centre C, and its horizontal parallel will intersect the vertical parallel of 431, the difference of longitude, by the edge of the index, it being in the same position as before. Hence the longitude in is 16° 31' W.

By Middle Latitude Sailing.

The course and departure are found as formerly, and the middle latitude is 43° 25', to which bring the edge of the index, and the horizontal parallel of 313, the departure, will intersect the index at 431, the difference of longitude.

PROB. VI. Both latitudes and departure given, to find the course, distance, and difference of longitude.

EXAMPLE. Let the latitude sailed from be 42°52 N. long. 9° 17'W, the departure 250 miles W, and the latitude come to 36° 18'N. Required the course and distance sailed, and the longitude come to?

By Mercator's Sailing.

Find the point of intersection of the horizontal parallel of 394, the difference of latitude, and the vertical parallel of 250, the departure; to this point bring the index, and the corresponding division thereon will be 467 miles, and the course on the scale of degrees by the edge of the index will be 32° 24'.

Take the interval between the latitudes on the enlarged meridian; which being laid off from the centre will reach to 512: now the horizontal parallel of 512 will cut the vertical parallel of 325, the difference of longitude, at the edge of the index. The longitude come to is therefore 14° 42' W.

By Middle Latitude Sailing.

The course and distance are to be found in the same manner as above. Then bring the index to 39° 35', the middle latitude, and the horizontal parallel of 250 will intersect the edge of the index at 324', the difference of longitude.

PROB. VII. Given one latitude, distance, and departure, to find the other latitude, course, and difference of longitude.

EXAMPLE. A ship from latitude 32n 38'N. longitude 17° 6'W, sailed 586 miles between the south and west, and made 336 miles of departure:—Required the course, and the latitude and longitude come to?

By Mercator's Sailing.

Move the index till the distance 586 intersects the vertical parallel of the departure 336; then the corresponding horizontal parallel will be 480, the difference of latitude, and the course 35°. Hence the latitude in is 24° 38' N.

Now take the interval between the latitudes on the enlarged meridian, which laid off from the centre will reach to 547, the horizontal parallel of which will cut the vertical parallel of 383, the difference of longitude. The longitude in is therefore 23° 29' W.

By Middle Latitude Sailing.

Find the course and difference of latitude as before, and hence the middle latitude is 28° 38', to which bring the index, and the horizontal parallel of 336, the departure, will intersect the index at 383, the difference of longitude.

It seems unnecessary to enlarge any further on the use of this instrument, as the above will make it sufficiently understood.

Great Circle Sailing.

CHAP. XII. *Of Great Circle Sailing.*

THE application of spherical trigonometry to the solution of triangles formed upon the surface of the earth is called *Great Circle Sailing*.

The earth being supposed an exact sphere, the shortest distance between two places is the arch of a great circle intercepted between them; and therefore the distance sailed upon a direct course from one place to another, will always be longer than the arch of a great circle contained between them, except when the rhumb line coincides with a great circle, which can only happen when the ship sails on a meridian or on the equator.

Although it is impossible to make a ship describe an arch of a great circle, yet she may be kept so near it as to make the error almost insensible.

The terms that enter into this sailing are, the latitudes of the places, their difference of longitude and distance, and the angles contained between the distance and the meridians of the places, called the *angles of position*.

PROB. I. Given the common latitude of two places on the same parallel, and their difference of longitude, to find the distance and angle of position (K).

EXAMPLE. Required the distance between St Mary's, in latitude 36° 57' N, longitude 25° 9' W. and Cape Henry, in latitude 36° 57' N, and longitude 76° 27' W.

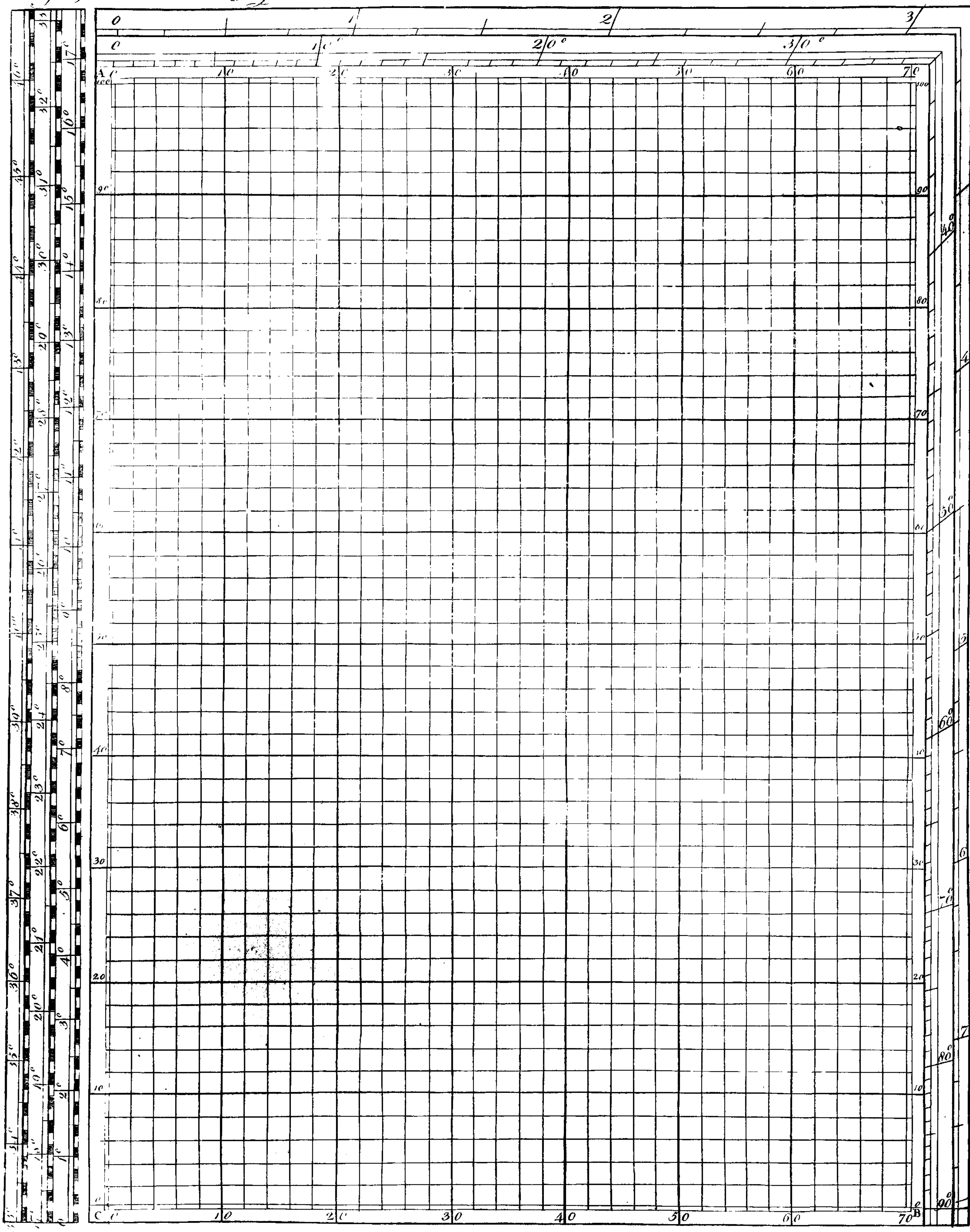
By Construction.

Describe the circle EFQS (fig. 60.) to represent the meridian of one of the places; draw the equator EQ and the earth's axis PS at right angles thereto; make ED, QA, each equal to the chord of 36° 57', the

Plate CCCXLI.

(K) This problem may be expressed thus:—Two places lying on the same parallel, and of these four, the latitude, difference of longitude, distance, and angle of position, any two being given to find the other two.——Now this problem contain four different cases, the most useful of which is given above. The others serve rather as exercises in spherical trigonometry than of any real utility in navigation, and are therefore omitted. The same is to be understood of the following problems.

Fig. 59. Fig. 58



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Great Circle Sailing.

the given latitude, and draw the parallel of latitude ABD, the radius of which is the tangent of 53° 3', the co-latitude; describe the meridian PBS with the secant of 51° 18' the difference of longitude; then A and B will be the two places. Draw the diameter AF, and through the points ABF describe a great circle; then the arch AB will be the distance, and the angle PAB the angle of position. Now these being measured by the rules given in *spherics* will, be found equal to 40° 28' and 73° 54' respectively.

By Calculation.

From P draw PG perpendicular to AB, by describing the arch with the secant of half the difference of longitude; then, in the right-angled spherical triangle AGP, are given AP = 53° 3' the complement of latitude, and the angle APG = 25° 39' half the difference of longitude; to find AG half the distance, and PAG the angle of position.

1. To find the distance.

As radius - -		10.00000
is to the sine of AP	53° 3'	9.90263
so is the sine of APG	25 39	9.63636
to the sine of AG	20 14	9.53899
	2	
Distance AB	40 28	

2. To find the angle of position.

As radius - - -		10.00000
is to the cosine of AP	53° 3'	9.77896
so is the tangent of APG	25 39	9.68142
to the cotangent of PAG	73 54	9.46038

Prob. II. Given the latitude of a place, and the difference of longitude between it and a place on the equator, to find the distance between them, and the angles of position.

Example. Required the shortest distance between the island of St Thomas, in latitude 0° 0', longitude 1° 0' E, and Port of St Julian, in latitude 48° 51' S, and longitude 65° 10' W?

By Construction.

Plate CCCXLI.

Describe the circle EPQS (fig. 61.), to represent the meridian of one of the places; draw the equator EQ, and axis PS; make EB equal to the chord of 48° 51', and B will represent Port St Julian; make CA equal to the semitangent of the complement of the difference of longitude; draw the diameter BF, and through the points BAF draw the great circle BAF; then AB will be the distance, ABE the angle of position at Port St Julian, and BAE the complement of that at St Thomas. These being measured by the rules given in spherics, will be found equal to 74° 35', 71° 36', and 51° 22'; respectively.

By Calculation.

In the right-angled spherical triangle AEB, AE, and EB are given, to find AB and the angles A and B.

1. To find the distance.

As radius - -		10.00000
is to to the cosine of AE	66° 10'	9.60646
so is the cosine of EB	48 51	9.81825
to the cosine of AB	74 35	9.42471

Now 74° 35' = 4475 miles, which is 57 miles less than the distance found by Mercator's Sailing.

2. To find the angle of position at St Thomas.

As radius -		10.00000
is to the sine of AE	66° 10'	9.96129
so is the cotangent of EB	48 51	9.94146
to the tang. ang. of position	38 38	9.90275

3. To find the angle of position at Port St Julian.

As radius -		10.00000
is to the sine EB	48° 51'	9.87679
so is the cotangent of AE	66 10	9.64517
to the cotangent of of ABE	71 36	9.52196

Hence a ship from St Thomas to Port St Julian must first steer S 38° 38' W, and then by constantly altering her course towards the west, so as to arrive at Port St Julian on a course S 71° 36' W, she will have sailed the shortest distance between those places.

Prob. III. Given the latitudes and longitudes of two places, to find the distance between them, and the angles of position.

Example. What is the shortest distance between the Lizard, in latitude 49° 57' N, longitude 5° 15' W, and Bermudas, in latitude 32° 35' N, and longitude 63° 28' W?

By Construction.

Describe the primitive circle (fig. 62.) to represent the meridian of one of the places; make EA = 32° 35', and A will represent Bermudas; make E *a*, Q *b* each equal to 49° 57'; then with the tangent of the co-latitude 40° 3' draw the parallel of latitude of the Lizard, and with the secant of 58° 13', the given difference of longitude, draw the oblique circle PBS, intersecting the parallel of latitude in B; which will be the position of the Lizard. Draw the diameter AF, and through the points A, B, F, describe a circle; and the arch AB will be the distance, and the angles A and B the angles of position, which are measured as before.

By Calculation.

In the oblique-angled spherical triangle APB are AP, BP, the co-latitudes, and the angle APB the difference of longitude; to find the distance AB, and the angles of position PAB, PBA.

1. To find the distance.

Difference of long.	58° 13'	versed sine	9.67513
AP -	57 25	sine	9.92563
BP -	40 3	sine	9.80852
Difference	17 22	nat. v. sine 04559	
		25661	9.40928
Distance AB	45 45	nat. v. sine 30220*.	

2. To find the angle of position at the Lizard.

As the sine of AB	45° 45'	9.85510
is to the sine of AP	57 25	9.92563
so is the sine of P	58 13	9.92944
to the sine of B	89 20	9.99997

3. To find the angle of position at Bermudas.

As the sine of AB	45° 45'	9.85510
is to the sine of BP	40 3	9.80852
so is the sine of P	58 13	9.92944
to the sine of A	49 47	9.88286

The shortest distance between the Lizard and Bermudas is 45° 45' or 2745 miles, which is 56 miles less than

* See Mackay's Treatise on the Longitude, where a complete Table of Nat. Versed Sines is given.

Great Circle Sailing.

than the distance found by Mercator's sailing. And a ship to describe the shortest tract must sail from the Lizard S. 89° 20′ W, and gradually lessen the course, so as to arrive at Bermudas on the rhumb bearing S. 49° 47′ W. The direct course by Mercator's sailing is S. 68° 10′ W.

From the preceding examples, it is evident that in order to sail on the arch of a great circle, the ship must continually alter her course. But as this is a difficulty too great to be admitted into the practice of navigation, it has been thought sufficiently exact to effect this by a kind of approximation; the principle of which is, that in small arches the difference between the arch and its chord or tangent is so small, that the one may be substituted for the other in any nautical operations.

Upon this principle, the great circles on the earth are supposed to be made up of short right lines, each of which is a segment of a rhumb line: and on this supposition the solution to the following problem is founded.

Prob. IV. Given the latitudes and longitudes of two places, to find the several points in a great circle passing through them, which alter in longitude from either of the places by a given quantity; together with the courses and distances between those points.

Rule. Compute the distance of the places, and their angles of position, by one of the preceding problems; find also the perpendicular from the pole to the great circle, passing through the given places, and the several angles at the pole made by the given alterations of longitude between the perpendicular and the successive meridians come to.

With this perpendicular, and the polar angles severally, find as many corresponding latitudes by the following analogy:

As rad. : co.tan-perp. : : cos. 1st pol. ang. : tang. 1st lat.
: : cos. 2nd pol. ang. : tang. 2nd lat.
&c. &c.

Now having the latitudes of the several points in the great circle, and the difference of longitude between each, find the several courses and distances between them; and these will be the courses and distances the ship must run to keep nearly on the arch of a great circle.

Example. I. A ship from a place in latitude 37° 0′ N, longitude 23° 0′ W, bound to a place in the same latitude, and in longitude 76° 27′ W, intends to sail as near the arch of a great circle as she can, by altering her course at every five degrees of longitude. Required the latitude of each point where the course is proposed to be altered, and also the courses and distances between those points?

Great Circle, Sailing.

The triangle APB (fig. 63.) being described, and the computation made as in Problem I. the distance will be found equal to 42° 6′, and the angle of position A or B=73° 9′.—Now the triangle APB being isosceles, the perpendicular PI falls in the middle of AB; and the latitudes, courses, and distances being known in the half BI, those in the half IA will also be known.

Plate CCCXLI.

Let the points a, b, c, d, &c. be the points arrived at on each alteration of five degrees of longitude; then will the arches Pa, Pb, Pc, Pd, &c. be the respective co-latitudes of those places, and are the hypothenuses of the right-angled spherical triangles PIa, PIb, PIc, PId, &c.

Now in the triangle PIB, given PB=53° 3′, the angle PBI=73° 9′, to find PI.

As radius	- - -	10.00000
is to the sine of PBI	73° 9′	9.98094
so is the sine of PB	53 0	9.90235
to the sine of PI	49 51	9.88329

The angle IPB $=\left(\frac{53^\circ\ 27'}{2}\right)$ 26° 43′½, angle IPa= 21° 43′½, IPb= 16° 43′½, IPc= 11° 43′½, IPd= 6° 43′½, are the several polar angles.

To find the latitude of the point a.

As radius		10.00000
is to the cotangent of PI	49° 51′	9.92612
so is the cosine first polar angle	21 43½	9.96800
to the tangent of 1st latitude	38 5	9.89412

By continuing the operation with the other polar angles, the successive latitudes from a to I will be 38° 56′, 39° 33′, 39° 57′

Now with the several latitudes, and respective differences of longitude, compute the courses and distances. The results are entered in the following Table; the calculations being performed on a piece of waste paper.

Polar Angles.	Successive Long.		Diff. Long.	Successive Lat.		Diff. Lat.	Meridian Parts.	Merid diff. lat,	Courses.		Distances.
IPB=26° 43½′	23°	0′		37°	0′		2392.6				
IPa=21 43½	28	0	300	38	5	65	2474.6	82.0	74°	43′	246.6
IPb=16 43½	33	0	300	38	56	51	2539.8	65.2	77	44	240.2
IPc=11 43½	38	0	300	39	33	37	2587.6	47.8	80	57	235.3
IPd= 6 43½	43	0	300	39	57	24	2618.8	31.2	84	4	231.9
	49	43½	403.5	40	9	12	2634.5	15.7	87	46	309.1
											1263.1

The courses, and the first distance, are found by Mercator's Sailing: but as the other courses are near the parallel, the distances cannot be very exactly found by this method; another method is therefore used. The sum of the distances is 1263.1, which doubled is 2526.2. agreeing with the distance found as before. It may be observed, that the distance found by this method cannot be less than the last distance, or that given by Great Circle Sailing, as some authors have found it.

Example II. A ship from the Lizard, in latitude 49° 57′ N, longitude 5° 15′ W, bound to a place in latitude 32° 25′ N, and longitude 66° 39′ W, proposes to sail on a great circle, and to alter her course at every

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Plate CCCXLI.

every five degrees of longitude. Required the latitudes of the places where the ſhip is to alter her courſe, and alſo the courſe and diſtance between each?

Having deſcribed the triangle (fig. 64.) and performed the computation as in Problem III. the diſtance AB is found =47° 54′, the angle of poſition PBA at the Lizard 87° 15′, and that at the place bound to 49° 35′.

Draw PI at right angles to AB. and in the equator lay off from the centre the tangents of 5, 10, 15, 20, &c. to 55 degrees, and theſe will be the centres of the arches of co-latitude to every 5° of difference of longitude.

To find the perpendicular PI.

As radius		10.00000
is to the ſine of PAB	49° 35′	9.88158
ſo is the ſine of PA	57 35	9.92643
to the ſine of PI	40 0	9.80801

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To find the polar angle API.

As radius		10.00000
is to the coſine of AP	57° 35′	9.72922
ſo is the tangent of PAB	59 35	10.06978
to the co-tangent of API	57 49	5.79900

Now the polar angle API, or the difference of longitude between the perpendicular and the meridian of the place bound to, 57° 49′, being taken from 61° 24′, the whole difference of longitude, leaves 3° 35′ for the difference of longitude between the Lizard and the perpendicular: alſo 5°, the propoſed alteration of longitude, being ſubtracted as often as it can be from 57° 49, leaves the ſeveral polar angles; with which and the perpendicular PI the ſeveral latitudes arrived at are found as in the preceding example: then with theſe latitudes and the differences of longitude between them, find the ſucceſſive courſes and diſtances. The ſeveral reſults are placed in the following Table; the calculations being performed on a piece of waſte paper.

Polar Angles.	Succeſſive Longs.	Diff. Long.	Succeſſive Lats.	Diff. Lat.	Meridian Parts.	Merid. diff. lat.	Courſes.	Diſtances,
	5° 14′		49° 57′		3469.8			138.3
IPB= 3° 35′	8 49	215	50 0	3	3474.5	4.7	88° 45′	108.7
IP*a* = 2 49	11 38	169	49 58	2	3471.4	3.1	88 57	193.8
IP*b* = 7 49	16 38	300	49 45	13	3451.2	20.2	86 9	196.6
IP*c* =12 49	21 38	300	49 18	27	3409.6	41.6	82 6	201.4
IP*d* =17 49	26 38	300	48 37	41	3347.2	62.4	78 15	207.3
IP*e* =22 49	31 38	300	47 42	55	3264.7	82.5	74 37	216.3
IP*f* =27 49	36 38	300	46 31	71	3160.4	104.3	70 50	226.8
IP*g* =32 49	41 38	300	45 3	88	3034.2	126.2	67 10	239.8
IP*h* =37 49	46 38	300	43 17	106	2886.4	147.8	63 46	255.9
IP*i* =42 49	51 38	300	41 10	127	2714.9	171.5	60 15	273.9
IP*k* =47 49	56 38	300	38 41	149	2520.5	194.4	57 3	296.1
IP*l* =52 49	61 38	300	35 46	175	2300.7	219.8	53 46	319.6
	66 38	300	32 25	201	2058.0	242.7	51 2	
								2874.5

As the four firſt courſes are near the parallel, the correſponding diſtances were not found by Mercator's Sailing. The ſum of the diſtances 2874.5 agrees very well with, and is not leſs than, 47° 54′, or 2874 miles, the ſhorteſt diſtance between the places.

Chap. XIII. *Of Sea-Charts.*

The charts uſually employed in the practice of navigation are of two kinds, namely, *Plane* and *Mercator's Charts*. The firſt of theſe is adapted to repreſent a portion of the earth's ſurface near the equator; and the laſt for all portions of the earth's ſurface. For a particular deſcription of theſe, reference has already been made from the article Chart, to thoſe of Plane and Mercator: and as theſe charts are particularly deſcribed under the above articles, it is therefore ſufficient in this place to deſcribe their uſe.

Uſe of the Plane Chart.

Prob. I. To find the latitude of a place on the chart.

Rule. Take the leaſt diſtance between the given place and the neareſt parallel of latitude: now this diſtance applied the ſame way on the graduated meridian, from the extremity of the parallel, will give the latitude of the propoſed place.

Thus the diſtance between Bonaviſta and the parallel of 15 degrees, being laid from that parallel upon the graduated meridian, will reach to 16° 5′, the latitude required.

Prob. II. To find the courſe and diſtance between two given places on the chart.

Rule. Lay a ruler over the given places, and take the neareſt diſtance between the centre of any of the compaſſes on the chart and the edge of the ruler; move this extent along, ſo as one point of the compaſs may touch the edge of the rule, and the ſtraight line joining their points may be perpendicular thereto; then will the other point ſhow the courſe: The interval between the places, being applied to the ſcale, will give the required diſtance.

Thus the courſe from Palma to St Vincent will be found to be about SSW ¾ W. and the diſtance 13°¼ or 795 m.

Prob. III. The courſe and diſtance ſailed from a known place being given, to find the ſhip's place on the chart.

Rule. Lay a ruler over the place ſailed from, parallel

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rallel to the rhumb, expressing the given course: take the distance from the scale, and lay it off from the given place by the edge of the ruler; and it will give the point representing the ship's present place.

Thus, suppose a ship had sailed SW*b*W 160 miles from Cape Palmas; then by proceeding as above, it will be found that she is in latitude 2° 57′ N.

The various other problems that may be resolved by means of this chart require no further explanation, being only the construction of the remaining problems in Plane Sailing on the chart.

Use of Mercator's Chart.

The method of finding the latitude and longitude of a place, and the course or bearing between two given places by this chart, is performed exactly in the manner as in the Plane Chart, which see.

PROB. I. To find the distance between two given places on the chart.

CASE I. When the given places are under the same meridian.

RULE. The difference or sum of their latitudes, according as they are on the same or on opposite sides of the equator, will be the distance required.

CASE II. When the given places are under the same parallel.

RULE. If that parallel be the equator, the difference or sum of their longitudes is the distance; otherwise, take half the interval between the places, lay it off upwards and downwards on the meridian from the given parallel, and the intercepted degrees will be the distance between the places.

Or, take an equal extent of a few degrees from the meridian on each side of the parallel, and the number of extents, and parts of an extent, contained between the places, being multiplied by the length of an extent, will give the required distance.

CASE III. When the given places differ both in latitude and longitude.

RULE. Find the difference of latitude between the given places, and take it from the equator or graduated parallel: then lay a ruler over the two places, and move one point of the compass along the edge of the ruler until the other point just touches a parallel; then the distance between the place where the point of the compass rested by the edge of the ruler, and the point of intersection of the ruler and parallel, being applied to the equator, will give the distance between the places in degrees and parts of a degree, which multiplied by 60 will reduce it to miles.

PROB. II. Given the latitude and longitude in, to find the ship's place on the chart.

RULE. Lay a ruler over the given latitude, and lay off the given longitude from the first meridian by the edge of the ruler, and the ship's present place will be obtained.

PROB. III. Given the course failed from a known place, and the latitude in, to find the ship's present place on the chart.

RULE. Lay a ruler over the place failed from in the direction of the given course, and its intersection with the parallel of latitude arrived at will be the ship's present place.

PROB. IV. Given the latitude of the place left and the course and distance failed, to find the ship's present place on the chart.

Method of finding the Latitude and Longitude at Sea.

RULE. The ruler being laid over the place failed from and in the direction of the given course, take the distance failed from the equator, put one point of the compass at the intersection of any parallel with the ruler, and the other point of the compass will reach to a certain place by the edge of the ruler. Now this point remaining in the same position, draw in the other point of the compass until it just touch the above parallel when sweeped round: apply this extent to the equator, and it will give the difference of latitude. Hence the latitude in will be known, and the intersection of the corresponding parallel with the edge of the ruler will be the ship's present place.

The other problems of Mercator's Sailing may be very easily resolved by this chart; but as they are of less use than those given, they are therefore omitted, and may serve as an exercise to the student.

BOOK II.

Containing the method of finding the Latitude and Longitude of a Ship at Sea, and the Variation of the Compass.

CHAP. I. *Of Hadley's Quadrant.*

HADLEY's quadrant is the chief instrument in use at present for observing altitudes at sea. The form of this instrument, according to the present mode of construction, is an octagonal sector of a circle, and therefore contains 45 degrees; but because of the double reflection, the limb is divided into 90 degrees. See ASTRONOMY and QUADRANT. Fig. 65. represents a quadrant of the common construction, of which the following are the principal parts. Plate CCCXLI.

1. ABC, the frame of the quadrant.
2. BC, the arch or limb.
3. D, the index; *a b*, the subdividing scale.
4. E, the index-glass.
5. F, the fore horizon-glass.
6. G, the back horizon-glass.
7. K, the coloured or dark glasses.
8. HI, the vanes or sights.

Of the Frame of the Quadrant.

The frame of the quadrant consists of an arch BC, firmly attached to the two radii AB, AC, which are bound together by the braces L M, in order to strengthen it, and prevent it from warping.

Of the Index D.

The index is a flat bar of brass, and turns on the centre of the octant: at the lower end of the index there is an oblong opening; to one side of this opening the vernier scale is fixed, to subdivide the divisions of the arch; at the end of the index there is a piece of brass, which bends under the arch, carrying a spring to make the subdividing scale lie close to the divisions. It is also furnished with a screw to fix the index in any desired position. The best instruments have an adjusting screw fitted to the index, that it may be moved more slowly, and with greater regularity and accuracy, than by the hand. It is proper, however, to observe, that the index must be previously fixed near its right position by the abovementioned screw.

Of

Method of finding the Latitude and Longitude at Sea.

Of the Index Glaſs E.

Upon the index, and near its axis of motion, is fixed a plane ſpeculum, or mirror of glaſs quickſilvered. It is ſet in a braſs frame, and is placed ſo that its face is perpendicular to the plane of the inſtrument. This mirror being fixed to the index moves along with it, and has its direction changed by the motion thereof; and the intention of this glaſs is to receive the image of the ſun, or any other object, and reflect it upon either of the two horizon-glaſſes, according to the nature of the obſervation.

The braſs frame with the glaſs is fixed to the index by the ſcrew *c*; the other ſcrew ſerves to re-place it in a perpendicular poſition, if by any accident it has been deranged.

Of the Horizon Glaſſes F, G.

On the radius AB of the octant are two ſmall ſpeculums: the ſurface of the upper one is parallel to the index glaſs, and that of the lower one perpendicular thereto, when *o* on the index coincides with *o* on the limb. Theſe mirrors receive the reflected rays, and tranſmit them to the obſerver.

The horizon-glaſſes are not entirely quickſilvered; the upper one F is only ſilvered on its lower half, or that next the plane of the quadrant, the other half being left tranſparent, and the back part of the frame cut away, that nothing may impede the ſight through the unſilvered part of the glaſs. The edge of the foil of this glaſs is nearly parallel to the plane of the inſtrument, and ought to be very ſharp, and without a flaw. The other horizon-glaſs is ſilvered at both ends. In the middle there is a tranſparent ſlit, through which the horizon may be ſeen.

Each of theſe glaſſes is ſet in a braſs frame, to which there is an axis paſſing through the wood work, and is fitted to a lever on the under ſide of the quadrant, by which the glaſs may be turned a few degrees on its axis, in order to ſet it parallel to the index-glaſs. The lever has a contrivance to turn it ſlowly, and a button to fix it. To ſet the glaſſes perpendicular to the plane of the inſtrument, there are two ſunk ſcrews, one before and one behind each glaſs: theſe ſcrews paſs through the plate on which the frame is fixed into another plate; ſo that by looſening one and tightening the other of theſe ſcrews, the direction of the frame with its mirror may be altered, and ſet perpendicular to the plane of the inſtrument.

Of the Coloured Glaſſes K.

There are uſually three coloured glaſſes, two of which are tinged red and the other green. They are uſed to prevent the ſolar rays from hurting the eye at the time of obſervation. Theſe glaſſes are ſet in a frame, which turns on a centre, ſo that they may be uſed ſeparately or together as the brightneſs of the ſun may require. The green glaſs is particularly uſeful in obſervations of the moon; it may be alſo uſed in obſervations of the ſun, if that object be very faint. In the fore-obſervations, theſe glaſſes are fixed as in fig. 65. but when the back-obſervation is uſed, they are removed to N.

Plate CCCXLI.

Of the two Sight Vanes H, I.

Each of theſe vanes is a perforated piece of braſs, deſigned to direct the ſight parallel to the plane of the quadrant. That which is fixed at I is uſed for the fore, and the other for the back, obſervation. The vane I has two holes, one exactly at the height of the ſilvered part of the horizon-glaſs, the other a little higher, to direct the ſight to the middle of the tranſparent part of the mirror.

Of the Diviſions on the Limb of the Quadrant.

The limb of the quadrant is divided from right to left into 90 primary diviſions, which are to be conſidered as degrees, and each degree is ſubdivided into three equal parts, which are therefore of 20 minutes each: the intermediate minutes are obtained by means of the ſcale of diviſions at the end of the index.

Of the Vernier or ſubdividing Scale.

The dividing ſcale contains a ſpace equal to 21 diviſions of the limb, and is divided into 20 equal parts. Hence the difference between a diviſion on the dividing ſcale and a diviſion on the limb is one-twentieth of a diviſion on the limb, or one minute. The degree and minute pointed out by the dividing ſcale may be eaſily found thus.

Obſerve what minute on the dividing ſcale coincides with a diviſion on the limb; this diviſion being added to the degree and part of a degree on the limb, immediately preceding the firſt diviſion on the dividing ſcale, will be the degree and minute required.

Thus ſuppoſe the fourteenth minute on the dividing ſcale coincided with a diviſion on the limb, and that the preceding diviſion on the limb to *o* on the vernier was $56^\circ\ 40'$; hence the diviſion ſhown by the vernier is $56^\circ\ 54'$. A magnifying glaſs will aſſiſt the obſerver to read off the coinciding diviſions with more accuracy.

Adjuſtments of Hadley's Quadrant.

The adjuſtments of the quadrant conſiſt in placing the mirrors perpendicular to the plane of the inſtrument. The fore horizon-glaſs muſt be ſet parallel to the ſpeculum, and the planes of the ſpeculum and back horizon glaſs produced muſt be perpendicular to each other when the index is at *o*.

Adjustment I. To ſet the index-glaſs perpendicular to the plane of the quadrant.

Method I. Set the index towards the middle of the limb, and hold the quadrant ſo that its plane may be nearly parallel to the horizon: then look into the index-glaſs; and if the portion of the limb ſeen by reflection appears in the ſame plane with that ſeen directly, the ſpeculum is perpendicular to the plane of the inſtrument. If they do not appear in the ſame plane, the error is to be rectified by altering the poſition of the ſcrews behind the frame of the glaſs.

Method II. This is performed by means of the two adjuſting tools fig. 66, 67, which are two wooden frames, having two lines on each, exactly at the ſame diſtance from the bottom.

Place the quadrant in a horizontal poſition on a table; put the index about the middle of the arch; turn back the dark glaſſes; place one of the abovementioned tools near one end of the arch, and the other at the oppoſite end, the ſide with the lines being towards the index-glaſs; then look into the index-glaſs, directing the ſight parallel to the plane of the inſtrument, and one of the tools will be ſeen by direct viſion, and the other by reflection. By moving the index a little, they may be brought exactly together

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ther. If the lines coincide, the poſition of the mirror is right; if not, they muſt be made to coincide by altering the ſcrews behind the frame, as before.

Adjustment II. To ſet the fore horizon-glaſs perpendicular to the plane of the inſtrument.

Set the index to *o*; hold the plane of the quadrant parallel to the horizon; direct the ſight to the horizon, and if the horizons ſeen directly and by reflection are apparently in the ſame ſtraight line, the fore horizon-glaſs is perpendicular to the plane of the inſtrument; if not, one of the horizons will appear higher than the other. Now if the horizon ſeen by reflection is higher than that ſeen directly, releaſe the neareſt ſcrew in the pedeſtal of the glaſs, and ſcrew up that on the farther ſide, till the direct and reflected horizons appear to make one continued ſtraight line. But if the reflected horizon is lower than that ſeen directly, unſcrew the fartheſt, and ſcrew up the neareſt ſcrew till the coincidence of the horizons is perfect, obſerving to leave both ſcrews equally tight, and the fore horizon-glaſs will be perpendicular to the plane of the quadrant.

Adjustment III. To ſet the fore horizon-glaſs, parallel to the index-glaſs, the index being at *o*.

Set *o* on the index exactly to *o* on the limb, and fix it in that poſition by the ſcrew at the under ſide; hold the plane of the quadrant in a vertical poſition, and direct the ſight to a well-defined part of the horizon; then if the horizon ſeen in the ſilvered part coincides with that ſeen through the tranſparent part, the horizon-glaſs is adjuſted; but if the horizons do not coincide, unſcrew the milled ſcrew in the middle of the lever on the other ſide of the quadrant, and turn the nut at the end of the lever until both horizons coincide, and fix the lever in this poſition by tightening the milled ſcrew.

As the poſition of the glaſs is liable to be altered by fixing the lever, it will therefore be neceſſary to re-examine it, and if the horizons do not coincide, it will be neceſſary either to repeat the adjuſtment, or rather to find the error of adjuſtment, or, as it is uſually called, the *index error*; which may be done thus:

Direct the ſight to the horizon, and move the index until the reflected horizon coincides with that ſeen directly; then the difference between *o* on the limb and *o* on the vernier is the index error; which is additive when the beginning of the vernier is to the right of *o* on the limb, otherwiſe ſubtractive.

Adjustment IV. To ſet the back horizon-glaſs perpendicular to the plane of the inſtrument.

Put the index to *o*; hold the plane of the quadrant parallel to the horizon, and direct the ſight to the horizon through the back ſight vane. Now if the reflected horizon is in the ſame ſtraight line with that ſeen through the tranſparent part, the glaſs is perpendicular to the plane of the inſtrument: If the horizons do not unite, turn the ſunk ſcrews in the pedeſtal of the glaſs until they are apparently in the ſame ſtraight line.

Adjustment V. To ſet the back horizon-glaſs perpendicular to the plane of the index-glaſs produced, the index being at *o*.

Let the index be put as much to the right of *o* as twice the dip of the horizon amounts to; hold the quadrant in a vertical poſition, and apply the eye to the back vane: then if the reflected horizon coincides with that ſeen directly, the glaſs is adjuſted; if they do not coincide, the ſcrew in the middle of the lever on the other ſide of the quadrant muſt be releaſed, and the nut at its extremity turned till both horizons coincide. It may be obſerved, that the reflected horizon will be inverted; that is, the ſea will be apparently uppermoſt and the ſky lowermoſt.

As this method of adjuſtment is eſteemed troubleſome, and is often found to be very difficult to perform at ſea, various contrivances have therefore been propoſed to render this adjuſtment more ſimple. Some of theſe are the following.

1. Mr Dollond's method of adjuſting the back horizon-glaſs.

In this method an index is applied to the back horizon-glaſs, by which it may be moved ſo as to be parallel to the index-glaſs, when *o* on the vernier coincides with *o* on the limb. When this is effected, the index of the back horizon-glaſs is to be moved exactly 90° from its former poſition, which is known by means of a divided arch for that purpoſe; and then the plane of the back horizon-glaſs will be perpendicular to the plane of the index-glaſs produced.

2. Mr Blair's method of adjuſting the back horizon-glaſs.

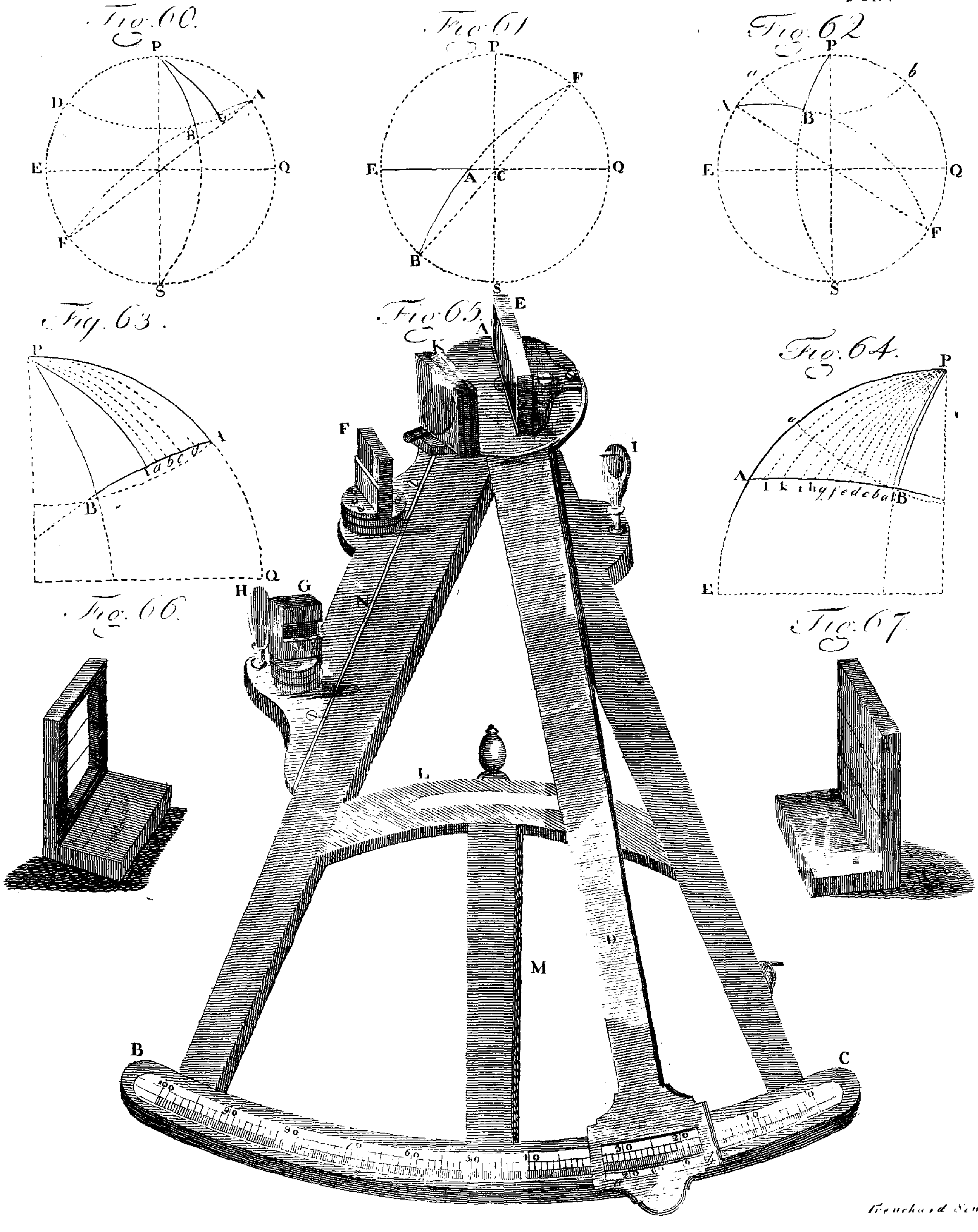
All that is required in this method is to poliſh the lower edge of the index-glaſs, and expoſe it to view. The back horizon-glaſs is adjuſted by means of a reflection from this poliſhed edge, in the very ſame method as the fore horizon-glaſs is adjuſted by the common method.

In order to illuſtrate this, let R I H E (fig. 68.) repreſent a pencil of rays emitted from the object R, incident on the index-glaſs I, from which it is reflected to the fore horizon-glaſs H, and thence to the eye at E. By this double reflection, an image of the object is formed at *r*. RHE repreſents another pencil from the ſame object R, coming directly through the fore horizon-glaſs to the eye at E; ſo that the doubly reflected image *r* appears coincident with the object R itſelf, ſeen directly. Plate CCCXLII.

When this coincidence is perfect, and the object R ſo very diſtant as to make the angle IRH inſenſible, the poſition of the ſpeculums I and H will differ inſenſibly from paralleliſm; that is, the quadrant will be adjuſted for the fore-obſervation. Now it is from the eaſe and accuracy with which this adjuſtment can at any time be made, that the fore-obſervation derives its ſuperiority over the back-obſervation. But by grinding the edge of the index glaſs perpendicular to its reflecting ſurface, and poliſhing it, the back-obſervation is rendered capable of an adjuſtment equally eaſy and accurate as the fore horizon-glaſs; for by a pencil of rays emitted from the object S, incident on the reflecting edge of the index-glaſs D, thence reflected to the back horizon-glaſs B, and from that to the eye at *e*, an image will be formed at *s*; which image being made to coincide with the object S itſelf, ſeen directly, aſcertains the poſition of the back horizon glaſs relative to the index-glaſs with the ſame preciſion, and in a manner equally direct, as the former operation does that of the fore horizon-glaſs.

Directions for adjuſting the Back Horizon-Glaſs.

The method of adjuſting the quadrant for the back-obſervation



Trenchard Sculp.

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obſervation is this. If it is to be done without making uſe of the teleſcope, place the index at *o*, and, applying the eye to the hole in the ſight vane (K), or tube for directing the ſight, direct it through the back horizon-glaſs to the horizon, if that is the object to be uſed for adjuſting. The two horizons are then to be made to coincide, holding the quadrant firſt in a vertical and then in an horizontal poſition; by which means both adjuſtments will be effected as in the fore-obſervation.

There will be no difficulty in finding the reflected horizon, if the obſerver firſt directs his eye to that part of the horizon-glaſs where he obſerves the image of the poliſhed edge of the index-glaſs, which will appear double. When the directed horizon is made to appear in this ſpace, the reflected one will be ſeen cloſe by it, unleſs the inſtrument wants a great adjuſtment. In this caſe, a little motion of the back horizon-glaſs backwards and forwards will preſently bring it in view.

When the horizon, or any obſcure terreſtrial object, is to be made uſe of for adjuſting by means of the reflecting edge, there is a precaution to be taken, without which the obſerver will ſometimes meet with what will appear an unaccountable difficulty; for if the ſky, or other object behind him, ſhould happen to be pretty bright, he will not be able to diſcern the horizon at all. This ariſes from the image of the object behind him, which is reflected from the ſilvered ſurface of the index-glaſs, appearing to coincide with the horizon; in which caſe, the bright picture of the former, which is formed in the bottom of the eye, prevents the fainter impreſſion of the latter from being perceived. This will be avoided, either by applying a black ſcreen over the ſilvered ſurface of the index-glaſs, or, without being at this trouble, by ſtanding at a door or window, ſo that only the dark objects within can be reflected from the index-glaſs: but if the obſervation is to be made in the open air, a hat, or any ſuch dark obſtacle, held before the ſilvered ſurface of the index-glaſs, will very effectually remove this inconvenience.

It may be remarked, that ſome obſervers, inſtead of making the principal adjuſtment, place the ſpeculums parallel, by moving the index without altering the poſition of the horizon-glaſs: and the difference between *o* on the vernier and *o* on the limb is the index error, which muſt be ſubtracted from all angles meaſured by the back-obſervation, when *o* on the index is to the right of *o* on the limb; and added when to the left.

3. Mr Wright's method of adjuſting the back horizon-glaſs of his improved patent quadrant.

Plate CCXLII.

Fig. 69. is a repreſentation of the quadrant complete in all its parts for uſe. A, is the reflecting ſurface of the index glaſs, which is made of the uſual length, and $\frac{9}{10}$ of an inch broad. The bottom part is covered in front by the braſs frame, and the reflecting ſurface is $\frac{7}{10}$ on the back. B, the fore horizon-glaſs, placed as uſual: O, the back horizon-glaſs, now placed under the fore-ſight vane on the firſt radius of the quadrant I: C, the ſight-vane of the fore-horizon-glaſs: D, the ſight-vane of the back horizon-glaſs: E, the coloured glaſſes in a braſs frame, in the proper place for the fore-obſervation: F, a hole in the frame to receive the coloured glaſſes when an obſervation is to be taken with the back horizon-glaſs in the common way, by turning the back to the ſun: G, a hole in the frame of the fartheſt radius K, to receive the coloured glaſſes when an obſervation is to be taken by the new method; which is by looking through the lower hole in the ſight-vane of the back horizon-glaſs, directly at the ſun in the line of ſight DN; the horizon from behind will then be reflected from the back of the index-glaſs to the horizon-glaſs, and from thence to the eye. (See fig. 73.) H, a braſs clamp on the upper end of the index, having a milled ſcrew underneath, which faſtens the round plate to the index when required. (See fig. 70.) IK, the graduated arch of the quadrant divided into 90 degrees: L, the braſs index which moves over the graduated arch: M, the vernier to ſubdivide the diviſions on the arch into ſingle minutes of a degree.

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Fig. 70. ſhows the upper part of the index L on a larger ſcale, with part of the braſs frame that faſtens the index-glaſs, and the three adjuſting ſcrews D to adjuſt its axis vertical to the plane of the quadrant: B, the centre on which the milled plate O moves over the index: The dotted line BF is the diſtance it is required to move: K, the adjuſting ſcrew to ſtop it in its proper place for adjuſting the back obſervation-glaſs: G, a piece of braſs faſtened to the index oppoſite to the clamp H, to keep the plate O always cloſe to the index L.

Fig. 71. repreſents the parallel poſition of the index and horizon-glaſſes after adjuſtment by the ſun: BC, a ray from the ſun incident on the index-glaſs C, and from thence reflected to the fore horizon-glaſs D, and again to the eye at E, in the line DE, where the eye ſees the ſun at A by direct viſion, and the image by reflection in one; the parallel lines AE and BC being ſo near to each other, that no apparent angle can be obſerved in the planes of the index and horizon glaſs, when adjuſted by a diſtant object.

In fig. 72. the index-glaſs is removed 45 degrees from the plane of the fore horizon-glaſs, and fixed in its proper place for adjuſting the back horizon-glaſs parallel to its plane, in the ſame manner as the fore horizon-glaſs is adjuſted.

In fig. 73. the index-glaſs (after the adjuſtment of the fore and back horizon-glaſſes) is carried forward by the index on the arch 90 degrees, and makes an angle of 45° with the plane of the fore horizon-glaſs, and is at right angles to the plane of the back horizon-glaſs. The eye at E now ſees the ſun in the horizon at H, reflected by the index and horizon-glaſſes from the zenith at Z, the image and object being 90 degrees

(K) Beſides the hole in the ſight vane commonly made, there muſt be another nearer to the horizon-glaſs, and ſo placed that an eye directed through it to the centre of the horizon-glaſs ſhall there perceive the image of the poliſhed edge of the index-glaſs. This hole muſt not be made ſmall like the other, but equal to the ordinary ſize of the pupil of the eye, there being on ſome occaſions no light to ſpare.

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degrees distant. The back horizon K is now reflected from the back surface of the index-glass C to the horizon-glass M, and from thence to the eye at D, in a right line with the fore horizon F. In order to make an exact contact of the fore and back horizons at F, the index must be advanced beyond the 90th degree on the arch, by a quantity equal to twice the dip of the horizon.

The quadrant is adjusted for the fore-observation as usual, having previously fixed the index-glass in its proper place by the milled screw at H, as represented in fig. 70.

To adjust the Quadrant for the Back-observation.

Plate CCCXLII.

Fasten the index to 90° on the limb; loosen the screw H (fig. 70.), and turn the plate O by the milled edge until the end of the adjusting screw K touch the edge of the clamp M; and by means of a distant object observe if the glasses are then parallel, as at fig. 71.: if they are, fasten the screw H; if not, with a screw-driver turn the screw K gently to the right or left to make them perfect, and then fasten the screw. Now remove the index back to O on the limb, and the index-glass will be parallel to the back horizon-glass E, fig. 72.: If not, make them so by turning the adjusting screw. of the glass E, the eye being at the upper hole in the sight-vane D, and the sight directed to the horizon, or any distant object in the direction DN (fig. 69.) Now the index remaining in this position, the index-glass is to be returned, to stop at the pin E, and it will be parallel to the fore horizon-glass as at first: then the quadrant will be adjusted for both methods of observation.

To observe the Sun's Altitude by the Back-observation.

Remove the coloured glasses to G (fig. 69.), and look through the lower hole in the sight-vane D, in the line of direction DN, directly to the sun, and move the index forward on the arch exactly in the same manner as in the fore-observation: make the contact of the sun's limb and the back horizon exact, and the degrees and minutes shown by the index on the limb is the sun's zenith distance. It may be observed, that the horizon will be inverted. If the sun's lower limb be observed, the semidiameter is to be subtracted from the zenith distance; but if the upper limb is observed, the semidiameter is to be added.

The observation may be made in the usual manner, by turning the back to the sun. In this case the coloured glasses are to be shifted to F, and proceed according to the directions formerly given.

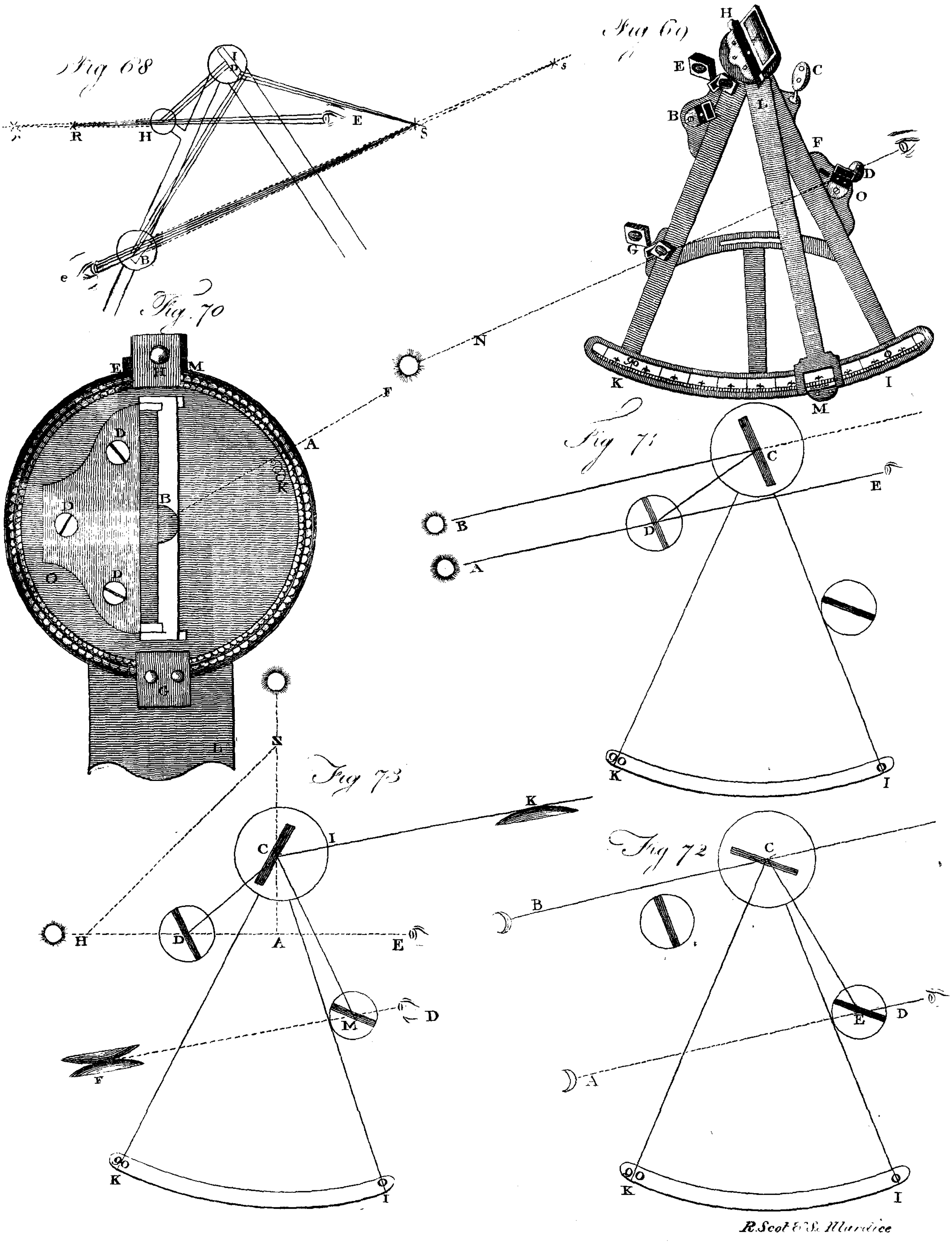
Use of Hadley's Quadrant.

The altitude of any object is determined by the position of the index on the limb, when by reflection that object appears to be in contact with the horizon.

If the object whose altitude is to be observed be the sun, and if so bright that its image may be seen in the transparent part of the fore horizon-glass, the eye is to be applied to the upper hole in the sight-vane; otherwise, to the lower hole: and in this case, the quadrant is to be held so that the sun may be bisected by the line of separation of the silvered and transparent parts of the glass. The moon is to be kept as nearly as possible in the same position; and the image of the star is to be observed in the silvered part of the glass adjacent to the line of separation of the two parts.

There are two different methods of taking observations with the quadrant. In the first of these the face of the observer is directed towards that part of the horizon immediately under the sun, and is therefore called the *fore observation*. In the other method, the observer's back is to the sun, and it is hence called the *back-observation*. This last method of observation is to be used only when the horizon under the sun is obscured, or rendered indistinct by fog or any other impediment.

In taking the sun's altitude, whether by the fore or back observation, the observer must turn the quadrant about upon the axis of vision, and at the same time turn himself about upon his heel, so as to keep the sun always in that part of the horizon glass which is at the same distance as the eye from the plane of the quadrant. In this way the reflected sun will describe an arch of a parallel circle round the true sun, whose convex side will be downwards in the fore-observation and upwards in the back; and consequently, when by moving the index, the lowest point of the arch in the fore-observation, or highest in the back, is made to touch the horizon, the quadrant will stand in a vertical plane, and the altitude above the visible horizon will be properly observed. The reason of these operations may be thus explained: The image of the sun being always kept in the axis of vision, the index will always show on the quadrant the distance between the sun and any object seen directly which its image appears to touch; therefore, as long as the index remains unmoved, the image of the sun will describe an arch everywhere equidistant from the sun in the heavens, and consequently a parallel circle about the sun, as a pole. Such a translation of the sun's image can only be produced by the quadrant's being turned about upon a line drawn from the eye to the sun, as an axis. A motion of rotation upon this line may be resolved into two, one upon the axis of vision, and the other upon a line on the quadrant perpendicular to the axis of vision; and consequently a proper combination of these two motions will keep the image of the sun constantly in the axis of vision, and cause both jointly to run over a parallel circle about the sun in the heavens: but when the quadrant is vertical, a line thereon perpendicular to the axis of vision becomes a vertical axis; and as a small motion of the quadrant is all that is wanted, it will never differ much in practice from a vertical axis. The observer is directed to perform two motions rather than the single one equivalent to them on a line drawn from the eye to the sun; because we are not capable, while looking towards the horizon, of judging how to turn the quadrant about upon the elevated line going to the sun as an axis, by any other means than by combining the two motions abovementioned, so as to keep the sun's image always in the proper part of the horizon-glass. When the sun is near the horizon, the line going from the eye to the sun will not be far removed from the axis of vision; and consequently the principal motion of the quadrant will be performed on the axis of vision, and the part of motion made on the vertical axis will be but small. On the contrary, when the sun is near the zenith, the line going to the sun is not far removed from a vertical line, and conse-



R.Scot & S. Murdice

quently the principal motion of the quadrant will be performed on a vertical axis, by the observer's turning himself about, and the part of the motion made on the axis of vision will be but small. In intermediate altitudes of the sun, the motions of the quadrant on the axis of vision, and on the vertical axis, will be more equally divided.

Observations taken with the quadrant are liable to errors, arising from the bending and elasticity of the index, and the resistance it meets with in turning round its centre: whence the extremity of the index, on being pushed along the arch, will sensibly advance before the index-glass begins to move, and may be seen to recoil when the force acting on it is removed. Mr Hadley seems to have been apprehensive that his instrument would be liable to errors from this cause; and in order to avoid them, gives particular directions that the index be made broad at the end next the centre, and that the centre, or axis itself, have as easy a motion as is consistent with steadiness; that is, an entire freedom from looseness, or *shake*, as the workmen term it. By strictly complying with these directions the error question may indeed be greatly diminished; so far, perhaps, as to render it nearly insensible, where the index is made strong, and the proper medium between the two extremes of a shake at the centre on one hand, and too much stiffness there on the other, is nicely hit; but it cannot be entirely corrected. For to more or less of bending the index will always be subject; and some degree of resistance will remain at the centre, unless the friction there could be totally removed, which is impossible.

Of the reality of the error to which he is liable from this cause, the observer, if he is provided with a quadrant furnished with a screw for moving the index gradually, may thus satisfy himself. After finishing the observation, lay the quadrant on a table, and note the angle; then cautiously loosen the screw which fastens the index, and it will immediately, if the quadrant is not remarkably well constructed, be seen to start from its former situation, more or less according to the perfection of the joint and the strength of the index. This starting, which is owing to the index recoiling after being released from the confined state it was in during the observation will sometimes amount to several minutes; and its direction will be opposite to that in which the index was moved by the screw at the time of finishing the observation. But how far it affects the truth of the observation, depends on the manner in which the index was moved in setting it to *o*, for adjusting the instrument; or in finishing the observations necessary for finding the index error.

The easiest and best rule to avoid these errors seems to be this: In all observations made by Hadley's quadrant, let the observer take notice constantly to finish his observations, by moving the index in the same direction which was used in setting it to *o* for adjusting; or in the observations necessary for finding the index error. If this rule is observed, the error arising from the spring of the index will be obviated. For as the index was bent the same way, and in the same degree in adjusting as in observing, the truth of the observations will not be affected by this bending.

To take Altitudes by the Fore-observation.

I. *Of the Sun.*

Turn down either of the coloured glasses before the horizon-glass, according to the brightness of the sun; direct the sight to that part of the horizon which is under the sun, and move the index until the coloured image of the sun appears in the horizon-glass; then give the quadrant a slow vibratory motion about the axis of vision; move the index until the lower or upper limb of the sun is in contact with the horizon, at the lowest part of the arch described by this motion; and the degrees and minutes shown by the index on the limb will be the altitude of the sun.

II. *Of the Moon.*

Put the index to *o*, turn down the green glass, place the eye at the lower hole in the sight-vane, and observe the moon in the silvered part of the horizon-glass; move the index gradually, and follow the moon's reflected image until the enlightened limb is in contact with the horizon, at the lower part of the arch described by the vibratory motion as before, and the index will show the altitude of the observed limb of the moon. If the observation is made in the daytime, the coloured glass is unnecessary.

III. *Of a Star or Planet.*

The index being put to *o*. direct the sight to the star through the lower hole in the sight-vane and transparent part of the horizon-glass; move the plane of the quadrant a very little to the left, and the image of the star will be seen in the silvered part of the glass. Now move the index, and the image of the star will appear to descend; continue moving the index gradually until the star is in contact with the horizon at the lowest part of the arch described; and the degrees and minutes shown by the index on the limb will be the altitude of the star.

To take Altitudes by the Back-observation.

I. *Of the Sun.*

Put the stem of the coloured glasses into the perforation between the horizon-glasses, turn down either according to the brightness of the sun, and hold the quadrant vertically; then direct the sight through the hole in the back sight-vane, and the transparent slit in the horizon-glass to that part of the horizon which is opposite to the sun; now move the index till the sun is in the silvered part of the glass, and by giving the quadrant a vibratory motion, the axis of which is that of vision, the image of the sun will describe an arch whose convex side is upwards; bring the limb of the sun, when in the upper part of this arch, in contact with the horizon; and the index will show the altitude of the other limb of the sun.

II. *Of the Moon.*

The altitude of the moon is observed in the same manner as that of the sun, with this difference only, that the use of the coloured glass is unnecessary unless the moon is very bright; and that the enlightened limb, whether

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whether it be the upper or lower, is to be brought in contact with the horizon.

III. *Of a Star or Planet.*

Look directly to the ſtar through the vane and tranſparent ſlit in the horizon-glaſs, move the index until the oppoſite horizon, with reſpect to the ſtar, is ſeen in the ſilvered part of the glaſs; and make the contact perfect as formerly. If the altitude of the ſtar is known nearly, the index may be ſet to that altitude, the ſight directed to the oppoſite horizon, and the obſervation made as before.

Sect. II. *Of finding the Latitude of a Place.*

The obſervation neceſſary for aſcertaining the latitude of a place, is that of the meridional altitude of a known celeſtial object; or two altitudes when the object is out of the meridian. The latitude is deduced with more certainty and with leſs trouble from the firſt of theſe methods, than from the ſecond; and the ſun, for various reaſons, is the object moſt proper for this purpoſe at ſea. It, however, frequently happens, that by the interpoſition of clouds, the ſun is obſcured at noon; and by this means the meridian altitude is loſt. In this caſe, therefore, the method by double altitudes becomes neceſſary. The latitude may be deduced from three altitudes of an unknown object, or from double altitudes, the apparent times of obſervation being given.

The altitude of the limb of an object obſerved at ſea, requires four ſeparate corrections in order to obtain the true altitude of its centre: theſe are for *ſemidiameter*, *dip*, *refraction*, and *parallax*. (See Astronomy, and the reſpective articles). The firſt and laſt of theſe corrections vaniſh when the obſerved object is a fixed ſtar.

When the altitude of the lower limb of any object is obſerved, its ſemidiameter is to be added thereto in order to obtain the central altitude; but if the upper limb be obſerved, the ſemidiameter is to be ſubtracted. If the altitude be taken by the back-obſervation, the contrary rule is to be applied. The dip is to be ſubtracted from, or added to, the obſerved altitude, according as the fore or back-obſervation is uſed. The refraction is always to be ſubtracted from, and the parallax added to, the obſerved altitude.

Prob. I. To reduce the ſun's declination to any given meridian.

Rule. Find the number in Table IX. anſwering to the longitude in the table neareſt to that given, and to the neareſt day of the month. Now, if the longitude is weſt, and the declination increaſing, that is, from the 20th of March to the 22d of June, and from the 22d of September to the 22d of December, the above number is to be added to the declination: during the other part of the year, or while the declination is decreaſing, this number is to be ſubtracted. In eaſt longitude, the contrary rule is to be applied.

Example I. Required the ſun's declination at noon 15th April 1793, in longitude 84° W?

Sun's declination at noon at Greenwich		10° 1'.8 N
Number from Table IX.	-	+ 5.0
Reduced declination	- -	10 6.8 N

Example II. Required the ſun's declination at noon 22d March 1793, in longitude 15½° E?

Sun's declination at noon at Greenwich		0° 56' N
Equation from table	- -	— 10
Reduced declination		0 46 N

Prob. II. Given the ſun's meridian altitude, to find the latitude of the place of obſervation.

Rule. The ſun's ſemidiameter is to be added to, or ſubtracted from, the obſerved altitude, according as the lower or upper limb is obſerved; the dip anſwering to the height from Table V. is to be ſubtracted if the fore-obſervation is uſed; otherwiſe, it is to be added; and the refraction anſwering to the altitude from Table IV. is to be ſubtracted: hence the true altitude of the ſun's centre will be obtained. Call the altitude ſouth or north, according as the ſun is ſouth or north at the time of obſervation; which ſubtracted from 90°, will give the zenith diſtance of a contrary denomination.

Reduce the ſun's declination to the meridian of the place of obſervation, by Problem I.; then the ſum or difference of the zenith diſtance and declination, according as they are of the ſame or of a contrary denomination, will be the latitude of the place of obſervation, of the ſame name with the greater quantity.

Example I. October 17th 1792, in longitude 32° E, the meridian altitude of the ſun's lower limb was 48° 53' S, height of the eye 18 feet. Required the latitude?

Ob.alt.ſun'slowerlimb,	48° 53' S	Sun'sdec.17.Oct.noon.	9° 37' S
Semidiameter	+0 16	Equation Table IX.	— 2
Dip and refraction	—0 5	Reduced declination	9 35 S
True alt. ſun's centre	49 4 S	Zenith diſtance	40 56 N
		Latitude	31 21 N

Example II. November 16th 1793, in longitude 158° W, the meridian altitude of the ſun's lower limb was 87° 37' N, height of the eye 10 feet. Required the latitude?

Obs.alt.ſun'slow.limb	87° 37' N.	Sun'sdec.noon.	18° 57' S
Semidiameter	+0 16	Equation table	+0 8
Dip and refract.	—0 3	Reduced dec.	19 5 S
True alt. ſun's centre	87 50 N.	Zenith diſtance	2 10 S
		Latitude	21 15 S

Example III. December 19th 1793, being nearly under the meridian of Greenwich, the altitude of the ſun's upper limb at noon was 4° 30' S, height of the eye 20 feet. Required the latitude?

Obſerved altitude of the ſun's upper limb		4° 30' S
Sun's ſemidiameter	- -	— 0 16
Dip and refraction	- -	— 0 15
True altitude of the ſun's centre	-	3 59 S
Zenith diſtance	- -	86 1 N
Declination	- - -	23 27 S
Latitude	- - -	62 34 N

Example

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Example IV. August 23d 1793, in longitude 107 E, the meridian altitude of the sun's lower limb by the back-observation was 61° 8′ N, and the height of the eye 14 feet. Required the latitude;

Observed the altitude sun's upper limb	61° 8′ N
Sun's semidiameter - -	—0 16
Dip - - -	+0 3½
Refraction - - -	—0 ½
True altitude of the sun's centre -	60 55 N
Zenith distance - - -	29 5 S
Reduced declination - -	11 20 N
Latitude - - - -	17 45 S

The dip in Table V. answers to an entirely open and unobstructed horizon. It, however, frequently happens, that the sun is over the land at the time of observation, and the ship nearer to the land than the visible horizon would be if unconfined. In this case, the dip will be different from what it would otherwise have been, and is to be taken from Table VI. in which the height is expressed at the top, and the distance from the land in the side column in nautical miles.—Seamen, in general, can estimate the distance of any object from the ship with sufficient exactness for this purpose, especially when that distance is not greater than six miles, which is the greatest distance of the visible horizon from an observer on the deck of any ship.

Prob. III. Given the meridian altitude of a fixed star, to find the latitude of the place of observation.

Rule. Correct the altitude of the star by dip and refraction, and find the zenith distance of the star as formerly; take the declination of the star from Table XI. and reduce it to the time of observation. Now, the sum or difference of the zenith distance and declination of the star, according as they are of the same or of a contrary name, will be the latitude of the place of observation.

Example I. December 1st 1793, the meridian altitude of Sirius was 59° 50′ S, height of the eye 14 feet. Required the latitude?

Observed altitude of Sirius -	59° 50′ S
Dip and refraction - -	—0 4
True altitude - -	59 46 S
Zenith distance - -	30 14 N
Declination - -	16 27 S
Latitude - -	13 47 N

Example II. February 17th 1797, the meridian altitude of Procyon was 71° 15′ N, the height of the eye 10 feet. Required the latitude?

Observed altitude of Procyon -	71° 15′ N
Dip and refraction - -	—0 3
True altitude - -	71 12 N
Zenith distance - -	18 48 S
Declination - -	5 45 N
Latitude - - -	13 3 S

Prob. IV. Given the meridian altitude of a planet, to find the latitude of a place of observation.

Rule. Compute the true altitude of the planet as directed in last problem, (which is sufficiently accurate for altitudes taken at sea); take its declination from the Nautical Almanac, page iv. of the month, and reduce it to the time and meridian of the place of observation; then the sum or difference of the zenith distance and declination of the planet will be the latitude as before.

Example I. December 10th 1792, the meridian altitude of Saturn was 68° 42′ N, and height of the eye 15 feet. Required the latitude?

Observed altitude of Saturn -	68° 42′ N
Dip and refraction - -	—0 4
True altitude - - -	68 38 N
Zenith distance - -	21 22 S
Declination - - -	7 26 N
Latitude - - -	13 56 S

Example II. April 16th 1793, the meridian altitude of Jupiter was 81° 5′ S, height of the eye 18 feet. Required the latitude?

Observed altitude of Jupiter - -	81° 5′ S
Dip - - - -	—0 3
True altitude - -	81 2 S
Zenith distance - -	8 58 N
Declination - - -	19 4 S
Latitude - - -	10 6 S

Prob. V. Given the meridian altitude of the moon, to find the latitude of the place of observation.

Rule. Take the number † answering to the ship's longitude, and daily variation of the moon's passing the meridian; which being applied to the time of passage given in the Nautical Almanac, will give the time of the moon's passage over the meridian of the ship.

Reduce this time to the meridian of Greenwich; and by means of the Nautical Almanac find the moon's declination, horizontal parallax, and semidiameter, at the reduced time.

Apply the semidiameter and dip to the observed altitude of the limb, and the apparent altitude of the moon's centre will be obtained; to which add the correction answering to the apparent altitude and horizontal parallax ‡, and the sum will be the true altitude of the moon's centre; which subtracted from 90°, the remainder is the zenith distance, and the sum or difference of the zenith distance and declination, according as they are of the same or of a contrary name, will be the latitude of the place of observation.

† Mackay's Treatise on the Longitude. Tab. XX.

‡ Ditto, Tab. XX.

Example I. December 24th 1792, in longitude 30° W, the meridian altitude of the moon's lower limb was 81° 15′ N, height of the eye 12 feet. Required the latitude?

Time of pass. over the mer. of Greenwich	= 9h 19′
Equation Table XX. - -	+0 4
Time of pass. over mer. ship - -	9 23
Longitude in time - -	2 0
Reduced time - - -	11 23
Moon's dec. at midnight, Tab. IX.	= 14° 53′ N
Eq. to time from midnight -	—0 4
Reduced declination - -	14 49 N
Moon's hor. par. - -	55′ 25″

Moon's femidiameter - -	15 6
Augmentation - -	+0 14
Aug. femidiameter - -	15 20
Obferved altitude of the moon's lower limb	81° 15′ N
Semidiameter - -	+0 15
Dip - - - -	—0 3
Apparent altitude of the moon's centre	81 27 N
Correction - -	+0 8
True altitude of moon's centre,	81 35 N
Zenith diftance - -	8 25 S
Declination - -	14 49 N
Latitude - -	6 42 N

EXAMPLE II. October 17th 1793, in longitude 8° W, the altitude of the moon's upper limb was 40° 27′ S, and height of the eye 20 feet. Required the latitude?

Time of paff. over mer. Greenwich	= 10h 52′
Equation to long. - -	0 0
Time of paff. over mer. fhip -	10 52
Longitude in time - -	0 32
Reduced time - -	11 24
Moon's dec. at midnight -	±0° 3′ N
Eq. to time from midnight -	—0 3
Reduced declination - -	0 0
Moon's hor. parallax - -	60′ 29″
Moon's femidiameter - -	16 29
Augmentation - -	+0 12
Aug. femidiameter - -	16 41
Obferved altitude moon's lower limb	40° 27′ S
Semidiameter and dip -	—0 21
Apparent altitude moon's centre -	40 6
Correction - -	+0 45
True altitude moon's centre -	40 51 S
Zenith diftance - -	49 9 N
Declination - -	0 0
Latitude - - -	49 9 N

Remark. If the object be on the meridian below the pole at the time of obfervation, then the fum of the true altitude and the complement of the declination is the latitude, of the fame name as the declination or altitude.

EXAMPLE I. July 1ft 1793, in longitude 15° W, the altitude of the fun's lower limb at midnight was 8° 58′, height of the eye 18 feet. Required the latitude?

Obferved altitude fun's lower limb	8° 58′
Semidiameter - -	+0 16
Dip and refraction - -	—0 10
True altitude of fun's centre -	9 4 N
Compl. declin. reduced to time and place	66 57 N
Latitude - - -	76 1 N

EXAMPLE II. December 1ft 1798, the altitude of the pole ftar below the pole was 52° 20′ N, height of the eye 12 feet. Required the latitude?

Obferved altitude, pole ftar -	52° 20′ N
Dip and refraction - -	—0 4
True altitude - -	52 16 N
Complement of declination -	1 46
Latitude - -	54 2 N

PROB. VI. Given the latitude by account, the declination and two obferved altitudes of the fun, and the interval of time between them, to find the true latitude.

RULE. To the log. fecant of the latitude by account, add the log. fecant of the fun's declination; the fum, rejecting 20 from the index, is the *logarithm ratio*. To this add the log. of the difference of the natural fines of the two altitudes, and the log. of the half elapfed time from its proper column.

Find this fum in column of middle time, and take out the time anfwering thereto; the difference between which and the half elapfed time will be the time from noon when the greater altitude was obferved.

Take the log. anfwering to this time from column of rifing, from which fubtract the log. ratio, the remainder is the logarithm of a natural number; which being added to the natural fine of the greater altitude, the fum is the natural cofine of the meridian zenith diftance; from which and the fun's declination the latitude is obtained as formerly.

If the latitude thus found differs confiderably from that by account, the operation is to be repeated, ufing the computed latitude in place of that by account (L).

EXAMPLE I. June 4th 1795, in latitude by account

(L) This method is only an approximation, and ought to be ufed under certain reftrictions; namely,

The obfervations muft be taken between nine o'clock in the forenoon and three in the afternoon. If both obfervations be in the forenoon, or both in the afternoon, the interval muft not be lefs than the diftance of the time of obfervation of the greateft altitude from noon. If one obfervation be in the forenoon and the other in the afternoon, the interval muft not exceed fours hours and a half; and in all cafes, the nearer the greater altitude is to noon the better.

If the fun's meridian zenith diftance be lefs than the latitude, the limitations are ftill more contracted. If the latitude be double the meridian zenith diftance, the obfervations muft be taken between half paft nine in the morning and half paft two in the afternoon, and the interval muft not exceed three hours and an half. The obfervations muft be taken ftill nearer to noon, if the latitude exceeds the zenith diftance in a greater proportion. See *Mafkelyne's Britifh Mariner's Guide, and Requifite Tables*, 2d. Ed.

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count 37° N at 10h 29′ A. M. *per* watch, the corrected altitude of the sun was 65° 24′, and at 12h 31′, the altitude was 74° 8′. Required the true latitude?

Time per wat.	Alt. N. Sines	Lat. by acc. 37° 0′ Secant	0.09765
10h 29′	65° 24′ 90924	Declination 22 28 Secant	0.03428
12 31	74 8 96190	Logarithm ratio	0,13193
2 2	Differ. 5266	Logarithm	3,72148
1 1		Half elapsed time	0,57999
31 10″		Middle time	4,43340
29 50		Rising	2.92740
		Log. ratio	0,13193
Natural number		624	2.79547
Greatest altitude	74° 8′ N. sine 96190		
Mer. zenith dist.	14 30 N. cosine 96814		
Declination	22 28		
Latitude	36 58 N.		

Example II. October 17th 1793, in latitude 43° 24′ N. by account, at 0h 38′ P. M. the correct altitude of the sun's centre was 36° 5′, and at 2h 46′ P. M. the altitude was 24° 49′. Required the latitude?

Times per wat.	Alt. N. Sines.	Lat by acc. 43° 24′ Secant	0.13872
0h 38′	36° 5′ 58896	Declination 9 32 Secant	0,00604
2 46	24 49 41972	Logarithm ratio	0,14476
2 8	Differ. 16924	Log.	4.22850
1 4		Half elapsed time	0.55066
1 41 30″		Middle time	4.93292
37 30		Rising	3.12570
		Log. ratio	0,14476
Natural number		957	2,98094
Greatest altitude	36° 5′ N. sine 58896		
Mer zen. distance	53 14 N. cosine 59853		
Declination	9 32		
Latitude	43 42 N.		

Example III. August 25th 1793, in latitude 57° N. by account, in the morning the altitude of the sun's lower limb was 34° 22′, and 1h 46′ after the altitude of the lower limb was 42° 12½′, the height of the eye 14 feet. Required the latitude?

First altitude	34° 22′	Second altitude	42° 12½
Sun's semidiameter	+0 16	Semidiameter	+0 16
Dip and refraction	—0 5	Dip and refract.	—0 4½
Corrected altitude	34 33	Corrected altit.	42 24

Interval of time.	Altit N. Sines. 34° 33′ 56713	Lat. by acc. 57° 0′ Secant.	0,26389
		Declination 10 33 Secant.	0,00741
	42 24 67430	Logarithm ratio	0,27130
1h 46′	Difference 10717	Log.	4,03007
53 0″		Half elapsed time	0,63978
1 43 30		Middle time	4,94115
50 30		Rising	3,38343
		Log. ratio	0,27130
Natural number		1295	3,11213
Greatest altitude	42° 24′ N. sine 67430		
Mer. zen. distance	46 35 N. cosine 68725		
Declination	10 33		
Latitude	57 8 N.		

The greatest altitude was observed 50′¼ before 12 or at 11h 9′½; hence the first altitude was observed at 9h 23′½ A. M.

Example IV. In latitude 49° 48′ N. by account, the sun's declination being 9° 37′ S. at 0h 32′ P. M. *per* watch, the altitude of the sun's lower limb was 28° 32′, and at 2h 41′ it was 19° 25′, the height of the eye 12 feet. Required the true latitude?

First observed altit.	28° 32′	Second altitude	19° 25′
Semidiameter	+0 16	Semidiameter	+0 16
Dip and refraction	—0 5	Dip and refr.	—0 6
True altitude	28 43	True altitude	19 35

Time per wat.	Alt. N. Sines.	Lat. by acc. 49° 48′ Secant.	0,19013
0h 32′	28° 43′ 48048	Declination 9 37 Secant.	0,00615
2 41	19 35 33518	Log. ratio	0,09628
2 9	Difference 14530	Log.	4,16227
1 4 30″		Half elapsed time	0,55637
1 37 0		Middle time	4,91492
32 30		Rising	3,00164
Natural number		639	2,80536
Mer. zen. dist.	60° 52 N. cosine 48687		
Declination	9 37 S.		
Latitude	51 15 N		

As the latitude by computation differs 1° 27′ from that by account, the operation must be repeated.

Computed latitude	51° 15′	Secant	0.20348
Declination	9 37	Secant	0.00615
Logarithm ratio	-	-	0.20963
Difference of nat. sines	14530	Log.	4.16227
Half elapsed time	1h 4′ 30″	Log.	0.55637
Middle time	1 40 20	Log.	4.92827
Rising -	0 35 50	Log.	3.08630
Natural number	753		2.87667
Gr. altitude	28° 43′ N. sine 48048		
Mer. zen. dist.	60 47 N. cosine 48801		
Declination	9 37		
Latitude	51 10 N.		

As this latitude differs only 5′ from that used in the computation, it may therefore be depended on as the true latitude.

Prob. VII. Given the latitude by account, the sun's declination, two observed altitudes, the elapsed time, and the course and distance run between the observations; to find the ship's latitude at the time of observation of the greater altitude.

Rule. Find the angle contained between the ship's course and the sun's bearing at the time of observation of the least altitude, with which enter the Traverse Table as a course, and the difference of latitude answering to the distance made good will be the reduction of altitude.

Now, if the least altitude be observed in the forenoon, the reduction of altitude is to be applied thereto by addition or subtraction, according as the angle between

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between the ship's course and the sun's bearing is less or more than eight points. If the least altitude be observed in the afternoon, the contrary rule is to be used.

The difference of longitude in time between the observations is to be applied to the elapsed time by addition or subtraction, according as it is east or west. This is, however, in many cases so inconsiderable as to be neglected.

With the corrected altitudes and interval, the latitude by account and sun's declination at the time of observation of the greatest altitude, the computation is to be performed by the last problem.

Example I. July 6th 1793, in latitude 58° 14′ N. by account, and longitude 16° E. at 10h 54′ A. M. *per* watch, the altitude of the sun's lower limb was 53° 17′, and at 1h 17′ P. M. the altitude was 52° 51′, and bearing *per* compass SW*b*W; the ship's course during the elapsed time was S*b*W½W, and the hourly rate of sailing 8 knots, the height of the eye 16 feet. Required the true latitude at the time of observation of the greater altitude?

Sun's bear. at 2d. ob. SW*b*W. Interval bet. observ. 2h 23′
Ship's course S*b*W½W Dist. run = 2h 23 × 8 = 19m.

Contained angle 3½ points.

Now to course 3½ points and distance 19 miles, the difference of latitude is 14.7 or 15 miles.

First observed alt.	53° 17′	Second observed alt.	52° 51′
Semidiameter	+0 16	Semidiameter	+0 16
Dip and refract.	—0 4	Dip and refraction	—0 4
True altitude	53 29	Reduction	—0 15
		Reduced altitude	52 48

Time of ob. of gr. alt.	10h 54′ A. M.	Sun's dec.	22° 39′ N.
Longitude in time	1 4	Eq. to r. t.	+ 1
Reduced time	9 50 A. M.	Red. decl.	22 40 N.

Time per wat. Alt. N. Sines. Lat. by acc. 58° 14′ Secant. 0,27863
10h 54′ 53° 29′ 80368 Declination 22 40 Secant. 0 03491

1 17 52 48 79653 Logarithm ratio 0,31354

2 23 Difference 715 Log. 2,85431
1 11 . 30″ Half elapsed time 0,51294

5 30 Middle time 3,68079

1 6 0 Rising 3,61469
Log. ratio 0,31354
Natural number 2001 3.30115
Greatest altitude 53° 29′ N. sine 80368

Mer. zen. distance 34 33 N. cosine 82369
Declination 22 40 N.

Latitude 57 13 N.

Since the computed latitude differs so much from that by account, it will be necessary to repeat the operation.

Computed latitude	57° 13′	Secant	0.26643
Declination	22 40	Secant	0.03491
Logarithm ratio			0.30134

Difference of natural sines	715	Log.	2.85431
Half elapsed time	1h 11′ 30″	Log.	0.51294
Middle time	5 20	Log.	3.66859
Rising	1 6 10	Log.	3.61686
Logarithm ratio			0 30134
Natural number	2068		3.31552
Greatest altitude 53° 29′ N. sine	80368		
Mer. zen. dist. 34 29 N. cosine	82436		
Declination 22 40 N.			
Latitude 57 9 N.			

As this latitude differs only 4 miles from that used in the computation, it may therefore be depended on as the true latitude.

Example II. Sept. 13th 1793, in latitude 38° 12′ N by account, and longitude 14° E. at 9h 28′ A. M. *per* watch, the altitude of the sun's lower limb was 40° 42′, and azimuth *per* compass SE½E, at 11h 16′ A. M. the altitude was 53° 11′; the ship's course during the elapsed time was W½N at the rate of 9 knots an hour, and height of the eye 12 feet. Required the ship's true latitude at the time of the second observation?

Sun's bear. at first obs. SE½E. Elapse time 1h. 48′
Ship's course, W½N. D. run = 1h48 × 9 = 16m

Contained angle 11¾ points; supplement 4¼ pts.

To course 4¼ points, and distance run 16 miles, the difference of latitude is 10′.7, or 11 miles.

First observed alt.	40° 42′	Second obs. alt.	53° 11
Sun's semidiameter	+0 16′	Semidiameter	+0 16
Dip and refraction	—0 4	Dip and refr.	—0 4
Reduction of alt.	—0 11	Corrected alt.	53 23
Reduced altitude,	40 43		

Time of ob. great. alt.	11h 16′	Sun's dec. at noon	3 32½
Longitude in time,	0 56	Eq. to time from n.	+ 1⅔
Reduced time,	10 20	Reduced declin.	4 34

Time per Watch. Alt. N. Sine. Lat by acc. 38° 12′ Secant 0,10466
9h 28′ 40° 43′ 65232 Declination 3 34 Secant 0,00084
11 16 53 23 80264 Logarithm ratio 0,10550

1 48 Differ. 15032 Log. - - 4,17702
0 54 Half elapsed time - 0,63181

1 37 Middle time - 4,91333
0 43 Rising - - 3,24427

Natural number 1376 3,13877

Mer. Zen. dist. 35° 16′ N. cosine 81640
Declination 3 34 Secant 0,00084

Latitude 38 50 Secant 0,10848

Logarithm ratio	- -		0,10932
Difference of natural sines	15032	Log.	4,17702
Half elapsed time	0h 54′ 0″	Log.	0,63181
Middle time -	1 37 50	Log.	4,91815
Rising -	0 43 10	Log.	3,26089
Natural number -	1418		3,15157

Greatest

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Greateſt altitude	53° 23′ N. ſine	80264
Mer. Zen. diſt.	35 14 N coſine	81682
Declination	3 34	
Latitude -	38 48 N.	

This latitude differing only 2 miles from that uſed in the computation, may therefore be relied on as the true latitude.

Remark. If the ſun comes very near the zenith, the ſines of the altitude will vary ſo little as to make it uncertain which ought to be taken as that belonging to the natural ſine of the meridian altitude. In this caſe, the following method will be found preferable.

To the log riſing of the time from noon found as before, add the log. ſecant of half the ſum of the eſtimate meridian altitude, and greateſt obſerved altitude; from which ſubtract the log. ratio, its index being increaſed by 10, and the remainder will be the log. ſine of an arch; which added to the greateſt altitude will give the ſun's meridian altitude.

Example. December 21ſt 1793, in latitude 22° 40′ S, by account, at 11h 57′ the correct altitude of the ſun's centre was 89° 10′, and at 12h 4′ 40″, the altitude was 88° 50′. Required the true latitude?

Times per Wat.	Alt.	N. Sines.		
			Lat. by acc. 22° 40′	Sec. 0,03491
11th 57′ 0″	89° 10′	99989	Declination 23 28	Sec. 0,03749
12 4 40	88 50	99970	Logarithm ratio	0,07240
0 7 10	Difference	10	log.	1,00000
0 3 50			Half elapſed time	1,77663
0 0 50			Middle time	2,84903
0 3 0			Riſing	0,93284

Comp. of lat. by acc.	67° 20′		
Declination	23 28		
Sum	90 48		
Eſtimate mer. altitude	89 12	89° 11′ ſec.	11.84609
Greateſt altitude	89 10		
			12.77893
Logarithm ratio + 5			5.07240
Arch	0 17′	ſine	7.70653
Greateſt altitude	89 10		
Meridian altitude	89 27	zen. diſt.	0 33′ N
		declination	23 28 S
		latitude	22 55 S

This differing from the aſſumed latitude, the work muſt be repeated.

Latitude	22° 55′	ſecant	0.03571
Declination	23 28	ſecant	0.03749
Logarithm ratio			0.07320
Difference of natural ſines,	1°	log.	1.00000
Half elapſed time	3′ 50″		1.77663
Middle time	0 50		2.84983
Riſing	3 0		0.93284
Comp. of lat.	67° 5′		
Declination	23 28		
Sum	90 33		

Mer. alt.	89 27	89° 18′½ ſec.	11.91827
Greateſt alt.	89 10		
			12.85111
Log. ratio + 5			5.07320
Arch	0 21		7.77791
Greateſt altitude	89 10		
Merid. altitude	89 31	zen. diſt.	0° 29′
	Declination		23 28
	Latitude		22 59 S

If the work be repeated with this laſt latitude, the latter part only may be altered.

Latitude	22° 59′	ſecant	0.03592
Declination	23 28	ſecant	0.03749
Eſt. mer. alt.	89 31	log. ratio	0.07341
Greateſt altitude	89 10	ar. com.—5	4.92659
Sum	178 41		
Half	89 20½	ſecant	1.93972
Riſing			0.93284
Arch	0 22	ſine	7.79915
Greateſt altitude	89 10		
Meridian altitude	89 32		
Zenith diſtance	0 28		
Declination	23 28		
Latitude	23 0 S.		

Prob. VIII. To find the latitude from double altitudes of the ſun and the elapſed time: one of theſe obſervations being taken near the eaſt or weſt points, and the other near the meridian.

Rule. With the latitude by account, the ſun's declination and leaſt altitude, compute the apparent time of obſervation by Problem VII. of next chapter. From whence and the interval of time between the obſervations, the time from noon when the greateſt altitude was obſerved will be known. To the logarithm riſing of which, add the logarithmic coſines of the ſun's declination and the latitude of the place by account; the ſum will be the logarithm of a natural number, which added to the natural ſine of the greater altitude, will give the natural coſine of the meridian zenith diſtance; and hence the latitude is found as formerly.

Or the time from noon being found, the latitude may be computed by the rule given in the preceding remark.

Example. September 1ſt 1793, in latitude 40° 0′ N by account, at 6h 5′ A. M. per watch, the altitude of the ſun's lower limb was 16° 21′, and at 11h 41′ the altitude was 57° 42′; the height of the eye 18 feet. Required the latitude?

Firſt alt.	16° 21′	Second alt.	57° 42′
Sun's ſemidia.	+0 16	Sun's ſem dia.	+0 16
Dip and refr.	—0 7	Dip and refrac.	—0 5
True altitude	16 30	True altitude	57 53

Lat.

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Lat. by acc.	40 0 N	Secant		0.11575
Declination	8 3 N	Secant		0.00430
Difference	31 57	nat. cosine	84851	
Altitude	16 30	nat. sine	28402	
		Difference	56449	4.75165
Time from noon of first obs.	5h 0′ 40″	rising		4.87170
Interval of time between obs.	4 45 0			
Time from noon of 2d obs.	0 15 40	rising		2.36839
Latitude by acc.	40° 0′	cosine		9.88425
Declination	8 3	cosine		9.99670
Natural number			178	2.24934
Greater altitude	57 53	nat. sine	84697	
Merid. zen. dist.	31 55	nat. cosine	84875	
Declination	8 3			
Latitude	39 58 N.			

Prob. IX. Given the altitudes of two known stars, observed at the same or at different times; and if at different times, the interval between the observations; to find the latitude.

Rule. If both altitudes be observed at the same time, call the difference between their right ascensions the reduced interval.

But if the altitudes be taken at different times, reduce the interval between the observations to sidereal time, by adding thereto the proportional part answering to the interval, and 3′ 56″, the daily acceleration of the fixed stars. Now to the right ascension of the first observed star, add the interval in sidereal time, and the difference between this sum and the right ascension of the other star will be the reduced interval.

To the logarithm rising of the reduced interval, add the logarithmic cosines of the stars declinations: subtract the natural number answering to the sum of these logarithms from the natural cosine of the difference or sum of the stars declinations, according as they are of the same or of a contrary name, and the remainder will be the natural sine of arch first.

To the logarithmic cosine of arch first add the logarithmic secant of declination of the star having the least polar distance, and the logarithm half elapsed time of the reduced interval, the sum will be the logarithm half elapsed time of arch second.

From the natural cosine of the difference between arch first and the altitude of the star having the greatest polar distance, subtract the natural sine of the altitude of the other star, and find the logarithm of the remainder; to which add the logarithm secant of arch first, and the logarithmic secant of the altitude of the star having the greatest polar distance, the sum will be the logarithm rising of arch third. The difference between arches second and third is arch fourth.

To the logarithm rising of arch fourth add the logarithmic cosines of the declination and altitude of the star having the greatest polar distance; subtract the corresponding natural number from the natural cosine of the difference between the altitude and declination, the polar distance being less than 90°; otherwise, from their sum, and the remainder will be the natural sine of the latitude.

Example I. January 1st 1793, the true altitude of Capella was 69° 23′, and at the same instant the true altitude of Sirius was 16° 19′. Required the latitude?

Right ascension of Capella			5h 1′ 25″	
Right ascension of Sirius			6 36 1	
Interval			1 34 36	
Interval	1h 34′ 36″	rising		3.92270
Capella's declin.	45° 46′ N	cosine		9.84160
Sirius's declin.	16 27 S	cosine		9.98185
Sum	62 13 N	cosine	46613	
			5599	3.74815
Arch first	24 13 N	sine	41014 cos.	9.96000
Capella's declin.	45 46	secant		0.15640
Interval	1h 34′ 36′	H. E. time		0.39670
Arch second	1 11 28	H. E. time		0.51310
Arch first	24 13	secant		0.04000
Sirius's altitude	16 19	secant		0.01785
Difference	7 54 N.	cosine	99051	
Capella's altitude	69 23 N	sine	93596	
			5455	3.73679
Arch third	1h 21′ 20″	rising		3.79464
Arch second	1 11 28			
Arch fourth	9 52	rising		1.96708
Sirius's declin.	16 27	cosine		9.98185
altitude	16 19	cosine		9.98215
Sum	32 46 N	cos.	84088	
			85	1.93008
Latitude	57 9 N	sine	84003	

Example II. In north latitude, Decem. 30th 1793, the true altitude of Menkar was 43° 38′; and 1h 18′ after the altitude of Rigel was 29° 51′. Required the latitude?

Observed Interval	1h 18′ 0″			
Equation	+ 0 0 13			
Inter. in sid. time	1 18 13			
Right as. of Menkar	2 52 31			
Sum	4 9 44			
Right asc. of Rigel	5 4 34			
Reduced interval	0 54 50	rising		3.45462
Declin. of Menkar	3 16½ N	cosine		9.99929
Declin. of Rigel	8 27 S	cosine		9.99526
Sum	11 43½ N	co.	97913	
			2813	3.44917
Arch first	71 59 N	sine	95100 co.	9.49037
Declin of Menkar	3 16½	secant		0.00071
Reduced interval	0 54 50	H. E. time		0.62529
Arch second	3 19 36	H E. time		0.11637

Arch

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Arch first	71° 59′	secant		0.50963
Altitude Rigel	29 51	secant		0.6181
Difference	42 8 N	cosine	74159	
Alt. of Menkar	43 38 N	sine	69004	
		Difference	5155	3.71223
Arch third	2h 24′ 27″	rising		4.28367
Arch second	3 19 36			
Arch fourth	0 55 9	rising		3.45960
Declin. of Rigel	8 27 S	cosine		9.99526
Alt. of Rigel	29 51	cosine		9.93819
Sum	38 18 N	cosine	78478	
			2472	3.39305
Latitude	49 28 N	sine	76006	

Chap. II. *Containing the Method of finding the Longitude at Sea by Lunar Observations.*

Sect. I. *Introduction.*

The observations necessary to determine the longitude by this method are, the distance between the sun and moon, or the moon and a fixed star near the ecliptic, together with the altitude of each. The stars used in the Nautical Almanac for this purpose are the following: *namely α Arietis, Aldebaran, Pollux, Regulus, Spica Virginis, Antares, α Aquilæ, Fomalhaut,* and *α Pegasi;* and the distances of the moon's centre from the sun, and from one or more of these stars, are contained in the viii. ix. x. and xi. pages of the month, at the beginning of every third hour apparent time, by the meridian of Greenwich. The distance between the moon and the sun, or one of these stars, is observed with a sextant; and the altitudes of the objects are taken as usual with a Hadley's quadrant.

In the practice of this method, it will be found convenient to be provided with three assistants; two of these are to take the altitudes of the sun and moon, or moon and star, at the same time the principal observer is taking the distance between the objects; and the third assistant is to observe the time, and write down the observations. In order to obtain accuracy, it will be necessary to observe several distances, and the corresponding altitudes; the intervals of time between them being as short as possible; and the sum of each divided by the number will give the mean distance and mean altitudes; from which the time of observation at Greenwich is to be computed by the rules to be explained.

If the sun or star from which the moon's distance is observed be at a proper distance from the meridian, the time at the ship may be inferred from the altitude observed at the same time with the distance: in this case, the watch is not necessary; but if that object be near the meridian, the watch is absolutely necessary, in order to connect the observations for ascertaining the apparent time at the ship and the longitude with each other.

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An observer without any assistants may very easily take all the observations, by first taking the altitudes of the objects, then the distance, and again their altitudes, and reduce the altitudes to the time of observation of the distance; or, by a single observation of the distance, the apparent time being known, the longitude may be determined.

A set of observations of the distance between the moon and a star, and their altitudes, may be taken with accuracy during the time of the evening or morning twilight; and the observer, though not much acquainted with the stars, will not find it difficult to distinguish the star from which the moon's distance is to be observed. For the time of observation nearly, and the ship's longitude by account being known, the estimate time at Greenwich may be found; and by entering the Nautical Almanac with the reduced time, the distance between the moon and given star will be found nearly. Now set the index of the sextant to this distance, and hold the plane of the instrument so as to be nearly at right angles to the line joining the moon's cusps, direct the sight to the moon, and by giving the sextant a slow vibratory motion, the axis of which being that of vision, the star, which is usually one of the brightest in that part of the heavens, will be seen in the silvered part of the horizon-glass.

Sect. II. *Of the Sextant.*

This instrument is constructed for the express purpose of measuring with accuracy the angular distance between the sun and moon, or between the moon and a fixed star, in order to ascertain the longitude of a place by lunar observations. It is, therefore, made with more care than the quadrant, and has some additional appendages that are wanting in that instrument.

Fig. 74 represents the sextant, so framed as not to be liable to bend (M). The arch AA is divided into 120 degrees, each degree is divided into three parts; each of these parts therefore, contains 20 minutes, which are again subdivided by the vernier into every half minute or 30 seconds. The vernier is numbered at every fifth of the longer divisions, from the right towards the left, with 5, 10, 15, and 20; the first division to the right being the beginning of the scale. Plate CCCXLIII.

In order to observe with accuracy, and make the images come precisely in contact, an adjusting screw B is added to the index, which may thereby be moved with greater accuracy than it can be by hand; but this screw does not act until the index is fixed by the finger screw C. Care should be taken not to force the adjusting screw when it arrives at either extremity of its adjustment. When the index is to be moved any considerable quantity, the screw C at the back of the sextant must be loosened; but when the index is brought nearly to the division required, this back screw should be tightened, and then the index may be moved gradually by the adjusting screw.

(M) Troughton's patent double-framed sextants are not liable to bend.

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There are four tinged glasses D, each of which is set in a separate frame that turns on a centre. They are used to defend the eye from the brightness of the solar image and the glare of the moon, and may be used separately or together as occasion requires.

There are three more such glasses placed behind the horizon-glass at E, to weaken the rays of the sun or moon when they are viewed directly through the horizon-glass. The paler glass is sometimes used in observing altitudes at sea, to take off the strong glare of the horizon.

The frame of the index-glass I, is firmly fixed by a strong cock to the centre plate of the index. The horizon-glass F is fixed in a frame that turns on the axes or pivots, which move in an exterior frame; the holes in which the pivots move may be tightened by four screws in the exterior frame. G is a screw by which the horizion glass may be set perpendicular to the plane of the instrument: should this screw become loose or move too easy, it may be easily tightened by turning the capstan-headed screw H, which is on one side of the socket through which the stem of the finger screw passes.

Plate CCCXLIII.

The sextant is furnished with a plain tube (fig. 75.) without any glasses; and to render the objects still more distinct, it has two telescopes, one (fig. 76.) representing the objects erect, or in their natural position: the longer one (fig. 77.) shows them inverted? it has a large field of view and other advantages, and a little use will soon accustom the observer to the inverted position, and the instrument will be as readily managed by it as by the plain tube alone. By a telescope the contact of the images is more perfectly distinguished; and by the place of the images in the field of the telescope, it is easy to perceive whether the sextant is held in the proper place for observation. By sliding the tube that contains the eye-glasses in the inside of the other tube, the object is suited to different eyes, and made to appear perfectly distinct and well defined.

The telescopes are to be screwed into a circular ring at K, this ring rests on two points against an exterior ring, and is held thereto by two screws; by turning one or other of these screws, and tightening the other, the axis of the telescope may be set parallel to the plane of the sextant. The exterior ring is fixed on a triangular brass stem that slides in a socket, and by means of a screw at the back of the quadrant may be raised or lowered so as to move the centre of the telescope to point to that part of the horizon-glass which shall be judged the most fit for observation. Fig. 78. is a circular head, with tinged glasses to screw on the eye end of either of the telescopes or the plain tube. The glasses are contained in a circular plate which has four holes; three of these are fitted with tinged glasses, the fourth is open By pressing the finger against the projecting edge of this plate and turning it round, the open hole, or any of the tinged glasses, may be brought between the eye-glass of the telescope and the eye.

Fig 79. is a magnifying glass, to assist the observer to read off the angle with more accuracy; and (fig. 80.) a screw-driver.

Adjustments of the Sextant.

The adjustments of a sextant are, to set the mirrors perpendicular to its plane and parallel to each other when the index is at Zeno, and to set the axis of the telescope parallel to the plane of the instrument. The three first of these adjustments are performed nearly in the same manner as directed in the section on the quadrant: as, however, the sextant is provided with a set of coloured glasses placed behind the horizon-glass, the index error may be more accurately determined by measuring the sun's diameter twice, with the index placed alternately before and behind the beginning of the divisions: half the difference of these two measures will be the index-error, which must be added to, or subtracted from, all observations, according as the diameter measured with the index to the left of *o* is less or greater than the diameter measured with the index to the right of the beginning of the divisions.

Adjustment IV. *To set the axis of the Telescope parallel to the Plane of the Instrument.*

Turn the eye end of the telescope until the two wires are parallel to the plane of the instrument and let two distant objects be selected, as two stars of the first magnitude, whose distance is not less than 90° or 100° : make the contact of these objects as perfect as possible at the wire nearest the plane of the instrument; fix the index in this position; move the sextant till the objects are seen at the other wire, and if the same points are in contact, the axis of the telescope is parallel to the plane of the sextant; but if the objects are apparently separted, or do parly cover each other, correct half the error by the screws in the circular part of the supporter, one of which is above and the other between the telescope and sextant; turn the adjusting screw at the end of the index till the limbs are in contact; then bring the objects to the wire next the instrument; and if the limbs are in contact, the axis of the telescope is adjusted: if not, proceed as at the other wire, and continue till no error remains.

It is sometimes necessary to know the angular distance between the wires of the telescope; to find which, place the wires perpendicular to the plane of the sextant, hold the instrument vertical, direct the sight to the horizon, and move the sextant in its own plane till the horizon and upper wire coincide; keep the sextant in this position, and move the index till the reflected horizon is covered by the lower wire; and the divsion shown by the index on the limb, corrected by the index error, will be the angular distance between the wires. Other and better methods will readily occur to the observer at land.

Use of the Sextant.

When the distance between the moon and the sun or a star is to be observed, the sextant must be held so that its plane may pass through the eye of the observer and both objects; and the reflected image of the most luminous of the two is to be brought in contact with the other seen directly. To effect this, therefore it is evident, that when the brightest object is to the right of the other, the face of the sextant must be held upwards; but if to the left downwards. When the face of the sextant is held upwards, the instrument should be suported with the right hand, and the index moved with the left hand. But when the face of the sextant is from the observer, it should be held with the

the left hand, and the motion of the index regulated by the right hand.

Sometimes a sitting posture will be found very convenient for the observer, particularly when the reflected object is to the right of the direct one; in this case, the instrument is supported by the right hand, the elbow may rest on the right knee, the right leg at the same time resting on the left knee.

If the sextant is provided with a ball and socket, and a staff, one of whose ends is attached thereto, and the other rests in a belt fastened round the body of the observer, the greater part of the weight of the instrument will by this means be supported by his body.

To observe the Distance between the Moon and any celestial object.

1. Between the sun and moon.

Put the telescope in its place, and the wires parallel to the plane of the instrument; and if the sun is very bright, raise the plate before the silvered part of the speculum; direct the telescope to the transparent part of the horizon-glass, or to the line of separation of the silvered and transparent parts according to the brightness of the sun, and turn down one of the coloured glasses, then hold the sextant so that its plane produced may pass through the sun and moon, having its face either upwards or downwards according as the sun is to the right or left of the moon; direct the sight through the telescope to the moon; and move the index till the limb of the sun is nearly in contact with the enlightened limb of the moon; now fasten the index, and by a gentle motion of the instrument make the image of the sun move alternately past the moon; and, when in that position where the limbs are nearest each other, make the coincidence of the limbs perfect by means of the adjusting screw; this being effected, read off the degrees and parts of a degree shown by the index on the limb; using the magnifying glass; and thus the angular distance between the nearest limbs of the sun and moon is obtained,

2. Between the moon and a star.

Direct the middle of the field of the telescope to the line of separation of the silvered and transparent parts of the horizon-glass; if the moon is very bright turn down the lightest coloured glass, and hold the sextant so that its plane may be parallel to that passing through the eye of the observer and both objects; its face being upwards if the moon is to the right of the star, but if to the left, the face is to be held from the observer; now direct the sight through the telescope to the star, and move the index till the moon appears by reflection to be nearly in contact with the star; fasten the index, and turn the adjusting screw till the coincidence of the star and enlightened limb of the moon is perfect: and the degrees and parts of a degree shown by the index will be the observed distance between the moon's enlightened limb and the star.

The contact of the limbs must always be observed in the middle betwen the parallel wires.

It is sometimes difficult for those not much accustomed to observations of this kind, to find the reflected image in the horizon-glass: it will perhaps in this case be found more convenient to look directly to the object, and, by moving the index, to make its image coincide with that seen directly.

Sect. III. *Of the circular Instrument of Reflection.*

This instrument was proposed with a view to correct the errors to which the sextant is liable; particularly the error arrising from the inaccuracy of the divisions on the limb. It consists of the following parts: a circular ring or limb, two moveable indices, two mirrors, a telescope, coloured glasses, &c.

The limb of this instrument is a complete circle of metal, and is connected with a perforated central plate by six radii: it is divided into 720 degrees; each degree is divided into three equal parts; and the division is carried to minutes by means of the index scale as usual.

The two indices are moveable about the same axis, which passes exactly through the centre of the instrument:—the first index carries the central mirror, and the other the telescope and horizon glass; each index being provided with an adjusting screw for regulating its motion, and a scale for showing the divisions on the limb.

The central mirror is placed on the first index immediately above the centre of the instrument, and its plane makes an angle of about 30° with the middle line of the index. The four screws in its pedestal for making its plane perpendicular to that of the instrument have square heads, and are therefore easily turned either way by a key for that purpose.

The horizon-glass is placed on the second index near the limb, so that as few as possible may be intercepted of the rays proceeding from the reflected object when to the left. The perpendicular position of this glass is rectified in the same manner as that of the horizon-glass of a sextant, to which it is similar. It has another motion, whereby its plane may be disposed so as to make a proper angle with the axis of the telescope, and a line joining its centre, and that of the central mirror.

The telescope is attached to the other end of the index. It is an achromatic astronomical one, and therefore inverts objects; it has two parallel wires in the common focus of the glasses, whose angular distance is between two and three degrees, and which, at the time of observation, must be placed parallel to the plane of the instrument. This is easily done, by making the mark on the eye-piece coincide with that on the tube. The telescope is moveable by two screws in a vertical direction with regard to the plane of the instrument, but is not capable of receiving a lateral motion.

There are two sets of coloured glasses, each set containing four, and differing in shade from each other. The glasses of the larger set, which belongs to the central mirror, should have each about half the degree of shade with which the correspondent glass of the set belonging to the horizon mirror is tinged. These glasses are kept tight in their places by small pressing screws, and make an angle of about 85° with the plane of the instrument; by which means the image from the coloured glass is not reflected to the telescope. When the angle to be measured is between 5° and 34°, one of the glasses of the largest set is to be placed before the horizon-glass.

The handle is of wood and is screwed to the back of the instrument, immediately under the centre, with which it is to be held at the time of observation.

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Plate CCCXLIII.

Fig. 81. is a plan of the inftrument, wherein the limb is reprefented by the divided circular plate; A is the central mirror, *a a*, the places which receive the ftems *a a* of the glafs fig. 84; EF, the firft or central index, with its fcale and adjufting fcrew; MN, the fecond or horizon index; GH, the telefcope; IK, the fcrews for moving it towards or from the plane of the inftrument: C, the place of the coloured glafs fig. 83; and D, its place in certain obfervations.

Fig. 82. is a fection of the inftrument, wherein the feveral parts are referred to by the fame letters as in fig. 81: Fig. 83. reprefents one of the horizon coloured glaffes; and fig. 84. one of the central coloured glaffes: Fig. 85. is the key for turning the adjufting fcrews of the mirrors: Fig. 86. is the handle: Fig. 87. a fection of one of the radii towards its middle: Fig. 88. is ufed in fome terreftrial obfervations for diminifhing the light of the direct object, whofe place at the time of obfervation is D: Fig. 89 is the tool for adjufting the central mirror, and for rectifying the pofition of the telefcope with regard to the plane of the inftrument; there is another tool exactly of the fame fize. The height of thefe is nearly equal to that of the middle of the central mirror.

Adjuftments of the Circular Inftrument.

I. *To fet the horizon-glafs fo that none of the rays from the central mirror fhall be reflected to the telefcope from the horizon mirror, without paffing through the coloured glafs belonging to this laft mirror.*—Place the coloured glafs before the horizon mirror; direct the telefcope to the filvered part of that mirror, and make it nearly parallel to the plane of the inftrument; move the firft index; and if the rays from the central mirror to the horizon-glafs, and from thence to the telefcope, have all the fame degree of fhade with that of the coloured glafs ufed, the horizon-glafs is in its proper pofition; otherwife the pedeftal of the glafs muft be turned until the uncoloured images difappear.

II. Place the two adjufting tools on the limb, about 350° of the inftrument diftant, one on each fide of the divifion on the left, anfwering to the plane of the central mirror produced: then the eye being placed at the upper edge of the neareft tool, move the central index till one half only of the reflected image of this tool is feen in the central mirror towards the left, and move the other tool till its half to the right is hid by the fame edge of the mirror; then, if the upper edges of both tools are apparently in the fame ftraight line, the central mirror is perpendicular to the plane of the inftrument; if not bring them into this pofition by the fcrews in the pedeftal of the mirror.

III. *To fet the horizon mirror perpendicular to the plane of the inftrument.*—The central mirror being previoufly adjufted, direct the fight through the telefcope to any well defined diftant object; then if, by moving the central index, the reflected image paffes exactly over the direct object, the mirror is perpendicular; if not, its pofition muft be rectified by means of the fcrews in the pedeftal of the glafs.

A planet, or ftar of the firft magnitude, will be found a very proper object for this purpofe.

IV. *To make the line of collimation parallel to the plane of the inftrument*—Lay the inftrument horizontally on a table; place the two adjufting tools on the limb, towards the extremities of one of the diameters of the inftrument; and at about 15 or 20 feet diftant let a well defined mark be placed fo as to be in the fame ftraight line with the tops of the tools; then raife or lower the telefcope till the plane paffing through its axis and the tops of the tools is parallel to the plane of the inftrument, and direct it to the fixed object; turn either or both of the fcrews of the telefcope till the mark is apparently in the middle between the wires; then is the telefcope adjufted; and the difference, if any, between the divifions pointed out by the indices of the fcrews will be the error of the indices. Hence this adjuftment may in future be eafily made.

In this procefs the eye tube muft be fo placed as to obtain diftinct vifion.

V. *To find that divifion to which the fecond index being placed the mirrors will be parallel, the central index being at Zero.*—Having placed the firft index exactly to *o*, direct the telefcope to the horizon mirror, fo that its field may be bifected by the line of feparation of the filvered and tranfparent parts of that mirror; hold the inftrument vertically, and move the fecond index until the direct and reflected horizons agree; and the divifion fhown by the index will be that required.

This adjuftment may be performed by meafuring the fun's diameter in contrary directions, or by making the reflected and direct images of a ftar or planet to coincide.

Ufe of the Circular Inftrument.

To obferve the diftance between the fun and moon.

I. The fun being to the right of the moon.

Set a proper coloured glafs before the central mirror, if the diftance between the objects is lefs than 35°; but if above that quantity, place a coloured glafs before the horizon mirror: make the mirrors parallel, the firft index being at *o*, and hold the inftrument fo that its plane may be directed to the objects, with its face downwards, or from the obferver: direct the fight through the telefcope to the moon: move the fecond index, according to the order of the divifions on the limb, till the neareft limbs of the fun and moon are almoft in contact: faften that index, and make the coincidence of the limbs perfect by the adjufting fcrew belonging thereto: then invert the inftrument, and move the central index towards the fecond by a quantity equal to twice the arch paffed over by that index: direct the plane of the inftrument to the objects: look directly to the moon, and the fun will be feen in the field of the telefcope: faften the central index, and make the contact of the fame two limbs exact by means of the adjufting fcrew: Then half the angle fhown by the central index will be the diftance between the neareft limbs of the fun and moon.

II. The fun being to the left of the moon.

Hold the inftrument with its face upwards, fo that its plane may pafs through both objects; direct the telefcope to the moon, and make its limb coincide with the neareft limb of the fun's reflected image, by moving the fecond index: now put the inftrument in an oppofite pofition; direct its plane to the objects, and the fight to the moon, the central index being previoufly moved towards the fecond by a quantity equal to twice the meafured diftance; and make the fame two limbs

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limbs that were before observed coincide exactly, by turning the adjusting screw of the first index: then half the angle shown by the first index will be the angular distance between the observed limbs of the sun and moon.

To observe the angular Distance between the Moon and a Fixed Star or Planet.

I. The star being to the right of the moon.

In this case the star is to be considered as the direct object; and the enlightened limb of the moon's reflected image is to be brought in contact with the star or planet, both by a direct and inverted position of the instrument, exactly in the same manner as described in the last article. If the moon's image is very bright, the lightest tinged glass is to be used.

II. The star being to the left of the moon.

Proceed in the same manner as directed for observing the distance between the sun and moon, the sun being to the right of the moon, using the lightest tinged glass if necessary.

Sect IV. *Of the Method of determining the Longitude from Observation.*

Prob. I. To convert degrees or parts of the equator into time.

Rule. Multiply the degrees and parts of a degree by 4, beginning at the lowest denomination, and the product will be the corresponding time. Observing that minutes multiplied by 4 produce seconds of time, and degrees multiplied by 4 give minutes.

Example I. Let 26° 45′ be reduced to time.

	26° 45′
	4
	1h 47′ 0″=time required.

Example II. Reduce 83° 37′ to time.

	83° 37′
	4
Corresponding time=	5 34 28

Prob. II. To convert time into degrees.

Rule. Multiply the given time by 10, to which add the half of the product. The sum will be the corresponding degrees.

Example I. Let 3h 4′ 28″ be reduced to degrees.

	3h 4′ 28″
	10
	30 44 40
Half	= 15 22 20
Corresponding deg.	= 46 7 0

Example II. Reduce 8h 42′ 36″ to degrees.

	8h 42′ 36″
	10
	87 6 0
	43 33 0
Answer	130 39 0

Prob. III. Given the time under any known meridian, to find the corresponding time at Greenwich.

Rule. Let the given time be reckoned from the preceding noon, to which the longitude of the place in time is to be applied by addition or subtraction, according as it is east or west; and the sum or difference will be the corresponding time at Greenwich.

Example I. What time at Greenwich answers to 6h 15′ at a ship in longitude 76° 45′ W?

Time at ship - -	6h 15′
Longitude in time -	5 7 W.
Time at Greenwich,	11 22

Example II. Required the time at Greenwich answering to 5h 46′ 39″ of May 1st, at Canton, whose longitude is 113° 2′ 15″ E.?

Time at Canton, May 1st	5h 46′ 39″
Longitude in time -	7 32 9 E.
Time at Greenwich, April 30.	22 14 30

Prob. IV. To reduce the time at Greenwich to that under any given meridian.

Rule. Reckon the given time for the preceding noon, to which add the longitude in time if east, but subtract it if west; and the sum or remainder will be the corresponding time under the given meridian.

Example I. What is the expected time of the beginning of the lunar eclipse of February 25, 1793, at a ship in longitude 109° 48′ E?

Beg. of eclipse at Greenwich *per* Naut Alm.	9h 23′ 45″
Ship's longitude in time, - -	7 19 12
Time of beginning of eclipse at ship,	16 42 57

Example II. At what time may the immersion of the first satellite of Jupiter be observed at Port St Julian, in longitude 68° 44′ W. which by the Nautical Almanac happens at Greenwich 24th March 1792, at 17h 53′ 1″?

App. time of immersion at Greenwich	17h 53′ 1″
Longitude of Pot St Julian in time,	4 34 56 W.
App. time of immer. at Port St Julian,	13 18 5

Prob. V. To find the equation of equal latitudes.

Rule. To the co-secant of half the interval of time in degrees add the tangent of the latitude, and to the cotangent of half the interval add the tangent of the declination: Now if the latitude and declination be of a contrary name, add the corresponding natural numbers; but if of the same name, subtract them. Then to the ar. co. log. of this sum or difference add the proportional logarithm of one-fourth of the interval expressed in time, and the proportional logarithm of the daily variation of declination, the sum will be the proportional logarithm of the equation of equal altitudes in minutes and seconds, which are to be esteemed seconds and thirds.

Example. Let the latitude of the place of observation be 57° 9′ N, the interval of time between the observations of the equal altitudes 5h 17′, the sun's declination 17° 48′ S, and the daily change of declination 16° 19½: Required the equation of equal altitudes?

Half the interval=2h 38′½=39° 37′

½ int.=39° 37	cos^t. 0.19542	cotang.		0.08209
Lat. 57 9	tan. 0.18997	dec. 17° 48′	ta.	9.50659
	0.38539	2.4288		
		3879		9.58868
Sum - -		2.8167	ar. co. lo.	9.5503

One-

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One-fourth interval	1h 19′ 15′	P. L. 0.3563
Daily variation of declination	16′ 19″$\frac{1}{2}$	P. L. 1.0424
Equation of equal altitudes	20″ 14‴	P. L. 0.9490

Prob. VI. To find the error of a watch by equal altitudes of the sun.

Rule. In the morning when the sun is more than two hours distant from the meridian, let a set of observations be taken, consisting, for the sake of greater accuracy, of at least three altitudes, which, together with the corresponding times *per* watch, are to be wrote regularly, the time of each observation being increased by 12 hours. In the afternoon, observe the instants when the sun comes to the same altitudes, and write down each opposite to its respective altitude.—Now half the sum of any two times answering to the same altitude will be the time of noon *per* watch uncorrect. Find the mean of all the times of noon thus deduced from each corresponding pair of observations, to which the equation of equal altitudes is to be applied by addition or subtraction according as the sun is receding from or approaching to the elevated pole, and the sum or difference will be the time *per* watch of apparent noon, the difference between which and noon will be the error of the watch for apparent time; and the watch will be fast or slow according as the time of noon thereby is more or less than twelve hours.

Example. January 29, 1786, in lat. 57° 9′ N, the following equal altitudes of the sun were observed: Required the error of the watch?

Alt		Time A.M.		P.M.
=8 5′	Time	21h 35′ 8″ A.M.		2h 55′ 43″ P.M.
8 10	-	36 8	-	54 42
8 20	-	38 9	-	52 41.2
8 25	-	39 12.5	-	51 38
		37.5		4.2
		21 37 9.37		2 53 41.05
				21 37 9.37
Sum	-	-	-	24 30 50.42
Time of noon *per* watch uncorrected				12 15 25.2
Equation of equal altitudes				=0 0 20.2
Time *per* watch of apparent noon				12 15 5.
Watch fast.		-		15 5.

The mean time of noon *per* watch is found by applying the equation of time with a contrary sine.

In practice it will be found convenient to put the index of the quadrant to a certain division, and to wait till either limb of the sun attains that altitude.

Prob. VII. Given the latitude of a place, the altitude and declination of the sun to find the apparent time, and the error of the watch.

Rule. If the latitude and declination are of different names, let their sum be taken; otherwise, their difference. From the natural cosine of this sum or difference subtract the natural sine of the corrected altitude. and find the logarithm of the remainder; to which add the log. secants of the latitude and declination: the sum will be the log. rising of the horary distance of the object from the meridian, and hence the apparent time will be known.

Example. I. September 15th 1792, in latitude 33° 56′ S, and longitude 18° 22′ E, the mean of the times *per* watch was 8h 12′ 10″ A. M. and that of the altitudes of the sun's lower limb 24° 48′; height of the eye 24 feet. Required the error of the watch?

Obs. alt. Sun's lower limb	24° 48′	Sun's declin. at noon per Naut. Almanac	2° 40′.5 S.
Semidiameter - -	+ 16.0	Equation to 3h 48′ A. M. -	+ 3.7
Dip - - - - -	— 4.7	to 18° 22′ East -	+ 1.2
Correction - - - -	— 1.9	Reduced declination - -	2 45.4 S.
True altitude Sun's centre -	24 57.4		
Latitude -	33 56	- secant - -	0.08109
Declination -	2 45.4	- secant -	0.00050
Sum - -	36 41.4	nat. cosine 80188	
Sun's altitude . -	4 57.4	nat. sine 42193	
		Difference 37995 log. -	4.57973
Sun's meridian distance -	3h 48′ 51″	rising	4.66132
Apparent time -	8 11 9		
Time per watch -	8 12 10		
Watch fast - -	1 1		

Example II. May 6th 1793, in latitude 56° 4′ N, and longitude 38° 30′ W, at 4h 37′ 4″ P. M. per watch, the altitude of the sun's lower limb was 25° 6.1, and height of the eye 19 feet. Required the error of the watch for apparent time?

Altitude sun's lower limb -	= 25° 6′.1	- Sun's declin. per Nautical Almanac	16° 44.3
Semidiameter - -	+ 15.9	- Equation to 4h 37. P. M. -	+ 3.4
Dip - -	— 4.1	- to 38° 30. W. -	+ 1.8
Correction - - - -	— 1.9	- Reduced declination - -	16 49.5
True alt. sun's centre -	25 16.0		

Latitude

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Latitude	56 4.0 N.	ſecant	0.25319
Declination	16 49.5 N.	ſecant	0.01900
Difference	39 14.5	nat. coſine 77448	
Sun's altitude	25 16.0	nat. ſine 42683	
		Difference 34765	4.54114
Apparent time	4h 38′ 12″	riſing	4.81333
Time per watch	4 37 4		
Watch ſlow	1 8		

Prob. VIII. Given the latitude of a place, the altitude of a known fixed ſtar, and the ſun's right aſcenſion, to find the apparent time of obſervation and error of the watch.

Rule. Correct the obſerved altitude of the ſtar, and reduce its right aſcenſion and declination to the time of obſervation.

With the latitude of the place, the true altitude and declination of the ſtar, compute its horary diſtance from meridian by laſt problem; which being added to or ſubtracted from its right aſcenſion according as it was obſerved in the weſtern or eaſtern hemiſphere, the ſum or remainder will be the right aſcenſion of the meridian.

From the right aſcenſion of the meridian ſubtract the ſun's right aſcenſion as given in the Nautical Almanac for the noon of the given day, and the remainder will be the approximate time of obſervation; from which ſubtract the proportional part of the daily variation of right aſcenſion anſwering thereto, and let the proportional part anſwering to the longitude be added or ſubtracted according as the longitude is eaſt or weſt, and the reſult will be the apparent time of obſervation; and hence the error of the watch will be known.

Example I. December 12th 1792, in latitude 37° 46′ N, and longitude 21° 15′ E, the altitude of Arcturus eaſt of the meridian was 34° 6′.4, the height of the eye 10 feet. Required the apparent time of obſervation?

Obſerved alt. of Arcturus	34° 6′.4		
Dip and refraction	— 4.4		
True altitude	34 2.0		
Latitude	37 46.0 N.	ſec. 0.10209	
Declination	20 14.4 N.	ſec. 0.02778	
Difference	17 31.6 N.	co. 95358	
Altitude of Arcturus	34 2.0 N.	ſine 55968	
		Difference 39390	4.59539
Arcturus's merid. diſt.	4h 8′ 10″	riſing	4.72526
right aſ.	14 6 13		
Right aſ. of merid.	9 58 3		
Sun's right aſ.	17 21 59		
Approximate time	16 36 4		
Eq. to approx. time	— 3 3		
Eq. to longitude	+ 16		
Ap. time of obſ.	16 83 17		

Example II. January 29th 1792, in latitude 53° 24′ N. and longitude 25° 18′ W, by account, at 14h 58′ 38″, the altitude of Procyon weſt of the meridian was 19° 58′; height of the eye 20 feet. Required the error of the watch?

Obſ. alt. of Procyon	19° 58′		
Dip and refraction	7		
True altitude	19 51		
Latitude	53 24	ſecant	0.22459
Declination	5 45	ſecant	0.00219
Difference	47 39	nat. coſ. 67366	
Altitude of Procyon	19 51	nat. ſine 33956	
		Difference 33410	4.52388
Procyon's merid. diſt.	4h 16′ 24″	riſing	4.75066
right aſ.	7 28 24		
Right aſ. of merid.	11 44 48		
Sun's right aſ.	20 47 22		
Approximate time	14 57 26		
Eq. to ap. time	—0 2 36		
Eq. to long.	—0 0 17		
Apparent time	14 54 33		
Time per watch	14 58 38		
Watch faſt	0 4 5		

Prob. IX. Given the altitude of the moon, the latitude of a place, and the apparent time at Greenwich, to find the apparent time at the place of obſervation.

Rule. Correct the altitude of the moon's limb by Problem V. p. 731, and reduce its right aſcenſion and declination, and the ſun's right aſcenſion to the Greenwich time of obſervation. Now with the latitude of the place, the declination and altitude of the moon, compute its meridian diſtance as before: Which being applied to its right aſcenſion by addition or ſubtraction, according as it is in the weſtern or eaſtern hemiſphere, will give the right aſcenſion of the meridian. Then the ſun's right aſcenſion ſubtracted from the right aſcenſion of the meridian, will give the apparent time of obſervation.

Example. March 3d 1792, in latitude 51° 38′ N, at 11h 29′ 7″ P. M. per watch, the altitude of the moon's lower limb was 37° 31′, the height of the eye being 10 feet, and the time at Greenwich 13h 43′. Required the error of the watch?

Alti-

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Altitude of the moon's lower limb	=37° 31'	Moon's right ascension at Green. time	7h 22' 54"
Semidiameter - -	+ 15	declination - -	17h 0 N.
Dip - - - -	— 3	Sun's right ascension - -	23h 2' 0"
Correction - - - -	+ 42		
Correct altitude of moon's centre	38 25	- - secant - -	0.20712
Latitude - - -	51 38 N.	- - secant - -	0.01940
Declination - -	17 0 N.	Nat. cosine - 82281	
		Nat. sine - 62138	
Difference - -	34 38		
Moon's altitude - -	38 25	Difference - 20143	4.30412
		rising - - - -	4.53064

Moon's meridian distance -	3° 14 36
right ascension -	7 22 54
Right ascension of meridian	10 37 30
Sun's right ascension - -	23 2 0
Apparent time at ship, - -	11 35 30
Time per watch - -	11 29 7
Watch slow. - -	6 23

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Prob. X. Given the apparent distance between the moon and the sun or a fixed star, to find the true distance.

Rule. To the logarithmic difference answering to the moon's apparent altitude and horizontal parallax, add the logarithmic sines of half the sum, and half the difference of the apparent distance and difference of the apparent altitudes; half the sum will be the logarithmic cosine of an arch: now add the logarithm sines of the sum and difference of this arch, and half the difference of the true altitudes, and half the sum will be the logarithmic cosine of half the true distance.

Example. Let the apparent altitude of the moon's centre be 48° 22', that of the sun's 27° 43', the apparent central distance 81° 23' 40", and the moon's horizontal parallax 58' 45". Required the true distance?

Apparent altitude sun's centre -	27° 43' 0"	Apparent altitude moon's centre	48° 22' 0"
Correction - - - -	— 1 40	Correction - -	+ 38 26
Sun's true altitude - -	27 41 20	Moon's true altitude - -	49 0 26
Sun's apparent altitude -	27 43	Sun's true altitude - -	27 41 20
Moon's apparent altitude, -	48 22	Difference - -	21 19 6
Difference - - - -	20 39	Half - -	10 39 33
Apparent distance - -	81 23 40	Logarithmic difference	9.994638
Sum - - - -	102 2 40	Half - 51° 1' 20" Sine	9.890639
Difference - - - -	60 44 40	Half - 30 22 20 Sine	9.703820
Half difference true altitudes -	10 39 33		19.589097
Arch - - - -	51 27 29	- - cosine - -	9.794548
Sum - - -	62 7 2	- - sine - - -	9.946417
Difference - -	40 47 56	- - sine - - -	9.815183
			19.761600
	40 32 16	- - cosine - -	9.880800
	2		
True distance - -	81 4 32		

Prob. XI. To find the time at Greenwich answering to a given distance between the moon and the sun, or one of the stars, used in the Nautical Almanac.

Rule. If the given distance is found in the Nautical Almanac opposite to the given day of the month, or to that which immediately precedes or follows it, the time is found at the top of the page. But if this distance is not found exactly in the ephemeris, subtract the prop. log. of the difference between the distances which immediately precede and follow the given distance; from the prop. log. of the difference between the given and preceding distances, the remainder will be the prop. log. of the excess of the time corre-

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corresponding to the given distance, above that answering to the preceding distance: And hence the apparent time at Greenwich is known.

Example. September 21, 1792, the true distance between the centres of the sun and moon was 68° 13′ 8″. Required the apparent time at Greenwich?

Given distance	68°	13′	8″		
Dist. at ix hours	67	53	27	Diff.=0° 19′ 41″	P. log. 9612
Dist. at xii hours	69	30	6	Diff.=1 36 39	P. log. 2701
Excess - -	0	36	39		P. log. 6911
Preceding time -	9	0	0		
App. time at Greenwich	9	36	39		

Prob. XII. The latitude of a place and its longitude by account being given, together with the distance between, and the altitude of the moon and the sun, or one of the stars in the Nautical Almanac; to find the true longitude of the place of observation.

Rule. Reduce the estimate time of observation to the meridian of Greenwich by Problem III. and to this time, take from the Nautical Almanac page vii. of the month, the moon's horizontal parallax and semidiameter. Increase the semidiameter by the augmentation answering to the moon's altitude.

Find the apparent and true altitudes of each object's centre, and the apparent central distance; with which compute the true distance by Problem X. and find the apparent time at Greenwich answering thereto by the last problem.

If the sun or star be at a proper distance from the meridian at the time of observation of the distance, compute the apparent time at the ship. If not, the error of the watch may be found from observations taken either before or after that of the distance; or the apparent time may be inferred from the moon's altitude taken with the distance, by Problem IX.

The difference between the apparent times of observation at the ship and Greenwich, will be the longitude of the ship in time; which is east or west according as the time at the ship is later or earlier than the Greenwich time.

Example I. March 17. 1792, in latitude 34° 53′ N, and longitude by account 27° W, about 9h A. M. the distance between the nearest limbs of the sun and moon was 68° 3¼′; the altitude of the sun's lower limb 33° 18′; that of the moon's upper limb 31° 3′; and the height of the eye 12 feet. Required the true longitude of the ship?

Time at ship - -	9h	0′	A. M.
Longitude in time - -	1	48	
Reduced time - -	10	48	A. M.
Altitude moon's upper limb -	31	3	0
Aug. semidiameter - -	—	16	19
Dip - - -	—	3	18
Apparent altitude -	30	43	23
Correction - - - -	+	49	26
Moon's true altitude -	31	32	49
Sun's apparent altitude -	33°	30′	48″
Moon's apparent altitude -	30	43	23
Difference - -	2	47	25
Apparent distance -	68	35	40
Sum - -	71	23	5
Difference - -	65	48	15
Half difference true altitudes	0	58	20
Arch - -	55	54	12
Sum - -	56	52	32
Difference - -	54	55	52
Half true distance -	34	6	53
			2
True distance - -	68	13	46

Dist. sun and moon's nearest limbs	68°	3′	15″
Sun's semidiameter -	+	16	6
Moon's semidiameter -	+	16	10
Augmentation - -	+	0	9
Apparent central distance -	68	35	40
Altitude sun's lower limb -	33	18	
Sun's semidiameter -	+	16	6
Dip - -	—	3	18
Sun's apparent altitude -	33	30	48
Correction - -	—0	1	19
Sun's true altitude - -	33	29	29
Moon's true altitude -	31	32	49
Difference - -	1	56	40
Half - - -	0	58	20

Logarithmic difference		-	9.996336
Half - 35° 41′ 32″½	Sine	-	9.765991
Half - 32 54 7½	Sine	-	9.734964
			19.497291
	Cosine	-	9.748645
	Sine	-	9.922977
	Sine	-	9.912998
			19.835975
	Cosine	-	9.917987

True distance - -	68° 13 46″			
Distance at XXI hours	69 11 20	Difference - 0° 57″ 34″	P. log. -	4951
Distance at noon -	67 32 38	Difference - 1 38 42	P. log. -	2610
Proportional part - - -		1 45 0	P. log. -	2341
Preceding time - - -		21 0 0		
Apparent time at Greenwich - - -		22 45 0		

Latitude -	34° 53.0′ N	Secant - - -	0.08602
Declination -	0 57.9 S	Secant - - -	0.00006
Sum -	35 50.9	Nat. cosine - 81057	
Sun's altitude -	33 29.5	Nat. sine - 55181	
Difference - - -		25876 - - -	4.41291
Time from noon -	3h 7′ 13″ -	Rising - -	4.49899
Apparent time -	20 52 47		
App. time at Green.	22 45 0		
Longitude in time -	1 52 13 = 28° 3′½ W.		

Example II. September 2. 1792, in latitude 13° 57′ N, and longitude by account 56° E, several observations of the moon and altair were taken; the mean of the times *per* watch was 1h 18′ 59″ A. M. that of the distance between altair and the moon's nearest limb 58° 45′ 26″; the mean of the altitude of the moon's lower limb 70° 33′; and that of altair 25° 27.4′; height of the eye 13 feet. Required the true longitude?

Time *per* watch -	1h 18′ 59″ A. M.	Distance moon and altair - -	58° 45′ 26″
Longitude in time	3 44 0	Augmented semidiameter - -	+0 16 28
Reduced time -	9 34 59	Apparent central distance - -	59 1 54
Altitude moon -	70° 33′	Altitude of altair - -	25° 27′.4
Semidiameter and dip	—0 13	Dip - - -	—0 3.4
Apparent alt. moon	70 20	Apparent altitude altair - -	25 24 0
Correction -	+0 19 40	Refraction - - - - -	—0 2 0
True altitude moon	70 39 40	True altitude altair - -	25 22 0
Moon's apparent alt.	70 20	Moon's true altitude - - -	70 39 40
Altair's apparent alt.	25 24	Difference - - -	45 17 40
Difference -	44 56	Half - - - -	22 38 50
Apparent distance	59 1 54	Logarithmic difference - - -	9.993101

Sum -	103 57 54	Half - 51° 58′ 57″	Sine -	9.896428
Difference -	14 5 54	Half - 7 2 57	Sine -	9.088919
Half diff. true alt.	22 38 50			18.978448
Arch -	72 1 57		Cosine -	9.489224
Sum -	94 40 47		Sine -	9.998548
Difference -	49 23 7		Sine -	9.880301
				19,878839
Half true distance	29 33 48½		Cosine -	9.939424
	2			
True distance -	59 7 37			
Distance at IX hours	58 51 17	Difference - 0° 16′ 20″	P. log. -	1.0422
— at XII hours	60 24 34	Difference 1 33 17	P. log. -	0.2855
Proportional part - - -		0 31 31	P. log. -	0.7567
Preceding time - - -		9 0 0		
Apparent time at Greenwich - -		9 31 31		

Latitude

Fig. 74.

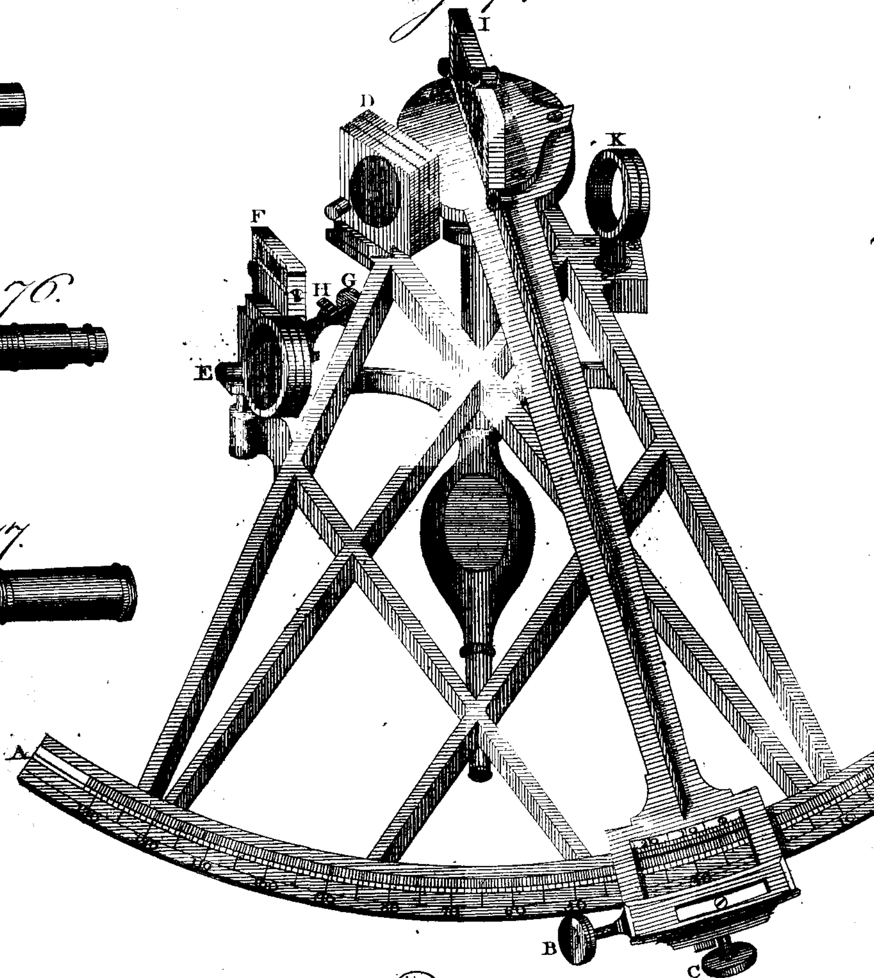

Fig. 75.

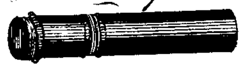

Fig. 76.

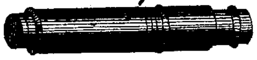

Fig. 77.

Fig. 78.

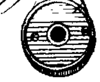

Fig. 79.

Fig. 80.

Fig. 83.

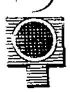

Fig. 81.

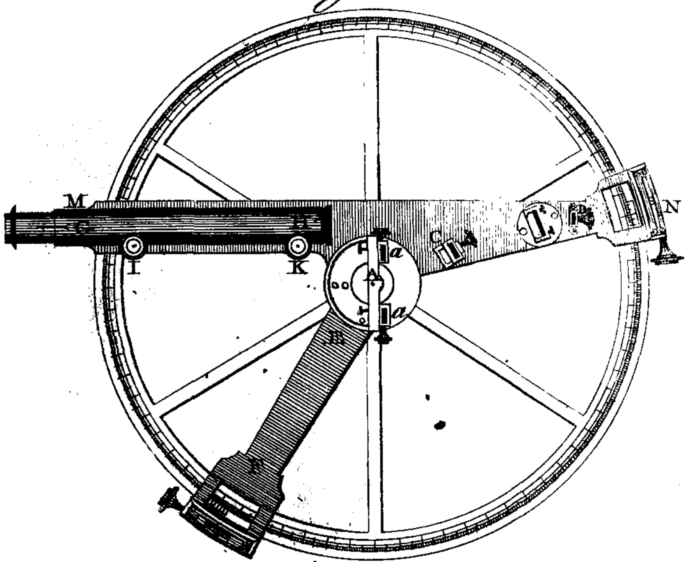

Fig. 86.

Fig. 84.

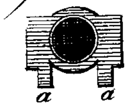

Fig. 87.

Fig. 88.

Fig. 85.

Fig. 82.

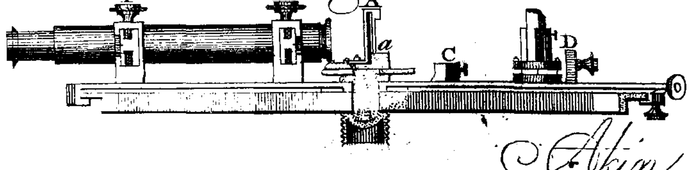

Fig. 89.

Akin Sc. Carolina

Variation of the Compass

Latitude	13° 57′ N		Secant	0.01300
Declination	8 19.8 N		Secant	0.00461
Difference	5 37.2	Nat. cosine	99519	
Altitude altair	25 22.	Nat. sine	42841	
Difference			56678	4.75341
Altair's meridian distance	4h 23′ 14″	Rising		4.77102
—— right ascension	19 40 40			
Right ascension meridian	0 3 54			
Sun's right ascension	10 46 17			
Apparent time at ship	13 17 37			
Apparent time at Greenwich	9 31 31			
Longitude in time	3 46 6 = 56° 31′½ East.			

For various other methods of determining the longitude of a place, the reader is referred to the article LONGITUDE.

CHAP. III. *Of the Variation of the Compass.*

THE variation of the compass is the deviation of the points of the mariner's compass from the corresponding points of the horizon; and is denominated *east* or *west* variation, according as the north point of the compass is to the east or west of the true north point of the horizon.

A particular account of the variation, and of the several instruments used for determining it from observation, may be seen under the articles AZIMUTH, COMPASS, and VARIATION: and for the method of communicating magnetism to compass needles, see MAGNETISM.

PROB. I. Given the latitude of a place, and the sun's magnetic amplitude, to find the variation of the compass.

RULE. To the log. secant of the latitude, add the log. sine of the sun's declination, the sum will be the log. cosine of the true amplitude; to be reckoned from the north or south according as the declination is north or south.

The difference between the true and observed amplitudes reckoned from the same point, and if of the same name, is the variation; but if of a different name, their sum is the variation.

If the observation be made in the eastern hemisphere, the variation will be east or west according as the observed amplitude is nearer to or more remote from the north than the true amplitude. The contrary rule holds good in observations taken in the western hemisphere.

EXAMPLE I. May 15. 1794, in latitude 33° 10′ N, longitude 18° W, about 5h A. M. the sun was observed to rise E*b*N. Required the variation?

Sun's dec. May 15. at noon	18° 58′ N.			
Equation to 7h from noon	—0 4			
—— to 18° W	+0 1			
Reduced declination	18 55		Sine	9.51080
Latitude	33 10		Secant	0.07723
True amplitude	N 67 13 E		Cosine	9.58803
True amplitude	N 67 13 E		Cosine	9.58803
Observed amplitude	N 78 45 E			
Variation	11 32			

; which is *west*, because the observed amplitude is more distant from the north than the true amplitude; the observation being made in the eastern hemisphere.

EXAMPLE II. December 20. 1793, in latitude 31° 38′ S, longitude 83° W, the sun was observed to set SW. Required the variation?

Latitude	31° 38′	Secant	0.06985
Declination	23 28	Sine	9.60012
True amplitude	S 62 7 W	Cosine	9.66997
Observed ampl.	S 45 0 W		
Variation	17 7		

; which is *east*, as the observed amplitude is farther from the north than the true amplitude, the observation being made at sun-setting.

It may be remarked, that the sun's amplitude ought to be observed at the instant the altitude of its lower limb is equal to the sum of 15 minutes and the dip of the horizon. Thus, if an observer be elevated 18 feet above the surface of the sea, the amplitude should be taken at the instant the altitude of the sun's lower limb is 19 minutes.

PROB. II Given the magnetic azimuth, the altitude and declination of the sun, together with the latitude of the place of observation; to find the variation of the compass.

RULE. Reduce the sun's declination to the time and place of observation, and compute the true altitude of the sun's centre.

Find the sum of the sun's polar distance and altitude and the latitude of the place, take the difference between the half of this sum and the polar distance.

To the log. secant of the altitude add the log. secant of the latitude, the log. cosine of the half sum, and the log. cosine of the difference; half the sum of these will be the log. sine of half the sun's true azimuth, to be reckoned from the south in north latitude, but from the north in south latitude.

The difference between the true and observed azimuths will be the variation as formerly.

EXAMPLE.

Variation of the Compass.

Example I. November 18. 1793, in latitude 50° 22′ N, longitude 24° 30′ W, about three quarters past eight A. M. the altitude of the sun's lower limb was 8° 10′, and bearing *per* compass S 23 18′ E; height of the eye 20 feet. Required the variation of the compass?

Sun's declin. 18th Nov. at noon	19° 25′ S.	Observed alt. sun's lower limb	=8° 10
Equation to 3¼h from noon	— 2	Semidiameter	+ 16
——to 24° 30′ W	+ 1	Dip and refraction	— 10
Reduced declination	19 24	True altitude	8 16
Polar distance	109 24		
Altitude	8 16	Secant	0.00454
Latitude	50 22	Secant	0.19527
Sum	168 2		
Half	84 1	Cosine	9.01803
Difference	25 23	Cosine	9.95591
			19.17375
Half true azimuth	22 43	Sine	9.58687
	2		
True azimuth	S. 45 26 E.		
Observed azimuth	S. 23 18 E.		
Variation	22 8 W.		

Example II. January 3. 1794, in latitude 33° 52′ N, longitude 53° 15′ E, about half past three the altitude of the sun's lower limb 41° 18′, and azimuth S. 50° 25′ W. the height of the eye being 20 feet. Required the variation?

Sun's declination at noon	21° 24′ S.	Observed alt. sun's lower limb	=41° 18
Equation to time from noon	— 2	Sun's semidiameter	+ 16
——to longitude	+ 2	Dip and refraction	— 6
Reduced declination	21 24 S.	True altitude	41 28
Polar distance	111 24		
Altitude	41 28	Secant	0.12532
Latitude	33 52	Secant	0.08075
Sum	186 44		
Half	93 22	Cosine	8.76883
Difference	18 2	Cosine	9.97558
			18.95048
	17 23	Sine	9.47524
	2		
True azimuth	S. 34 46 W.		
Observed azimuth	S. 50 25 W.		
Variation	15 39 W.		

Chap. IV. *Of a Ship's Journal.*

A journal is a regular and exact register of all the various transactions that happen aboard a ship whether at sea or land, and more particularly that which concerns a ship's way, from whence her place at noon or any other time may be justly ascertained.

That part of the account which is kept at sea is called *sea-work;* and the remarks taken down while the ship is in port are called *harbour-work.*

At sea, the day begins at noon, and ends at the noon of the following day: the first 12 hours, or those contained between noon and midnight, are denoted by P. M. signifying *after mid-day;* and the other 12 hours, or those from midnight to noon, are denoted by A. M. signifying *before mid-day.* A day's work marked Wednesday March 6. began on Tuesday at noon, and ended on Wednesday at noon. The days of the week are usually represented by astronomical characters. Thus ☉ represents Sunday; ☽ Monday; ♂ Tuesday; ☿ Wednesday; ♃ Thursday; ♀ Friday; and ♄ Saturday.

When a ship is bound to a port so situated that she will be out of sight of land, the bearing and distance of the port must be found. This may be done by Mercator's or Middle-latitude Sailing; but the most expeditious method is by a chart. If islands, capes, or headlands intervene, it will be necessary to find the several course and distances between each successively

Ship's Journal.

cessively. The true course between the places must be reduced to the course *per* compass, by allowing the variation to the right or left of the true course, according as it is west or east.

At the time of leaving the land, the bearing of some known place is to be observed, and its distance is usually found by estimation. As perhaps the distance thus found will be liable to some error, particularly in hazy or foggy weather, or when that distance is considerable, it will therefore be proper to use the following method for this purpose.

Let the bearing be observed of the place from which the departure is to be taken; and the ship having run a certain distance on a direct course, the bearing of the same place is to be again observed. Now having one side of a plane triangle, namely the distance sailed and all the angles, the other distances may be found by Prob. I. of Oblique Sailing.

The method of finding the course and distance sailed in a given time is by the compass, the log line, and half-minute-glass. These have been already described In the royal navy, and in ships in the service of the East India company, the log is hove once every hour; but in most other trading vessels only every two hours.

The several courses and distances sailed in the course of 24 hours, or between noon and noon, and whatever remarks that are thought worthy of notice, are set down with chalk on a board painted black called the *log-board*, which is usually divided into six columns: the first column on the left hand contains the hours from noon to noon; the second and third the knots and parts of a knot sailed every hour, or every two hours, according as the log is marked; the fourth column contains the courses steered; the fifth the winds; and in the sixth the various remarks and phenomena are written. The log-board is transcriber every day at noon into the log-book, which is ruled and divided after the same manner.

The courses steered must be corrected by the variation of the compass and leeway. If the variation is west, it must be allowed to the left hand of the course steered: but if east, to the right hand in order to obtain the true course. The leeway is to be allowed to the right or left of the course steered according as the ship is on the larboard or starboard tack. The method of finding the variation, which should be determined daily if possible, is given in the preceding chapter; and the leeway may be understood from what follows.

When a ship is close hauled, that part of the wind which acts upon the hull and rigging, together with a considerable part of the force which is exerted on the sails, tends to drive her to the leeward. But since the bow of a ship exposes less surface to the water than her side, the resistance will be less in the first case than in the second: the velocity in the direction of her head will therefore in most cases be greater than the velocity in the direction of her side; and the ship's real course will between the two directions. The angle formed between the line of her apparent course and the line she really describes through the water is called the *angle of leeway*, or simply the *leeway*.

There are many circumstances which prevent the laying down rules for the allowance of leeway. The construction of different vessels, their trim with regard to the nature and quantity of their cargo, the position and magnitude of the sail set, and the velocity of the ship, together with the swell of the sea, are all susceptible of great variation, and very much affect the leeway, The following rules are, however, usually given for this purpose,

1. When a ship is close hauled, has all her sails set, the water smooth, with a little breeze of wind, she is then supposed to make little or no leeway.

2. Allow one point when the top gallant sails are handed.

3. Allow two points when under close reefed topsails.

4. Allow two points and an half when one topsail is handed.

5. Allow three points and an half when both top-sails are handed.

6. Allow four points when the fore course is handed.

7. Allow five points when under the mainsail only.

8. Allow six points when under-balanced mizen.

6. Allow seven points when under bare poles.

These allowances may be of some use to work up the day's works of a journal which has been neglected, but a prudent navigator will never be guilty of this neglect. A very good method of estimating the leeway is to observe the bearing of the ship's wake as frequently as may be judged necessary; which may be conveniently enough done by drawing a small semicircle on the tafferal, with its diameter at right angles to the ship's length, and dividing its circumference into points and quarters. The angle contained between the semidiameter which points right aft and that which points in the direction of the wake is the leeway. But the best and most rational way of bringing the leeway into the day's log is to have a compass or semicircle on the tafferal, as before described, with a low crutch or swivel in its centre; after heaving the log, the line may be slipped into the crutch just before it is drawn in, and the angle it makes on the limb with the line drawn right aft will show the leeway very accurately: which as a necessary article, ought to be entered into a separate column against the hourly distance on the log-board.

In hard blowing weather, with a contrary wind and a high sea, it is impossible to gain any advantage by sailing. In such cases, therefore, the object is to avoid as much as possible being driven back. With this intention it is usual to lie to under no more sail than is sufficient to prevent the violent rolling which the vessel would otherwise acquire, to the endangering her masts, and straining her timbers, &c. When a ship is brought to, the tiller is put close over to the leeward, which brings her head round to the wind. The wind having then very little power on the sails, the ship loses her way through the water; which ceasing to act on the rudder, her head falls off from the wind, the sail which she has set fills, and gives her fresh way through the water; which acting on the rudder brings her head again to the wind. Thus the ship has a kind of vibratory motion, coming up to the wind and falling off from it again alternately. Now the middle point between those upon which she comes up and falls off is taken

taken for her apparent course: and the leeway and variation is to be allowed from thence, to find the true course.

The setting and drift of currents, and the heave of the sea, are to be marked down, These are to be corrected by variation only.

The computation made from the several courses corrected as above, and their corresponding distances, is called a *day's work;* and the ship's place, as deduced therefrom, is called her place by *account*, or *dead-reckoning*.

It is almost constantly found that the latitude by account does not agree with that by observation. From an attentive consideration of the nature and form of the common log, that its place is alterable by the weight of the line, by currents, and other causes, and also the errors to which the course is liable, from the very often wrong position of the compass in the binnacle, the variation not being well ascertained, an exact agreement of the latitudes cannot be expected.

When the difference of longitude is to be found by dead reckoning, if then the latitudes by account and observation disagree, several writers on navigation have proposed to apply a conjectural correction to the departure or difference of longitude. Thus, if the course be near the meridian, the error is wholly attributed to the distance, and the departure is to be increased or diminished accordingly; if near the parallel. the course only is supposed to be erroneous; and if the course is towards the middle of the quadrant, the course and distance are both assumed wrong. This last correction will, according to different authors, place the ship upon opposite sides of her meridian, by account. As these corrections are, therefore, no better than guessing, they should be absolutely rejected.

If the latitudes are not found to agree, the navigator ought to examine his log-line and half-minute-glass, and correct the distance accordingly. He is then to consider if the variation and leeway have been properly ascertained; if not, the courses are to be again corrected, and no other alteration whatever is to be made on them. He is next to observe if the ship's place has been affected by a curent or heave of the sea, and to allow for them according to the best of his judgement. By applying these corrections, the latitudes will generally be found to agree tolerably well; and the longitude is not to receive any farther alteration.

It will be proper, however, for the navigator to determine the longitude of the ship from observation as often as possible: and the reckoning is to be carried forward in the usual manner from the last good observation; yet it will perhaps be very satisfactory to keep a separate account of the longitude by dead-reckoning.

General Rules for working a Day's Work.

Correct the several courses for variation and leeway; place them, and the corresponding distances, in a table prepared for that purpose. From whence, by Traverse Sailing, find the difference of latitude and departure made good: hence the corresponding course and distance, and the ships present latitude, will be known.

Find the middle latitude at the top or bottom of the Traverse Table, and the distance answering to the departure found in a latitude column, will be the difference of longitude; Or, the departure answering to the course made good, and the meridional difference of latitude in a latitude column, is the difference of longitude. The sum, or difference of which, and the longitude left, according as they are of the same or of a contrary name, will be the ship's present longitude of the same name with the greater.

Compute the difference of latitude between the ship and the intended port, or any other place whose bearing and distance may be required; find also the meridional difference of latitude and the difference of longitude. Now the course answering the meridional difference of latitude found in a latitude column, and the difference of longitude in a departure column, will be the bearing of the place, and the distance answering to the difference of latitude will be the distance of the ship from the proposed place. If these numbers exceed the limits of the Table, it will be necessary to take aliquot parts of them: and the distance is to be multiplied by the number by which the difference of latitude is divided.

It will sometimes be necessary to keep an account of the meridian distance, especially in the Baltic or Mediterranean trade, where charts are used in which the longitude is not marked. The meridian distance on the first day is that day's departure: and any other day it is equal to the sum or difference of the preceding day's meridian distance and the day's departure, according as they are of the same or of a contrary denomination.

Ship's Journal.

A JOURNAL of a VOYAGE from London to Funchal in Madeira, in his Majesty's Ship the Resolution, A—— M—— Commander, *anno* 1793.

Days of Month	Winds.	Remarks on board his Majesty's ship Resolution, 1793.
♄ Sept. 28.	SW.	Strong gales and heavy rain. At 3 P. M. sent down top-gallant-yards; at 11 A. M. the pilot came on board.
☉ Sept. 29.	SW.	Moderate and cloudy, with rain. At 10 A. M. cast loose from the sheer hulk at Deptford; got up top-gallant yards and made sail down the river. At noon running through Blackwall reach.
☽ Sept. 30.	SW. Variable.	The first part moderate, the latter squally with rain. At half past one anchored at the Galleons, and moored ship with near a whole cable each way in 5 fathoms, a quarter of a mile off shore. At 3 A. M. strong gales: got down top-gallant yards. A. M. the people employed working up junk. Bent the sheet cable.
♂ Octob. 1.	SSW. SW.	Fresh gales and squally. P. M. received the remainder of the boatswain's and carpenter's stores on board. The clerk of the cheque mustered the ship's company.
☿ October 2.	Variable. N *b*E.	Variable weather, with rain. At noon weighed and made sail; at 5 anchored in Long-reach in 8 fathoms. Received the powder on board. At 6 A. M. weighed and got down the river. At 10 A. M. past the Nore; brought to and hoisted in the boats; double reefed the topsails, and made sail for the Downs. At noon running for the flats of Margate.
♃ Octob. 3.	N*b*E. N.	First part stormy weather; latter moderate and clear. At 4 P. M. got through Margate Roads. At 5 run through the Downs; and at 6 anchored in Dover-road, in 10 fathoms muddy ground. Dover Castle bore north, and the south Foreland NE*b*E½E off shore 1¼ miles. Discharged the pilot. Employed making points, &c. for the sails. Scaled the guns.
♀ Octob. 4.	N. NNE.	Moderate and fair. Employed working up junk. Received from Deal a cutter of 17 feet, with materials. A. M. strong gales and squally, with rain; got down top-gallant yards.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ♄ October 5, 1793.
1				NNE.	Fresh gales with rain.
2					Hove short.
3					Weighed and made sail.
4	4				
5	6		WSW.		
6	7				
7	7				
8	7				Shortened sail.—Dungeness light NE*b*E.
9	6	4	W*b*N.	NE.	
10	6				
11	6				
12	6				Fresh breezes, and cloudy.
1	6				
2	6				
3	6				
4	6				Ditto weather.
5	6				
6	6				Got up top-gallant yards.
7	6				Set studding sails.
8	7				Ditto weather.
9	7	5			
10	7	5			
11	7	6			
12	8				St Alban's Head N¼E.

A Journal

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ☉ October 6, 1793.
1	8		W*b*N.	NE.	A fresh steady gale.
2	8				
3	8				
4	8				Do. weather.
5	8				Spoke the Ranger of London, from Carolina.
6	8				Took in studding sails.
7	8				
8	8				Do. weather.
9	8				
10	8				
11	8				Eddistone light N*b*W.
12	8				Do. weather.
1	8				Eddistone light NE.
2	7	5			
3	7	5			
4	7				Do. weather.
5	7		W*b*S.		
6	7				Set lower studding sails.
7	7	4			
8	7	6			Fresh breeze and clear weather.
9	7	3			
10	7	5			
11	7	2			
12	7				Do. weather.

Course.	Dist.	D.L	Dep.	N. Latitude by Acc.	N. Latitude by Obs.	D. Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var. obs.		
S 52° ½ W.	93	57	74	49° 11′	49° 9′	114′ W.	6° 18′		2¼ points.		

As there is no land in sight this day at noon, and from the course and distance run since the last bearing of the Eddistone light was taken, it is not to be supposed that any part of England will be seen, the departure is therefore taken from the Eddistone; and the distance of the ship from that place is found by resolving an oblique angled plane triangle, in which all the angles are given, and one side, namely, the distance run (16 miles) between the observations. Hence the distance from the Eddistone at the time the last bearing of the light was taken will be found equal to 18 miles; and as the bearing of the Eddistone from the ship at that time was NE, the ship's bearing from the Eddistone was SE.. Now the variation 2¼ points W. being allowed to the left of SW. gives S*b*W¾W, the true course. The other courses are in like manner to be corrected, and inserted in the following table, together with their respective distances, beginning at 10 o'clock A. M. the time when the last bearing of the Eddistone was taken. The difference of latitude, departure, course, and distance, made good, are to be found by Traverse Sailing.

Courses.	Dist.	Diff. of Latitude. N.	Diff. of Latitude. S.	Departure. E.	Departure. W.
S*b*W¾W.	18		17.0		6.1
W*b*S¼S.	22		5.3		21.3
SW¼W.	58		34.6		46.6
S 52°½W.	93		56.9 = 57m.		74.0

Latitude of Eddistone - 50° 8′ N.

Latitude by account - 49 11. N.
Sum - - - 99 19
Middle latitude - - 49 40

Now to middle latitude as a course, and the departure 74m. in a latitude column, the difference of longitude in a distance column is 114 = 1° 54′ W.
Longitude of Eddistone - 4 24 W.

Longitude in by account - 6 18 W.

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ☽ October 7. 1793.
1	6	5	WSW.	NE.	Fresh breezes.
2	6	5			Sounded 62 ; fine sand.
3	6				
4	5	3			Moderate and cloudy.
5	5				Unbent the cables, and coiled them.
6	5			N.	Took in studding sails.
7	5				
8	4	7			Do weather.
9	4	5			
10	4	5			
11	4				
12	4				Do. weather
1	4				
2	4				
3	4				
4	4				Light breeze.
5	3		SW*b*W.	NW.	
6	3				A sail S*b*E.
7	3				
8	3				Hazy weather.
9	3		SW.	Var.	
10	3				
11	3				
12	2				Do. weather.

Course.	Dist.	D.L.	Dep.	N. Latitude by Acc.	N. Latitude by Obs.	D. Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var. by ac.	Porto Sancto's Bearing.	Porto Sancto's Distance.
S 38° W.	99	78	62	47° 51′		93′W.	7° 51′		2½ pts.	S 23°½W.	974 m.

The courses being corrected for variation, and the distances summed up, the work will be as under.

Courses.	Dist.	Diff. of Latitude. N.	Diff. of Latitude. S.	Departure. E.	Departure. W.
SW¼S.	77		57.0		51.7
SSW¾W.	12		10.3		6.2
S*b*W¾W.	11		10.4		3.7
S 38°W.	99		77.7		61.6

		1° 18′
Yesterday's lat by obser.	=	49 9N.
Latitude by account	=	47 51N.
Sum	- -	97 0
Middle latitude	-	48 30

To middle latitude 48½°, and departure 61.6 in a latitude column, the corresponding difference of longitude in a distance column is 93′ - - = 1° 33W.

Yesterday's longitude	6 18W.
Longitude in by account	7 51W.

It is now necessary to find the bearing and distance of the intended port, namely Funchal; but as that place is on the opposite side of the island with respect to the ship, it is therefore more proper to find the bearing of the east or west end of Madeira; the east end is, however, preferable. But as the small island of Porto Sancto lies a little to the NE of the east end of Madeira, it therefore seems more eligible to find the bearing and distance of that island.

To find the bearing and distance of Porto Sancto.

Latitude of ship	47° 51N.	Mer. parts 3278	Longitude of ship	7° 51W.
Lat. of Porto Sancto	32 58N.	Mer. parts 2097	Lon. Porto Sancto	16 25W.
Difference of latitude	14 53=893	M.D. lat 1181	Difference of long.	8 34=514

The course answering to the meridional difference of latitude and difference of longitude is about 23°½, and the distance corresponding to the difference of latitude is 974 miles. Now as Porto Sancto lies to the southward and westward of the ship, the course is therefore S 23°½W ; and the variation, because west being allowed to the right hand, gives SW¼W nearly, the bearing *per* compass; and which is the course that ought to be steered.

A Journal

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ♂ October 8, 1793.
1	2		SW.	NW.	Little wind and cloudy.
2	1			Variable.	
3					Tried the current and found none.
4			Ship's head to the SW.		
5					Calm.
6					
7					Calm; a long ſwell from the SW.
8			Ship's head from SW to SSE.		
9					
10	1		WSW.	S.	
11	1				
12	2				Light airs and hazy.
1	2				
2	2				
3	2				
4	3				Moderate wind and cloudy.
5	3		W.	SbW.	
6	4				Set top-gallant ſails.
7	5				
8	5				
9	5				
10	5		W$\frac{1}{2}$N.	SSW.	
11	5				By double altitudes of the ſun the latitude was
12	5				found to be 47° 28′ N.

Courſe.	Diſt.	D.L.	Dep.	N. Latitude by Acc.	N. Latitude by Obſ.	D. Long.	W. Long. by Acc.	W. Long. by Obſ.	W. Var.	Porto Sancto's Bearing.	Porto Sancto's Diſtance.
S 61° W.	51	25	45	47° 26′	47° 28′	67′ W.	8° 58′		2 points.	S 21° W.	932

The ſeveral courſes corrected will be as under.

Courſes.	Diſt.	Diff. of Latitude N.	Diff. of Latitude S.	Departure E.	Departure W.
SSW.	3		2.8		1.1
SW.	13		9.2		9.2
WSW.	22		8.4		20.3
WbS$\frac{1}{2}$S.	15		4.4		14.4
S 61° W.	51		24.8 = 25		45.0

Yeſterday's latitude	47	51
Latitude by account	47	26
Sum - -		77
Middle latitude - -	47	39

To middle latitude 47°$\frac{2}{3}$, and departure 45′ in a latitude column, the difference of longitude in a diſtance column is 67′ = 1° 7W.

Yeſterday's longitude	7	51W
Longitude in by account	8	58W

To find the bearing and diſtance of Porto Sancto.

Latitude of ſhip	47° 28 N.	Mer. parts	3244	Longitude	8° 58′ W.
Lat. of Porto Sancto	32 58 N.	Mer. parts	2097	Longitude	16 25 W.
Difference of latitude	14 30 = 870	M. D. lat.	1147	D. longitude	7 27 = 447′

Hence the bearing of Porto Sancto is S. 21° W, and diſtance 932 miles. The courſe per compaſs is therefore S. W. nearly.

A Journal

A Journal from England to Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ☿ October 9, 1793.
1	5		W*b*N.	SW*b*S.	Squally with rain.
2	5				Handed top-gallant sails.
3	5	5			In 1st reef topsails.
4	5	4			Dark gloomy weather. Tacked ship.
5	5	6	SE*b*S.		
6	5				In 2d reef top-sails, and down top-gallant yards.
7	4				
8	4				Stormy weather; in fore and mizen topsails and
9	3				3d reef maintop sail. Handed the maintop sail,
10			up SE*b*S. off ESE.		bent the main-stay sail, and brought to with it and
11	}				the mizen; reefed the mainsail, at 10, wore and lay
12	}		upWSW off WNW.		to under the mainsail, got down top-gallant masts;
1	3		W*b*N.		at 12 set the foresail, and balanced the mizen.
2	3	6			
3	3	5	WNW.	SW.	The sea stove in several half ports.
4	3	5			
5	4				The swell abates a little.
6	4		W*b*N.	SW*b*S.	
7	3	2			The swell abates fast.
8	3	4			Up top-gallant-masts.
9	3	4	W.	SSW.	
10	4				Set the topsails.
11	5				
12	5				Clear weather; good observation.

Course.	Dist.	D.L	Dep.	N. Latitude by Acc.	N. Latitude by Obs.	D. Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var.	Porto Sancto's Bearing	Porto Sancto's Distance.
W*b*N$\frac{1}{2}$N.	43	12	41	47° 40	47° 39	61'	9° 59'		2 points.		

There is no leeway allowed until 2 o'clock P. M. when the top-gallant sails are taken in; from 2 to 3 one point is allowed; from 3 to 6, one and a half points are allowed; from 6 to 8 one and three-fourth points are allowed: from 8 to 9, three points; from nine to 10 four and an half points; from 10 to 12, five points; from 12 to 10 A. M. three and an half points; and from thence to noon two points leeway are allowed. Now the several courses being corrected by variation and leeway will be as under; but as the corrected courses from 2 to 3 P. M. and from 10 to 12 A. M. are the same, namely, west; this, therefore, is inserted in the table, together with the sum of the distances, as a single course and distance. In like manner the courses from 12 to 2, and from 5 to 8 being the same, are inserted as a single course and distance.

Courses.	Dist.	Diff. of Latitude. N.	Diff. of Latitude. S.	Departure. E.	Departure. W.
W*b*S.	10		20.0		9.8
W.	15.5				15.5
W$\frac{1}{2}$N.	5.4	0.5			5.4
E*b*S$\frac{1}{2}$S.	10.6		3.1	10.1	
E*b*S$\frac{1}{4}$S.	8		1.9	7.8	
E.	3			3.0	
NE*b*E.	1	0.6		0.8	
NW*b*W.	2	1.1			1.7
NW*b*W$\frac{1}{2}$W.	17.2	8.1			15.2
NW$\frac{1}{2}$W.	11	7.0			8.5
W*b*N$\frac{1}{2}$N.	7.4	2.1			7.1
		19.4	7.0	21.7	63.2
		7.0			21.7
W*b*N$\frac{1}{2}$N.	43	1 4			41.5

Yest. latitude 47 28 N.

Lat. by account 47 40 N.

To middle latitude 47° 34', and departure 41.5 the difference of longitude is - 61' = 1° 1' W.

Yesterday's longitude - 8 58 W.

Longitude in by acconnt 9 59 W.

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ♃ October 9, 1793.
1	5	3	W.	SSW.	Fresh gales with rain.
2	5	7			
3	6				
4	6				Do. weather.
5	6				Out 3d reef topsails.
6	6				Lost a log and line.
7	5	6			
8	5	4			Do. weather.
9	5	5			
10	5	2			
11	5				
12	5				Do. weather.
1	5	5			
2	5				
3	5				
4	4				Moderate and cloudy, out all reefs.
5	4		WSW.	S	
6	4				Sprung fore top-gallant yard, got up another.
7	4	3			
8	4	4	SW*b*W.	SSE.	Do. weather.
9	4	6			A sail NE.
10	5	3			Employed working up junk.
11	5	4		SE*b*S.	A swell from the NW, which by estimation has
12	5				set ship 7 miles in the opposite direction.

Course.	Dist.	D.L	Dep.	N. Latitude by Acc.	N. Latitude by Obs.	D. Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var.	Porto Sancto's Bearing.	Porto Sancto's Distance.
S 74° W	108	30	104	47° 9′		153′ W.	12° 32′		2 Point.	S 12° W.	870 m.

Two points leeway are allowed on the first course, one on the second; and as the ship is 7 points from the wind on the third course, there is no leeway allowed on it. The opposite point to NW, that from which the swell set, with the variation allowed upon it, is the last course in the Traverse Table.

Courses.	Dist.	Diff. of Latitude. N.	Diff. of Latitude. S.	Departure. E.	Departure. W.
W.	86.2				86.2
SW*b*W.	12.3		6.8		10.2
SW*b*S.	24.7		20.5		13.7
ESE.	7		2.7	6 5	
S 74 W.	108		30.0	6.5	110.1
Yesterday's latitude		47 39			6.5
Latitude by account		47 9			103.6
Sum		48			
Middle latitude		47 24			

To middle latitude 47 24, and departure 103.6, the difference of longitude is 153′ = 2° 33 W.
Yesterday's longitude - 9 59 W.
Longitude in - 12 32 W.

To find the bearing and distance of Porto Sancto.

Latitude of ship	-	47° 9′ Mer. parts	-	3216	Longitude	-	12° 32′ W.
Lat. Porto Sancto	-	32 58 Mer. parts	-	2097	Longitude	-	16 25 W.
Difference of latitude		14 11=851′ M. D. lat.		1119	D longitude	-	3 53=233.

Hence the bearing of Porto Sancto is S 12° W. and distance 870 miles; the course *per* compass is therefore about SW*b*W.

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A Journal

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ♀ October 11, 1793.
1	4		SW*b*S.	ESE.	Moderate wind and fair weather.
2	3				Shortened sail and set up the topmast rigging.
3	2				
4	3				Do. weather.
5	4				Variation *per* amplitude 21° W.
6	4	6			
7	4	4			
8	4	5			A fine steady breeze.
9	5			E.	By an observation of the moon's distance from
10	5				α Pegasi, the ship's longitude at half past 8 was
11	5				12° 28′ W.
12	5	2			Clear weather.
1	5	7			
2	6				
3	6			ENE.	
4	6				Do weather.
5	6	2			
6	6				
7	6	3			
8	6				Set studding sails, &c.
9	7				
10	7				One sail in sight.
11	8				
12	8				Do. weather, good observation.

Course.	Dist.	D.L.	Dep.	N. Latitude by Acc.	N. Latitude by Obs.	D. Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var. Obs.	Porto Sancto's Bearing.	Porto Sancto's Distance.
S 12° 45′ W.	128	125	28	45° 4′	44° 59′	41′ W.	13° 13′	12° 59′	21°	S 12° W.	737 m.

The observed variation S 21° being allowed to the left of SW*b*S. gives 12° 45′ W, the corrected course and the distance summed up is 127.9, or 128 miles. Hence the difference of latitude is 124.8, and the departure 28.2. The latitude by account is therefore 45° 4′ N, and the middle latitude 46° 6′, to which, and the departure 28.2: in a latitude column, the difference of longitude in a distance column is 41′ W; which being added to 12° 32′ W, the yesterday's longitude, gives 13° 13′ W, the longitude in by account. But the longitude by observation was 12° 28′ W. at half past 8 P. M.; since that time the ship has run 96 miles; hence the departure in that interval is 21.2 m. Now half the difference of latitude 47 m. added to 44° 59′, the latitude by observation at noon, the sum 45° 46′ is the middle latitude; with which and the departure 21.2, the difference of longitude is found to be 31′ W; which therefore added to 12° 28′, the longitude observed, the sun is 12° 59′ W, the longitude by observation reduced to noon.

To find the bearing and distance of Porto Sancto.

Latitude ship	44° 59′ N.	Mer. parts	3028	Longitude	12° 59′ W.
Lat. of Porto Sancto	32 58 N.	Mer. parts	2097	Longitude	16 25 W.
Difference latitude	12 1 = 721	M. D. lat.	931	D. longitude	3. 26 = 206′

Hence the bearing of Porto Sancto is S. 12° W, and distance 737 miles. The course to be steered is therefore S 33° W, or SW*b*W. nearly.

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ♄ October 12, 1793.
1	8		SW*b*S.	E*b*N.	Fresh gales, and cloudy.
2	7	5			
3	8				
4	8	6			Do. weather.
5	8	4			
6	8				Hauled down studding-sails.
7	7	5			
8	7	3			Do. weather.
9	7	4			
10	7	2			
11	7	6			
12	7	5		ENE.	A steady gale and fine weather.
1	7				
2	7	5			
3	7				
4	7	3			Do. weather.
5	7	2			
6	7				
7	7	4			Out studding sails alow and aloft.
8	8				Variation *per* azimuth 20° 14' W.
9	8				A sail in the SW. quarter.
10	8				
11	7	6			Sailmaker altering a lower studding-sail.
12	8				Fine weather, and cloudy.

Course.	Dist.	D.L	Dep.	N. Latitude by Acc.	N. Latitude by Obs.	D. Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var. Obs.	Porto Sancto's Bearing.	Porto Sancto's Distance.
S 13° 31' W.	183	178	43	42° 1'		59' W.	14° 12'	13° 58'	20° 14'	S 12° W.	555 m.

The course corrected by variation is S 13° 31' W, and the distance run is 113 miles: hence the difference of latitude is 177.9, and the departure 42.8.

Yesterday's latitude by observation -	44° 59' N.	Mer. parts - - -	3028
Difference of latitude - - -	2 58 S.		
Latitude in by account - -	42 1 N.	Mer. parts - -	2783
Meridional difference of latitude - - - -			245

Now to course 13°½, and meridional difference of latitude 245 in a latitude column, the difference of longitude in a departure column is 59' W: hence the yesterday's longitudes by account and observation, reduced to the noon of this day, will be 14° 12' W. and 13° 58' respectively.

To find the bearing and distance of Porto Sancto.

Latitude ship -	42° 1' N.	Mer. parts -	2783	Longitude -	13° 58' W.
Lat. Porto Sancto	32 58 N.	Mer. parts -	2097	Longitude -	16 25 W.
Difference of latitude	9 3=543'	M. D. latitude -	686	D. longitude	2 27=147.

The meridional difference of latitude and difference of longitude will be found to agree nearest under 12°, the correct bearing of Porto Sancto; and the variation being allowed to the right hand of S. 12° W, gives S32¼W, the bearing *per* compass; and the distance answering to the difference of latitude 543, under 12 degrees, is 555 miles.

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn	Fa.	Courses.	Winds.	Remarks, ☉ October 13, 1793.
1	8		SW*b*S.	ENE.	A steady gale, and fine weather.
2	8	5			
3	8	6			At 34 minutes past three, the distance between the
4	8				nearest limbs of the sun and moon, together with
5	8				the altitude of each, were observed; from whence
6	8	4			the ship's longitude at that time is 14° 1' W.
7	8				
8	7	5			Hauled in the lower studding-sails.
9	7				At 9h 22', by an observation of the moon's distance
10	7				from α Pegasi, the longitude was 14° 20' W.
11	7				
12	7				Fresh gales, and clear.
1	7				
2	8			ESE.	
3	7				
4	7				Do. weather.
5	7				
6	7				
7	8				Variation *per* amplitude 19° 51' W.
8	8				Do. *per* azimuth 19° 28' W. Set studding-sails.
9	8	4			
10	8	2			Carried away a fore-top-mast studding sail boom,
11	8				got up another.
12	7	4			Fresh gales. Took in studding-sails.

Course.	Dist.	D.L.	Dep.	N. Latitude by Acc.	N. Latitude by Obs.	D. Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var. by obs.	Porto Sancto's Bearing.	Porto Sancto's Distance.
S*b*W¼W.	184	178	45	39° 3'		59'W.	15° 11'	14° 52'	1¾ pts.		

The mean of the variations is about 1¾ points W: hence the course corrected is S*b*W¼W; with which and the distance run 184 miles, the difference of latitude is 178.5, and the departure 44.7.

Yesterday's latitude - -	42° 1' N.	Mer. parts - -	2783
Difference of latitude - -	2 58 S.		
Latitude in by account -	39 3 N.	Mer. parts - -	2549
Meridional difference of latitude - - - - - -			234

Now, to course 1¼ points, and meridional difference of latitude is 234, the difference of longitude is about 59 m.: which, added to the yesterday's longitude by account 14° 12' W, the sum 15° 11' W. is the longitude in by account at noon. The longitudes by observation are reduced to noon as follow:

The distance run between noon and 3h 34' P. M. is 29 miles; to which, and the course 1¼ points, the difference of latitude is - - 28'

Yesterday's latitude at noon - -	42 1 N.		
Latitude at time of observation -	41 33 N.	Mer. parts - -	2746
Latitude at noon - -	39 3 N.	Mer. parts - -	2549
Meridional difference of latitude - - - - - -			197

Then, to course 1¼ points, and meridional difference of latitude 197 in a latitude column, the difference of longitude in a departure column is 49' W; which added to 14° 1' W, the longitude by observation, the sum 14° 50' W. is the longitude reduced to noon.

Again, the distance run between the preceding noon and 9h 22' P. M. is 75 miles: hence the corresponding difference of latitude is 72.8, or 73 miles; the ship's latitude at that time is therefore 40° 48' N.

Latitude at time of observation -	40° 48' N.	Mer. parts - - -	2686
Latitude at noon - -	39 3 N.	Mer. parts - - -	2549
Meridional difference of latitude - - - - - -			137

Now with the corrected course, and meridional difference of latitude the difference of longitude is 34' W; which added to 14° 20' W, the sum is 14° 54' W, the reduced longitude. The mean of which and the former reduced longitude is 14° 52' W, the correct longitude.

A Journal

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ☽ October 14, 1793.
1	8		SWbS.	EbS.	Fresh gales and hazy, single reefed top-sails.
2	7	5			
3	7	5			Got down top-gallant yards.
4	7				Do. weather, and a confused swell running.
5	7	4	SSW.		
6	7	1			
7	7				
8	6	5			More moderate.
9	6			Variable.	
10	5				
11	5				
12	4				Do. with lightning all round the compass.
1	3				
2	3				
3	3	5	SWbS.	SEbS.	
4	4				Squally with rain.
5	5				
6	4				
7	2	5			
8	2		SW.	SSE.	Moderate weather; out reefs, and up top-gallant-
9	3				yards.
10	3	5			
11	4	5	WSW.	S.	At 11h 10' A. M. the latitude from double altitudes
12	5				of the sun was 37° 10'. Clear weather.

Course.	Dist.	D.L	Dep.	N. Latitude by Acc.	N. Latitude by Obs.	D. Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var. obs.	Porto Sancto's Bearing	Porto Sancto's Distance.
S 16° W.	116	111	32	37° 12'	37° 8'	41' W.	15° 52'	15° 33'	$1\frac{3}{4}$ points.	S 10° W.	254 m.

As the ship is close hauled from 2 o'clock A. M. $1\frac{1}{4}$ points leeway are allowed upon that course, and 1 point on the two following courses.

Courses.	Dist.	Diff. of Latitude N.	Diff. of Latitude S.	Departure. E.	Departure. W.
SbW$\frac{1}{4}$W.	30		29.1		7.3
S$\frac{1}{4}$W.	54		53.9		2.7
SSW$\frac{1}{2}$W.	19		16.8		9.0
SW$\frac{3}{4}$S.	8.5		6.8		5.1
SWbW$\frac{1}{4}$W.	9.5		4.9		8.1
S 16° W.	116		111.5=1° 51'		32.2

Yesterday's latitude 39 3 } M. lat. 38° 7'
Latitude in by account 37 12 }

To middle latitude 38°, and departure 32.2 in a latitude column, the difference of longitude in a distance column, is 41'

	by account		by obs.
Yesterday's long. by account	15° 11' W.	by obs.	14° 52' W.
Difference of longitude	41 W.		41 W.
Longitude in	15 22		15 33 W.

The latitude by observation at 11h 10' A. M. is 37° 10', and from that time till noon the ship has run about 4 miles. Hence the corresponding difference of latitude is 2 miles, which subtracted from the latitude observed, gives 37° 8', the latitude reduced to noon.

To find the bearing and distance of Porto Sancto.

Latitude of ship	37° 8' N.	Mer. parts	2403	Longitude	15° 33' W.
Lat. of Porto Sancto	32 58 N.	Mer. parts	2097	Longitude	16 25 W.
Difference of latitude	4 10=250	M. D. Lat.	306	Diff. Long.	52

Hence the bearing of Porto Sancto is S 10° W, or SSW$\frac{1}{4}$W. nearly, *per* compass, and the distance is 254 miles.

A Journal

A Journal from England towards Madeira.

Ship's Journal.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ♂ October 15, 1793.
1	4		W*b*S.	S*b*W.	Moderate and clear weather.
2	4				
3	3	6			Employed working points and rope-bands.
4	3				Do. weather.
5	3	4			
6	3		W*b*N.	SW*b*S.	
7	3				
8	3	2			Fine clear weather.
9	4				
10	4				
11	3	5			
12	3	3		Variable.	Do. weather.
1	3				
2	4		W.		
3	3				
4	2		WNW.		
5	2	4	NW*b*W.	SW*b*W.	
6	3				
7	3				Variation per mean of ſeveral azimuths 18° 0′ W.
8	3	6			Do. weather. Tacked ſhip.
9	4		S*b*E.		
10	5				Sailmakers making wind-ſails.
11	5	4			
12	5	6			A fine ſteady breeze. Cloudy.

Courſe.	Diſt.	D.L	Dep.	N. Latitude by Acc.	N. Latitude by Obſ.	D. Long.	W. Long. by Acc.	W. Long. by Obſ.	W. Var. Obſ.	Porto Sancto's Bearing.	Porto Sancto's Diſtance.
S 68° W.	56	21	52	36° 47′		65′ W.	16° 57′	16° 38′	18°	S¼E.	229 m.

Half a point of leeway is allowed on each courſe; but as the variation is expreſſed in degrees, it will be more convenient and accurate to reduce the ſeveral courſes into one, leeway only being allowed upon them. The courſe thus found is then to be corrected for variation, with which and the diſtance made good the difference of latitude and departure are to be found.

Courſes.	Diſt.	Diff. of Latitude. N.	Diff. of Latitude. S.	Departure. E.	Departure. W.
W½S.	18		1.8		17.9
W*b*N½N.	27	7.8			25.8
W½N,	7	0.7			7.0
NW*b*W½W.	2	0.9			1.8
NW½W.	12	7.6			9.3
S*b*E½E.	20		19.1	5.8	
		17.0	20.9	5.8	61.8
			17.0		5.8
S 86°W	56		3.9		56.0

Var. 18 W

Tr.cou. S68 W to which and the diſtance of 56 m. the difference of latitude is 21 m. and the departure 51.9 m. Hence the latitude in at noon is 36° 47′ W, and middle latitude 36° 58′, to which and the departure 51.9 in a latitude column, the difference of longitude in a diſtance column is 65° W.

	By acc.	By obſ.
Yeſterday's long.	15° 52′ W.	15° 33′ W.
Difference of longitude	1 5 W.	1 5 W.
Longitude in	16 57	16 38 W.

To find the bearing and diſtance of Porto Sancto.

Latitude ſhip	-	36° 47′ N.	Mer. parts	-	2376	Longitude -	16° 38′ W.
Lat. Porto Sancto		32 58 N.	Mer. parts	-	2097	Longitude -	16 25 W.
Difference of latitude		3 49=229′	M. D. latitude	-	279	D. longitude	0 13

Hence the courſe is S¼E, diſtance 229 miles; and the courſe *per* compaſs is S*b*W½W. nearly.

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ☿ October 16, 1793.
1	6		S*b*E.	SW*b*W.	Fresh gales.
2	6	4			
3	7		S	W.	
4	7				Do. and cloudy.
5	7				
6	7	4			
7	7	6			
8	7				A steady fresh gale.
9	8		S*b*W.	NW.	
10	8				
11	8				
12	8				Do. weather.
1	8				
2	8				
3	8				
4	9				Do. weather.
5	9		S*b*W½W.		
6	9			N.	
7	9				Variation *per* amplitude 1½ points W.
8	8	5			
9	9				People employed occasionally.
10	9			NE*b*E.	
11	7				
12	8				Do. weather. Observed sun's meridian altitude.

Course.	Dist.	D.L	Dep.	N. Latitude by Acc.	N. Latitude by Obs.	D. Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var. obs.	Porto Sancto's Bearing	Porto Sancto's Distance.
S 8° E.	186	1° 5′	26	33° 42′	33° 46′	31′ E.	16° 26′	16° 7′	1½ points.	S 17° W.	50 m.

Half a point of leeway is allowed on the first course; which and the others, are corrected for variation as usual.

Courses.	Dist.	Diff. of Latitude. N.	Diff. of Latitude. S.	Departure. E.	Departure. W.
SE*b*S.	12.4		10.3	6.9	
S*b*E½E.	43.		41.2	12.5	
S½E.	65.		64.7	6.4	
S.	68.5		68.5		
S 8° E.	186		184.7	25.8	

	3° 5′	
Yesterday's latitude	36 47 N.	
Latitude by account	33 42 N.	
Sum	70 29	
Middle latitude	35 15	

To middle latitude and departure the difference of longitude in a distance column is 31′ E.

Yesterday's longitude by acc.	16 57′ W.	by obs.	16 38′ W.
Difference of longitude -	0 31 E.	-	31 E.
Longitude in -	16 26 W.	-	16 7 W.

To find the bearing and distance of Porto Sancto.

Latitude ship	33° 46′ N.	Mer. parts	2155	Longitude	16° 7′ W.
Lat. of Porto Sancto	32 58 N.	Mer. parts	2097	Longitude	16 25 W.
Difference of latitude	48	Mer. Diff. lat.	58	Diff. long.	0 18

Hence the bearing of Porto Sancto is S. 17° W. and distance 50 miles.

A Journal

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ♃ October 17, 1793.
1	5		SSW.	NE*b*E.	Moderate wind and clear.
2	5				Saw the island of Porto Sancto, SW*b*S.
3	5		S.		Hanled up to round the east end of Porto Sancto.
4	5				Bent the cables.
5	5				
6	6				
7	6				
8	7				Squally weather.
9	8		SW*b*S.		Porto Sancto W*b*S.
10	7				
11	7		SW*b*W.		
12	6				Do. with rain. Porto Sancto NE.
1	6		SW.		The Deserters SW*b*S.
2	5				
3	6				
4	7				The Deserters WSW. 3 or 4 leagues.
5	6				
6			Various.		Hauled up round the east end of the Deserters.
7					
8			NNW.		Violent squalls; clewed up all at times.
9			NW*b*N.		
10					Running into Funchal Roads.
11					
12					Anchored in Funchal Road, with the best bower in 30 fathom black sand and mud. Brazen head E*b*S$\frac{1}{2}$S, Loo Rock NW, the Great Church NNE, and the southernmost Deserter SE$\frac{1}{2}$S; off shore two-thirds of a mile. Saluted the fort with 13 guns; returned by ditto. Found here his majesty's ship Venus, and 7 English merchant ships.

This journal is performed by inspection agreeable to the precepts given. Other methods might have been used for the same purpose; for which the two instruments already described and explained seem well adapted. We cannot, however, omit recommending the sliding gunter, which will be found very expeditious, not only in performing a day's work, but also in resolving most other nautical problems. See *Sliding-Gunter*.

It will be found very satisfactory to lay down the ship's place on a chart at the noon of each day, and her situation with respect to the place bound to, and the nearest land will be obvious. The bearing and distance of the intended or any other port, and other requisites may be easily found by the chart as already explained; and indeed, every day's work may be performed on the chart; and thus the use of tables superseded.

EXPLANATION of the TABLES.

Table I. *To reduce points of the compass to degrees, and conversely.*

The two first and two last columns of this table contain the several points and quarter-points of the compass; the third column contains the corresponding number of points and quarters; and the fourth, the degrees, &c. answering thereto. The manner of using this table is obvious.

Table II. *The miles and parts of a mile in a degree of longitude at every degree of latitude.*

The first column contains degrees of latitude, and the second the corresponding miles in a degree of longitude; the other columns are a continuation of the first and second. If the given latitude consists of degrees and minutes, a proportional part of the difference between the miles answering to the given and following degrees of latitude is to be subtracted from the miles answering to the given degree.

Example. Required the number of miles in a degree of longitude in latitude 57° 9′?

The difference between the miles answering to the latitudes of 57° and 58° is 0.89.

Then as 60′ : 9′ :: 0.89 : 0.13
Miles answering to 57° 32.68

Miles answering to 57° 9′ 32.55

This Table may be used in parallel and Middle Latitude Sailing.

Table III. *Of the Sun's Semidiameter.*

This table contains the angle subtended by the sun's semidiameter at the earth, for every sixth day of the year. The months and days are contained in the first column, and the semidiameter expressed in minutes and seconds in the second colum. It is useful in correcting

Explanation of the Tables.

ing altitudes of the ſun's limb, and diſtances between the ſun's limb and the moon.

TABLE IV. *Of the Refraction in Altitude.*

THE refraction is neceſſary for correcting altitudes and diſtances obſerved at ſea; it is always to be ſubtracted from the obſerved altitudes, or added to the zenith diſtance. This table is adapted to a mean ſtate of the atmoſphere in Britain, namely to 29.6 inches of the barometer, and 50° of the thermometer. If the height of the mercury in theſe inſtruments be different from the mean, a correction is neceſſary to reduce the tabular to the true refraction. See REFRACTION.

TABLES V. VI. *Of the Dip of the Horizon.*

THE firſt of theſe tables contains the dip anſwering to a free or unobſtructed horizon; and the numbers therein, as well as in the other table, are to be ſubtracted from the obſerved altitude, when the fore-obſervation is uſed; but added, in the back-obſervation.

When the ſun is over the land, and the ſhip nearer it than the viſible horizon when unconfined: in this caſe, the ſun's limb is to be brought in contact with the line of ſeparation of the ſea and land: the diſtance of that place from the ſhip is to be found by eſtimation or otherwiſe; and the dip anſwering thereto, and the height of the eye, is to be taken from Table VI.

TABLE VII. *Of the Correction to be applied to the time of high water at full and change of the moon, to find the time of high water on any other day of the moon.*

THE uſe of this table is fully explained at Section II. Chap. I. Book I. of this article.

TABLES VIII. IX. X. *Of the Sun's declination, &c.*

THE firſt of theſe tables contains the ſun's declination, expreſſed in degrees, minutes, and tenths of a minute, for four ſucceſſive years, namely, 1793, 1794, 1795, and 1796: and by means of Table X. may eaſily be reduced to a future period; obſerving that, after the 28th of Febuary 1800, the declination anſwering to the day preceding that given is to be taken.

EXAMPLE I. Required the ſun's declination May 1. 1799?

May 1. 1799 is four years after the ſame day in 1795,

Sun's declination May 1. 1795	-	15° 9'.1 N
Equation from Table X.	-	+0 0 .6
Sun's declination May 1. 1799	-	15 9 .7 N

EXAMPLE II. Required the ſun's declination Auguſt 20. 1805?

The given year is 12 years after 1793, and the time is after the end of February 1800.

Now, Sun's dec. Auguſt 19. 1793	12°34'.6
Equation from Table X. to 12 years	—0 1 .2
Suns declination Auguſt 20. 1805	12 32 .7

The declination in Table VIII. is adapted to the meridian of Greenwich, and Table IX. is intended to reduce it to any other meridian, and to any given time of the day under that meridian. The titles at the top and bottom of this table direct when the reduction is to be added or ſubtracted.

TABLE XI. *Of the Right Aſcenſions and Declinations of Fixed Stars.*

This table contains the right aſcenſions and declinations of 60 principal fixed ſtars, adapted to the beginning of the year 1793. Columns fourth and ſixth contain the annual variation ariſing from the preceſſion of the equinoxes, and the proper motion of the ſtars; which ſerves to reduce the place of a ſtar to a period a few years after the epoch of the table with ſufficient accuracy. When the place of a ſtar is wanted, after the beginning of 1793, the variation in right aſcenſion is additive; and that in declination is to be applied according to its ſign. The contrary rule is to be uſed when the given time is before 1793.

EXAMPLE. Required the right aſcenſion and declination of Bellatrix, May 1. 1798?

Right aſcenſion January 1. 1793	=	5h 14 3"
Variation = $3''.21 \times 5\frac{1}{3}$ y.	=	+0 0 17
Right aſcenſion, May 1. 1798	=	5 14 20
Declination		6° 8' 53"N
Variation = $4'' \times 5\frac{1}{3}$ y.	=	+0 0 21
Declination May 1. 1798	=	6 9 14 N

The various other tables neceſſary in the practice of navigation are to be found in moſt treatiſes on that ſubject. Thoſe uſed in this article are in Mackay's Treatiſes on the Longitude and Navigation.

TABLE

TABLE I. *To reduce Points of the Compass to Degrees, and conversely.*

North-east Quadrant.	South-east. Quadrant.	Points.		D.	M.	S.	South-west. Quadrant.	North-west. Quadrant.
North.	South.	0	0	0	0	0	South.	North.
N¼E	S¼E	0	¼	2	48	45	S¼W	N¼W
N½E	S½E	0	½	5	37	30	S½W	N½W
N¾E	S¾E	0	¾	8	26	15	S¾W	N¾W
N*b*E	S*b*E	1	0	11	15	0	S*b*W	N*b*W
N*b*E¼E	S*b*E¼E	1	¼	14	3	45	S*b*W¼W	N*b*W¼W
N*b*E½E	S*b*E½E	1	½	16	52	30	S*b*W½W	N*b*W½W
N*b*E¾E	S*b*E¾E	1	¾	19	41	15	S*b*W¾W	N*b*W¾W
NNE	SSE	2	0	22	30	0	SSW	NNW
NNE¼E	SSE¼E	2	¼	25	18	45	SSW¼W	NNW¼W
NNE½E	SSE½E	2	½	28	7	30	SSW½W	NNW½W
NNE¾E	SSE¾E	2	¾	30	56	15	SSW¾W	NNW¾W
NE*b*N	SE*b*S	3	0	33	45	0	SW*b*S	NW*b*N
NE¾N	SE¾S	3	¼	36	33	45	SW¾S	NW¾N
NE½N	SE½S	3	½	39	22	30	SW½S	NW½N
NE¼N	SE¼S	3	¾	42	11	15	SW¼S	NW¼N
NE	SE	4	0	45	0	0	SW	NW
NE¼E	SE¼E	4	¼	47	48	45	SW¼W	NW¼W
NE½E	SE½E	4	½	50	37	30	SW½W	NW½W
NE¾E	SE¾E	4	¾	53	26	15	SW¾W	NW¾W
NE*b*E	SE*b*E	5	0	56	15	0	SW*b*W	NW*b*W
NE*b*E¼E	SE*b*E¼E	5	¼	59	3	45	SW*b*W¼W	NW*b*W¼W
NE*b*E½E	SE*b*E½E	5	½	61	52	30	SW*b*W½W	NW*b*W½W
NE*b*E¾E	SE*b*E¾E	5	¾	64	41	15	SW*b*W¾W	NW*b*W¾W
ENE	ESE	6	0	67	30	0	WSW	WNW
E*b*N¾N	E*b*S¾S	6	¼	70	18	45	W*b*S¾S	W*b*N¾N
E*b*N½N	E*b*S½S	6	½	73	7	30	W*b*S½S	W*b*N½N
E*b*N¼N	E*b*S¼S	6	¾	75	56	15	W*b*S¼S	W*b*N¼N
E*b*N	E*b*S	7	0	78	45	0	W*b*S	W*b*N
E¾N	E¾S	7	¼	81	33	45	W¾S	W¾N
E½N	E½S	7	½	84	22	30	W½S	W½N
E¼N	E¼S	7	¾	87	11	15	W¼S	W¼N
East.	East.	8	0	90	0	0	West.	West.

TAB. II. *The Miles and Parts of a Mile in a Degree of Longitude at every Degree of Latitude.*

D L.	Miles.	D.L.	Miles.	D.L.	Miles.	D.L.	Miles.	D.L.	Miles.	D.L	Miles.
1	59.99	16	57.67	31	51.43	46	41.68	61	29.09	76	14.51
2	59.97	17	57.36	32	50.88	47	40.92	62	28.17	77	13.50
3	59.92	18	57.06	33	50.32	48	40.15	63	27.24	78	12.48
4	59.86	19	56.73	34	49.74	49	39.36	64	26.30	79	11.45
5	59.77	20	56.38	35	49.15	50	38.57	65	25.36	80	10.42
6	59.67	21	56.01	36	48.54	51	37.76	66	24.41	81	9.38
7	59.56	22	55.63	37	47.92	52	36.94	67	23.45	82	8.35
8	59.44	23	55.23	38	47.28	53	36.11	68	22.48	83	7.32
9	59.26	24	54.81	39	46.62	54	35.26	69	21.50	84	6.28
10	59.08	25	54.38	40	45.95	55	34.41	70	20.52	85	5 23
11	58.89	26	53.93	41	45.28	56	33.55	71	19.54	86	4.18
12	58.68	27	53.46	42	44.95	57	32.68	72	18.54	87	3.14
13	58.46	28	52.97	43	43.88	58	31.79	73	17.54	88	2.09
14	58.22	29	52.47	44	43.16	59	30.90	74	16.53	89	1.05
15	57.95	30	51.96	45	42.43	60	30.00	75	15.52	90	0.00

TAB. III. *The Sun's Semidiameter.*

Mon.	Day.	Sun's Semidiam.	
January.	1	16′	19″
	7	16	19
	13	16	19
	19	16	18
	25	16	17
February.	1	16	16
	7	16	15
	13	16	14
	19	16	13
	25	16	12
March.	1	16	10
	7	16	9
	13	16	7
	19	16	6
	25	16	4
April.	1	16	2
	7	16	1
	13	15	59
	19	15	57
	25	15	56
May.	1	15	54
	7	15	53
	13	15	52
	19	15	51
	25	15	50
June.	1	15	49
	7	15	48
	13	15	47
	19	15	47
	25	15	47
July.	1	15	47
	7	15	47
	13	15	47
	19	15	48
	25	15	48
August.	1	15	49
	7	15	50
	13	15	51
	19	15	52
	25	15	53
September.	1	15	55
	7	15	56
	13	15	58
	19	15	59
	25	16	1
October.	1	16	3
	7	16	4
	13	16	6
	19	16	8
	25	16	9
November.	1	16	11
	7	16	13
	13	16	14
	19	16	15
	25	16	16
December.	1	16	17
	7	16	18
	13	16	18
	19	16	19
	25	16	19

TABLE IV.
Refraction in Altitude.

App. Alt. D. M.	Refrac. M. S.	App. Alt. D. M.	Refrac. M. S.	App. Alt. D.	Refrac. M. S.
0 0	33 0	6 30	7 51	30	1 38
0 5	32 10	6 40	7 40	31	1 35
0 10	31 22	6 50	7 30	32	1 31
0 15	30 35	7 0	7 20	33	1 28
0 20	29 50	7 10	7 11	34	1 24
0 25	29 6	7 20	7 2	35	1 21
0 30	28 22	7 30	6 53	36	1 18
0 35	27 41	7 40	6 45	37	1 16
0 40	27 0	7 50	6 37	38	1 13
0 45	26 20	8 0	6 29	39	1 10
0 50	25 42	8 10	6 22	40	1 8
0 55	25 5	8 20	6 15	41	1 5
1 0	24 49	8 30	6 8	42	1 3
1 5	23 54	8 40	6 1	43	1 1
1 10	23 20	8 50	5 55	44	0 59
1 15	22 47	9 0	5 48	45	0 57
1 20	22 15	9 10	5 42	46	0 55
1 25	21 44	9 20	5 36	47	0 53
1 30	21 15	9 30	5 31	48	0 51
1 35	20 46	9 40	5 25	49	0 49
1 40	20 18	9 50	5 20	50	0 48
1 45	19 51	10 0	5 15	51	0 46
1 50	19 25	10 15	5 7	52	0 44
1 55	19 0	10 30	5 0	53	0 43
2 0	18 35	10 45	4 53	54	0 41
2 5	18 11	11 0	4 47	55	0 40
2 10	17 48	11 15	4 40	56	0 38
2 15	17 26	11 30	4 34	57	0 37
2 20	17 4	11 45	4 29	58	0 35
2 25	16 44	12 0	4 2[illegible]	59	0 34
2 30	16 24	12 20	4 16	60	0 33
2 35	16 4	12 40	4 9	61	0 32
2 40	15 45	13 0	4 3	62	0 30
2 45	15 27	13 20	3 57	63	0 29
2 50	15 9	13 40	3 51	64	0 28
2 55	14 52	14 0	3 45	65	0 26
3 0	14 36	14 20	3 40	66	0 25
3 5	14 20	14 40	3 35	67	0 24
3 10	14 4	15 0	3 30	68	0 23
3 15	13 49	15 30	3 24	69	0 22
3 20	13 34	16 0	3 17	70	0 21
3 25	13 20	16 30	3 10	71	0 19
3 30	13 6	17 0	3 4	72	0 18
3 40	12 40	17 30	2 59	73	0 17
3 50	12 15	18 0	2 54	74	0 16
4 0	11 51	18 30	2 49	75	0 15
4 10	11 29	19 0	2 44	76	0 14
4 20	11 8	19 30	2 39	77	0 13
4 30	10 48	0 0	2 35	78	0 12
4 40	10 29	20 30	2 31	79	0 11
4 50	10 11	21 0	2 27	80	0 10
5 0	9 54	21 30	2 24	81	0 9
5 10	9 38	22 0	2 20	82	0 8
5 20	9 23	23 0	2 14	83	0 7
5 30	9 8	24 0	2 7	84	0 6
5 40	8 54	25 0	2 2	85	0 5
5 50	8 41	26 0	1 56	86	0 4
6 0	8 2[illegible]	27 0	1 51	87	0 3
6 10	8 15	28 0	1 47	88	0 2
6 20	8 3	29 0	1 42	89	0 1

TABLE V.
Dip of the Horizon.

Height of eye. Feet.	Dip. of Horizon M. S.	Height of Eye. Feet.	Dip of Horizon M. S.	Height of Eye. Feet.	Dip of Horizon M. S.	Height of Eye. Feet	Dip of Horizon M. S.
1	0 57	11	3 10	21	4 22	35	5 39
2	1 21	12	3 18	22	4 28	40	6 2
3	1 39	13	3 26	23	4 34	45	6 24
4	1 55	14	3 34	24	4 40	50	6 44
5	2 8	15	3 42	25	4 46	55	7 4
6	2 20	16	3 49	26	4 52	60	7 23
7	2 31	17	3 56	27	4 58	70	7 59
8	2 42	18	4 3	28	5 3	80	8 32
9	2 52	19	4 10	29	5 9	90	9 3
10	3 1	20	4 16	30	5 14	100	9 33

TABLE VI.
Dip of the Sea at different distances from the Observer.

Dist. of land in sea miles.	Height of the eye above the sea in feet.							
	5	10	15	20	25	30	35	40
	Dip.	Dip.	Dip.	Dip.	Dip.	Dip.	Dip.	Dip.
	M	M.	M.	M.	M	M.	M.	M.
0 ¼	11	22	34	45	56	68	79	90
0 ½	6	11	17	22	28	34	39	45
0 ¾	4	8	12	15	19	23	27	30
1 0	4	6	9	12	15	17	20	23
1 ¼	3	5	7	9	12	14	16	19
1 ½	3	4	6	8	10	11	14	15
2 0	2	3	5	6	8	10	11	12
2 ½	2	3	5	6	7	8	9	10
3 0	2	3	4	5	6	7	8	8
3 ½	2	3	4	5	6	6	7	7
4 0	2	3	4	4	5	6	7	7
5 0	2	3	4	4	5	5	6	6
6 0	2	3	4	4	5	5	6	6

TABLE VII.

The correction to be applied to the Time of High-water at Full and Change of the Moon, to find the time of High-water on any other day.

Interval of Time.	After New or Full Moon.	Before 1st or 3d Quarter.	After 1st or 3d Quarter.	Before New or Full Moon.
	Additive.	Additive.	Additive.	Subtractive.
D. H.	H. M.	H. M.	H. M.	H. M.
0 0	0 0	5 6	5 6	0 0
0 6	0 8	4 51	5 22	0 9
0 12	0 17	4 37	5 40	0 18
0 18	0 26	4 23	6 0	0 27
1 0	0 36	4 9	6 20	0 37
1 6	0 45	3 56	6 39	0 47
1 12	0 54	3 44	6 58	0 57
1 18	1 2	3 32	7 18	1 7
2 0	1 11	3 21	7 37	1 17
2 6	1 19	3 11	7 56	1 28
2 12	1 28	3 1	8 14	1 39
2 18	1 37	2 50	8 31	1 51
3 0	1 46	2 40	8 47	2 4
3 6	1 54	2 30	9 2	2 16
3 12	2 3	2 21	9 17	2 29
3 18	2 12	2 12	9 31	2 44
4 0	2 21	2 3	9 44	2 58

TABLE VIII. *Sun's Declination for* 1793, *being the first after leap year.*

Days.	January.	February.	March.	April.	May.	June.	July.	Auguſt.	September.	October.	November.	December.
1	22° 57'1S.	16° 52'3S.	7° 17'0S.	4° 49'9N	15° 17'8N	22° 9'6N	23° 5'3N	17° 52'6N	8° 3'0N	3° 27'7S.	14° 41'1S.	21° 56'9S.
2	22 51.5	16 34.8	6 54.1	5 12.9	15 35.6	22 17.3	23 0.8	17 37.2	7 41.0	3 51.0	15 0.1	22 5.7
3	22 45.5	16 17.1	6 31.1	5 35.8	15 53.2	22 24.7	22 56.0	17 21.4	7 18.9	4 14.3	15 18.9	22 14.1
4	22 39.0	15 59.0	6 8.0	5 58.7	16 10.5	22 31.6	22 50.7	17 5.4	6 56.7	4 37.5	15 37.4	22 22.0
5	22 32.1	15 40.7	5 44.8	6 21.4	16 27.5	22 38.1	22 45.0	16 49.1	6 34.4	5 0.7	15 55.6	22 29.5
6	22 24.7	15 22.1	5 21 6	6 44.0	16 44.3	22 44.3	22 38.9	16 32.5	6 11.9	5 23.8	16 13.6	22 36.6
7	22 16.9	15 3.3	4 58.2	7 6.6	17 0.9	22 50.0	22 32.4	16 15.7	5 49.4	5 46.8	16 31.2	22 43.2
8	22 8.6	14 44.2	4 34.8	7 28.9	17 17.1	22 55.4	22 25.6	15 58.5	5 26.8	6 9.7	16 48.7	22 49.4
9	21 59.9	14 24.8	4 11.4	7 51.2	17 33.0	23 0.3	22 18.3	15 41.2	5 4.0	6 32.6	17 5.8	22 55.1
10	21 50.8	14 5.2	3 47.9	8 13.3	17 48.7	23 4.9	22 10.7	15 23.5	4 41.2	6 22.4	17 22.6	23 0.4
11	21 41.3	13 45.4	3 24.3	8 35.3	18 4.0	23 9.0	22 2.7	15 5.7	4 18.3	7 18.0	17 39.1	23 5.2
12	21 31.3	13 25.4	3 0.7	8 57.2	18 19.1	23 12.7	21 54.3	14 47.6	3 55.4	7 40.6	17 55.3	23 9.6
13	21 20.9	13 5.1	2 37.0	9 18.9	18 33.8	23 16.0	21 45.5	14 29.2	3 32.3	8 3.1	18 11.2	23 13.5
14	21 10.8	12 44 6	2 13.4	9 40.4	18 48.2	23 18.9	21 36.3	14 10.7	3 9.2	8 25.4	18 26.8	23 16.9
15	20 58.9	12 23.9	1 49.7	10 1.8	19 2.3	23 21.4	21 26.8	13 51.9	2 46.1	8 47.7	18 42.1	23 19.9
16	20 47.3	12 3.1	1 26.0	10 23.1	19 16.1	23 23.5	21 17.0	13 32.9	2 22.9	9 9.8	18 57.0	23 22 4
17	20 35.4	11 42.0	1 2.3	10 44.1	19 29.6	23 25.2	21 6.7	13 13.6	1 59.6	9 31.7	19 11.6	23 24.4
18	20 23.0	11 20.8	0 38.6	11 5.0	19 42.7	23 26.5	20 56.1	12 54.2	1 36.4	9 53.6	19 25.8	23 26.0
19	20 10.2	10 59.4	0 14.9S.	11 25.7	19 55.5	23 27.3	20 45.2	12 34.6	1 13.0	10 15.3	19 39.7	23 27.0
20	19 57.1	10 37.8	0 8.7N	11 46.2	20 8.0	23 27.7	20 33.9	12 14.7	0 49.7	10 36.8	19 53.2	23 27.7
21	19 43.6	10 16.3	0 32.4	12 6.5	20 20.1	23 27.8	20 22.3	11 54.7	0 26.3	10 58.2	20 6.4	23 27.8
22	19 29.7	9 54.1	0 56.0	12 26.6	20 31.9	23 27.3	20 10.3	11 34.5	0 2.9N	11 19.4	20 19.2	23 27.5
23	19 15.5	9 32.1	1 19.7	12 46.5	20 43.3	23 26.6	19 58.0	11 14.1	0 20.5S.	11 40.4	20 31.6	23 26.7
24	19 0.9	9 9.9	1 43 2	13 6.2	20 54.3	23 25.3	19 45.3	10 53.5	0 43.9	12 1.3	20 43.7	23 25.4
25	18 46.0	8 47.6	2 6.8	13 25.7	21 5.0	23 23.7	19 32.3	10 32.7	1 7.4	12 22.0	20 55.3	23 23.7
26	18 30.7	8 25.1	2 30.2	13 44.9	21 15.4	23 21.7	19 19.0	10 11.8	1 30.8	12 42.5	21 6.6	23 21.5
27	18 15.1	8 2.6	2 53.7	14 4.0	21 25.3	23 19.2	19 5.4	9 50.7	1 54.2	13 2.8	21 17.5	23 18.8
28	17 59.2	7 39.9	3 17.1	14 22.8	21 34.9	23 16.4	18 51 5	9 29.5	2 17.6	13 22.9	21 27.9	23 15.6
29	17 42.9		3 40.4	14 41.3	21 44.2	23 13.1	18 37.2	9 8.1	2 41.0	13 42.8	21 38.0	23 12 0
30	17 26.4		4 3.6	14 59.7	21 58.0	23 9.4	18 22.6	8 46 5	3 4.4	14 2.5	21 47.6	23 7 9
31	17 9.5		4 26.8		22 1.5		18 7.8	8 2[illegible].8		14 29.9		23 3.4

TABLE VIII. *Sun's Declination for* 1794, *being the second after leap year.*

Days.	January	February.	March.	April.	May.	June.	July.	uguſt.	September.	October.	November.	December.
1	22° 58'4S.	16° 56'5S.	7° 22'6S.	4° 44'3N	15° 13'0N	22° 7'7N	23° 6'4N	17° 56'3N	8° 8'2N	3° 22'2S.	14° 36'5S.	21 54'7S.
2	22 52.9	16 39.1	6 59.7	5 7.4	15 31.3	22 15.5	23 2.0	17 40 9	7 46.3	3 45.5	14 55.6	22 3.6
3	22 47.0	16 21.4	6 36.7	5 30.4	15 49.0	22 23.0	22 57.2	17 25.2	7 24.2	4 8.7	15 14.3	22 12.1
4	22 40.6	16 3.4	6 13.6	5 53.2	16 6.4	22 30.0	22 52.0	17 9.2	7 2.1	4 31.9	15 32.9	22 20.1
5	22 33.8	15 45.1	5 50.4	6 16.0	16 23.5	22 36.6	22 46.4	16 53.0	6 39.8	4 55.1	15 51.2	22 27.7
6	22 26.5	15 26.6	5 27.2	6 38.6	16 40.3	22 42.8	22 40.4	16 36.5	6 17.4	5 18.1	16 9.2	22 34.9
7	22 18 8	15 7.8	5 3.8	7 1.2	16 56.9	22 48.7	22 34.0	16 19.7	5 54.9	5 41.2	16 26.9	22 46.6
8	22 10.7	14 48.8	4 40.5	7 23.6	17 13.2	22 54.1	22 27.3	16 2.7	5 32.3	6 4.1	16 44 4	22 47.9
9	22 2.1	14 29.5	4 17.0	7 45.8	17 29.2	22 59.2	22 20.1	15 45.4	5 9.6	6 27.0	17 1.6	22 53.7
10	21 53.1	14 10.0	3 53.5	8 8.0	17 44.9	23 3.8	22 12.6	15 27.9	4 46.8	6 49.7	17 18.4	22 59.1
11	21 43.6	13 50.2	3 30.0	8 30.0	18 0.3	23 8.0	22 4.7	15 10.1	4 24.0	7 12.4	17 35.0	23 4.1
12	21 33.8	13 30.3	3 6.4	8 51.9	18 15.4	23 11.9	21 56.4	14 52.1	4 1.0	7 35.0	17 51.3	23 8.5
13	21 23.5	13 10.1	2 42.8	9 13.6	18 30 2	23 15.3	21 47.7	14 33.8	3 38.0	7 57.5	18 7.3	23 12.5
14	21 12.8	12 49.7	2 19.2	9 35.2	18 44.7	23 18.3	21 38.6	14 15.3	3 15.0	8 19.9	18 23.0	23 16.1
15	21 1.7	12 29.1	1 55.5	9 56.6	18 58.9	23 20.9	21 29.2	13 56.5	2 51.8	8 42.2	18 38.3	23 19.2
16	20 50.2	12 8.2	1 31.8	10 17.8	19 12.8	23 23.1	21 19.4	13 37.6	2 28.6	9 4.3	18 53.3	23 21.8
17	20 38.4	11 47.2	1 8.2	10 38.9	19 26.3	23 24.8	21 9.3	13 18.4	2 5.4	9 26.3	19 8.0	23 23.9
18	20 26.1	11 26.1	0 44.5	10 59.8	19 39.5	23 26.2	20 58.8	12 59.0	1 42 1	9 48.2	19 22.3	23 25.6
19	20 13.4	11 4.7	0 20.8S.	10 20.6	19 52.4	23 27.2	20 47.9	12 39.4	1 18.8	10 9.9	19 36.3	23 26.8
20	20 0.4	10 43.1	0 2.9N	11 41.1	20 4.9	23 27.7	20 36.7	12 19.6	0 55.4	10 31.5	19 50.0	23 27.6
21	19 47.0	10 21.4	0 26.5	12 1.5	20 17.1	23 27.8	20 25.2	11 59.6	0 32.0	10 53.0	20 3.2	23 27.8
22	19 33.2	9 59.6	0 50.2	12 21.6	20 29.0	23 27.5	20 13.2	11 39 4	0 8.6N	11 14.2	20 16.1	23 27.6
23	19 19.0	9 37.5	1 13.8	12 41.6	20 40.5	23 26.8	20 1.0	11 19.0	0 14.8S	11 35.3	20 28.6	23 26.9
24	19 4.5	9 15.4	1 37.4	13 1.4	20 51.6	23 25.7	19 48.4	10 58.5	0 38.3	11 56.3	20 40.8	23 25.1
25	18 49.7	8 53.1	2 1.0	13 20.9	21 2.4	23 24.2	19 35.5	10 37.8	1 1.7	12 17.0	20 52.6	23 24.2
26	18 34.5	8 30.6	2 24.5	13 40.2	21 12.9	23 22.2	19 22.3	10 16.8	1 25.2	12 37.6	21 3.9	23 22.1
27	18 18.9	8 8.1	2 47.9	13 59.3	21 23.0	23 19.9	19 8.7	9 55.8	1 48.6	12 57.9	21 14.9	23 19.5
28	18 3.1	7 45.4	3 11.4	14 18.2	21 32.7	23 17.1	18 54.8	9 34.6	2 12.0	13 18.1	21 25.5	23 16.5
29	17 46.9		3 34.7	14 36.9	21 42.0	23 13.9	18 40.7	9 13.2	2 35.4	13 38.0	21 35.6	23 13.0
30	17 30.4		3 58.0	14 55.2	21 50.9	23 10.4	18 26.2	8 51.7	2 58.8	13 56.8	21 45.4	23 9.0
31	17 13.6		4 21.2		1 59.5		18 11.4	8 30.0		14 17.3		23 4.6

Table VIII. *Sun's Declination for 1795, being the third after leap year.*

Days.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	22°59'7S.	17° 0'7S.	7°28'1S.	4°38'8N	15° 9'1N	22° 5'8N	23° 7'4N	18° 0'0N	8°13'5N	3°16'4S.	14°31'8S.	21°52'4S.
2	22 54.3	16 43.4	7 5.3	5 1.8	15 27.1	22 13.7	23 3.1	17 44.7	7 51.7	3 39.7	14 50.9	21 1.4
3	22 48.5	16 25.8	6 42.3	5 24.8	15 44.8	22 21.2	22 58.5	17 29.1	7 29.6	4 3.0	15 9.7	22 10.0
4	22 42.3	16 7.9	6 19.3	5 47.7	16 2.2	22 28.3	22 53.3	17 13.2	7 7.5	4 26.2	15 28.3	22 18.2
5	22 35.5	15 49.7	5 56.1	6 10.4	16 19.4	22 35.0	22 47.8	16 57.0	6 45.2	4 49.4	15 46.7	22 25.9
6	22 28.4	15 31.3	5 32.9	6 33.1	16 36.3	22 41.4	22 42.0	16 40.6	6 22.9	5 12.5	16 4.8	22 33.2
7	22 20.8	15 12.5	5 9.6	6 55.6	16 52.9	22 47.3	22 35.7	16 23.9	6 0.4	5 35.5	16 22.6	22 40.0
8	22 12.8	14 53.6	4 46.3	7 18.1	17 9.3	22 52.9	22 29.0	16 6.9	5 37.8	5 58.5	16 40.1	22 46.4
9	22 4.3	14 34.4	4 22.8	7 40.4	17 25.3	22 58.0	22 21.9	15 49.7	5 15.1	6 21.4	16 57.4	22 52.4
10	21 55.4	14 14.9	3 59.4	8 2.6	17 41.1	23 2.7	22 14.5	15 32.2	4 52.4	6 44.2	17 14.4	22 57.9
11	21 46.0	13 55.2	3 35.8	8 24.6	17 56.6	23 7.1	22 6.7	15 14.4	4 29.5	7 6.9	17 31.0	23 2.9
12	21 36.3	13 35.3	3 12.3	8 46.5	18 11.8	23 11.0	21 58.4	14 56.4	4 6.6	7 29.6	17 47.4	23 7.5
13	21 26.1	13 15.1	2 48.6	9 8.3	18 26.7	23 14.5	21 49.8	14 38.2	3 43.6	7 52.1	18 3.5	23 11.7
14	21 15.5	12 54.8	2 25.0	9 29.9	18 41.3	23 17.6	21 40.9	14 19.7	3 20.5	8 14.5	18 19.2	23 15.3
15	21 4.5	12 34.2	2 1.3	9 51.4	18 55.6	23 20.3	21 31.5	14 1.0	2 57.4	8 36.8	18 34.7	23 18.5
16	20 53.1	12 13.4	1 37.7	10 12.7	19 9.5	23 22.6	21 21.9	13 42.1	2 34.2	8 59.0	18 49.8	23 21.2
17	20 41.3	11 52.4	1 13.9	10 33.9	19 24.1	23 24.5	21 11.8	13 23.0	2 10.9	9 21.1	19 4.5	23 23.5
18	20 29.2	11 31.3	0 50.2	10 54.8	19 36.4	23 25.9	21 1.3	13 3.6	1 47.6	9 43.0	19 18.9	23 25.3
19	20 16.6	11 9.9	0 26.5	11 15.6	19 49.4	23 27.0	20 50.6	12 44.1	1 24.3	10 4.8	19 33.0	23 26.6
20	20 3.6	10 48.4	0 2.8S.	11 36.2	20 2.0	23 27.6	20 39.4	12 24.3	1 0.9	10 26.4	19 46.7	23 27.5
21	19 50.3	10 26.7	0 20.8N	11 56.7	20 14.3	23 27.9	20 27.9	12 4.4	0 37.6	10 47.8	20 0.1	23 27.9
22	19 36.6	10 4.9	0 44.5	12 16.9	20 26.2	23 27.7	20 16.1	11 44.2	0 14.2N	11 9.1	20 13.1	23 27.8
23	19 22.5	9 42.9	1 8.1	12 36.9	20 37.8	23 27.0	20 4.0	11 23.9	0 9.2S.	11 30.3	20 25.7	23 27.2
24	19 8.1	9 20.7	1 31.8	12 56.7	20 49.1	23 26.0	19 51.5	11 3.4	0 32.7	11 51.2	20 37.9	23 26.2
25	18 53.3	8 58.5	1 55.3	13 16.3	21 0.0	23 24.6	19 38.6	10 42.7	0 56.1	12 12.0	20 49.7	23 24.6
26	18 38.2	8 36.1	2 18.9	13 35.7	21 10.5	23 22.7	19 25.5	10 21.9	1 19.5	12 32.6	21 1.2	23 22.7
27	18 22.8	8 13.5	2 42.3	13 54.8	21 20.6	23 20.5	19 12.0	10 0.9	1 42.9	12 53.0	21 12.2	23 20.2
28	18 7.0	7 50.9	3 5.8	14 13.8	21 30.4	23 17.8	18 58.2	9 39.7	2 6.3	13 13.2	21 22.9	23 17.3
29	17 50.9		3 29.1	14 32.5	21 39.8	23 14.8	18 44.1	9 18.4	2 29.7	13 33.2	21 33.1	23 13.9
30	17 34.5		3 52.4	14 50.9	21 48.9	23 11.3	18 29.7	8 56.9	2 53.1	13 52.9	21 43.0	23 10.1
31	17 17.7		4 15.6		21 57.5		18 15.0	8 35.3		14 12.0		

Table VIII. *Sun's Declination for 1796 being leap year.*

Days.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	23° 1'0S	17° 5'0S.	7°11'0S.	4°56'1N	15°22'7N	22°11'8N	23° 4'2N	17°48'5N	7°57'0N	3°34'1S.	14°46'4S.	21°59'4S.
2	22 55.7	16 47.8	6 48.0	5 19.1	15 40.5	22 19.5	22 59.6	17 32.9	7 35.0	3 57.4	15 5.3	22 8.1
3	22 50.0	16 30.2	6 25.0	5 42.1	15 58.0	22 26.7	22 54.6	17 17.1	7 12.9	4 20.6	15 24.0	22 16.3
4	22 43.9	16 12.4	6 1.9	6 4.9	16 15.2	22 33.5	22 49.2	17 1.0	6 50.6	4 43.8	15 42.4	22 24.2
5	22 37.3	15 54.2	5 38.6	6 27.6	16 32.2	22 39.9	22 43.4	16 44.6	6 28.3	5 7.0	16 0.5	22 31.6
6	22 30.2	15 35.8	5 15.4	6 50.2	16 49.0	22 46.0	22 37.3	16 27.9	6 5.8	5 30.0	16 18.4	22 38.5
7	22 22.7	15 17.2	4 52.0	7 12.7	17 5.4	22 51.6	22 30.7	16 11.0	5 43.2	5 53.0	16 36.0	22 45.0
8	22 14.8	14 58.3	4 28.6	7 35.0	17 21.6	22 56.9	22 23.7	15 53.8	5 20.6	6 16.0	16 53.3	22 51.1
9	22 6.4	14 39.1	4 5.1	7 57.3	17 37.4	23 1.7	22 16.3	15 36.4	4 57.8	6 38.8	17 10.4	22 56.7
10	21 57.6	14 19.7	3 41.5	8 19.4	17 53.0	23 6.1	22 8.6	15 18.7	4 35.0	7 1.5	17 27.1	23 1.8
11	21 48.4	14 0.0	3 18.0	8 41.3	18 8.2	23 10.1	22 0.5	15 0.8	4 12.1	7 24.2	17 43.6	23 6.5
12	21 38.7	13 40.1	2 54.3	9 3.1	18 23.2	23 13.8	21 52.0	14 42.6	3 49.1	7 46.7	17 59.7	23 10.7
13	21 28.7	13 20.0	2 30.7	9 24.8	18 37.9	23 17.0	21 43.1	14 24.2	3 26.1	8 9.1	18 15.5	23 14.5
14	21 18.2	12 59.7	2 7.0	9 46.3	18 52.2	23 19.8	21 33.9	14 5.6	3 3.0	8 31.5	18 31.0	23 17.8
15	21 7.3	12 39.2	1 43.4	10 7.7	19 6.2	23 22.1	21 24.2	13 46.8	2 39.8	8 53.6	18 46.2	23 20.7
16	20 56.0	12 18.5	1 19.7	10 28.8	19 19.9	23 24.1	21 14.3	13 27.7	2 16.6	9 15.7	19 1.0	23 23.0
17	20 44.3	11 57.5	0 56.0	10 49.8	19 33.3	23 25.7	21 3.9	13 8.4	1 53.3	9 37.6	19 15.5	23 24.9
18	20 32.2	11 36.4	0 32.3	11 10.7	19 46.3	23 26.8	20 53.3	12 48.9	1 30.1	9 59.4	19 29.6	23 26.4
19	20 19.7	11 15.2	0 8.6S	11 31.3	19 59.0	23 27.5	20 42.2	12 29.2	1 6.7	10 21.1	19 43.4	23 27.3
20	20 6.9	10 53.7	0 15.1N	11 51.7	20 11.4	23 27.9	20 30.8	12 9.3	0 43.3	10 42.6	19 56.9	23 27.8
21	19 53.6	10 32.1	0 38.7	12 12.0	20 23.4	23 27.8	20 19.1	11 49.3	0 20.0N	11 3.9	20 9.9	23 27.9
22	19 40.0	10 10.3	1 2.4	12 32.0	20 35.1	23 27.3	20 7.0	11 29.0	0 3.4S.	11 25.1	20 22.6	23 27.4
23	19 26.1	9 48.4	1 26.0	12 51.9	20 46.4	23 26.3	19 54.6	11 8.5	0 26.9	11 46.1	20 35.0	23 26.5
24	19 11.7	9 26.3	1 49.5	13 11.5	20 57.4	23 25.0	19 41.9	10 47.9	0 50.3	12 7.0	20 46.9	23 25.1
25	18 57.1	9 4.0	2 13.1	13 30.9	21 8.0	23 23.3	19 28.8	10 27.1	1 13.7	12 27.6	20 58.5	23 23.2
26	18 42.0	8 41.7	2 36.6	13 50.2	21 18.2	23 21.1	19 15.4	10 6.1	1 37.2	12 48.0	21 9.6	23 20.9
27	18 26.7	8 19.2	3 0.0	14 9.1	21 28.5	23 18.6	19 1.7	9 45.0	2 0.6	13 8.3	21 20.4	23 18.1
28	18 11.0	7 56.6	3 23.3	14 27.9	21 37.6	23 15.6	18 47.6	9 23.7	2 24.0	13 28.4	21 30.8	23 14.8
29	17 55.0	7 33.8	3 46.6	14 46.4	21 46.7	23 12.2	18 33.3	9 2.2	2 47.4	13 48.2	21 40.7	23 11.1
30	17 38.6		4 9.9	15 4.7	21 55.5	23 8.4	18 18.6	8 40.6	3 10.8	14 7.8	21 50.3	23 6.8
31	17 22.0		4 33.0		22 3.8		18 3.7	8 18.9		14 27.2		23 2.2

TABLE IX. To reduce the Sun's Declination to any other Meridian, and to any given Time under that Meridian.

Add in W. Sub. in E.	Sub. in W. Add in E.	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°	160°	170°	180°	Add in W. Sub. in E.	Sub. in W. Add in E.
		LONGITUDE.																			
December. 21	December. 21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	June. 21	June. 21
20	22	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	20	22
19	23	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	19	23
18	24	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	18	24
17	25	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.9	17	25
16	26	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.8	0.9	1.0	1.0	1.1	16	26
15	27	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.8	0.9	0.9	1.0	1.1	1.2	1.2	1.3	15	27
14	28	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.9	1.0	1.1	1.2	1.3	1.4	1.4	1.5	14	28
13	29	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	13	29
12	30	0.1	0.2	0.3	0.4	0.5	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.0	12	30
December. 11	31	0.1	0.2	0.4	0.5	0.6	0.7	0.8	1.0	1.1	1.2	1.3	1.5	1.6	1.7	1.8	1.9	2.1	2.2	June. 11	July. 1
10	January. 1	0.1	0.3	0.4	0.5	0.7	0.8	0.9	1.1	1.2	1.3	1.5	1.6	1.7	1.9	2.0	2.1	2.3	2.4	10	2
9	2	0.1	0.3	0.4	0.6	0.7	0.9	1.0	1.2	1.3	1.5	1.6	1.8	1.9	2.0	2.2	2.3	2.5	2.6	9	3
8	3	0.1	0.3	0.5	0.6	0.8	0.9	1.1	1.3	1.4	1.6	1.7	1.9	2.1	2.2	2.4	2.5	2.7	2.8	8	4
7	4	0.2	0.3	0.5	0.7	0.8	1.0	1.2	1.4	1.5	1.7	1.9	2.0	2.2	2.4	2.6	2.7	2.9	3.1	7	5
6	5	0.2	.4	0.5	0.7	0.9	1.1	1.3	1.4	1.6	1.8	2.0	2.2	2.4	2.5	2.7	2.9	3.1	3.3	6	6
5	6	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5	5	7
4	7	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.3	2.5	2.7	2.9	3.1	3.3	3.5	3.7	4	8
3	8	0.2	0.4	0.6	0.9	1.1	1.3	1.5	1.7	1.9	2.2	2.4	2.6	2.8	3.0	3.2	3.5	3.7	3.9	3	9
2	9	0.2	0.4	0.7	0.9	1.1	1.4	1.6	1.8	2.0	2.3	2.5	2.7	3.0	3.2	3.4	3.6	3.9	4.1	2	10
1	January. 10	0.2	0.5	0.7	0.9	1.2	1.4	1.7	1.9	2.1	2.4	2.6	2.9	3.1	3.3	3.6	3.8	4.1	4.3	1	July. 11
November. 30	11	0.2	0.5	0.7	1.0	1.2	1.5	1.7	2.0	2.2	2.5	2.7	3.0	3.2	3.5	3.7	4.0	4.2	4.5	May. 31	12
29	12	0.3	0.5	0.8	1.0	1.3	1.6	1.8	2.1	2.3	2.6	2.9	3.1	3.4	3.6	3.9	4.2	4.4	4.7	30	13
28	13	0.3	0.5	0.8	1.1	1.4	1.6	1.9	2.2	2.4	2.7	3.0	3.3	3.5	3.8	4.1	4.3	4.6	4.9	29	14
27	14	0.3	0.6	0.8	1.1	1.4	1.7	2.0	2.3	2.5	2.8	3.1	3.4	3.7	4.0	4.2	4.5	4.8	5.1	28	15
26	15	0.3	0.6	0.9	1.2	1.5	1.8	2.0	2.3	2.6	2.9	3.2	3.5	3.8	4.1	4.4	4.7	5.0	5.3	27	16
25	16	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	3.9	4.3	4.6	4.9	5.2	5.5	26	17
24	17	0.3	0.6	0.9	1.3	1.6	1.9	2.2	2.5	2.8	3.1	3.5	3.8	4.1	4.4	4.7	5.0	5.3	5.7	25	18
23	18	0.3	0.6	1.0	1.3	1.6	1.9	2.3	2.6	2.9	3.2	3.6	3.9	4.2	4.5	4.9	5.2	5.5	5.8	24	19
22	19	0.3	0.7	1.0	1.3	1.7	2.0	2.3	2.7	3.0	3.3	3.7	4.0	4.3	4.7	5.0	5.4	5.7	6.0	23	20
November. 21	January. 20	0.3	0.7	1.0	1.4	1.7	2.1	2.4	2.8	3.1	3.4	3.8	4.1	4.5	4.8	5.2	5.5	5.9	6.2	May. 22	July. 21
20	21	0.4	0.7	1.1	1.4	1.8	2.1	2.5	2.8	3.2	3.5	3.9	4.3	4.6	5.0	5.3	5.7	6.0	6.4	21	22
19	22	0.4	0.7	1.1	1.5	1.8	2.2	2.5	2.9	3.3	3.6	4.0	4.4	4.7	5.1	5.5	5.8	6.2	6.6	20	23
18	23	0.4	0.7	1.1	1.5	1.9	2.2	2.6	3.0	3.4	3.7	4.1	4.5	4.9	5.2	5.6	6.0	6.4	6.7	19	24
17	24	0.4	0.8	1.1	1.5	1.9	2.3	2.7	3.1	3.4	3.8	4.2	4.6	5.0	5.4	5.7	6.1	6.5	6.9	18	25
16	25	0.4	0.8	1.2	1.6	2.0	2.3	2.7	3.1	3.5	3.9	4.3	4.7	5.1	5.5	5.9	6.3	6.7	7.1	17	26
15	26	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.2	5.6	6.0	6.4	6.8	7.2	16	27
14	27	0.4	0.8	1.2	1.6	2.1	2.5	2.9	3.3	3.7	4.1	4.5	4.9	5.3	5.8	6.2	6.6	7.0	7.4	15	28
13	28	0.4	0.8	1.3	1.7	2.1	2.5	2.9	3.4	3.8	4.2	4.6	5.0	5.5	5.9	6.3	6.7	7.1	7.6	14	29
11	30	0.4	0.9	1.3	1.7	2.2	2.6	3.1	3.5	3.9	4.4	4.8	5.2	5.7	6.1	6.6	7.0	7.4	7.9	12	31
November. 9	February. 1	0.4	0.9	1.4	1.8	2.3	2.7	3.2	3.6	4.1	4.5	5.0	5.4	5.9	6.4	6.8	7.3	7.7	8.2	May. 10	August. 2
7	3	0.5	0.9	1.4	1.9	2.3	2.8	3.3	3.8	4.2	4.7	5.2	5.6	6.1	6.6	7.0	7.5	8.0	8.5	8	4
5	5	0.5	1.0	1.4	1.9	2.4	2.9	3.4	3.9	4.3	4.8	5.3	5.8	6.3	6.8	7.3	7.7	8.2	8.7	6	6
3	7	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	4	8
1	9	0.5	1.0	1.5	2.0	2.5	3.1	3.6	4.1	4.6	5.1	5.6	6.1	6.7	7.2	7.7	8.2	8.7	9.2	2	10
October. 30	11	0.5	1.0	1.6	2.1	2.6	3.1	3.7	4.2	4.7	5.3	5.8	6.3	6.8	7.3	7.9	8.4	8.9	9.5	April. 30	12
28	13	0.5	1.1	1.6	2.1	2.7	3.2	3.8	4.3	4.8	5.4	5.9	6.5	7.0	7.5	8.1	8.6	9.1	9.7	28	14
26	15	0.5	1.1	1.6	2.2	2.7	3.3	3.8	4.4	4.9	5.5	6.0	6.6	7.2	7.7	8.2	8.8	9.3	9.9	26	16
24	17	0.6	1.1	1.7	2.2	2.8	3.4	3.9	4.5	5.0	5.6	6.2	6.7	7.3	7.9	8.4	9.0	9.6	10.1	24	18
21	20	0.6	1.1	1.7	2.3	2.9	3.5	4.0	4.6	5.2	5.8	6.3	6.9	7.5	8.1	8.7	9.2	9.8	10.4	21	21
October. 18	23	0.6	1.2	1.8	2.4	3.0	3.5	4.1	4.7	5.3	5.9	6.5	7.1	7.7	8.3	8.9	9.5	10.0	10.6	April. 18	August. 24
15	26	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.9	8.5	9.1	9.7	10.3	10.9	15	27
12	March. 1	0.6	1.2	1.8	2.5	3.1	3.7	4.3	4.9	5.5	6.2	6.8	7.4	8.0	8.6	9.2	9.8	10.5	11.1	12	30
9	4	0.6	1.2	1.9	2.5	3.1	3.7	4.4	5.0	5.6	6.3	6.9	7.5	8.1	8.8	9.4	10.0	10.6	11.3	9	September. 2
6	7	0.6	1.3	1.9	2.5	3.2	3.8	4.4	5.1	5.7	6.3	7.0	7.6	8.2	8.9	9.5	10.1	10.8	11.4	6	5
3	10	0.6	1.3	1.9	2.6	3.2	3.8	4.5	5.1	5.8	6.4	7.0	7.7	8.3	9.0	9.6	10.3	10.9	11.5	3	8
Septem. 30	13	0.6	1.3	1.9	2.6	3.2	3.9	4.5	5.2	5.8	6.5	7.1	7.7	8.4	9.0	9.7	10.3	11.0	11.6	March. 31	11
27	16	0.7	1.3	1.9	2.6	3.2	3.9	4.5	5.2	5.8	6.5	7.1	7.8	8.4	9.1	9.7	10.4	11.0	11.7	28	14
24	19	0.7	1.3	2.0	2.6	3.2	3.9	4.5	5.2	5.9	6.5	7.2	7.8	8.5	9.1	9.8	10.4	11.1	11.7	25	17
21	22	0.7	1.3	2.0	2 6	3.3	3.9	4.6	5.2	5.9	6.5	7.2	7.8	8.5	9.1	9.8	10.4	11.1	11.7	22	20
Add aft. N. Sub bef. N.	Sub. aft. N. Ad. bef. N.	$0^h\frac{2}{3}$	$1^h\frac{1}{3}$	2^h0	$2^h\frac{2}{3}$	$3^h\frac{1}{3}$	4^h0	$4^h\frac{2}{3}$	$5\frac{1}{3}$	6^h0	$6^h\frac{2}{3}$	$7^h\frac{1}{3}$	8^h0	$8^h\frac{2}{3}$	$9^h\frac{1}{3}$	10^h0	$10^h\frac{2}{3}$	$11^h\frac{1}{3}$	12^h0	Add aft. N. Sub. be. N.	Sub. aft. N. Ad. bef. N.
		Time from Noon.																			

TABLE X. *Change of Sun's declin.*

Mont.	Days.	Complete Years. 4	8	12	16
January.	1	0'—1	0'—3	0'—4	0'—6
	7	0 .2	0 .4	0 .7	0 .9
	13	0 .3	0 .6	0 .9	1 .2
	19	0 .4	0 .7	1 .1	1 .4
	25	0 .4	0 .8	1 .3	1 .7
February.	1	0 .5	1 .0	1 .5	2 .0
	7	0 .5	1 .1	1 .6	2 .2
	13	0 .6	1 .2	1 .7	2 .3
	19	0 .6	1 .2	1 .9	2 .5
	25	0 .7	1 .3	2 .0	2 .6
March.	1	0 .7	1 .3	2 .0	2 .7
	7	0 .7	1 .4	2 .1	2 .7
	13	0 .7	1 .4	2 .1	2 .8
	19	0 .7	1 .4	2 .1	2 .8
	25	0+.7	1+4	2+1	2+.8
April.	1	0 .7	1 .4	2 .1	2 .8
	7	0 .7	1 .4	2 .1	2 .7
	13	0 .7	1 .3	2 .0	2 .6
	19	0 .6	1 .3	1 .9	2 .5
	25	0 .6	1 .2	1 .8	2 .4
May.	1	0 .6	1 .1	1 .7	2 .3
	7	0 .5	1 .0	1 .6	2 .1
	13	0 .5	0 .9	1 .4	1 .9
	19	0 .4	0 .8	1 .2	1 .6
	25	0 .3	0 .7	1 .0	1 .3
June.	1	0 .3	0 .5	0 .8	1 .0
	7	0 .2	0 .4	0 .5	0 .7
	13	0 .1	0 .2	0 .3	0 .4
	19	0 .0	0 .0	0 .1	0 .1
	25	0—.1	0— 1	0— 2	0— 3
July.	1	0 .1	0 .3	0 .4	0 .6
	7	0 .2	0 .4	0 .7	0 .9
	13	0 .3	0 .6	0 .9	1 .2
	19	0 .4	0 .7	1 .1	1 .4
	25	0 .4	0 .9	1 .3	1 .7
August.	1	0 .5	1 .0	1 .5	2 .0
	7	0 .5	1 .1	1 .6	2 .2
	13	0 .6	1 .2	1 .8	2 .4
	19	0 .6	1 .3	1 .9	2 .5
	25	0 .7	1 .3	2 .0	2 .6
September.	1	0 .7	1 .4	2 .0	2 .7
	7	0 .7	1 .4	2 .1	2 .8
	13	0 .7	1 .4	2 .1	2 .8
	19	0 .7	1 .4	2 .1	2 .9
	25	0+7	1+4	2+1	2+8
October.	1	0 .7	1 .4	2 .1	2 .8
	7	0 .7	1 .4	2 .0	2 .7
	13	0 .7	1 .3	2 .0	2 .6
	19	0 .6	1 .3	1 .9	2 .5
	25	0 .6	1 .2	1 .8	2 .4
November.	1	0 .5	1 .1	1 .6	2 .2
	7	0 .5	1 .0	1 .5	2 .0
	13	0 .4	0 .9	1 .3	1 .8
	19	0 .4	0 .8	1 .2	1 .5
	25	0 .3	0 .7	1 .0	1 .3
December.	1	0 .2	0 .5	0 .7	1 .0
	7	0 .2	0 .4	0 .5	0 .7
	13	0 .1	0 .2	0 .3	0 .4
	19	0 .0	0 .0	0 .1	0 .1
	25	0— 1	0— 1	0— 1	0— 2

TABLE XI *The Right Ascensions and Declinations of the principal fixed Stars, adapted to the beginning of the Year* 1793.

Name of Stars.	Mag.	Right Ascen. in Time.			Ann. Var.	Declination.			Ann. Var.
γ Pegasi	2	0h	2'	35"	3'.06	14°	1'	55"N	+20".0
β Ceti	2	0	33	11	3 .01	19	7	32 S	—19 .8
Alrucabah, pole star	2.3	0	50	44	12 .42	88	12	8 N	+19 .6
Mirach	2	0	58	10	3 .31	34	31	13 N	+19 .4
Achernar	1	1	30	0	2 .25	58	17	33 S	—18 .5
Almaach	2	1	51	15	3 .62	41	19	47 N	+17 .7
Menkar	2	2	51	28	3 .11	3	16	17 N	+14 .7
Algol	Var.	2	54	45	3 .85	40	8	47 N	+14 .5
Algenib	2	3	9	38	4 .21	49	6	40 N	+13 .6
Aldebaran	1	4	24	3	3 .42	16	4	48 N	+ 8 .2
Capella	1	5	1	25	4 .41	45	46	15 N	+ 5 .1
Rigel	1	5	4	31	2 .87	8	27	9 S	— 4 .8
β Tauri	2	5	13	13	3 .78	28	25	1 N	+ 4 .1
Bellatrix	2	5	14	3	3 .21	6	8	53 N	+ 4 .0
δ Orionis	2	5	21	27	3 .07	0	27	50 S	— 3 .4
ε Orionis	2	5	25	44	3 .04	1	20	48 S	— 3 .0
ζ Orionis	2	5	30	20	3 .03	2	3	52 S	— 2 .6
α Columbæ	2	5	32	10	2 .17	34	11	34 S	— 2 .4
Betelguese	1	5	43	58	3 .24	7	21	17 N	+ 1 .4
β Canis Majoris	2.3	6	13	37	2 .65	17	51	56 S	+ 1 .2
Canopus	1	6	19	22	1 .33	52	35	16 S	+ 1 .7
Sirius	1	6	36	1	2 .65	16	26	35 S	+ 4 .3
δ Canis Majoris	2	6	59	59	2 .44	26	4	32 S	+ 5 .2
Castor	1.2	7	21	22	3 85	32	19	30 N	— 6 .9
Procyon	1.2	7	28	27	3 .14	5	45	3 N	— 7 .5
Pollux	2.3	7	32	37	3 .69	28	30	42 N	— 7 .9
ζ Navis	2	7	56	19	2 .11	39	25	36 S	+ 9 .7
γ Navis	2	8	3	10	1 .85	46	43	54 S	+10 .3
Acubens	3	8	47	8	3 .30	12	39	6 N	—13 .4
β Navis	1	9	10	54	0 .75	68	52	2 S	+14 .8
Alphard	2	9	17	24	2 .93	7	46	7 S	+15 .2
Regulus	1	9	57	20	3 .20	12	58	21 N	—17 .2
η Navis	2	10	37	4	2 .30	58	36	3 S	+18 .7
β Ursæ Majoris	2	10	49	14	3 .71	57	29	17 N	—19 .1
Dubhe	2.	10	50	49	3 .85	62	52	9 N	—19 .1
β Leonis	2	11	38	29	3 . 6	15	43	47 N	—19 .9
γ Ursæ Majoris	2	11	46	51	3 .22	54	50	47 N	—20 .0
α Crucis	1	12	15	14	3 .24	61	57	6 S	+20 .0
γ Crucis	2	12	19	47	3 .24	55	57	2 S	+20 .0
β Crucis	2	12	35	46	3 .41	58	33	19 S	+19 .8
Aliath	2	12	44	51	2 .67	57	5	14 N	—19 .7
Spica Virginis	1	13	14	18	3 .13	10	4	31 S	+19 .0
ζ Ursæ Majoris	2	13	15	32	2 .43	56	0	41 N	—19 .0
Benetnach	2	13	39	23	2 .40	50	21	7 N	—18 .2
β Centauri	1.2	13	49	23	4 .11	59	21	49 S	+17 .8
Arcturus	1	14	6	13	2 .72	20	15	58 N	—19 .1
α Centauri	1	14	26	1	4 .45	59	58	44 S	+16 .1
Alphacca	2	15	25	55	2 .53	27	25	16 N	—12 .5
β Scorpii	2	15	53	26	3 .47	10	13	29 S	+10 .5
Antares	1	16	16	44	3 .64	25	57	22 S	+ 8 .7
Ras. Algethi	2	17	5	13	2 .73	14	38	18 N	— 4 .8
Ras. Alhague	2	17	25	20	2 .77	12	43	28 N	— 3 .0
Vega	1	18	29	56	2 .02	38	35	51 N	+ 2 .6
Altair	1.2	19	40	41	2 .92	8	19	48 N	+ 8 .5
Deneb	2	20	34	22	2 .03	44	32	51 N	+12 .5
α Gruis	2	21	55	6	3 .85	47	57	8 S	—17 .1
Fomalhaut	1	22	46	10	3 .33	30	42	51 S	—19 .0
Scheat	2	22	53	45	2 .87	26	57	41 N	+19 .2
Markab	2	22	54	27	2 .96	14	5	42 N	+19 .2
α Andromadæ	2	23	57	43	3 .07	27	56	51 N	+20 .0

Inland Navigation.

Navigation of the antients. See Phœnicia and Trade.

Inland Navigation, the method of conveying commodities from one part of a country to another by means of rivers, lakes, canals, or arms of the sea, penetrating far into the internal parts. See the article Canal.

The advantages of this mode of conveyance, in an extensive and populous country, are sufficiently obvious; whether we take into account the superior cheapness, facility, or quickness with which great quantities of goods can thus be carried from one place to another; or the advantages which may accrue to agriculture and other arts, by thus conveying manures, the produce of the ground, or heavy manufactured goods, to and from distant quarters; which would be altogether, impracticable by a land-carriage, without incurring a much greater expence than commodities could bear. The good effects of inland navigation are particularly evident in the vast empire of China, and in the states of Holland. In both these countries, the multitude of canals undoubtedly contributes to the opulence of the inhabitants, both by the more free scope they give to trade, and the advantages derived from them to agriculture; not to mention, that by means of the canals themselves the ground is often meliorated and made capable of producing both corn and pasture, where otherwise it would perhaps yield neither, or at least very imperfectly. These countries, however, particularly Holland, are very flat, and thus very much fitted for this kind of navigation: Great Britain and Ireland are less so, on account of the greater inequality of their surface; though in them also the making of canals is now become very common, notwithstanding the immense expence with which such undertakings are attended.

In a late treatise upon this subject by Mr Edmund Leach surveyor, the author considers the advantages which might accrue to the kingdoms of Britain and Ireland, were their Inland navigation improved as much as it might be; and he considers both countries as exceedingly proper for improvements of this kind on account of the number of fine streams of water they contain. "Every county (says he) in each kingdom is furnished with rivers and streams of water; very few, if any, of which but may be made navigable to within a mile or two of their sources," by the method he proposes.

The method of making canals hitherto practised, is so fully described under the article Canal, that nothing needs be said upon it in this place. Mr Leach observes, that all the artificial inland navigations made in this, as well as in other kingdoms, have been done by beginning them at the foot or mouth of a river, or at the utmost extent of the ebb or flow of the tide; proceeding thence upwards, either in the ordinary course of the river by sinking, widening, and cleansing it; then with the assistance of a lock and dam to raise the boats or other vessels to a higher level. This is next to be cut, widened, and cleansed as before, till we come to a third level, when the vessels are to be raised as in the former; proceeding thus, as it were step by step, till we arrive at the extent of the intended navigation. Otherwise the navigation is carried by an artificial side-cut or canal near the course of the river, raised up by locks and dams as before. These methods, however, tho' probably of very great service to the country, are attended with many and considerable inconveniences.

1. Every river or other stream is the natural receptacle of all the springs, rains, and floods, which discharge themselves into it; by which means it sometimes discharges such torrents of water as sweep every thing away before them. This not only interrupts the navigation for a time, but is often attended with the most intolerable expence.

2. The original making of the canal with a number of locks and dams, such as is described under the article Canal, must also be very expensive.

3. Some rivers run very rapidly in particular places; and if the descent of the bed be very great, it will require a number of the locks and dams already mentioned to make such a river navigable, though the navigation should extend but a few miles from the mouth.

4. The passing of the locks is always attended with a considerable difficulty, besides the loss of time and expence.

To obviate all these inconveniences, Mr Leach proposes to begin and carry on his canal in a manner precisely the reverse of that just now described. In his method, the canal is to be begun as near the source of the river as possible; that is, as near as there is a probability of having water in the driest seasons sufficient to fill the canal; of which there can be but little required, as a stream sufficient to turn an ordinary mill must be sufficient to answer all the purposes of such a canal. Thus the navigation may be carried up much higher than in the ordinary canals with dams and locks. If a canal be made properly and the sides and bottom plastered with a cement that may be made of the same earth and clay saved in making the trunk, very little water will be requisite to keep it full. Our author supposes that a stream sufficient to turn an ordinary mill will be sufficient to keep it full, even if the canal should be 20 miles long.

To construct a canal of this kind, we must make choice of a level as near the head of the river as possible; this level must be continued for a considerable way, so that the water may not have the least current, but may absolutely stagnate. Thus the original bed of the river will soon be left at a distance, and the stagnant canal will become higher and higher with respect to it, in proportion to the descent of the ground or rapidity of the river. Having proceeded this way as far as convenient, the vessels must be let down by a machine (to be afterwards described) into the bed of the original river, or from one elevated canal to another much lower; perhaps 10, 15, or 20 fathoms.

By this perfect stagnation of the water in the canals, there will be no danger of washing off the plastering from the sides and bottom, so that the only waste of water will be by evaporation, and what is required for working the machine above mentioned; which, as it is only required at particular times when vessels are to be raised or lowered, must be very trifling, and cannot bear any proportion to the constant supply at the head of the canal.

In order to keep the first level easily, and for a considerable way, it will be necessary to avoid the many valleys which are naturally to be met with near the original river, by the descent of other streams into it.

Hence canals constructed on the plan recommended by our author must run out in serpentine windings a considerable way into the country, which will augment its length greatly beyond that of the original river; and thus a much greater number of people, and larger extent of country, will reap the benefit of it than if it were continued in a straight line. "One inconvenience (says our author) attending the old inland navigations that are carried on in or nigh the original rivers, is their being confined within too small a space of land, and where, for the most part, there is the least occasion either for water to water the land, or for manure to enrich the soil; whereas, by beginning a canal near the head of a river, and by continuing it on one common level, if the river have any thing of a descent, and runs pretty rapid, the original river and its valley is soon left, and the canal is removed up into the side of the hill, where there is generally most occasion for manure and water both; and the further on it is continued, and the more rapid the river runs the further the navigation is removed from the valley and the original course of the river, till it is brought to the place designed for the purpose of transferring the vessels down at once by a machine into the original river, the sea, or into another canal"

Notwithstanding the advantages which attend this new mode of construction, our author acknowledges that there are some cases in which the old method only can be put in practice.

With regard to the size, form and expence of canals of this kind, Mr Leach gives a computation from one which was intended to be made in the county of Cornwall, and which was called the *Tamar* canal. An act of parliament was obtained for this in 1774. A navigable canal was to be made from Bude Haven, in the county of Cornwall on the Bristol Channel, to the navigable part of the river Tamar; the design being to open a communication between the English and Bristol Channels through the counties of Devon and Cornwall. By the act, it was determined that the canal should not exceed 63 feet in breadth, nor should the ground be cut more than 39 inches deep below the surface, excepting in places where docks or basons were to be made, or where cranes or other engines were to be erected for particular purposes. The breadth allowed (73 feet) was to comprehend the water itself, the two towing paths, one on each side, and the fences beyond. The breadth of the canal itself was to be 21 feet at the surface and 12 at bottom; the depth on the under side, 39 inches, as already said, the towing paths 12 feet broad each: and beyond these an hedge or rail at the distance of six feet on each side from the paths. There were to be drains as usual in canals; one on the under side for carrrying off the superfluous water from the canal, the other on the upper side for carrying off the water which might accidentally fall into it in rains, or by springs in the higher grounds. Thus the whole would not exceed the breadth proposed by act of parliament; while the canal itself would be sufficiently large for every necessary purpose Mr Leach computes, that on this canal two boats, carrying 10 tons each, might very easily pass; and he recommends this as the proper size of canals in other parts of the kingdom.

Canals of this kind, our author observes, will, for the most part, be made in the side of an hill or rising ground; whence the greatest part of the earth dug out of it will be thrown upon the under side. Here it will elevate the ground sufficiently to form a towing path, together with an elevated space whereon to plant the hedge or fence. On the higher side, 12 feet of the ground must be cut down to within 18 inches of the surface of the water; and the earth and stones dug out in making this path will make the fence on the outside for keeping off the cattle. As by the act of parliament, however, there is a greater breadth allowed in some places for making docks or basons, our author calculates the whole breadth of the canal at 66 feet; and according to this breadth he makes his computations.

1. The first and principal expence is the digging of the trunk of the canal; but this must vary so much according to the nature of the ground, that no certain estimate of the expence can be made. Sometimes the ground may be soft, and easily cut, sometimes hard and rocky, sometimes marshy and boggy, &c. There must also be a very considerable difference in the expence of cutting the canal, according as the ground on one side of it is more or less elevated. Mr Leach, after making the proper calculations, supposes that in every perch of a canal of the kind under consideration, there must be removed $40\frac{1}{7}$ cubical yards, or 1085 cubical feet, of earth. Agreements with the workmen are commonly made by the cubic yard. It is rare that a cubic yard can be removed for less than 2d. "nor (says our author) will any sort of ground require more than 9d. except in passing through a rock, which will not often happen, unless where, by the situation of the land through which the canal may pass, it should require to be cut more than four feet under the surface, as it may sometimes happen in cutting through a hill or neck of land, whereby the course of the canal may be shortened. According to this estimate, Mr Leach has formed a table of the expence of making canals from 2d. the cubic yard to 9d. The smallest expence of these per mile is L. 107 : 11s : $1\frac{1}{2}$; the greatest L. 483 : 19 : 9. Sometimes, however, the expence may be even greater: so that the mile may cost L. 600, or near it; but this must be accounted an extraordinary expence, and not often to be expected.

In digging the trunk of the canal, care must be taken to preserve all the sand, stones, and gravel, for the purpose of making drains or gutters and the towing paths; also for the making of a wall, the outside face of which is to be 21 feet distant from the edge of the canal. The design of this is to prevent the earth and rubbish from being thrown to too great a distance from the side of the canal; and likewise for the purpose of raising a bank on the lower side about 16 or 18 inches above the surface of the water in the canal, when it is full up to the drains. On the top of this bank the towing path is to be made 12 feet wide on that side of the canal; and if this wall should be raised four feet above the surface of the towing path, it would be a fence to keep the cattle off from that side. In making the towing path on the other side, the surface of the land must be sunk to within 16 or 18 inches of the surface of the water in the canal when full; and the turf, earth, stones,

ſtones, &c. taken from thence in making the towing path on that ſide, will make the other fence of the canal.

2. Drains or gutters muſt be made under the towing paths, on both ſides of the canal. On the upper ſide they muſt be made through the hedge or fence at all convenient places, for admitting ſprings and rivulets, as well as rain water into the canal. On the higher ſide, theſe ſhould be about 132 feet diſtant from one another, excluſive of thoſe for the admiſſion of ſprings. On the lower ſide, it is neceſſary to have drains at the diſtance of 66 feet from each other; which will be 80 drains per mile. Theſe may be conſtructed for 2s. 6d. each, which amounts to L. 10 per mile. On the higher ſide they will coſt about four ſhillings per drain; and at the diſtance of 132 feet betwixt each drain, the expence will be L. 8 per mile.

In making the drains on the lower ſide, great care muſt be taken to have them truly level, and parallel to the horizon; the bottom part of the drain being exactly 39 inches perpendicular above the bottom of the canal; as on the true placing of theſe drains, and the true level of the bottom of the canal, entirely depends the regularity of the deepneſs of the water.

3. The value of the ground through which the canal is to paſs muſt alſo be conſidered. From the obſervations and memorandums which our author took in the year 1774, concerning the ground through which the Tamer canal was to paſs, he concluded that one eighth part of the land through which the tract paſſed was worth 40s. per acre; another eighth, 20s.; a third eighth part, 10s; and all the reſt not worth more than five; and a great deal of it not more than two; the average of the whole being 15s an acre. "Then (ſays he), if the good, indifferent, and bad land be worth on an average, 15s. an acre, and as 30 years value is a capital price for lands, it will at that rate, amount to 22l. 10s. per acre. The ſtipulated breadth of the canal with the towing paths and hedges being, as already ſaid, 66 feet, which is exactly a gunter's chain: then, 10 ſuch chains in length and one in breadth form exactly a ſtatute acre of land; and ten chains in length is a furlong: ſo that every mile of canal will thus take up eight acres of land, which, at 22l. 10s. per acre, amounts to 180l. per mile.

4. Bridges are likewiſe a conſiderable article of expence in the making of canals. Mr leach ſuppoſes that there may be one common road bridge and two ſwivel bridges required per mile; the former may be erected for 60l. and the latter for 30l. each; ſo that the expence of all together will amount to 120l. per mile.

5. As in ſome particular places, on account of ſhort turns, and where docks and baſons and landing places are to be made, a greater wideneſs will be required, our author allows half an acre more land for every furlong on this account; which brings an additional expence of 90l. per mile.

6. It will always be neceſſary to have ſluices for emptying the canal; each of which will coſt 20l. Mr Leach allows a ſluice and ſtop-gate for every mile; and as theſe coſt 20l, each, we have thus a farther expence of 40l. per mile.

7. The wall on the lower ſide aginſt the bank of earth and towing path may be built for three ſhillings per perch; and as every mile contains 320 perches, the expence of the wall will be 48l. per mile.

8. Our author calculates the towing path on the lower ſide at the ſame price: ſo that it alſo makes an addition of 48l. per mile; but as he eſtimates the higher towing path and hedge at 8 s per perch, this will amount to 128 l. per mile.

Thus, according to our author's calculation, the whole expence of making a canal with its neceſſary appendages will amount to L 944 : 13 : $4\frac{2}{7}$ per mile; and by the calculation of another engineer, the particulars of which he alſo enumerates, it would not exceed L. 1032 : 13 : $4\frac{1}{7}$. This our author thinks a moderate expence; but an objection naturally ocurs from the great lengths to which ſuch canals muſt neceſſarily run; a remarkable inſtance of which he gives in the propoſed Tamar canal, where, though the diſtance betwixt Bude Haven and the navigable part of the river Tamer is no more than 28 miles in a ſtraight line, the length of the canal would not have been leſs than 80 miles. This length, however, according to our author, "ought not to be an object of diſcouragement, but on the contrary an inducement and an encourgement to promote the extending of it as much as poſſible into the country, as it will bring a market to every man's door that it draws nigh in its paſſage, and be a means to improve a greater quantity of uncultivated lands; and the navigation will be thereby much more extenſive, and a much larger number of inhabitants will reap the advantages thereof, than if it had been carried on upon the original river."

We have already taken notice, that in the method of conſtructing canals juſt now mentioned, there will at certain intervals be places where the veſſels muſt be raiſed and lowered by means of mechanical powers, inſtead of the dams and locks made uſe of in other canals. Theſe machines are compounded of an inclined plane and wheel in axis. The inclined plane is a parallelogram whoſe length reaches from the end of one canal to the beginning of another, or to the ſea or navigable river, to which the veſſel is next to be conveyed; the breadth ought to be $22\frac{1}{2}$ feet. It may be made of good oak or deal plank, and ſufficiently ſtrong to bear the weight to be laid upon it; and it muſt be very ſtrongly ſupported by beams of oak or other wood. It ought to be divided in the middle by a ledge or rib of 12 inches ſquare, the ſide ribs being nine by 12 inches. The elevation muſt depend upon particular circumſtances. Fig. 1. ſhows the inclined part of the machine; AB being the wooden part juſt deſcribed, placed between the ſide of the hill W and the navigable river F. According to the dimenſions already given, the two paths A and B on which the veſſels move are exactly ten feet wide. G repreſents the canal, brought perhaps from the diſtance of ſeveral miles to the top of the precipice WW. At the end of the canal, and quite acroſs from R to R, muſt be built a very ſtrong wall; in which are two ſluices with flood-gates at K and L, to let out the water occaſionally. Between the head of the plane AB, and the end of the canal G, is a horizontal platform divided into two parts, as is repreſented in the figure by the letters HI. At the end of the canal are ſix rollers

Plate CCCXXIV.

Inland Navigation.

rollers M and N, of uſe in carrying the boats and lighters in and out of the canal. Near the end of the canal, at S and T, are two other ſluices, with their flood-gates, for letting out a quantity of fluid to drive the other part of the machine. O and P repreſent the two ends of the towing paths, one on each ſide of the canal.

Plate CCCXLIV

Fig. 2. ſhows the vehicle by which the lighters are conveyed up and down the inclined plane, by the two paths A and B, fig. 1. AA (fig. 2.) repreſents part of the inclined plane, B the vehicle in the poſition in which it rolls up and down the paths. C is the body of the vehicle, which is made hollow, to contain a quantity of water occaſionally uſed as a counterbalance for its correſponding vehicle. DDD are three rollers between the bottom of the vehicle and the plane, for the purpoſe of rolling the boats up and down. HHH are ſix rollers; four on the horizontal part of the vehicle on which the boat E is to reſt in its paſſage up and down the plane; the other two rollers are in a moveable part, which is faſted to the body of the vehicle with a pair of very ſtrong hinges; and in the paſſage of the vehicle up and down the plane it turns up between the head of the boat and the plane, preventing the former from rubbing againſt the plane. When the vehicle gets up to the top, this moveable part falls down on the platform marked HI, becoming parallel with the horizontal part of the vehicle; after which it ſerves as a launch and paſſage to place the boat upon the rollers MN (fig. 1.) at the end of the canal. This paſſage part of the vehicle, together with the three rollers at the end of the canal, is likewiſe of great uſe in towing a boat out of the canal, in order to place it on the horizontal part. At the bottom of the cavity of the vehicle is a large hole F, with a valve opening inwardly. Through this hole the water enters when the vehicle, ſinks into the navigable river F, for the purpoſe of receiving a boat on the top or horizontal part of the vehicle till it is quite full; and will then ſink entirely under water, while the boat is towed in on the horizontal part. A ſmall rope K is faſtened to the valve, on purpoſe to lift it up, and to keep it ſo while the vehicle and boat are aſcending up the plane out of the canal, that ſo the water may diſcharge itſelf till as much as is neceſſary be got out; or till it becomes an equal balance for the correſponding vehicle and its contents, which are deſcending by the other path. Hence we ſee, that every machine muſt have two of thoſe vehicles furniſhed with rollers as already deſcribed, and ſo conſtructed that one may be as nearly as poſſible a counterbalance to the other. As it is neceſſary that the vehicles ſhould be water tight, the inſides, of them muſt be caulked very tight; and they ſhould be capacious enough to hold as much water as will balance the largeſt boat with its contents. Here it may be obſerved, that every veſſel will be balanced by as many cubic feet of water as it diſplaces by being put into the water when loaded. The quantity may eaſily be known, by obſerving how far the boat ſinks in the water, and calculating the bulk of the part immerſed.

The machine which puts the vehicles in motion, may either be conſtructed with an under ſhot or breaſt-water-wheel; by an over-ſhot water-wheel; or by two walking-wheels, for men to walk in as in cranes, &c.

Fig. 3. ſhows a front view of the under-ſhot water-wheel movement: where A is the end of the axis or cylinder of the cog or ſpur-wheel; the diameter of which axis is four feet, and its length not leſs than 22 feet, as it muſt be extended quite acroſs the canal from one ſide to the other, and placed on the top of very ſtrong ſupporters on each ſide of the canal, about ſeven feet above the ſurface of the water, as the loaded boat is to paſs backwards and forwards under the cylinder, and at a convenient diſtance from the wall RR (fig. 1.) and placed between the two ſluices S and T; on the end of which cylinder is the cog-wheel B (fig. 3.) The wheel B is ſuppoſed to be 20 feet in diameter, having on its edge 120 cogs: and underneath the cog wheel is the breaſt-water one, C, 24 feet in diameter from the tip of one aller-board to the tip of its oppoſite. On the end of the axis of the water-wheel D is a trundle two feet and an half in diameter, with 15 rounds or ſtaves contained therein. This muſt be placed between the two ſluices S and T, to let the water out of the canal; which, falling on the float-boards, will turn the wheel round from the right hand towards the left, when the ſluice on the left hand of the wheel is opened; but the contrary way when that on the right is opened—The water falling upon the boards paſſes along with the wheel in the circular cavity EGF, and is diſcharged at G, whatever way the wheel may turn.

To the axis or cylinder of this machine, which muſt always be horizontal, are fixed two pair of ſtrong ropes; the ends of each pair faſtened to the upper part of the cylinder; it being neceſſary that they ſhould act in contrary directions. Each muſt extend the whole length of the plane, and their ſtrength muſt be proportioned to the weight neceſſary to be ſuſtained. The two vehicles already mentioned are faſtened to the other ends of the ropes; ſo that one pair of the ropes are wound up by the cylinder turning one way, and the other by its turning the contrary way. Thus, when one of the vehicles is at the upper part of the path A, ready to diſcharge its boat and cargo into the upper canal, the other boat will be at the foot of the path B, all under water in the lower canal, and ready for the reception of a boat to be towed in on the horizontal part of it; ſo that as one vehicle rolls up on one ſide of the plane, the other will roll down on the other ſide, and *vice verſa*.

Fig. 1.

Fig. 4. ſhows the movement by means of an over-ſhot water-wheel. It conſiſts of a water-wheel C, and two ſpur or cog-wheels A and B. The water-wheel is 18 feet in diameter, and has two rows of buckets placed contrariwiſe to one another, that it may turn round in contrary directions, according as the one or the other ſluice, S or T, is opened. On its axis F is a trundle of three feet diameter, having 18 rounds or ſtaves which fall into the cogs of the ſecond ſpur-wheel B, cauſing it to turn round in a direction contrary to that of the water-wheel. This ſecond wheel is likewiſe 18 feet in diameter, with a trundle of three feet, having 18 rounds or ſtaves.—The diameter of the upper ſpur-wheel A is alſo 18 feet, but the diameter of its axis is ſix feet. On the edge of the wheel are 108 cogs. Theſe fall in between the ſtaves of the axis of the other ſpur-wheel; and thus the third wheel turns round the ſame way with the water-wheelC. The cylinder of this upper ſpur-wheel

wheel muſt be placed acroſs the canal betwixt the two ſluices, on very ſtrong ſupporters, as explained in the former movement, and the two pair of ropes in the ſame manner.

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The movement of the walking-wheel is ſhown (fig. 5.) A1 and A2 are two wheels for men to walk in, each of them 24 feet in diameter. B1 and B2 are the axes or cylinders of the two wheels, of equal lengths; viz. 11 feet each, and four in diameter.—At one end of each of the two cylinders C1 and C2, is a wheel of the ſame diameter with the cylinder. On the edges of theſe wheels are teeth of an equal number in each wheel; and as the teeth of the wheels mutually fall into each other, the revolutions of both muſt be performed in the ſame time. By this contrivance alſo the cylinders will turn different ways; and the ropes on the two different cylinders will conſtantly one pair be wound up, and the other wound down, by the natural moving of the machine. DDD is the frame that ſupports the whole, which muſt be made very firm and ſecure.

Let us now ſuppoſe, that there is a boat in the upper canal to be brought down, but none to go up for a balance. In this caſe, as one of the vehicles muſt be at the top to receive the boat, the other will be at the bottom to take in water. Let then any of the movements juſt deſcribed be ſet to work, and it is plain, that as the upper vehicle with its boat deſcends, the under vehicle will aſcend with the water; the valve being in the mean time lifted up till a ſufficient quantity of water has flowed out, to make the one nearly a counterbalance to the other; ſo that the veſſel may ſlide down gently and without any violence.

If it happens that a boat is to go up while none is to come down, one of the vehicles being at the foot of the plane under water, and in readineſs to have the boat towed upon its horizontal part, one of the ſluices at K or L is to be opened, and a quantity of water let into the ciſtern of the upper vehicle ſufficient to counterbalance the boat with its contents which is to aſcend. This being done, the machine is ſet to work, the valve of the under vehicle kept open till the water is all diſcharged; and then the boat will roll up to the top of the plane.

From this deſcription of the canal and machinery for raiſing and lowering the veſſels, the reader can be at no loſs to underſtand the principles on which it depends. It would be ſuperfluous to adduce examples, or follow our author through his calculations relative to particular caſes. We ſhall only obſerve, that the difference of time in which veſſels may be raiſed or lowered by the machinery juſt deſcribed, in compariſon with what can be done in the common way by dams and locks, muſt give a very favourable idea of the new method. According to Mr Leach's computations, a boat with its cargo weighing 10 ton might be raiſed by the walking-machine in 12 or 14 minutes, by the underſhot-wheel in 15 minutes, and by the overſhot-wheel in 30 minutes; and that through a ſpace of no leſs than 30 fathoms meaſured on the inclined plane, or 114 feet perpendicular.

NAULUM, a piece of money put into the mouth of a perſon deceaſed among the Romans, to enable him to pay Charon the ferryman for his paſſage. It was to be of the current coin of the reigning emperor: from this money then the time of the perſon's death may be known. The ſum for poor men was a farthing, but the rich in general were very liberal to the old tar Charon, as appears from the number of coins often found in the neighbourhood of Rome on opening the graves of great men. Charon was looked upon as a very moroſe and obſtinate old fellow, who would not carry over any man without his fare; and hence the proverbial uſe of that verſe in Juvenal,

Furor eſt poſt omnia perdere naulum.

A ſimilar cuſtom took place among the Greeks; but the money put into the mouth of the deceaſed was called Δανακη.

NAUMACHIA, in antiquity, a ſhow or ſpectacle among the ancient Romans, repreſenting a ſea fight. Theſe mock ſea-fights are ſuppoſed to have originated at the time of the firſt Punic war, when the Romans firſt inſtructed their men in the knowledge of naval affairs. Afterwards they were intended to entertain the populace, as well as to improve the ſeamen. They were often like other ſhows exhibited at the expence of individuals, to increaſe their popularity.

In theſe ſpectacles they ſometimes ſtrove to excel each other in ſwiftneſs; and ſometimes engaged in a warlike manner. The Naumachiæ of Claudius indeed was a moſt ſavage diverſion. The combatants uſed to deſtroy each other to amuſe a tyrant and a cruel mob. As they paſſed before him, they uſed this melancholy greeting, "*Ave Imperator, morituri te ſalutant.*" The emperor replied, "*Avete vos.*" This they underſtood as an anſwer of kindneſs, and a grant of their lives: but they ſoon diſcovered that it proceeded from wanton cruelty, and barbarous inſenſibility. In the time of the emperor Domitian, ſuch a vaſt number of veſſels engaged as would have nearly formed two regular fleets for a real fight, and the channel of water was equal in magnitude to a natural river. The emperor Heliogabalus is reported to have filled the channel where the veſſels were to ride with wine inſtead of water. Tritons and ſea-monſters were frequently exhibited during the engagement. Suetonius and Dio Caſſius inform us, that at one of theſe ſea-fights of Domitian a violent ſhower fell; the emperor, however, continued till the end of the engagement, often changing his clothes, nor would he ſuffer any one to depart; and as the rain continued for ſeveral hours, many were ſeized with diſtempers, and ſome even died, Suet. cap. 4. Dio, lib. lxvii. Naumachiæ were alſo places fitted up for theſe ſhows, a ſort of circus's or amphitheatres, with ſeats and porticos, &c.: there were ſeveral of them at Rome; three built by Auguſtus, one by Claudius, another by Domitian, and another by Nero; which ſerved for the reverſe of his medals. Claudius uſed the lake Fucinus as a Naumachia.

NAUMBURG, a town of Germany, in the circle of Upper Saxony, capital of the county of Saxe-Naumburg, ſituated on the river Sala, in E. Long. 11. 20. N. Lat. 51. 12.

NAUPACTUS, or NAUPACTUM, (anc. geog.) a city of Ætolia, at the mouth of the Evenus. The word is derived from ναυς and πηγνυμι, becauſe it was there that the Heraclidæ built the firſt ſhip which carried them to Peloponneſus. It firſt belonged to the Locri Ozolæ, and afterwards fell into the hands of the Athenians, who gave it to the Meſſinians, who had been driven from Peloponnesus by the Lacedemonians. It became the property of the Lacedemonians after the battle of Ægospotames, and it was restored to the Locri. Philip of Macedonia afterwards took it, and gave it to the Ætolians; from which circumstance it has generally been called one of the chief cities of their country. E. Long. 22. 20. N. Lat. 38. 0.

There was on the shore a temple of Neptune, and near it a cave filled with offerings, and dedicated to Venus, where widows resorted to request new husbands of the goddess. Pausan. lib. 10. p. 898.

NAUPLIA, (anc. geog.), a maritime city of Peloponnesus. It was the naval station of the Argives. The fountain Canathos was in its neighbourhood.

NAUPLIUS, (fab. hist.), a son of Neptune and Amymone, king of Eubœa. He was the father of the famous Palamedes, who was so unjustly sacrificed to the artifice and resentment of Ulysses by the Greeks at the Trojan war. The death of Palamedes highly enraged Nauplius; and to revenge the injustice of the Grecian princes, he endeavoured to debauch their wives, and ruin their characters. When the Greeks returned from the Trojan war, Nauplius was pleased to see them distressed in a storm on the coasts of Eubœa; and to make their disaster still more universal, he lighted fires on such places as were surrounded with the most dangerous rocks, that the fleet might be shipwrecked upon the coast. This had the desired effect; but Nauplius was so disappointed when he saw Ulysses and Diomedes escape from the general distress, that he threw himself into the sea. According to some mythologists there were two persons of this name, a native of Argos, who went to Colchis with Jason. He was son of Neptune and Amymone.—The other was king of Eubœa, and lived about the time of the Trojan war. He was, as some observe, son of Clytonas, one of the descendants of Nauplius the Argonaut. The Argonaut was remarkable for his knowledge of sea affairs and of astronomy. He built the town of Nauplia, and sold Auge daughter of Aleus to king Teuthras, to screen her from her father's resentment.

NAUPORTUS, or NAUPORTUM, (anc. geog.), a town on a cognominal river, towards its source, in Pannonia Superior. The reason of the name, according to Pliny, is, that the ship Argo, after coming up the Danube, the Save, and the Laubach, was thence carried on mens shoulders over the Alps into the Adriatic. The river Nauportus rises in the Alps, near Longaticum, at the distance of six miles from the town Nauportum; which was a colony of the Taurisci, a people on the confines of Noricum. Now *Upper Laubach* in Carinthia, on the river Laubach. E. Long. 14. 40. N. Lat. 46. 28.

NAUSCOPY, the art of discovering the approach of ships or the neighbourhood of land at a considerable distance. This pretended art was invented by a M. Bottineau, employed in the King and Company's service in the island of France, from the year 1782 to 1784; and the account of it is given by the inventor as follows:

"This knowledge is not derived either from the undulation of the waves, or from the subtilty of sight, nor from any particular sensation; but merely from observation of the *horizon*, which discovers signs indicating the proximity of ships or of land.

"On the *approximation* of a ship towards the land, or towards another ship, there appears in the atmosphere a *meteor* of a particular nature, visible to every one without any *painful attention*. It is not by any kind of accident that this meteor appears under these circumstances; on the contrary, it is the necessary result of the approximation of one vessel towards another, or towards the land. The existence of the *meteor*, and the knowledge of its different modifications, are what constitute the certainty and the precision of my informations.

"If I am asked, how it is possible that the approach of a ship towards land should give birth to any *meteor* whatsoever in the atmosphere, and what connection there can be between two objects at such a distance from each other? I reply, that I am not obliged to give an account of the *hows* and the *wherefores*; that it is sufficient for me to have discovered the fact, without being obliged to account for its principle."

The writer concludes, by desiring to be called on for experimental proofs, and by promising in future a complete treatise of Nauscopy, with maps, plates, &c.

This complete treatise, as far as we know, has not yet been published, nor do we expect ever to see such a treatise on the subject as will satisfy the minds of those who are persuaded that every effect must have an adequate cause. The administrators of the island, who gave to M. Bottineau what he calls a *report*, containing the most authentic and most explicit testimony of the reality of the discovery, seem to be of our opinion; and yet they speak of this discovery with doubt, and with a degree of respect to which we think it can lay no claim. Their report is in the form of a letter directed to the *Marechal de Castries*: and that our infidelity may not deprive the public of what, in the immense catalogue of possibilities, *may* lead to a useful discovery, we shall here subjoin a copy of it.

Port Louis, Island of France, the 18th February 1784.

"My Lord, A letter which you have written on the 6th of April to M. Bottineau, employed in the King and Company's service in this colony, obliges us not to refuse him one for you, of which he proposes being himself the bearer. The desire only of being useful to his country, is (as he says) the motive which determines him to take this step. He would be angry with himself were he to conceal a discovery which hath hitherto escaped the most enlightened persons, and of which he only is in possession. This discovery is the art of announcing the presence of one or several ships, at 100, 150, and as far as 200 leagues distance. This is by no means the result of his studies, nor the fortunate application of the principles of any particular science; his science is in his eyes only, and he can have no other; what we call *penetration* and *genius* cannot make up to him what he is deficient in from education. He perceives (as he says) in nature, some signs which indicate to him the presence of the vessels, as we know that there is a fire in a place when we perceive the smoke which comes from it. This is the comparison which he makes use of himself to those who have conversed with him about his art; this (though he has kept his secret to himself)

Fig 1

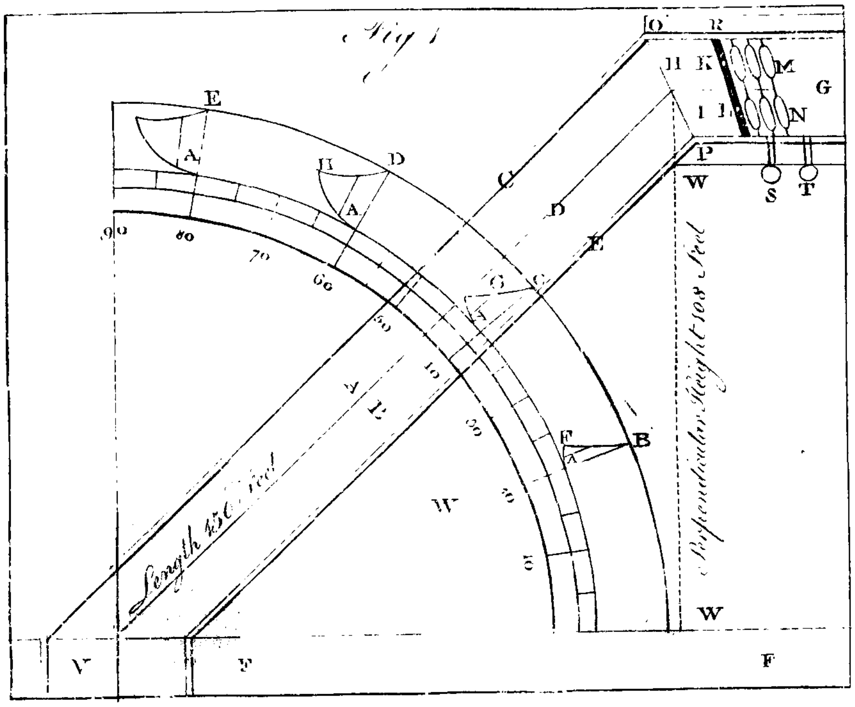


Fig 2

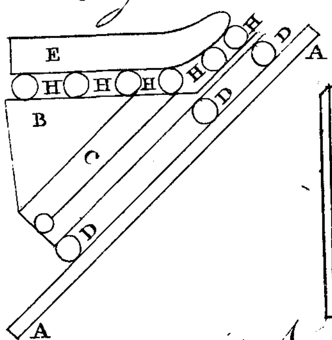
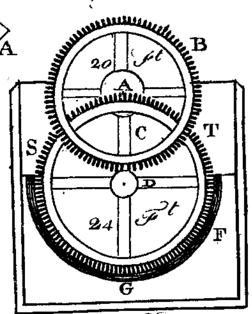


Fig 3



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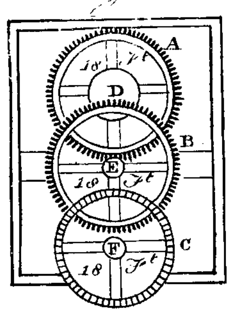

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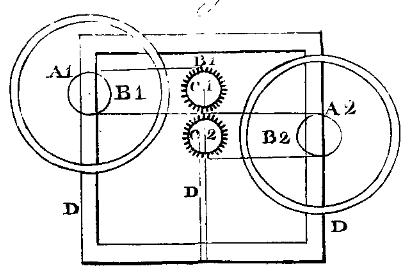


Napiers Rods

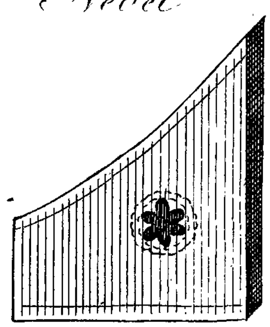
No 1

1	1	2	3	4	5	6	7	8	9	0
2	2	4	6	8	1/0	1/2	1/4	1/6	1/8	0
3	3	6	9	1/2	1/5	1/8	2/1	2/4	2/7	0
4	4	8	1/2	1/6	2/0	2/4	2/8	3/2	3/6	0
5	5	1/0	1/5	2/0	2/5	3/0	3/5	4/0	4/5	0
6	6	1/2	1/8	2/4	3/0	3/6	4/2	4/8	5/4	0
7	7	1/4	2/1	2/8	3/5	4/2	4/9	5/6	6/3	0
8	8	1/6	2/4	3/2	4/0	4/8	5/6	6/4	7/2	0
9	9	1/8	2/7	3/6	4/5	5/4	6/3	7/2	8/1	0

No 2

1	4	7	6	8
2	8	1/4	1/2	1/6
3	1/2	2/1	1/8	2/4
4	1/6	2/8	2/4	3/2
5	2/0	3/5	3/0	4/0
6	2/4	4/2	3/6	4/8
7	2/8	4/9	4/2	5/6
8	3/2	5/6	4/8	6/4
9	3/6	6/3	5/4	7/2

Nebel



R Scott & S. Hardie

Nauscopy.

self) is the plainest thing he has said, in order to make it be understood that he hath not made this discovery by the knowledge of any art or science, which had been the object of his application, or of his former studies.

"It is according to him the effect of chance; he hath taken nature in the act, and hath discovered his secret; so that his science, or rather the first elements of it, hath not cost him the least trouble: but the thing which hath cost him a great deal of labour, and which may be really called his own, is the art of judging of the exact distance.

"According to him, the signs very clearly indicate the presence of ships; but none but those who can well read these signs can draw any conclusions from them with regard to distances; and this art of reading them well, is, according to him, a true and a very laborious study: for this reason he hath himself, for a very long time, been the dupe of his science. It is at least 15 years since he first foretold here the arrival of ships. At first this was regarded only as a frolic. Wagers were laid on both sides. He often lost, because the ships did not arrive at the time prescribed by him. From thence came his application to find out the cause of these mistakes; and the perfection of his art is the result of this application.

"Since the war, his informations have greatly increased, and probably were sufficiently exact to excite the attention of the public. The noise of them reached us with the degree of enthusiasm which is always excited by the marvellous. He himself spoke of the reality of his science with the tone of a man convinced. It would have been too cruel to have dismissed him as a visionary.

"Besides, every thing depended upon proofs, and we required that he should produce some: in consequence, he hath regularly sent us, for eight months, the informations which he thought he might venture to send us; and the result is, that several of the ships he announced are arrived at the time he foretold, after several days of information.

"Others have come later than was expected, and some have not appeared at all.

"With regard to some of these, it hath been ascertained, that their delay had been occasioned by calms or by currents. M. Bottineau is persuaded, that those which never appeared were foreign vessels which went on; and accordingly we have learned, that some English ships were arrived in India, which might perhaps have been in sight of the island at the time indicated. But this is no more than a conjecture, which our occupations have not allowed us to investigate. What we can ascertain is, that in general it appears that M. Bottineau hath made just observations: whether it is owing to chance or to his abilities, it might be, perhaps, imprudent to determine. It is however certain, that the fact is so extraordinary, under whatever light it is considered, that we have not thought ourselves able either to affirm or deny it: and we have wished the Sieur Bottineau to compel us to take one or the other side of the question, by trusting his secret to some trusty and able person.—But this he hath refused, being probably afraid that he should not acquire by the discovery all the benefit which he imagines he may reap from it.

"Supposing the reality of the discovery, we do not believe that its utility can be as important as M. Bottineau persuades himself it is; but it might perhaps throw a great light upon natural history. In order to be useful, it would be necessary that the discovery should be confined to one nation, and remain unknown to all others. This will be impossible, if every fleet, every vessel, and every privateer, is obliged to carry a man on board who is in possession of this secret.—We remain, with respect, my Lord, your's, &c. Le V[te]. de Souilliac, chevreau."

Nausea, Nautilus.

NAUSEA, or SICKNESS; a retching or propensity and endeavour to vomit, arising from something which irritates the stomach.

NAUTILUS, in zoology; a genus belonging to the order of vermes testacea. The shell consists of one spiral valve, divided into several apartments by partitions. There are 17 species, chiefly distinguished by particularities in their shells.

Bonani observes, that this genius of shell-fish is very well named from the Greek ναυτιλος, which signifies both "a ship" and "a sailor;" for that the shells of all the nautili carry the appearance of a ship with a very high poop. Different authors, both ancient and modern, have called the nautilus by the names of *pompilus*, *nauplius*, *nauticus*, *ovum polypi*, *polypus testaceus*: and the French call it *le voilier*. It is by some imagined, that men first learned the art of navigation from this animal.

The most remarkable division of the nautili is into the thin and thick-shelled kinds. The first is called *nautilus papyraceus;* and its shell is indeed no thicker than a piece of paper when out of the water. This species is not at all fastened to its shell: but there is an opinion, as old as the days of Pliny, that this creature creeps out of its shell, and goes on shore to feed. When this species is to sail, it expands two of its arms on high, and between these supports a membrane, which it throws out on this occasion; this serves for its sail, and the two other arms it hangs out of its shell, to serve occasionally either as oars or as a steerage; but this last office is generally served by the tail. When the sea is calm, it is frequent to see numbers of these creatures diverting themselves in this manner: but as soon as a storm rises, or any thing gives them disturbance, they draw in their legs, and take in as much water as makes them specifically heavier than that in which they float; and then they sink to the bottom. When they rise again, they void this water by a number of holes, of which their legs are full. The other nautilus, whose shell is thick, never quits that habitation. This shell is divided into 40 or more partitions, which grow smaller and smaller as they approach the extremity or centre of the shell: between every one of these cells and the adjoining ones there is a communication by means of a hole in the centre of every one of the partitions. Through this hole there runs a pipe of the whole length of the shell. It is supposed by many, that by means of this pipe the fish occasionally passes from one cell to another; but this seems by no means probable, as the fish must undoubtedly be crushed to death by passing through it. It is much more likely that the fish always occupies the largest chamber in its shell; that is, that it lives in the cavity between the mouth and the first partition,

tion, and that it never removes out of this; but that all the apparratus of cells, and a pipe of communication which we so much admire, serves only to admit occasionally air or water into the shell, in such proportion as may serve the creature in its intentions of swimming.

Some authors call this shell the *concha margaritifera:* but this can be only on account of the fine colour on its inside, which is more beautiful than any other mother-of-pearl; for it has not been observed that this species of fish ever produced pearls. It must be observed, that the polypus is by no means to be confounded with the paper-shelled nautilus, notwithstanding the great resemblance in the arms and body of the inclosed fish; nor is the cornu ammonis, so frequently found fossile, to be confounded with the thick-shelled nautilus, though the concamerations and general structure of the shell are alike in both; for there are great and essential differences between all these genera. There is a pretty copious and minute account of this curious animal in the Gentleman's Magazine, vol. xxii. p. 6. 7. 8. and 301. and vol. xxv. p. 128.

NAVY, the fleet or shipping of a prince or state. See MARINE.

The management of the British navy-royal under the lord high admiral of Great Britain, is entrusted to principal officers and commissioners of the navy, who hold their places by patent. The principal officers of the navy are four, viz. the treasurer, whose business it is to receive money out of the exchequer, and to pay all the charges of the navy, by warrant from the principal officers: comptroller, who attends and controuls all payment of wages, is to know the rates of stores, to examine and audit all accounts, &c.: surveyor, who is to know the states of all stores, and see wants supplied; to estimate repairs, charge boatswains, &c. with what stores they receive, and at the end of each voyage to state and audit accounts: clerk of the acts, whose business it is to record all orders, contracts, bills, warrants, &c.

The commissioners of the navy are five: the first executes that part of the comptroller's duty which relates to the comptrolling the victualler's accounts; the second, another part of the said comptroller's duty relating to the account of the storekeepers of the yard; the third has the direction of the navy at the port of Portsmouth; the fourth has the same at Chatham; and the fifth at Plymouth. There are also other commissioners at large, the number more or less according to the exigencies of public affairs; and since the increase of the royal navy, these have several clerks under them, with salaries allowed by the king.

The victualling of the royal navy hath formerly been undertaken by contract; but is now managed by commissioners, who hold their office on Tower-hill, London. The navy-office is where the whole business concerning the navy is managed by the principal officers and commissioners.

The royal navy of Great Britain is now in a very flourishing state, having been diligently kept up in late reigns, as the natural strength of the kingdom. When it is complete, it is divided into three squadrons, distinguished by the colours of the flags carried by the respective admirals belonging to the same, viz. *red*, *white*, and *blue;* the principal commander of which bears the title of *admiral:* and each has under him a vice-admiral and a rear-admiral, who are likewise flag-officers.

NAVY Exercise. See EXERCISE.

NAVY-Discipline, or *Regulations*. See *MARITIME-State.*

NAWORTH-CASTLE, in Cumberland, 10 miles from Carlisle, near the Gelt. This castle is still entire and inhabited. It is a large pile, square, and built round a court. On the north it stands over the river Ithing, at a great height, the banks shagged with wood. The whole house is a very irregular building, the rooms numerous, accessible by 16 staircases, with most frequent and sudden ascents and descents, &c.—The great hall has a gallery at one end, adorned with four vast crests carved in wood, viz. a griffin and dolphin, with the scollops; an unicorn, and an ox with a coronet round his neck. In front is a figure in wood of an armed man; two others, perhaps vassals, in short jackets and caps; a pouch pendant behind, and the mutilated remains of Priapus to each; one has wooden shoes. These seem the *ludibrium aulæ* in those gross days. The top and upper end of the room is painted in squares, to the number of 107, representing the Saxon kings and heroes. The chimney here is five yards and a half broad. Within this is another apartment, hung with old tapestry, a head of Ann of Cleeves; on one side of her a small picture of a lady in full length, &c. and many others. Many of these paintings were brought from Kirk-Oswald-castle when that was demolished. The chapel has a ceiling, and part of its wainscot of the same kind, being paintings of Patriarchs, Jewish kings, &c. It has a floor of plaster of Paris, as have some other of the rooms. Some of the apartments are very large and spacious. The small Popish chapel is above stairs, and joining to this chapel is the library, which has a wooden roof; the books are old, there are not above one or two of the manuscripts here now. This castle was built by one of the Dacre's, about the reign of Henry III. In the garden walls were stones with Roman inscriptions, which the late earl of Carlisle gave to Sir Thomas Robinson, and were by him removed to his museum at Rooksby: On one of these stones is this inscription, *peditum centum quinquaginta Britannorum;* whence it appears that the Romans, when in possession of Britain, sometimes indulged the national troops with the favour of garrisoning their own territories.

NAXIA, or NAXOS, a considerable island of the Archipelago, 25 miles in length, and 88 in circumference. The whole island is covered with orange, olive, lemon, cedar, citron, pomegranate, fig, and mulberry trees; and there are a great many springs and brooks. This island has no harbour; and yet they carry on a considerable trade in barley, wine, figs, cotton, silk, flax, cheese, salt, oxen, sheep, mules, and oil. They burn only oil of mastic, though olive-oil is exceeding cheap. It is inhabited both by Greeks and Latins, who live in great dread of the Turks; for when the meanest of their ships appear here, they always wear red caps like galley-slaves, and tremble before the lowest officer; but as soon as they are gone, they put on their caps of velvet. The ladies are so vain, that when they return out of the country, they have 40 women in their train, half on foot and half on asses; one of whom carries a napkin or two, another a petticoat, another a pair of stockings, and so on; which is a very ridiculous sight to strangers. There are four archbishops sees in this island, and a great many villages; but so thin of people, that the whole island does not contain above 8000 inhabitants. The highest mountan is *Zia*, which signifies "the mountain of Jupiter." There are but few antiquities, except some small remains of the temple of Bacchus. Some say they have mines of gold and silver; however, there is one of emery, which is so common here, and so cheap, that the English often ballast their ships therewith.

Naxos, or *Naxia*, a considerable town, and capital of the isle of Naxos, over-against the isle of Paros, with a castle and two archbishops sees, the one Greek and the other Latin. The greatest part of the inhabitants are Greeks. E. Long. 25. 51. N. Lat. 37. 8.

NAXUS, now Naxia, formerly *Strongyle*, *Dia*, *Dionysias*, *Callipolis*, and *Little Sicily*. It was called *Strongyle*, from a Greek word, signifying "round," though in reality it is rather square than round. The names of *Dia* or *Divine*, and *Dionysias*, were given it as being consecrated in a peculiar manner to the fabulous god Dionysus or Bacchus. The appellation of *Callipolis* Pliny and Solinus derive from the metropolis of the island, formerly a most beautiful city, which is the import of the word Callipolis. The great fertility of the country gave rise to the name of *Little Sicily*, Naxus being the most fruitful of all the Cyclades, as Agathemerus informs us, and no less fertile than Sicily itself. As for the name of *Naxus*, some assert that it was borrowed from one Naxus, under whose conduct the Carians possessed themselves of the island; others pretend it received its name from Naxus, the son of Endymion. Stephanus, Suidas, and Phavorinus, derive the name of *Naxos* from the Greek word *naxai*, signifying "to sacrifice," and will have it to have been so called from the many sacrifices offered here to Bacchus. With these Bocchart agrees, as to its being called *Naxos* from the sacrifices performed here in honour of Bacchus, but will have the word *naxos* to be a corruption of the Phœnician *nacsa*, or *nicsa*, signifying "a sacrifice, offering." Naxos is, according to Pliny, 75, but reckoned by the present inhabitants 100, miles in compass. It has Paros to the west, Myconos and Delos to the north, and Ios to the south. This island is the most fruitful of the Archipelago, and was formerly famed for the excellent wines it produced. Archilochus, as quoted by Athenæus, compares them to the nectar of the gods; and Asclepiades, cited by Stephanus, assures us, that Bacchus took more delight in Naxos than in any other place whatsoever, having himself taught the inhabitants to cultivate their vines. The wine of Naxos maintains to this day its ancient reputation, being by some deemed the best of the Levant. Besides wine, this island abounds with all sorts of delicious fruits, the plains being covered with orange, olive, lemon, cedar, citron, pomegranate, mulberry, and fig trees. It was formerly famous for quarries of that sort of marble which the Greeks called *ophites*, from its being green, and speckled with white spots like the skin of a serpent. The best emerald is found here on the mountains near the western coast, whence the neighbouring cape is called by the Italians *capo smeriglio*, or the emerald cape. As to the inhabitants of Naxos, Diodorus relates that the island was first peopled by the Thracians. These were in a little time subdued by a body of Thessalians, who having possessed the island for the space of 200 years and upwards, were compelled to abandon it by a drought and famine.

After the Trojan war, the Carians settled here and called the island *Naxos*, from their king, who was the son of Polemon. He was succeeded by his son Leucippus, and Leucippus by his son Smardius, in whose reign Theseus, coming out of Crete, landed here with Ariadne, whom he was, in his sleep, commanded by Bacchus to leave in this island. In process of time a colony of Cnidians and Rhodians settled here under the conduct of Hippothous and Xuthus; the last of all the Ionians, who, in time, possessed the whole island; whence the Naxians are, by Herodotus, called *Ionians*, and ranked among the Athenian colonies. E. Long. 26. 5. N. Lat. 36. 30. It is about 105 miles in circumference and about 30 broad.

Naxus, (anc. geog.), a town of Crete, famous for its hones, called *lapis Naxius*. Another of Sicily, built by the Chalcidian; situated on the south side of Mount Taurus, destroyed by Dionysius the tyrant; from whose ruins Tauromenium, built by Timoleon, either arose or was increased, (Plutarch).

NAYLOR (James), a noted English enthusiast, was born, about 1616, in the parish of Ardesley, not far from Wakefield in Yorkshire. His father, though a farmer, and the proprietor of an estate, gave his son but a mean education; which is perhaps to be regretted, for his parts were very considerable. He married when very young and settled in Wakefield parish. In 1641, he was a private soldier under Lord Fairfax, being then a presbyterian: but he afterwards became an independent, and was made quarter-master under General Lambert. In 1651-2, he was converted by George Fox the apostle of the quakers, and soon commenced a preacher and prophet among that people. One of his prophecies was, that the last and general judgment should be on the 15th day of the ensuing November. The falsehood of this prediction was soon perceived, and of course his imposture ought to have been detected; but such is the power of enthusiasm over the human mind, that his fame rose daily; and upon his going to London in 1655, he excited to no common pitch the envy of his brethren. He had strange fancies of celestial illuminations, and considered himself as a great favourite of heaven. In 1656 he went into the west of England, but his extravagancies were so great and his opinions so blasphemous, that even in those days of fanatical delusion, they were heard with such horror, that the author of them was imprisoned in Exeter gaol; from which however he was relieved in the space of a month. Upon this he determined to return to London; but taking Bristol in his way, he made his entrance into that city in imitation of our Saviour's entrance into Jerusalem, the people strewing the way, &c. and calling out "Holy, holy, holy, lord god of Sabaoth; hosanna in the highest, &c." So impious a conduct could

could not escape animadversion he was apprehended with six of his associates. On examination he defended all that had passed; and was soon after with his followers sent to London, imprisoned, and condemned to be whipt, and then put to hard labour. The sentence, though much petitioned against, was executed, and he recovered his senses, expressed his repentance, and was again received by the Quakers, who during his impious frenzy, had disowned him. In 1659 he was freed from prison; and the following year set off to see his wife and children; but being robbed and left bound by the way, he was found in that state and carried to a friend's house at Rippon, where he died in November 1660. He was accounted the author of several works. His eccentricities, however, rather than his writings, have preserved his character; and he stands forward to the world, not so much as a man of genius or parts, though he was in some measure possessed of both, but rather as a striking example of the power of enthusiasm over the human mind, and of the danger of giving way to the religious reveries of an overheated imagination.

NAYRES, the nobility of the Malabar coast. We may with truth affirm that they are the oldest nobility in the world; for the most ancient writers mention them, and quote the law that permits the Nayre ladies to have many husbands; every one being allowed four. Their houses which stand single, have as many doors as the lady has husbands. When one of them visits her, he walks round the house, striking with his sabre on his buckler: he then opens his door, and leaves a domestic with his arms in a kind of porch, who serves to inform others that the lady is engaged. It is said, that one day in the week the four doors are all opened, and all her husbands visit her, and dine together with her. Each husband gives a sum of money, or portion, at the time of marriage; and the wife only has the charge of the children. The Nayres, even the Samorin, and the other princes, have no other heirs than the children of their sisters. This law was established, that the Nayres, having no family, might be always ready to march against the enemy. When the nephews are of age to bear arms, they follow their uncles. The name of *father* is unknown to a Nayre child. He speaks of the husbands of his mother and of his uncles, but never of his father.

NAZARETH, a little city in the tribe of Zebulun, in Lower Galilee, to the west of Tabor, and to the east of Ptolemais. Eusebius says, it is fifteen miles from Legion towards the east. This city is much celebrated in the scriptures for having been the usual place of the residence of Jesus Christ for the first 33 years of his life. Luke ii. 51. It was there our Saviour became incarnate, where he lived in obedience, to Joseph and Mary, and from whence he took the name of a Nazarean. After he had begun to execute his mission, he preached there sometimes in the synagogue, *id.* iv. 16. But because his countrymen had no faith in him, and were offended at the meanness of his original, he did not many miracles there, Math. xiii. 54. 58. nor would he dwell therein: so he fixed his habitation at Capernaum for the latter part of his life, *id.* iv. 13. The city of Nazareth was situated upon an eminence; and on one side there was a precipice from whence the Nazareans one day had a design of throwing down our Saviour, because he upbraided them with their incredulity, Luke iv. 29.

St Epiphanius says, that in his time Nazareth was only a village, and that to the reign of Constantine it was inhabited by Jews alone, exclusive of all Christians. Adamnanus, a writer of the seventh age, says, that in his time there were two great churches to be seen at Nazareth, one in the midst of the city, built upon two arches, in the place where our Saviour's house had stood. Under the two arches now mentioned, was a very fine fountain, which furnished water to the whole city, and from whence water was drawn also by the help of a pulley for the use of the church above. The second church of Nazareth was built in a place where the house stood wherein the angel Gabriel revealed to the virgin Mary the mystery of our Lord's incarnation; and we are assured that the church of incarnation, which is supported by two arches, is still in being to this day. Mr Maundrell tells us, that there is a convent built over what is said to be the place of annunciation; for the chamber where she received the angel's salutation was about 500 years ago removed from Nazareth, and, according to the Roman legends, transported by angels to Lorretto, then a small village in the pope's dominions, now become a bishop's see.—However, Calmet's opinion (which is certainly the true one) upon the different translations of this famous house of Loretto is, that they were no other than so many different buildings made upon the model of the church of Nazareth, just as in several places sepulchres have been built upon the model of that at Jerusalem. Mariti tells us, that in the eastern part of the city stands the church dedicated to the Blessed Virgin: the zeal of the Cœnobites raised it from the ruins of that which had been destroyed by the Saracens. It is a very handsome building, and consists of three naves; in the middle of which is the principal altar, to which there is an ascent by two magnificent stairs, much admired for their iron ballustrades, the work of an ingenious monk of the convent. The descent to the grotto or annunciation chapel below is by steps of beautiful marble, cut with great taste. Two beautiful columns of oriental granite strike the eye of the observer in the entrance. They appear to have been constructed both to support and ornament the grotto. The altar of this subterranean chapel is extremely elegant; and the different kinds of marble with which it is ornamented, receive an additional lustre from the combined light of several silver lamps presented by Christian princes. On solemn festivals, the walls and the pilasters are ornamented with various pieces of tapestry, representing the mysteries of the Virgin; a superb present from the House of Austria. In the western part of the city stands a Christian church, built, as is said, on the site of the ancient synagogue where Jesus showed the Jews the accomplishment of the prophecies in his person. This place served a long time as a shelter for flocks, but at present it is in good repair. In the neighbourhood may be seen a fountain of excellent water, which is, however esteemed by the people on another account. They conjecture that it was contiguous to the habitation of the Virgin, and that it was used by her. At some distance is a large stone of a round form, called *Christ's Table*. It is

Nazarite.

pretended that he came hither more than once with his disciples to eat. The inhabitants of Nazareth pay it a kind of worship, by burning perfumes and incense around it. It is situated in 35° E. Long. and in 32° N. Lat.; and formerly held the third rank under the patriarchs of Jerusalem. At present it is part of the domains of the chief of Acre. The ancient city, after the ravages of fanaticism, was reduced to a miserable hamlet, containing only a few Arab huts. Under the protection of Daher Omar, however, it recovered very considerably, and is now of far more importance.

NAZARITE, or NAZAREAN, or *Nazarines*, a term which may signify, 1. One that is of Nazareth, or any native of this city. 2. It was given to Jesus Christ and his disciples, and is commonly taken in a sense of derision and contempt, in such authors as have written against Christianity. 3. It has been taken for a sect of heretics called Nazareans. 4. For a Nazarite, a man that has laid himself under the obligation of a vow to observe the rules of Nazariteship, whether it be for his whole life, as Samson and John the Baptist, or only for a time, as those mentioned in Numbers vi. 18, 19, 20. Amos ii. 11, 12. Lastly, the name Nazarite in some passages of scripture denotes a man of particular distinction and great dignity in the court of some prince. But we must speak of these several sorts of Nazarites something more distinctly.

The name of Nazarene belongs to Jesus Christ, not only because of his having lived the greatest part of his life at Nazareth, and because this city has always been considered as his country, but also because the prophets had foretold that he should be called a Nazarene, Matth. ii. 23. "And he came and dwelt in a "city called Nazareth, that it might be fulfilled which "was spoken by the prophets, He shall be called a "Nazarene." We find no particular place in the prophets in which it is said that the Messiah should be called a Nazarene; and St Matthew only quotes the prophets in general. Perhaps he would insinuate, that the consecration of the Nazarites, and the great purity of which they made profession, was a type and a sort of prophecy of those of our Saviour, or else that the name נזיר *Nazir* or *Nazarite* given to the patriarch Joseph, Gen. xlix. 26. Deut. xxxiii. 16. was a prophecy which was to be fulfilled in the person of Jesus Christ, of whom Joseph was a figure. Lastly, St Jerom was of opinion, that St Matthew here alludes to that passage of Isaiah xi. 1. and lx. 21. "And "there shall come forth a rod out of the stem of Jesse "and a branch (in Hebrew *Nezer*) shall grow out of "his roots." This branch or *Nezer*, and this rod, are certainly intended to denote Jesus Christ, by the general consent of all the fathers and interpreters.

When the word Nazarean is put for the heretics known by this name, it denotes Christians converted from Judaism, whose chief error consisted in defending the necessity or expediency of the works of the law, and who obstinately adhered to the practice of the Jewish ceremonies. The name of Nazarenes at first had nothing odious in it, and it was often given to the first Christians. The fathers frequently mention the gospel of the Nazarenes, which differs nothing from that of St Matthew, which was either in Hebrew or Syriac, for the use of the first converts, but was afterwards corrupted by the Ebionites. These Nazareans preserved this first gospel in its primitive purity. Some of them were still in being in the time of St Jerom, who does not reproach them with any error. They were very zealous observers of the law of Moses, but had the traditions of the Pharisees in very great contempt.

Nazarite, when put to signify those under the ancient law who made a vow of observing a more than ordinary degree of purity (Numb. *ubi cit.*), denotes a man or woman who engage themselves by a vow to abstain from wine and all intoxicating liquors, to let their hair grow without cutting or shaving, not to enter into any house that was polluted by having a dead corpse in it, nor to be present at any funeral. And if by chance any one should have died in their presence, they began again the whole ceremony of their consecration and Nazariteship. This ceremony generally lasted eight days, sometimes a month, and sometimes their whole lives. When the time of their Nazariteship was accomplished, the priest brought the person to the door of the temple, who there offered to the Lord a he-lamb for a burnt-offering, a she-lamb for an expiatory sacrifice, and a ram for a peace-offering. They offered likewise loaves and cakes, with wine necessary for the libations. After all this was sacrificed and offered to the Lord, the priest or some other shaved the head of the Nazarite at the door of the tabernacle, and burnt his hair, throwing it upon the fire of the altar. Then the priest put into the hand of the Nazarite the shoulder of the ram roasted, with a loaf and a cake, which the Nazarite returning into the hands of the priest, he offered them to the Lord, lifting them up in the presence of the Nazarite. And from this time he might again drink wine, his Nazariteship being now accomplished.

As to those that were perpetual Nazarites, as were Samson and John the Baptist, it appears that they were consecrated to their Nazariteship by their parents, and continued all their lives in this state, without drinking wine or cutting their hair.

Those that made a vow of Nazariteship out of Palestine, and could not come to the temple when their vow was expired, contented themselves with observing the abstinence required by the law, and after that cutting their hair in the place where they were: as to the offerings and sacrifices prescribed by Moses, which were to be offered at the temple by themselves or by others for them, they deferred this till they could have a convenient opportunity. Hence it was, that St Paul being at Corinth, and having made the vow of a Nazarite, he had his hair cut off at Cenchrea, and put off fulfilling the rest of his vow till he should arrive at Jerusalem, Acts xviii. 18. When a person found that he was not in a condition to make a vow of Nazariteship, or had not leisure to perform the ceremonies belonging to it, he contented himself by contributing to the expence of the sacrifice and offerings of those that had made and fulfilled this vow; and by this means he became a partaker in the merit of such Nazariteship. When St Paul came to Jerusalem, in the year of Christ 58, the apostle St James the Less, with the other brethren, said to him, Acts xxi. 23, 24. that to quiet the minds of the converted Jews, who had

been

been informed that he every where preached up the entire abolition of the law of Moses, he ought to join himself to four of the faithful who had a vow of Nazariteship upon them, and contribute to the charge of the ceremony at the shaving of their heads; by which the new converts would perceive that he continued to keep the law, and that what they had heard of him was not true.

The Hebrew word *Nazir*, or Nazarite, which is made use of to express a man exalted to great dignity, as it is said of the patriarch Joseph, Gen. xlix. 26. and Deut. xxxiii. 16 "that he was separate from his brethren," as it is in our translation; or as the vulgate and others understand the Hebrew, "that he was "as a Nazarite among his brethren," is variously understood. Some think that the Hebrew word נזיר *Nazir*, in these places, signifies one who is crowned, chosen, separated, or distinguished: the word נזיר *Nazier* signifies a crown. The Septuagint translate this word a chief, or him that is honoured. Calmet thinks that this was a term of dignity in the courts of eastern princes; and that at this day in the court of Persia the word *Nazir* signifies the superintendant general of the king's household, the chief officer of the crown, the high steward of his family, treasures, and revenues; and that in this sense Joseph was the Nazir of the court of Pharaoh. Le Clerc translates the *Nazir*, a prince and calls Joseph "the prince of his brethren," in the two places already quoted, Mr Pool declares in favour of this last translation. See *Joseph. Chardin. Chrysost. St Jerom, &c.*

NAZIANZEN. See *Gregory Nazianzen*.

NAZIM, the lord lieutenant, viceroy, or governor of a province in Hindostan; the same as *Lubahdar*, or *Nabob*.

NEALED, among seamen, is used when the sounding is deep water close to the shore; as also when the shore is sandy, clayey, oozy, or foul and rocky ground.

NEALING, or rather ANNEALING, a term used for the preparing of several matters, by heating or baking them in the oven, or the like.

Nealing of glass, is the baking of glass, to dry, harden, and give it the due consistence, after it has been blown, and fashioned into the proper works.—This is usually performed in a kind of tower called the *leer*, built over the melting furnace. See GLASS.

Nealing of glass is also used for the art of staining glass with metalline colours. "One fine use of silver (says Mr Boyle) was only discovered since the art of annealing upon glass came to be practised. For prepared silver, or even the crude metal, being burnt on a glass plate, will tinge it of a fine yellow or golden colour. And there are several mineral earths, and other coarse matters of use in this art, which by means of fire impart transparent colours to glass, and sometimes very different ones from those of the bodies themselves.

Nealing of steel, is the heating it in the fire to a blood-red heat, and then taking it out, and letting it cool gently of itself. This is done to make it softer, in order to engrave or punch upon it. See TEMPERING and ENGRAVING.

Nealing is also used for the art or act of burning or baking earthen or other ware in an oven. The miners at Mendip, when they meet with a rock they cannot cut through, anneal it by laying on wood and coal, and contriving the fire so that they quit the mine before the operation begins, it being dangerous to enter it again before it be quite cleared of the smoke.

Nealing of tile is used in ancient statutes for the burning of tile. The word is formed of the Saxon *onælan, accendere*, to light, burn.

NEAP, or NEEP-TIDES, are those tides which happen when the moon is in the middle of the second and fourth quarters. The neap tides are low tides, in respect of their opposites the spring-tides. As the highest of the spring-tides is three days after the full or change, so the lowest of the neap is four days before the full or change. On which occasion the seamen say that it is deep neap.

NEAPED. When a ship wants water, so that she cannot get out of the harbour, off the ground, or out of the dock, the seamen say she is *neaped*, or *beneaped*.

NEAPOLIS (anc. geog.), a city of the Higher Egypt, in the Nomos Panopolitanus, between Thebæ to the south, and Panopolis to the north, on the east side of the Nile; otherwise called *Caene*.—A second Neapolis of Babylonia, situated near the Euphrates on the south side.—A third of Campania, an ancient town and a colony from Cumæ. (See Velleius, Pliny, Strabo); accounted a Greek city, and a great stickler for Greek usages, (see Livy, Tacitus). Its hot baths were in nothing inferior to those of Baiæ, according to Strabo: at two miles distance from it stands the monument of Virgil, held in religious veneration by learned posterity. The Younger Pliny relates, that Virgil's birth-day was more religiously observed by Silius Italicus than his own, especially at Naples, where he resorted to his tomb as to a temple. The city is washed by the river Sebethos. Virgil feigns the nymph Sebethis to preside over the stream. Now *Naples*, capital of the kingdom of that name. See NAPLES.—A fourth, Neapolis of Caria, near the Meander. (Ptolemy).—A fifth, an inland town of Cyrenaica, situated between Ptolemais and Arsinoe, (Ptolemy); and to be distinguished from the Cænopolis, or Neapolis, on the east border of the same province, (id). A sixth of Ionia, (Strabo); which belonged first to the Ephesians, but afterwards to the Samians, who exchanged Marathesium, a more distant city, for a nearer.—A seventh, Neapolis of Macedonia Adjacta, situated at the distance of 12 miles to the east of Philippi, (Antonine).—An eighth, Neapolis of Pisidia, on the borders of Galatia, situated between Amblada and Pappa, (Ptolemy).—A ninth, of Samaria, the ancient *Sichem*, which see; so called upon its restoration by the Romans, (Coin, Pliny, Josephus).—A tenth, of Sardinia, situated on the south-west side of the island, 30 miles to the north of Metalla; now called *Neapoli*.—An eleventh, of the Regio Syrtica, called also *Leptis*.—A twelfth, of Zeugitana on the Mediterranean, to the east of Clypea, and south of the Promontorium Mercurii.

NEAT, or *Net Weight*, the weight of a commodity alone, clear of the cask, bag, case, or even filth. See NET.

NEBIO, or NEBBIO, a ruined city of Italy, on the north

north side of the island of Corsica, with a bishop's see, whose bishop resides at San Florenzo, from which it is a mile distaut.

NEBO, (anc. geog.), a very high mountain, a part of the mountains Abarim, and their highest top, whither Moses was ordered to ascend to take a view of the land of Canaan, and there die. Situated in the land of Moab, over-against Jerico; with a cognominal town at its foot (Isaiah) belonging to the Reubenites, which afterwards returned to the Moabites; in Jerome's time desolate: eight miles to the south of Heshbon.

NEBO, or *Nabo*. See NABO.

NEBUCHADNEZZAR. See NABUCHADNEZZAR.

NEBULY, or NEBULEE, in heraldry, is when a coat is charged with several little figures, in form of words running within one another, or when the outline of a bordure, ordinary, &c. is indented or waved.

NECESSITY, whatever is done by a cause or power that is irresistible; in which sense it is opposed to freedom. Man is a necessary agent, if all his action be so determined by the causes preceeding each action, that not one past action could possibly not have come to pass, or have been otherwise than it hath been; nor one future action can possibly not come to pass, or be otherwise than it shall be. But he is a free agent, if if he be able, at any time, under the circumstances and causes he then is, to do different things; or in other words, if he be not unavoidably determined in every point of time, by the circumstances he is in, and the causes he is under, to do that one thing he does, and not possibly to do any other thing. Whether a man is a necessary or a free agent, is a question which has been debated with much ingenuity by writers of the first eminence, from Hobbes and Clarke, to Priestley and Gregory. See METAPHYSICS, Part III. chap. 5. and PREDESTINATION.

NECESSITY, in mythology, a power superior to all other powers, and equally irresistible by gods and by men. Herodotus, as he is quoted by Cudworth, mentions an oracle which declared that "God himself could not shun his destined fate." And among the fragments of Philemon collected by Le Clerc, is the following sentence:

Δουλοι βασιλεων, εσμεν οἱ βασιλεις θεων, ὁ θεος αναγκης.

"We are subject to kings, kings to the gods, and God to necessity." Hence it is, that in the Iliad, we find Jove himself the sire of gods and men, regretting that he was restrained by *necessity* from rescuing his favourite son from the sword of Patroclus. Nay to such a height was this impiety carried in the earliest ages of Greece, that we find hesiod and Homer teaching that the gods themselves were generated by *necessity*, of night and chaos.

This power though always represented as blind and unintelligent, was however worshipped as a goddess, bearing in her hand large iron-nails, wedges, anchors and melted lead *, as emblems of the inflexible severity of her nature. "In the city of Corinth she had a temple, in which the goddess *Violence* likewise resided, and into which no person was ever permitted to enter but the priest who officiated *in sacris* †."

* Horace, Lib. i. Ode 35.

† Pausanias in Corinth, Cap. 4.

Learned men have exercised their ingenuity in vain attempts to trace this portentous notion to its origin. Some, who wished to interpret it in a pious sense, have supposed that the gods who were subject to *necessity* were only those who were the ministers of the supreme *numen*; and that by *necessity* itself was means nothing more than divine providence. But this is not consistent with Hesiod and Homer's generation of the gods, or with the epithets *sæva necessitas, dura necessitas*, by which this power was perpetually distinguished. Others, and among them Mosheim, have supposed that this monstrous fable was invented by the pagan priests, and diligently inculcated upon the minds of the people in order to excuse the villainies of the objects of their worship. For, says he, who could be indignant at Jupiter's numberless adulteries, after it was known that in all his actions he was the servant of blind necessity! In the thefts of *Mercury*, the whoredoms of *Venus* and the frequent squabbles of the other gods, there could be no moral turpitude, if they were under the influence of a superior power.

Numina cum videas duris obnoxia fatis,
Invidia possis exonerare deos ‡.

‡ Martial. Epigram Lib ix. N. 88. Ed. Amstel. 1701.

This account of the matter is at least as plausible as any other which is usually given; but the real case undoubtedly was, that when men "did not like to retain God in their knowledge, God gave them over to a reprobate mind to do those things which are not convenient; when their foolish heart was darkened, and professing themselves to be wise, they became fools." See PARCÆ.

NECESSITY, in law, as it implies a defect of will, excuses from the guilt of crimes. See CRIME.

Compulsion and inevitable *necessity* are a constraint upon the will, whereby a man is urged to do that which his jugment disapproves; and which, it is to be presumed, his will (if left to itself) would reject. As punishments are therefore only inflicted for the abuse of that free-will which God has given to man, it is highly just and equitable that a man should be excused for those acts which are done through unavoidable force and compulsion.

1. Of this nature, in the first place, is the obligation of *civil subjection*, whereby the inferior is constrained by the superior to act contrary to what his own reason and inclination would suggest: as when a legislator establishes iniquity by a law, and commands the subject to do an act contrary to religion or sound morality. How far this excuse will be admitted *in foro conscientiæ* or whether the inferior in this case is not bound to obey the divine rather than the human law, it is not our business to decide; though, among the casuists, it is believed the question will hardly bear a doubt. But, however that may be, obedience to the laws in being is undoubtedly a sufficient extenuation of civil guilt before the municipal tribunal. The sheriff who burnt Latimer and Ridley, in the bigotted days of Queen Mary, was not liable to punishment from Elisabeth for executing so horrid an office; being justified by the commands of that magistracy which endeavoured to restore Superstition, under the holy auspices of its merciless sister, Persecution.

As to persons in private relations, the principal case where constraint of a superior is allowed as an excuse for criminal misconduct, is with regard to the matrimonial subjection of the wife to her husband:

Necessity. for neither a son nor servant are excused for the commission of any crime, whether capital or otherwise, by the command or coercion of the parent or master; though in some cases the command or authority of the husband, either express or implied, will privilege the wife from punishment, even for capital offences. And therefore, if a woman commit theft, burglary, or other civil offences against the laws of society, by the coercion of her husband, or even in his company, which the law construes a coercion, she is not guilty of any crime; being considered as acting by compulsion, and not of her own will. Which doctrine is at least 1000 years old in this kingdom, being to be found among the laws of King Ina the West-Saxon. And it appears, that, among the northern nations on the continent this privilege extended to any woman transgressing in concert with a man, and to any servant that committed a joint offence with a freeman: the male or freeman only was punished, the female or slave dismissed; *procul dubio quod alterum libertas, alterum necessitas impelleret*. But (besides that in our law, which is a stranger to slavery, no impunity is given to servants, who are as much free agents as their masters) even with regard to wives, this rule admits of an exception in crimes that are *mala in se*, and prohibited by the law of nature; as murder, and the like: not only because these are of a deeper dye, but also, since in a state of nature no one is in subjection to another, it would be unreasonable to screen an offender from the punishment due to natural crimes, by the refinements and subordinations of civil society. In treason also (the highest crime which a member of society can, as such, be guilty of), no plea in coverture shall excuse the wife: no presumption of the husband's coercion shall extenuate her guilt: as well because of the odiousness and dangerous consequence of the crime itself, as because the husband, having broken through the most sacred tie of social community by rebellion against the state, has no right to that obedience from a wife, which he himself as a subject has forgotten to pay. In inferior misdemeanors also, we may remark another exception, that a wife may be indicted and set in the pillory with her husband, for keeping a brothel: for this is an offence touching the domestic œconomy or government of the house, in which the wife has a principal share; and is also such an offence as the law presumes to be generally conducted by the intrigues of the female sex. And in all cases where the wife offends alone, without the company or coercion of her husband, she is responsible for her offence as much as any feme-sole.

2. Another species of compulsion or necessity is what our law calls *duress per minus*; or threats and menaces, which induce a fear of death or other bodily harm, and which take away for that reason the guilt of many crimes and misdemeanors, at least before the human tribunal. But then that fear which compels a man to do an unwarrantable action ought to be just and well grounded; such, "*qui cadere possit in virum constantem, non timidum et meticulosum*," as Bracton expresses it, in the words of the civil law. Therefore, in time of war or rebellion, a man may be justified in doing many treasonable acts by compulsion of the enemy or rebels, which would admit of no excuse in the time of peace. This, however, seems only, or at least principally, to hold as to positive crimes, so created by the laws of society, and which therefore society may excuse; but not as to natural offences, so declared by the law of God, wherein human magistrates are only the executioners of divine punishment. And therefore though a man be violently assaulted, and hath no other possible means of escaping death but by killing an innocent person, this fear and force shall not acquit him of murder: for he ought rather to die himself than escape by the murder of an innocent. But in such a case he is permitted to kill the assailant: for there the law of nature, and self-defence its primary canon, have made him his own protector.

3. There is a third species of necessity, which may be distinguished from the actual compulsion of external force or fear: being the result of reason and reflection, which act upon and constrain a man's will, and oblige him to do an action which without such obligation would be criminal. And that is, when a man has his choice of two evils set before him, and, being under a necessity of choosing one, he chooses the least pernicious of the two. Here the will cannot be said freely to exert itself, being rather passive than active; or, if active, it is rather in rejecting the greater evil than in choosing the less. Of this sort is that necessity, where a man by the commandment of the law is bound to arrest another for any capital offence, or to disperse a riot, and resistance is made to his authority: it is here justifiable, and even necessary, to beat, to wound or perhaps to kill, the offenders, rather than permit the murderer to escape, or the riot to continue. For the preservation of the peace of the kingdom, and the apprehending of notorious malefactors, are of the utmost consequence to the public; and therefore excuse the felony, which the killing would otherwise amount to.

4. There is yet another case of necessity, which has occasioned great speculation among the writers upon general law; viz. whether a man in extreme want of food or clothing may justify stealing either, to relieve his present necessities. And this both Grotius and Puffendorf, together with many other of the foreign jurists, hold in the affirmative; maintaining by many ingenious, humane, and plausible reasons, that in such cases the community of goods, by a kind of tacit concession of society, is revived. And some even of our lawyers have held the same; though it seems to to be an unwarranted doctrine, borrowed from the notions of some civilians: at least it is now antiquated, the law of England admitting no such excuse at present. And this its doctrine is agreeable not only to the sentiments of many of the wisest ancients, particularly Cicero who holds, That *suum cuique incommodum ferendem est, potius quam de alterius commodus detra endum;* but also to the Jewish law, as certified by King Solomon himself: "If a thief steal to satisfy his soul when he is hungry, he shall restore seven fold, and shall give all the substance of his house:" which was the ordinary punishment for theft in that kingdom. And this is founded upon the highest reason; for mens properties would be under a strange insecurity, if liable to be invaded according to the wants of others: of which wants no man can possibly be an adequate judge, but the party himself who pleads them. In England espe-

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especially, there would be a peculiar impropriety in admitting so dubious an excuse: for by the laws such sufficient provision is made for the poor by the power of the civil magistrate, that it is impossible that the most needy stranger should ever be reduced to the necessity of thieving to support nature. The case of a stranger is, by the way, the strongest instance put to Baron Puffendorf, and whereon he builds his principal arguments: which, however they may hold upon the continent, where the parsimonious industry of the natives orders every one to work or starve, yet must lose all their weight and efficacy in England, where charity is reduced to a system, and interwoven in the very constitution. Therefore the laws ought by no means to be taxed with being unmerciful, for denying this privilege to the necessitous; especially when we consider, that the king, on the representation of his ministers of justice, hath a power to soften the law, and to extend mercy in cases of peculiar hardship. An advantage which is wanting in many states, particularly those which are democratical: and these have in its stead introduced and adopted, in the body of the law itself, a multitude of circumstances tending to alleviate its rigour. But the founders of that constitution thought it better to vest in the crown the power of pardoning particular objects of compassion, than to countenance and establish theft by one general undistinguishing law.

NECHO, king of Egypt, began his reign 690 B.C. and was killed eight years after by Sabacon king of Ethiopia. Psammiticus his son succeeded him, and was the father, as Herodotus informs us, of Necho II. who reigned in the 616 B. C. This Necho II. is celebrated in history for attempting, though in vain, to cut a canal from the Nile to the Arabian gulf. He carried his arms as far as the Euphrates, and conquered the city of Carchemish. This prince is not only known in scripture under the name of *Necho*, but also in profane history. He no sooner succeeded to the crown than he raised great land armies, and fitted out vast fleets, as well upon the Mediterranean as upon the Red Sea: he gave battle to the Syrians near the city of Migdol; routed them, and made himself master of the city of Cadytis. The learned, however, are not agreed about this city Cadytis. Some will have it to be Cades in Arabia Petræa, others Jerusalem; and others say it is the city of Cedes, or Kedesh, in Galilee, in the tribe of Naphtali.

The scriptures acquaint us with the whole expedition of Necho in all its particulars, 2 Kings xxiii. 29. &c. and 2 Chr. xxxv. 20. 21, &c. In the year of the world 3394, this prince having drawn out his army into the field to make war with the Assyrians or Babylonians, and to take the city of Carchemish, otherwise called *Circusium*, upon the Euphrates, Josiah king of Judah, who was a tributary to the king of Babylon, marched to oppose his passage. Necho, who had no designs against him, sent to tell him, What have I to do with you, King of Judah? It is not against you that I am come forth, but against another people, against whom the Lord has commanded me to make war. Leave off therefore to set yourself against me, for fear the Lord should punish you for your resistance. But Josiah would not hearken to the remonstrances of Necho, but gave him battle at Megiddo, where he received the wound of which he died. The people of Jerusalem set up Jehoahaz for king of Judah, and Necho soon passed forwards, without making any longer stay in Judea.

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But at his return from his expedition, which was very successful, he halted at Riblah in Syria; and sending for Jehoahaz king of the Jews, he deposed him, loaded him with chains, and sent him into Egypt. Then coming to Jerusalem, he set up Eliakim, or Jehoiakim, in his place, and exacted the payment of 100 talents of silver and one talent of gold from the country. Jeremiah (xlvi. 2.) acquaints us, that the city of Carchemish was taken from Necho by Nebuchadnezzar king of Babylon, in the fourth year of Jehoiakim king of Judah: so that Necho did not enjoy his conquest above four years. Josephus adds, that the king of Babylon pursuing his victory, brought under his dominion all the country which is between the Euphrates and Egypt, excepting Judea. Thus Necho was again reduced within the limits of his own country.

NECK, in anatomy, is the slender part situated between the head and trunk of the body. See ANATOMY, n° 31.

NECOPHORON, in botany, a name used by Pliny and other authors for the *smilax aspera*, or *rough bindweed*.

NECROLIUM, a word used by some of the alchemical writers to express a remedy almost always capable of averting death, and continuing life to its utmost period.

NECROLOGY, *necrologium*, formed of νεκρος, "dead," and λογος, "discourse or enumeration," a book anciently kept in churches and monasteries, wherein were registered the benefactors of the same, the time of their deaths, and the days of their commemoration; as also the deaths of the priors, abbots, religious, canons, &c. This was otherwise called *calendar* and *obituary*.

NECROMANCY, the art of revealing future events by a pretended communication with the dead.

This superstitious and impious imposture appears to have had its origin at a very early period in Egypt, and to have been thence propagated in every nation with the manners of which history has made us acquainted. The conquests of Sesostris might introduce it into India; the Israelites would naturally borrow it from the people among whom they sojourned 400 years; and it would easily find its way into Phœnicia, from the vicinity of that country to the land of its nativity. From the Egyptians and Phœnicians it was adopted, with the other rites of paganism, by the Greeks; and it was imported into Rome with Grecian literature and Grecian manners. It was not however confined to the pagan nations of antiquity; it spread itself through all the modern nations of Europe, and took such deep root as to be long retained even after those nations were converted to the Christian faith.

Of its early antiquity we have complete evidence in the writings of Moses, where it is severely condemned as an abomination to the Lord*; and though it appears to have been even then spread into Phœnicia, we might yet conclude its birth-place to have been Egypt, because, at their *exody*, the Israelites were corrupted

* Deut. xviii. 10, 11. 12.

corrupted only by Egyptian ſuperſtitions, and becauſe necromancy ſeems to be one of thoſe whoredoms which the prophet Ezekiel repreſents his countrymen as having brought with them from Egypt, and continued to practiſe till they were carried captives into Babylon.

If from ſacred we proceed to conſult profane authors, we ſhall find them not only affirming Egypt to have been the birth-place of necromancy, but in ſome degree accounting for the origin of ſo impious a deluſion. From Diodorus the Sicilian † we learn, that the Grecian fable of *Charon* the ferry-man of hell, of *Styx*, *Coccytus*, the *Elyſian Fields*, *Tartarus*, the judgement of *Minos*, and *Radamanthus*, &c. with the whole ſcenery of the infernal regions, were imported from Egypt into Greece. The ancient Egyptians, and indeed all the people of the eaſt, made uſe of caves for burying places, which were well ſuited to the ſolemn ſadneſs of the ſurviving friends, and proper receptacles for thoſe who were never more to behold the light. In Egypt, many of thoſe ſubterraneous cavities being dug out of the natural rock, ſtill remain and command the admiration of travellers; and near to the pyramids in particular there are ſome apartments of a wonderful fabric, which though they extend in length 4400 feet, and are about 30 feet in depth, appear to have been, if not entirely dug, at leaſt reduced to form by the chizzel or pick axe of the artiſt.

† Lib. 1. § 2.

From the practice of burying in ſuch caverns ſprung the opinion that the infernal manſions were ſituated ſomewhere near the centre of the earth, which by the Egyptians was believed to be not very diſtant from its ſurface ‡. In theſe dreary manſions, it was very eaſy for ſuch adepts as the prieſts of Egypt to fabricate Erebus, Tartarus, the Elyſian Fields, and all thoſe ſcenes which were diſplayed before the initiated (ſee Mysteries), and by them deſcribed to the million of the people. As it was in thoſe dark abodes that necromancy was practiſed, it would be no difficult matter for ſuch magicians as withſtood Moſes to impoſe ſo far upon the credulous vulgar, as to make them believe, that in conſequence of their avocations they actually ſaw the ghoſts of their friends aſcend out of the earth. It appears from the book of Exodus, that the Iſraelitiſh women were, even in the wilderneſs, well acquainted with the uſe of the mirror, which was therefore undoubtedly known to the Egyptians. But a mirror of a particular form and properly illuminated at the inſtant required, might eaſily be made to reflect, in a cavern from which all other light was carefully excluded, the image of the deceaſed, who was called upon by the necromancer; and we can readily conceive, that with reſpect to the queſtion to be propoſed, a perſon might be concealed, prepared to give ſuch ambiguous anſwers as would ſatisfy the inquirer, and at the ſame time ſave the credit of the oracle. The terrified imaginations of the ſpectators would aid the deluſion, and make a very ſlight reſemblance paſs for the ghoſt or ειδωλον of their departed friend; or the necromancer might aſſign plauſible reaſons why a ſpectre, after having dwelt for ſome time in the infernal regions, ſhould loſe ſomething of its reſemblance to the body which it animated. Such juggling tricks, though performed by artiſts leſs accompliſhed than Jannes and Jambres, have gained credit among people much more enlightened than the Egyptians can poſſibly have been when the ſcience of necromancy was invented by their prieſts.

‡ Bryant's Analyſis of Mythology.

That the Iſraelites, notwithſtanding the prohibition of their legiſlator, continued to practice the rites of necromancy, is apparent from Saul's tranſaction with the witch of Endor (ſee Magic). From the ſame tranſaction, it is likewiſe apparent that the witches of Iſrael, and therefore in all probability the necromancers of Egypt, pretended to evocate the ghoſts of the dead by a *dæmon* or *familiar ſpirit*, which they had at their command to employ upon every emergency. This dæmon was called ob; and therefore Saul deſires his ſervants to find him a woman who was miſtreſs of an ob (A). It is probable that thoſe wretched impoſtors had in their pay ſome perſons who occaſionally acted the part of the dæmon, and when the execution of the plot required their agency, emitted, by means of a cavity dug for that purpoſe, a low hollow voice from below the ground. Hence we find Iſaiah, in his denunciations againſt Ariel*, ſaying, "Thou ſhalt be brought down, and ſhall ſpeak out of the ground; and thy ſpeech ſhall be low out of the duſt, and thy voice ſhall be as one that hath a familiar ſpirit (an ob) out of the ground, and thy ſpeech ſhall whiſper out of the duſt."

* Chap. xxix. 4.

But though the Egyptian prieſts were undoubtedly the inventors of the whole myſtery of necromancy, and though it was from them imported into Greece by the Selli or prieſts of Dodona, it does not appear that the Grecian necromancers pretended to be maſters of obs or familiar ſpirits. Mopſus, Orpheus, Linus, Eumolpus, &c. who either travelled into Egypt in queſt of knowledge, or were actually natives of that country, inſtructed the early Greeks in this occult ſcience: but whatever might be the practice of theſe apoſtles themſelves, their diſciples profeſſed to do all

(A) The original or radical, ſignification of this word occurs in Job xxxii. ver. 19; where Elihu compares his belly to new bottles, which he calls *oloth*, the plural of *ob*. But as bottles were then made of leather, new bottles filled with wine and ready to burſt, as Elihu deſcribes them, would of courſe be of a form nearly globular. Hence it may be inferred that the original import of *ob* was *round* or *globular*: but *b* and *p* being labials, are often changed into each other; and therefore from the Hebrew *ob* is derived the Greek οψ *oculus* οπτομαι *video*, and the Latin *ops*, a name under which the earth was worſhipped. *Upis* was a name of Diana or the moon: the father of one of the Dianas was likewiſe *upis*; but this *upis* was undoubtedly the ſun. Now the difference between *upis* and *opis* is nothing; hence we are led to believe that as they are all derived from *ob*, this word was employed by the early idolaters of Egypt to denote the firſt and greateſt of Pagan gods, the ſun. If ſo, thoſe wretches who pretended to be miſtreſſes of *obs*, were exactly the ſame kind of impoſtors with the Pythoneſſes of the Greeks.

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all the feats of magic by performing certain rites, by offering certain sacrifices, by muttering a certain form of words, by charms, spells, and exorcisms. By these they pretended to evocate the dead as certainly as the Egyptians and Jews did by their *familiar spirits*. By a small display of critical learning this might be easily proved from the popular story of Orpheus and Euridice, which certainly was founded on one of these necromantic deceptions exhibited in a cave near Dodona, where the priests had a *hades* or infernal mansion, in humble imitation of those with which the first of them were well acquainted in Egypt. It is indeed evident, without the aid of criticism; no man of any letters is ignorant, that whatever superstitions of this kind prevailed among the Romans were borrowed from the Greeks. But we all know that Virgil makes one of his shepherds, by means of certain herbs, poisons, and senseless charms, raise up ghosts from the bottoms of their graves; and Lucan has fabricated a story of this kind which may be considered as an exact parallel to the which of Endor. Just before the battle of Pharsalia he makes† young Pompey travel by night to a Thessalian sorceress, and anxiously inquire of her the issue of the war. This female necromancer, by a tedious process of charms and incantations, conjures up the ghost of a soldier who had been lately slain. The phantom, after a long preamble, denounces a prediction much of the same kind with that which the king of Israel received from Samuel at Endor; and though we have elsewhere shown, that nothing but the spirit of God could have foreseen the inevitable destruction of Saul, his sons, and his army (see Magic), it was very easy for any man of tolerable sagacity to foresee the defeat of Pompey's raw and undisciplined troops by the hardy veterans of the victorious Cæsar.

† Lib. vi. ver. 570. et seq.

It would be endless to enumerate all the fallacious evocations of ghosts, and the ambiguous responses returned by those pretended spirits, of which we have accounts from the poets and historians of the celebrated nations of antiquity. We shall therefore proceed to mention a few which occur in the fabulous history of more modern nations, and then leave the subject to the meditation of our readers. In Mallet's northern antiquities, we have the following account of a necromantic exploit, between which and the descent of the ancient heroes into hell, it is impossible not to remark a striking similitude.

"Odin the sovereign of man arises. He saddles his horse Sleipner; he mounts, and is conveyed to the subterraneous abode of *Hela*. The dog which guards the gates of death meets him. His breast and his jaws are stained with blood. He opens his voracious mouth to bite, and barks a long time at the father of magic. Odin pursues his way; and the infernal cavern resounds and trembles under his horse's hoofs. At length he reaches the deep abode of death, and stops near the eastern gate, where stands the tomb of the prophetess. He sings with a voice adapted to call up the dead: he looks towards the world; he engraves Runic characters on her tomb; he utters mysterious words; and he demands an answer, until the prophetess is constrained to arise and thus utter the words of the dead—"Who is this unknown that dares to disturb my repose, and drag me from the grave, in which I have been dead so long, all covered with snow, and moistened with the rains?" &c.

The Gallic druids pretended to be masters of the same secret. This is evident from the name of a species of divination, not uncommon among the Scotch Highlanders so lately as in the beginning of the present century. By a gentleman excellently versed in the antiquities of that people, and a steady friend to the writer of this article, we have been informed, that not many years ago some of the Highlanders relied implicitly upon certain oracular responses, called in their language *taghairm*. This word seems to be compounded of *ta*, which in some parts of the highlands is still used to denote a spirit or ghost, and *ghairm*, which signifies *calling upon* or invoking. *Taghairm*, therefore, in its original import, is *necromancy* in the most proper sense of that word.

There were different kinds of *taghairm*, of which one was very lately practised in *Sky*. The diviner covered himself with a cow's hide, and repaired at night to some deep sounding cave, whither the person who consulted him followed soon after without any attendants. At the mouth of the cave he proposed aloud the questions of which he wanted solutions; and the man within pronounced the responses in a tone of voice similar to that with which the obs, or pretended dæmons of antiquity, gave from beneath the ground their oracular answers. That in the latter days of *taghairm*, the Gallic diviners pretended to evocate ghosts, and from them to extort solutions of difficulties proposed, we have no positive evidence; but that such was the original pretence, there can be little doubt, when we reflect either upon the place where this species of divination was practised, or upon the import of the word by which it was denominated.

As we have been led to mention *taghairm*, we shall beg leave to make a few observations on another species of it, called *taghairm an uisge*, or "*taghairm* by water." This too was last practised in the Isle of Sky, by a man of the name of *M'Cuidhean*, whose ancestors had long been famous for the art. He lived near a beautiful cascade on a small river; and when consulted on any matter of consequence, he covered his whole body with a cow's hide, that necessary implement of Highland divination, and placed himself between the water of the cascade and the rock over which it flowed. Then another man with a heavy pole gave repeated strokes to the water, and the diviner behind it crying out now and then in Gaelic, "Is this a stock of arn?" This operation was continued till M'Cuidhean was perceived to be frantic or furious, when he was considered as in a condition to answer the most important questions. He was frequently consulted about futurity; and though he could not in a proper sense of the word, be called a *necromancer*, his responses were listened to as proceeding from something more than human. A degree of frenzy, either real or affected, seems to have accompanied the predictions of certain kinds of diviners in all ages; and we cannot help remarking the similarity between the madness of M'Cuidhean and that of the Sybil in the sixth book of the Æneid; though we

 cannot

cannot suppose the one to have been borrowed from the other.

At, Phœbi nondum patiens, immanis in antro
Bacchatur vates, magnum si pectore possit
Excussisse Deum: tanto magis ille fatigat
Os rabidum, fera corda domans, fingitque premendo.

Struggling in vain, impatient of her load,
And lab'ring underneath the pond'rous god;
The more she strove to shake him from her breast,
With more and far superior force he press'd.
Dryden.

That all these pretences, whether ancient or modern, to the power of divination by means of familiar spirits, or by the art of necromancy, were groundless as well as impious, it would be affronting the understandings of our readers to offer any proof. Under the article MAGIC we have said enough on the subject, and perhaps more than enough, to those who know that dæmons, if they have any existence, and the departed spirits of good and bad men, are all under the controul of Him who governs the intellectual as well as material world by fixed and equal laws.—These details of superstition, however, will not be useless, if, by showing how poor and wretched a creature man becomes when left to his own inventions, they shall make any one grateful for the benefits of good government, and the blessings of revealed religion.

NECROPOLIS, a suburb of Alexandria in Egypt. It signifies "the City of the Dead;" wherein there were temples, gardens, and superb mausoleums. Here Cleopatra is said to have applied the aspic to her breast, to prevent being led in triumph by Augustus, who endeavoured to save her.

NECROSIS, νεκρωσις, in medicine, a complete mortification of any part; called also *sideratio* and *sphacelus*.

NECTANEBUS, or NECTANABIS, a king of Egypt, who defended his country against the Persians. His grandson of the same name made an alliance with Agesilaus king of Sparta, and with his assistance he quelled a rebellion of his subjects. Sometime after he was joined by the Sidonians, Phœnicians and inhabitants of Cyprus, who had revolted from the king of Persia. This powerful confederacy was soon attacked by Darius the king of Persia, who marched at the head of his troops. Nectanebus, to defend his frontiers against so dangerous an enemy, levied 20,000 mercenary soldiers in Greece, the same number in Libya, and 60,000 were furnished in Egypt. This numerous body was not equal to the Persian forces, and Nectanebus, defeated in a battle, gave up all hopes of resistance, and fled into Ethiopia, where he found a safe asylum. His kingdom of Egypt became from that time tributary to the king of Persia.

NECTAR, among ancient poets, the drink of the fabulous deities of the heathens; in contradistinction from their solid food, which was called *ambrosia*.

NECTARINE, a fruit differing in nothing from the common peach, of which it is a species, than in having a smoother rind and a firmer pulp. See PERSICA.

NECTARIUM, from *nectar*, the fabled "drink of the gods;" defined by Linnæus to be a part of the corolla, or appendage to the petals, appropriated for containing the honey, a species of vegetable salt under a fluid form, that oozes from the plant, and is the principal food of bees and other insects.

Notwithstanding this definition which seems to consider the nectarium as necessary a part of the corolla as the petals; it is certain that all flowers are not provided with this appendage, neither indeed is it essential to fructification.

There is, besides a manifest impropriety in terming the nectarium a part of the corolla. Linnæus might with equal propriety, have termed it a part or appendage of the stamina, calyx, or pointal, as the appearance in question is confined to no particular part of the flower, but is as various in point of situation as of form. The truth is, the term *nectarium* is exceedingly vague: and, if any determinate meaning can be affixed to it, is expressive of all the singularities which are observed in the different parts of flowers.

Milne's Bot. Dict.

The tube, or lower part of flowers with one petal, Linnæus considers as a true nectarium, because it is generally found to contain the sweet liquor formerly mentioned. This liquor Pontedera compares to that called *amnios* in pregnant animals, which enters the fertile or impregnated seeds: but that this is not at least its sole use, is evident from this circumstance, that the honey or liquor in question is to be found in flowers where there are either no seeds, or those which, from the want of male organs, cannot be impregnated. Thus the male flowers of nettle and willow, the female flowers of sea-side laurel and black bryony, the male and female flowers of clutia, higgelaria, and butcher's broom, all abound with the honey or nectar alluded to.

Dr Vaillan was of opinion, that the nectarium was an essential part of the corolla; for which reason he distinguished the singular appearances in fennel-flower and columbine by the name of *petals*: the coloured leaves which are now termed the *petals* he denominates the *flower cup*.

That the nectarium, however, is frequently distinct from the petals, is evident, both from the well known examples just mentioned, as likewise from the flowers of monkshood, hellebore, isopyrum, fennel-flower of Crete, barrenwort, grass of Parnassus, chocolate-nut, cherleria and sauvagesia.

These general observations being premised, we proceed to take a nearer and more particular view of the principal diversities, both in form and situation, of this striking appendage to the flower. 1. In many flowers the nectarium is shaped like a spur or horn; and that either in flowers of one petal, as valerian, water-milfoil (*articularia*), butter-wort, and calves snout; or in such as have more than one, as lark spur, violet, fumatory, balsam, and orchis. 2. In the following plants, the nectarium is properly a part of the corolla, as lying within the substance of the petals: ranunculus, lily, iris, crown-imperial, water-leaf, mouse-tail, ananas or pine apple, dog's-tooth violet, piperidge bush, valisneria, hermannia, uvularia, and swertia. 3. The nectarium is frequently placed in a series or row within the petals, though entirely unconnected with their substance. In this situation it often resembles a cup, as in narcissus. A nectarium of this kind is said by Linnæus to crown the corolla. The following are examples: daffodil, sea-daffodil, campion, viscous campion,

pion, swallow-wort, stapelia, cynanchum, nepenthes, cherleria, balsam-tree, African spiræa, witch-hazel-olax, and passion-flower. 4. In Indian cress, buckler, mustard, Barbadoes cherry, and monotropa, the nectarium is situated upon or makes part of the calyx. 5. The nectarium in bastard flower-fence is seated upon the antheræ or tops of the stamina; whence the name *adenanthera*, or *glandular anthera*, which has been given to this genus of plants. In the following list it is placed upon the filaments; bean-caper, bay, fraxinella, marvel of Peru, bell-flower, lead-wort, roella, and commelina. 6. In hyacinth, flowering-rush, stock July-flower, and rocket, the nectarium is placed upon the seed-bud. 7. In honey-flower, orpine, buckwheat, collinsonia, lathræa, navel-wort, mercury, clutia, kiggelaria, sea-side laurel, and African spiræa, it is attached to the common receptacle. Lastly, in ginger, nettle, dyer's weed, heart-seed, costus, turmeric, grewia, bastard orpine, vanelloe, skrew-tree, and willow, the nectarium is of a very singular construction, and cannot properly fall under any of the foregoing heads.

In discriminating the genera, the nectarium often furnishes an essential character.

Plants which have the nectarium distinct from the petals, that is, not lodged within their substance, are affirmed by Linnæus to be generally poisonous. The following are adduced as examples: monk's-hood, hellebore, columbine, fennel-flower, grass of Parnassus, barren wort, oleander, marvel of Peru, bean-caper, succulent swallow-wort, fraxinella, and honey-flower.

NECUIA, in botany, a name given by the ancient Greeks to a species of mullein.

The Greeks and Romans both used the stalks of a peculiar kind of mullein, called *thryallis* by Nicander. For the making of wicks of lamps we have a kind of mullein called *lychnites*, and candle-wick mullein, from the λυχνιτις of Dioscorides; but it is not certain that ours is the same plant.

The ancients used the stalks of many different plants for the wicks of their candles and lamps. The rush, stripped of its bark, was as commonly in use with them as with the moderns for this purpose; and they also used the nettle, this mullein, and many other plants, whose stalks were composed of tough filaments for the same purpose; beating them out like hemp, and when dry dipping them in melted resin, and other such inflammable substances. When thus prepared, they are readily inflammable, like our flambeau; and this mullein, having stalks more long and large, and more firm than all the others, was used to make those lights with which they set fire to the funeral pile, for consuming the ashes of their dead friends.

NECYDALIS, in zoology, a genus of insects belonging to the order of coleoptera. The feelers are setaceous; the elytra are shorter and narrower than the wings; the tail is simple. There are 11 species, chiefly distinguished by the size and figure of their elytra. Barbut says, "Its head is black, eyes are large and prominent, jaws are of a dark brown. The antennæ placed on the top of the head between the eyes have their first articulation long and raised upright, the rest bent and turned aside. The antennæ vary as to length and colour. In individuals whose thorax are yellow, they are brown, and equal only to two-thirds of the body in length. On the contrary, in those whose thorax is black, they are likewise black, and somewhat longer than the body. The thorax is margined; in some it is yellow and longer; in others it is black, shorter, and edged only with a little yellow. The elytra are blackish, somewhat clearer in the middle, and terminating in a lemon coloured spot. The wings are rather black, something longer than the body, exceed the elytra by one-third, and are crossed one over the other. In those that have their thorax yellow, the legs and under part of the belly are so likewise. In individuals with a black thorax, the legs are black as well as the belly, which has only a little yellow on the sides. I suspect the latter to be the males. The larva is as yet unknown."

NEDHAM (Marchmont), an English satyrical writer, was born at Burford Oxon. about the month of August 1620. His father died in 1621; but the following year his mother was again married to one Christopher Glynn, vicar and schoolmaster of Burford; who perceiving his son-in law's pregnancy of parts and genius, took him under his own tuition, and at the age of 14 sent him to All Soul's College, Oxon. Here he was made one of the choristers, and continued till 1637, when having taken the degree of A. B. which made it inconsistent to continue in that office, he went to St Mary's Hall till he became an usher in Merchant Taylor's school, London. About the beginning of the civil wars, he became clerk to an attorney at Gray's Inn, where, writing a good court hand, he obtained a decent subsistence. Not long after this he began a weekly paper, under the title of *Mercurius Britannicus*, on the side of the parliament: it commenced about the middle of August 1643, coming out on Mondays, in one sheet, and continued till the end of 1646. It procured him popularity, and being an active man he was distinguished by the title of Capt. Nedham of Gray's Inn. Of these mercuries (for there were a number of them published on both sides of the great question which then divided the nation) it is well observed by Johnson, that they taught many to talk whom they could not teach to judge. Nedham's was, indeed, addressed as much to the passions as the reason; and, by telling every man that he was equal to his king, he so flattered vulgar pride, that his licentious opinions were received as the dictates of an oracle. About this time he studied physic, and in 1645 began to practise; by which, and his political writings, he supported a genteel figure. But, for some scorn and affront put upon him, he suddenly left his party, and, obtaining the favour of a royalist, was introduced into the king's presence at Hampton-court in 1647, and asking pardon upon his knees readily obtained it; so that being admitted to the king's favour, he wrote soon after another paper, entitled *Mercurius Pragmaticus;* which being equally witty with the former, as satirical against the Presbyterians, and full of loyalty, made him known and admired by the wits of that side. However, being narrowly sought after, he left London, and for a time lay concealed at the house of Dr Peter Heylin, at Minster Lovel, near Burford, till at length being discovered, he was imprisoned in Newgate, and in danger of his life. Lenthal, the speaker of the house of Commons, who knew him and his

Nedham. Needham. relations well, and Bradshaw, president of the high court of justice, treated him favourably, and not only got his pardon, but with promise of rewards and places persuaded him to change his side once more for the independents, who then were the uppermost party.—In this temper he published a third weekly paper, called *Mercurius Politicus*, which came out every Wednesday, in two sheets 4to, commencing with the 9th of June 1649, and ending with the 6th of June 1650, which being Thursday, he began again with number 1. from Thursday June 6, to Thursday June 13, 1650, beginning, "Why should not the commonwealth have "a fool, as well as the king had, &c." This paper, which contained many discourses against monarchy, and in behalf of a free state, especially those that were published before Cromwell was made protector, was carried on without any interruption till about the middle of April 1660, when, as several times before, it was prohibited by an order of the council of state.—Upon the return of Charles II. our author lay hid, till, by virtue of some money well placed, he obtained his pardon under the great seal; after which he exercised the faculty of physic among the Dissenters, which brought him in a considerable benefit till his death, which happened suddenly in 1678. Wood, who knew him, tells us that he was a person endowed with quick natural parts, was a good humanist, poet, and boon droll; and, had he been constant to his cavaliering principles, would have been beloved and admired by all; but being mercenary, and preferring his interest to his conscience, friendship, and love to his prince, was much hated by the royal party to the last. In short, there was no depending on this scurrilous ill-natured author. He followed whenever interest or passion led, and remains a notorious instance of the danger of brilliant parts, of which he certainly was possessed, without judgment or integrity to controul them. Wood, who in his Athen. Oxon. quoted above, gives a very copious account of him, says: "At length this most seditious, mutable, and railing "author, M. Nedham, died suddenly, in the house "of one Kidder, in D'Eureux-court near Temple-"bar, London, in 1678, and was buried near the "entrance of the chancel of the church of St Cle-"ments Danes."

Athen. Oxon. vol. ii.

NEEDHAM (John Tuberville), was born at London the 10th of September in the year 1713. His parents were descended from ancient and noble families. His father, who had once possessed a considerable patrimony at Hillton, in the county of Monmouth, was of the younger and Catholic branch of the Needham family: the head of the elder and Protestant branch was lord Kilmory, created viscount in the year 1625. The father of Mr Needham died young, and left but a small fortune to his four children. His eldest son, who is the subject of this article, prosecuted his studies under the secular clergy of the English college of Douai, where he took orders, taught rhetoric for several years, gave eminent proofs of sagacity and genius, and surpassed all the other professors of that seminary in the knowledge of experimental philosophy. In 1740, he was engaged by his superiors in the service of the English mission, and was entrusted with the direction of the school erected at Twyford, near Winchester, for the education of the Roman Catholic youth. In 1744, he was appointed professor of philosophy in the English college at Lisbon, where, on account of his bad health, he remained only 15 months. After his return, he passed several years at London and Paris, which were principally employed in microscopical observations and in other branches of experimental philosophy. The results of these observations and experiments were published in the Philosophical Transactions of the Royal Society of London in 1749, and in a volume in 12mo at Paris in 1750; and an account of them was also given by M. de Buffon, in the first volumes of his Natural History. There was an intimate connection between this illustrious French naturalist and Mr Needham: they made their experiments and observations together; though the results and systems which they deduced from the same objects and operations were totally different. Mr Needham was admitted to a place in the Royal Society of London in the year 1747, and in the Antiquarian Society some time after. From the year 1751 to 1767 he was chiefly employed in finishing the education of several English and Irish noblemen, by attending them as tutor in their travels through France, Italy, and other countries. He then retired from this wandering life to the English seminary at Paris, and in 1768 was chosen by the Royal Academy of Sciences in that city a corresponding member.

Needham.

When the regency of the Austrian Netherlands, in order to the revival of philosophy and literature in that country, formed the project of an Imperial academy, which was preceded by the erection of a small literary society to prepare the way for its execution, Mr Needham was invited to Brussels by Count Cobentzel and the president Neny, and was appointed successively chief director of both these foundations. He held this place, together with some ecclesiastical preferments in the Low Countries, until his death, which happened the 30th of December 1781. "His piety, temperance, and purity of manners (we follow the expression of of the Abbé Mann) were eminent: his attachment to the doctrines and duties of Christianity was inviolable. His zealous opposition to modern infidels was indefatigable and even passionate. His probity was untainted. He was incapable of every species of duplicity; his beneficence was universal, and his unsuspicious candour rendered him often a dupe to perfidy." These and other good qualities the panegyrist attributes to his deceased friend; and the learned authors of the Monthly review, to whom Mr Needham was known, admit the justness of the panegyric. He was undoubtedly (say they) both an honest man and a worthy citizen; but though his death be a real loss to the literary world, yet he died seasonably for himself; for had he lived to see Joseph the IId. and the Great making so free with the paint, patches, and trinkets of the mother church, confiscating her lands, abolishing her convents, suppressing her holidays, introducing common sense into her worship, erecting political conductors to disperse the thunder of the vatican, and atchieving many other things in this style of improvement, it would have vexed full sore his feeling heart. For this honest man was narrow even to superstition and bigotry in his religious system; and we never knew a man in whom there was such an unaccountable unacconntable mixture of implicit faith and philosophical curiosity as in Mr Needham. He was a keen and judicious observer of nature, had a peculiar dexterity in confirming his observations by experiments, and he was always occupied (sometimes indeed with too much fancy and precipitation) in generalizing facts, and reducing them to his system. "His pen (says Abbé Maun) was neither remarkable for fecundity nor method; his writings are rather the great lines of a subject expressed with energy. and thrown upon paper in a hurry, than finished treatises," His works are well known both in Britain and in France.

NEEDHAM, in Suffolk, 73 miles from London, stands on the Orwell, 9 miles from Ipswich, in the road to Huntingdonshire, Its market is on Wednesday, and fair in October 28.

NEEDLE, a very common little instrument or utensil made of steel, pointed at one end, and pierced at the other, used in sewing, embroidery, tapestry, &c.

Needles make a very considerable article in commerce, though there is scarce any commodity cheaper, the consumption of them being almost incredible.—The sizes are from n°1. the largest, to n° 25. the smallest. In the manufacture. of needles, German and Hungarian steel are of most repute.

In the making of them, the first thing is to pass the steel through a coal fire, and under a hammer, to bring it out of its square figure into a cylindrical one. This done, it is drawn through a large hole of a wire-drawing iron, and returned into the fire, and drawn through a second hole of the iron smaller than the first; and thus successively from hole to hole, till it has acquired the degree of fineness required for that species of needles: observing every time it is to be drawn, that it be greased over with lard, to render it more manageable. The steel thus reduced to a fine wire, is cut in pieces of the length of the needles intended. These pieces are flatted at one end on the anvil, in order to form the head and eye: they are then put into the fire, to soften them farther; and thence taken out and pierced at each extreme of the flat part on the anvil, by force of a puncheon of well-tempered steel, and laid on a leaden block to bring out, with another puncheon, the little piece of steel remaining in the eye. The corners are then filed off the square of the heads, and a little cavity filed on each side of the flat of the head; this done, the point is formed with a file, and the whole filed over: they are then laid to heat red hot on a long narrow iron, crooked at one end, in a charcoal fire; and when taken out thence, are thrown into a bason of cold water to harden. On this operation a good deal depends; too much heat burns them, and too little leaves them soft; the medium is learned by experience. When they are thus hardened, they are laid in an iron shovel on a fire more or less brisk in proportion to the thickness of the needles; taking care to move them from time to time. This serves to temper them, and take off their brittleness; great care here too must be taken of the degree of heat. They are then straigthened one after another with the hammer, the coldness of the water used in hardening them having twisted the greatest part of them.

The next process is the polishing them. To do this, they take 12,000 or 15,000 needles, and range them in little heaps against each other on a piece of new buckram sprinkled with emery-dust. The needles thus disposed, emery-dust is thrown over them, which is again sprinkled with oil of olives; at last the whole is made up into a roll, well bound at both ends. This roll is then laid on a polishing table, and over it a thick plank loaded with stones, which two men work backwards and forwards a day and a half, or two days, successively; by which means the roll thus continually agitated by the weight and motion of the plank over it, the needles withinside being rubbed against each other with oil and emery, are insensibly polished. After polishing, they are taken out, and the filth washed off them with hot water and soap: they are then wiped in hot bran, a little moistened, placed with the needles in a round box, suspended in the air by a cord, which is kept stirring till the bran and needles be dry. The needles thus wiped in two or three different brans, are taken out and put in wooden vessels, to have the good separated from those whose points or eyes have been broken either in polishing or wiping; the points are then all turned the same way, and smoothed with an emery stone turned with a wheel. This operation finishes them, and there remains nothing but to make them into packets of 250 each. Needles were first made in England by a native of India in 1545, but the art was lost at his death; it was, however, recovered by Christopher Greening in 1560, who was settled with his three children, Elizabeth, John, and Thomas, by Mr Damar, ancestor of the present Lord Milton, at Long Crendon in Bucks, where the manufactory has been carried on from that time to this present day.

Dipping-NEEDLE, or *Inclinatory Needle*, a magnetical needle, so hung, as that, instead of playing horizontally, and pointing out north and south, one end dips, or inclines to the horizon, and the other points to a certain degree of elevation above it. Plate CCCXLV. fig. 1.

The dipping needle was invented in the year 1576 by one Robert Norman a compass-maker at Wapping. The occasion of the discovery, according to his own account, was, that it being his custom to finish and hang the needles of his compasses before he touched them, he always found, that immediately after the touch the north-point would bend or incline downward under the horizon; insomuch that, to balance the needle again, he was always forced to put a piece of wax on the south end as a counterpoise. The constancy of this effect led him at length to observe the percise quantity of the dip, or to measure the greatest angle which the needle would make with the horizon; and this at London he found to be 71° 50′. In 1723 Mr Graham made a great many observations on the dipping-needle, and found the angle to be between 74 and 75 degrees. Mr Nairne, in 1772, found it to be somewhat above 72°. It is not certain whether the dip varies, as well as the horizontal direction, in the same place. The trifling difference between Mr Forman and Mr Nairne would lead us to imagine that the dip was unalterable; but Mr Graham, who was a very accurate observer, makes the difference more considerable. It is certain, however, from a great number of experiments and observations, that the dip is variable in different latitudes, and that it increases in going northwards. It appears from a table of observations made with the marine dipping-needle in a voyage

voyage towards the north pole in 1733, that in lat. 60. 18. the dip was 75°; and in lat. 70. 45. it was 77° 52'; in lat. 80. 12. it was 81° 52'; and in lat. 80. 27. it was 82° 2½'.

Several authors have endeavoured to apply this discovery of the dip to the finding of the latitude; and Mr Bond attempted to apply it to the finding of the longitude alſo; but for want of obſervations and experiments he could not make any progreſs. The affair was farther proſecuted by Mr Whiſton, who publiſhed a treatiſe on the longitude, and for ſome time imagined it was poſſible to find it exactly by means of the dip of the needle; yet he at laſt deſpaired of it, for the following reaſons. 1. The weakneſs of the magnetic power. 2. The concuſſion of the ſhip, which he found it exceeding difficult to avoid ſo much as was neceſſary for the accuracy of the experiments. 3. The principal objection was an irregularity in the motions of all magnetic needles, both horizontal and dipping, by which they, within the compaſs of about a degree, vary uncertainly backward and forward; even ſometimes, in a few hours time, without any evident cauſe. For a particular account of theſe variations both of the horizontal and dipping needle, ſee the article Variation.

Mr Nairne made a dipping-needle in 1772 for the board of longitude, which was uſed in the voyage towards the north-pole. This is repreſented Plate CCCXLV. fig. 2. The needle AA is 12 inches long, and its axis, the ends BB of which are made of gold alloyed with copper, reſts on friction-wheels CCCC, of four inches diameter, each end on two friction-wheels; which wheels are balanced with great care. The ends of the axes of the friction-wheels are likewiſe of gold alloyed with copper, and moved in ſmall holes made in bell-metal: and oppoſite to the ends of the axes of the needle and the friction-wheels, are flat agates, ſet in at DDD, finely poliſhed. The magnetic needle vibrates within a circle of bell-metal, EEE, divided into degrees and half degrees; and a line, paſſing through the middle of the needle to the ends, points to the diviſions. The needle of this inſtrument was balanced before it was made magnetical; but by means of a croſs, the ends of which are FFFF, (contrived by the reverend Mr Mitchell) fixed on the axis of the needle, on the arms of which are cut very fine ſcrews to receive ſmall buttons, that may be ſcrewed nearer or farther from the axis, the needle may be adjuſted both ways to a great nicety, after being made magnetical, by reverſing the poles, and changing the ſides of the needle. GG are two levels, by which the line of 0 degrees of the inſtrument is ſet horizontal, by means of the four adjuſting ſcrews LLLL; H is the perpendicular axis by which the inſtrument may be turned, that the divided face of the circle may front the eaſt or weſt; to this axis is fixed an index I, which points to an oppoſite line on the horizontal plate K when the inſtrument is turned half round; MMMM are ſcrews which hold the glaſs-cover to keep the needle from being diſturbed by the wind. When this needle is conſtructed for ſea, it is ſuſpended by an univerſal joint on a triangular ſtand, and adjuſted vertically by a plumb-line and button above the divided circle and the dovetail work at the upper 90; and the diviſions on the circle are adjuſted ſo as to be perpendicular to the horizon by the ſame plumb-line, and an adjoining ſcrew; and when it is adjuſted, a pointer annexed to a ſcrew, which ſerves to move the divided circle, is fixed at the loweſt 90. Whenever the inſtrument is uſed to find the dip, it muſt be ſo placed that the needle may vibrate exactly in the magnetic meridian.

Magnetical Needle, in navigation, a needle touched with a loadſtone, and ſuſtained on a pivot or centre: on which playing at liberty, it directs itſelf to certain points in or under the horizon: whence the magnetical needle is of two kinds, viz. horizontal or inclinatory. See the article Magnet.

Horizontal needles are thoſe equally balanced on each ſide of the pivot that ſuſtains them; and which playing horizontally with their two extremes, point out the north and ſouth points of the horizon. For their application and uſe, ſee the article Compass.

In the conſtruction of the horizontal needle, a piece of pure ſteel is provided; of a length not exceeding ſix inches, leſt its weight ſhould impede its volubility; very thin, to take its verticity the better; and not pierced with any holes, or the like, for ornament ſake, which prevent the equable diffuſion of the magnetic virtue. A perforation is then made in the middle of its length, and a braſs cap or head ſoldered on, whoſe inner cavity is conical, ſo as to play freely on a ſtyle or pivot headed with a fine ſteel point. The north point of the needle in our hemiſphere is made a little lighter than the ſouthern: the touch always deſtroying the balance, if well adjuſted before, and rendering the north end heavier than the ſouth, and thus occaſioning the needle to dip.

The method of giving the needle its verticity or directive faculty has been ſhown already under the article Magnet; but if, after touching, the needle be out of its equilibrium, ſomething muſt be filed off from the heavier ſide, till it balance evenly.

Needles in ſea compaſſes are uſually made of a rhomboidal or oblong form: we have given their ſtructure already under the article Compass.

The needle is not found to point preciſely to the north, except in very few places; but deviates from it more or leſs in different places, and that too at different times; which deviation is called its *declination* or *variation from the meridian*. See the article Variation.

Surgeons Needles are generally made crooked, and their points triangular; however they are of different forms and ſizes, and bear different names, according to the purpoſes they are uſed for.

The largeſt are needles for amputation; the next, needles for wounds; the fineſt needles for ſutures. They have others very ſhort and flat, for tendons; others, ſtill ſhorter, and the eye placed in the middle, for tying together of veſſels, &c. Needles for couching cataracts are of various kinds; all of which have a ſmall, broad, and ſharp point or tongue; and ſome with a ſulcus at the point. Surgeons have ſometimes uſed two needles in this operation; one with a ſharp point for perforating the coats of the eye, and another with a more obtuſe point for depreſſing or couching the opaque cryſtalline lens: but care ſhould be taken in the uſe of any of theſe, that they be firſt well poliſhed with cloth or leather, before they are applied to the eye.

Mr Warner obſerves, that the blade of the couching needle

Lay-Nett. Plate CCCXLV. Dipping Needle

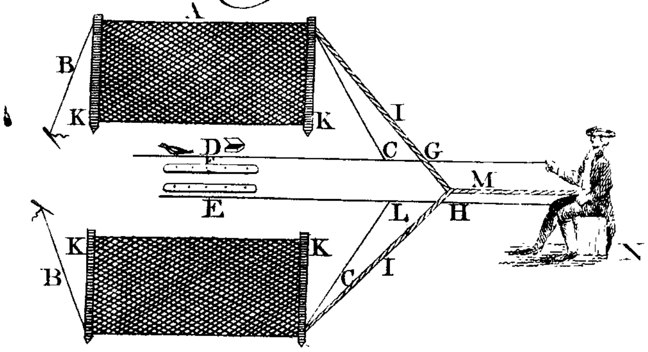

Fig. 2.

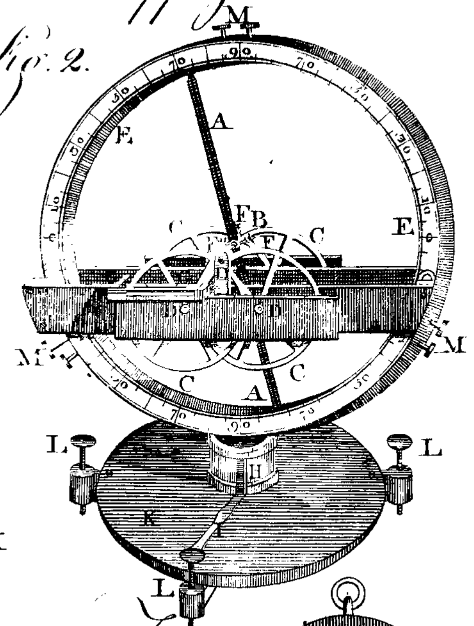

Fig. 1.

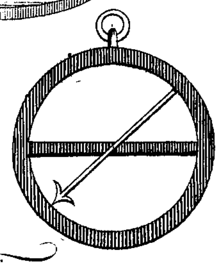

Fig. 3.

Newtonian Philosophy.

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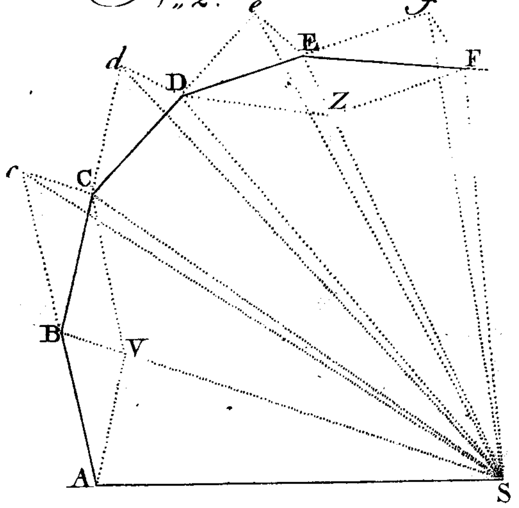

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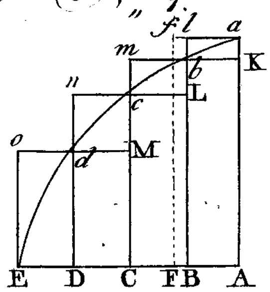


Nereis.

Fig. 1.

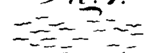


Fig. 2.

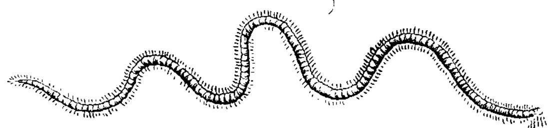
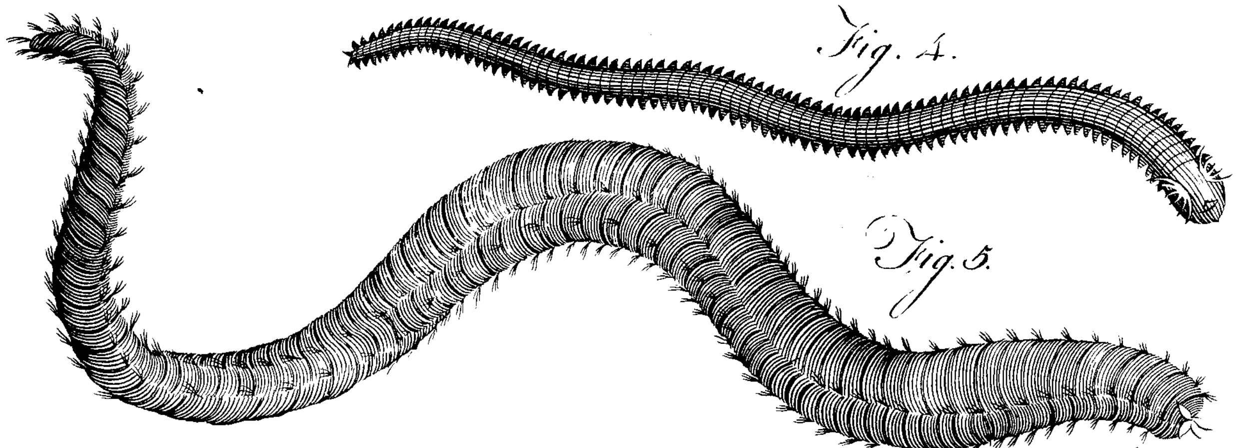


Fig. 4.

Fig. 5.



Grav'd by James Akin of S.o Carolina

needle should be at least a third part larger than those generally used upon this occasion, as great advantages will be found in the depressing of the cataract, by the increased breadth of the blade of that instrument. The handle, also, if made somewhat shorter than usual, will enable the operator to perform with greater steadiness, than he can do with a larger handled instrument.

It is to be observed, that needles of silver pierce more easily in stitching arteries after an amputation, than those made of steel.

Needle-Fish. See Sygnathus.

Needles, sharp-pointed rocks north of the Isle of Wight. They are situated at the western extremity of the island, which is an acute point of high land, from which they have been disjoined by the washing of the sea. There were of these lofty white rocks formerly three, but about 14 years ago the tallest of them, called *Lot's Wife*, which arose 120 feet above low-water mark, and in its shape resembling a needle, being undermined by the constant efforts of the waves, overset, and totally disappeared.

NEEDS, or St Neots, six miles from Huntingdon, 58 miles from London, so called from the monument of a saint of that name in it, who was burnt by the Danes, is a large well-built town, having a handsome strong church, with a prodigious fine steeple, and a good stone-bridge over the Ouse, by which coals are brought to it, and sold through the country. It has a charity-school for 25 poor children. Its market is on Thursday; fairs on Holy Thursday, Aug. 1. Corpus-Christi Thursday, June 13, and December 17.; and it is famous for a medicinal spring.

NEEDWOOD-forest, in Staffordshire, between the Trent, Dove, and Blythe, and near Uttoxeter, is said to exceed all the forests in England in the excellency of its soil and the fineness of its turf.

NE EXEAT REGNO, in law, is a writ to restrain a person from going out of the kingdom without the king's licence. F. N. B. 85. It may be directed to the sheriff, to make the party find surety that he will not depart the realm, and on refusal to commit him to prison: or it may be directed to the party himself; and if he then goes, he may be fined. And this writ is granted on a suit being commenced against a man in the chancery, when the plaintiff fears the defendant will fly to some other country; and thereby avoid the justice and equity of the court; which hath been sometimes practised: and when thus granted, the party must give bonds to the masters of the rolls, in the penalty of 1000l. or some other large sum; for yielding obedience to it; or satisfy the court, by answer, affidavit, or otherwise, that he hath no design of leaving the kingdom, and give security.

NEFERN, in Pembrokeshire, a village in whose church-yard is a remarkable old cross. The church has no pavement in it, and the frequent burials have raised the ground within it to seven or eight feet higher than without. In process of time, instead of a church, it will be only a sepulchre. It is pleasantly situated on the banks of a river of the same name near Newport.

NEFASTI dies, in Roman antiquity, an appellation given to those days wherein it was not allowed to administer justice, or hold courts. They were so called because, *non fari licebat*, the prætor was not allowed to pronounce the three solemn words or formulas of the law, *do*, *dico*, *addico*, I give, I appoint, I adjudge. These days were distinguished in the calendar by the letter N. for *nefastus*; or N. P. *Nefastus Primo*, when the day was only *nefastus* in the forenoon, or first part. The days of a mixed kind were called *intercisi*.

NEGAPATAN, a town of Asia in the peninsula on this side the Ganges, and on the coast of Coromandel. It was first a colony of the Portuguese, but was taken from them by the Dutch. The factory purchase very little besides tobacco and long linen cloths: however, the Dutch have thought proper to erect a fort here. It is situated in E. Long. 79. 10 N. Lat. 11. 15.

NEGATION, in logic, an act of the mind affirming one thing to be different from another: as that the soul is not matter. See Logic.

NEGATIVE, in general, something that implies a negation: thus we say, negative quantities, negative powers, negative signs, &c.

Negative-Sign. The use of the negative sign, in algebra, is attended with several consequences that at first sight are admitted with difficulty, and has sometimes given occasion to notions that seem to have no real foundation. This sign implies, that the real value of the quantity represented by the letter to which it is prefixed is to be subtracted; and it serves, with the positive sign, to keep in view what elements or parts enter into the composition of quantities, and in what manner, whether as increments or decrements, (that is, whether by addition or subtraction), which is of the greatest use in this art.

In consequence of this, it serves to express a quantity of an opposite quality to the positive, as a line in a contrary position; a motion with an opposite direction; or a centrifugal force in opposition to gravity; and thus often saves the trouble of distinguishing, and demonstrating separately, the various cases of proportions, and preserves their analogy in view. But as the proportions of lines depend on their magnitude only, without regard to their position, and motions and forces are said to be equal, or unequal, in any given ratio, without regard to their directions; and, in general, the proportion of quantity relates to their magnitude only, without determining whether they are to be considered as increments or decrements; so there is no ground to imagine any other proportion of $-b$ and $+a$ (or of -1 and 1) than that of the real magnitudes of the quantities represented by b and a, whether these quantities are, in any particular case, to be added or subtracted. It is the same thing to subtract a decrement, as to add an equal increment, or to subtract $-b$ from $a-b$, as to add $+b$ to it: and because multiplying a quantity by a negative number implies only a repeated subtraction of it, the multiplying $-b$ by $-n$, is subtracting $-b$ as often as there are units in n; and is therefore equivalent to adding $+b$ so many times, or the same as adding $+nb$. But if we infer from this, that 1 is to $-n$ as $-b$ to nb, according to the rule, that unit is to one of the factors as the other factor is to the product, there is no ground to imagine that there is any mystery in this, or any other meaning than that the real magnitudes represented by 1, n, b, and nb are proportional. For that rule relates only to the magnitude of the factors and product, without determining whether any factor, or the product, is to be added or subtracted. But this likewise must be determined in algebraic computations; and this is the proper use of the rules concerning the signs, without which the operation could not proceed. Because a quantity to be subtracted is never produced in composition by any repeated addition of a positive, or repeated subtraction of a negative, a negative square number is never produced by composition from the root. Hence $\surd{-1}$, or the square root of a negative, implies an imaginary quantity; and, in resolution, is a mark or character of the impossible cases of a problem, unless it is compensated by another imaginary symbol or supposition, when the whole expression may have a real signification. Thus $1+\surd{-1}$, and $1-\surd{-1}$ taken separately, are imaginary, but their sum is 2; as the conditions that separately would render the solution of a problem impossible, in some cases destroy each others effect when conjoined. In the pursuit of general conclusions, and of simple forms representing them, expressions of this kind must sometimes arise where the imaginary symbol is compensated in a manner that is not always so obvious.

By proper substitutions, however, the expression may be transformed into another, wherein each particular term may have a real signification as well as the whole expression. The theorems that are sometimes briefly discovered by the use of this symbol, may be demonstrated without it by the inverse operation, or some other way; and though such symbols are of some use in the computations by the method of fluxions, its evidence cannot be said to depend upon arts of this kind. See Maclaurin's Fluxions, book ii. chap. 1. and Ludlam's Algebra, *passim*.

NEGATIVE *Electricity*. See the article ELECTRICITY. *passim*. See also POSITIVE *Electricity*.

NEGINOTH. This term is read before some of the Psalms, as Psalm lxvii. It signifies *string instruments of music*, to be played on by the fingers, or women musicians; and the titles of those psalms where this word is found, may be thus translated, *A psalm of David to the master of music, who presides over the string-instruments*.

NEGOMBO, a sea-port town of Asia, on the west coast of Ceylon. It has a fort built by the Portuguese, which was taken from them by the Dutch in 1640. E. Long. 80. 25. N. Lat. 17. 0.

NEGRIL POINT, the most westerly promontory of the island of Jamaica.

NEGRO, *Homo pelli nigra*, a name given to a variety of the human species, who are entirely black, and are found in the Torrid zone, especially in that part of Africa which lies within the tropics. In the complexion of negroes we meet with many various shades; but they likewise differ far from other men in all the features of their face. Round cheeks, high cheek-bones, a forehead somewhat elevated, a short, broad, flat nose, thick lips, small ears, ugliness, and irregularity of shape, characterize their external appearance. The negro women have the loins greatly depressed, and very large buttocks, which gives the back the shape of a saddle. Vices the most notorious seem to be the portion of this unhappy race: idleness, treachery, revenge, cruelty, impudence, stealing, lying, profanity, debauchery, nastiness, and intemperance, are said to have extinguished the principles of natural law, and to have silenced the reproofs of conscience. They are strangers to every sentiment of compassion, and are an awful example of the corruption of man when left to himself.

The origin of the negroes, and the cause of their remarkable difference from the rest of the human species, has much perplexed the naturalists. Mr Boyle has observed, that it cannot be produced by the heat of the climate: for though the heat of the sun may darken the colour of the skin, yet experience does not show that it is sufficient to produce a new blackness like that of the negroes.

In Africa itself, many nations of Ethiopia are not black; nor were there any blacks originally in the West Indies. In many parts of Asia, under the same parallel with the African region inhabited by the blacks, the people are but tawny. He adds, that there are negroes in Africa beyond the Southern tropic; and that a river sometimes parts nations, one of which is black and the other only tawny. Dr Barriere alleges, that the gall of Negroes is black, and being mixed with their blood is deposited between the skin and scarf-skin. However, Dr Mitchel of Virginia, in the Philosophical Transactions, n° 476, has endeavoured by many learned arguments to prove, that the influence of the sun in hot countries, and the manner of life of their inhabitants, are the remote causes of the colour of the Negroes, Indians, &c. Lord Kaimes, on the other hand, and such philosophers as he, whose genius and imagination are too lively to submit to a dry and painful investigation of facts, have contended, that no physical cause is sufficient to change the colour, and what we call the regular features of white men, to the dark hue and deformity of the woolly-headed negro. Their arguments have been examined with much acuteness and ingenuity by Dr Stanhope Smith of New Jersey, Dr Hunter, and professor Zimmerman, who have made it in a high degree probable, that the action of the sun is the original and chief cause of the black colour, as well as distorted features, of the negro. See AMERICA, n° 48—51. and COMPLEXION.

True negroes are found in no quarter of the globe where the heat of the climate is not very great. They exist no where but in the Torrid zone, and only in three regions situated in that zone, to wit, in Senegal, in Guinea, and on the western shores of Africa, in Nubia, and the Papous land, or what is called *New Guinea*. In all these regions the atmosphere is scorching, and the heat excessive. The inhabitants of the north are whitest; and as we advance southwards towards the line, and those countries on which the sun's rays fall more perpendicularly, the complexion gradually assumes a darker shade. And the same men, whose colour has been rendered black by the powerful action of the sun, if they remove to the north, gradually become whiter (at least their posterity), and lose their burnt colour. Whites, when transported into the burning regions of the Torrid zone, are at first subject to fever; the skin of the face, hands, and feet, becomes burnt, hardens, and falls off in scales. Hitherto the colour of negroes appears to be only local, extrinsic, and accidental, and their short frizzled

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frizzled and ſparſe hair is to be accounted for in the very ſame manner.

Climate poſſeſſes great and evident influence on the hair, not only of men, but of all other animals. If in one caſe theſe tranſmutations are acknowledged to be conſiſtent with identity of kind, they ought not in the other to be eſteemed criterions of different ſpecies. Nature has adapted the pliancy of her work to the ſituations in which ſhe may require it to be placed. The beaver and ſheep removed to the warm latitudes exchange, the one its fur, and the other its wool, for a coarſe hair that preſerves the animal in a more moderate temperature. The coarſe and black ſhag of the bear is converted, in the arctic regions, into the fineſt and whiteſt fur. The colour of the hair is likewiſe changed by climate. The bear is white under the arctic circle; and, in high northern latitudes, foxes, hares, and rabbits, are found white. Similar effects of climate are diſcernible on mankind. The hair of the Danes is generally red; of the Engliſh, fair or brown; and of the French, commonly black. The hair of all people of colour is black, and that of the African negroes is likewiſe ſparſe and curled in a manner peculiar to themſelves; but this peculiarity is analogous to the effect which a warm climate has on almoſt every other animal. Cold, by obſtructing the perſpiration, tends to throw out the perſpirable matter accumulated at the ſkin in an additional coat of hair. A warm climate, by opening the pores, evaporates this matter before it can be concreted into the ſubſtance of hair; and the laxneſs and aperture of the pores render the hair liable to be eaſily eradicated by innumerable incidents. Its curl may reſult in part from the nature of the ſecretion by which it is nouriſhed, and in part from external heat. That it depends in ſome degree on the quality of the ſecretion is rendered highly probable from its appearance on the chin and other parts of the human body. Climate is as much diſtinguiſhed by the nature and proportion of the ſecretions as by the degree of heat: (See Physiology, ſect. 6.) Whatever be the nutriment of the hair, it is evidently combined in the torrid zone of Africa with ſome fluid of a highly volatile or ardent quality which produces the rank ſmell of many African nations. Saline ſecretions tend to curl and to burn the hair The evaporation of any volatile ſpirits would render its ſurface dry and diſpoſed to contract; whilſt the centre continuing diſtended by the vital motion, theſe oppoſite dilatations and contractions would neceſſarily produce a curve, and make the hair grow involved. External and violent heat parching the extremities of the hair, tends likewiſe to involve it. A hair held near the fire inſtantly coils itſelf up. Africa is the hotteſt country on the globe; and the influence of its heat, either external or internal, or both, in giving the peculiar form to the hair of the natives, appears, not only from its ſparſeneſs and its curl, but from its colour. It is not of a ſhining, but of an aduſt black; and its extremities tend to brown, as if it had been ſcorched by the fire.

The peculiaries of the negro-features and form may likewiſe be accounted for from the exceſſive heat of the climate and the ſtate of African ſociety. Being ſavages, they have no arts to protect them from the rays of a burning ſun. The heat and ſerenity of the ſky preſerving the lives of the children without much care of the parents they ſeem of courſe to be, in the interior parts of the country, negligent of their offspring. Able themſelves to endure the extremes of that ardent climate, they inure their children to it from their moſt tender age. They ſuffer them to roll in the duſt and ſand beneath the direct rays of a vertical ſun. The mother, if ſhe be engaged, lays down the infant on the firſt ſpot ſhe finds, and is ſeldom at the pains to ſeek the miſerable ſhelter of a barren ſhrub, which is all that the interior country affords. When we reflect on the influence of a glare of light upon the eye, and on the contortions of countenance produced by our efforts to repel or prevent it, we need not wonder that the pliant features of a negro-infant ſhould, by conſtant expoſure, acquire that permanent irregularity which we term their characteriſtic uglineſs. But beſides the climate, food and clothing and modes of life have prodigious effects on the human form and features. This is apparent even in poliſhed ſocieties, where the poor and labouring part of the community are much more coarſe in their features, and ill-formed in their limbs, than perſons of better fortune and more liberal means of ſubſiſtence. What an immenſe difference exiſts in Scotland, for inſtance, between the chiefs and the commonalty of the Highland clans? If they had been ſeparately found in different countries, they would have been ranged by ſome philoſophers under different ſpecies. A ſimilar diſtinction takes place between the nobility and peaſantry of France, of Spain, of Italy, and of Germany.

That food and clothing, and the different modes of life, have as great an influence upon the ſhapes and features of the Africans as upon the natives of Europe, is evident from the different appearances of the negroes in the ſouthern republics of America according to the ſtations in which they are employed. "The field ſlaves (ſays Dr Smith) are badly fed, clothed, and lodged. They live in ſmall huts on the plantations, where they labour, remote from the ſociety and example of their ſuperiors. Living by themſelves, they retain many of the cuſtoms and manners of their African anceſtors. The domeſtic ſervants, on the other hand, who are kept near the perſons, or employed in the families of their maſters, are treated with great lenity; their ſervice is light; they are fed and clothed like their ſuperiors; they ſee their manners, adopt their habits, and inſenſibly receive the ſame ideas of elegance and beauty. The field ſlaves are, in conſequence, ſlow in changing the aſpect and figure of Africa. The domeſtic ſervants have advanced far before them in acquiring the agreeable and regular features, and the expreſſive countenance of civil ſociety. The former are frequently ill-ſhaped. They preſerve, in a great degree, the African lips, noſe, and hair. Their genius is dull, and their countenance ſleepy and ſtupid. The latter are ſtraight and well proportioned; their hair extended to three, four, and ſometimes even to ſix or eight inches; the ſize and ſhape of the mouth handſome, their features regular, their capacity good, and their look animated."

Upon the whole, we hope that the reader, who ſhall candidly weigh in his own mind what we have ſaid at preſent and under the article Complexion, will agree with us, that the black colour in the torrid zone, the ſparſe criſp hair of the negroes, and the peculiarities of their features and form, proceed from cauſes altogether extrinſic; that they depend on local temperature and the ſtate of ſociety; and that they are as accidental as the various

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various shades of colour which characterize the different nations of Europe. If the whites be considered as the stock whence all others have sprung, it is easy to conceive how they have degenerated into negroes. Some have conjectured that the complete change may have taken place at the end of three centuries, whilst others have thought that it could not be effected in less than double that period. Such conjectures can be formed from no certain data; and a much greater length of time is undoubtedly necessary before negroes, when transplanted into our temperate countries, can entirely lose their black colour. By crossing the breed with whites, every taint of the negro-colour may be expelled, we believe, from the fifth generation (A).

But the most serious charge brought against the poor negroes is, that of the *vices* said to be natural to them. If they be indeed such as their enemies represent them, treacherous, cruel, revengeful, and intemperate, by a necessity of *nature*, they must be a different race from the whites; for though all these vices abound in Europe, it is evident that they proceed not from nature, but from wrong education, which gives to the youthful mind such deep impressions as no future exertion can completely eradicate. Let us inquire coolly if the vices of the negroes may not have a similar origin.

Edwards's History of the West Indies, vol ii.

In every part of Africa with which the nations of Europe have any commerce, slavery prevails of the worst kind. Three-fourths of the people are slaves to the rest, and the children are born to no other inheritance. "Most parts of the coast differ in their governments; some are absolute monarchies, while others draw near to an aristocracy. In both the authority of the chief or chiefs is unlimited, extending to life; and it is exercised as often as criminal cases require, unless death is commuted into slavery; in which case the offender is sold, and if the shipping will not buy the criminal, he is immediately put to death. Fathers of free condition have power to sell their children, but this power is very seldom enforced." In Congo, however, a father * will sell a son or daughter, or perhaps both, for a piece of cloth, a collar or girdle of coral or beads, and often for a bottle of wine or brandy. A husband may have as many wives as he pleases, and repudiate or even sell them, though with child, at his pleasure. The wives and concubines, though it be a capital crime for the former to break the conjugal faith, have a way to rid themselves of their husbands, if they have set their affections upon a new gallant, by accusing them of some crime for which the punishment is death. In a word, the bulk of the people in every state of Africa are born slaves to great men, reared as such, held as property, and as property sold (see SLAVERY). There are indeed many circumstances by which a free man may become a slave: such as being in debt, and not able to pay; and in some of such cases, if the debt be large, not only the debtor, but his family likewise, become the slaves of his creditor, and may be sold. Adultery is commonly punished in the same manner, both the offending parties being sold, and the purchase-money paid to the injured husband. *Obi*, or pretended witchcraft (in which all the negroes firmly believe, see WITCHCRAFT), is another, and a very common offence, for which slavery is adjudged the lawful punishment; and it extends to all the family of the offender. There are various other crimes which subject the offender and his children to be sold; and it is more than probable, that if there were no buyers, the poor wretches would be murdered without mercy.

* Mod. Univ. History. vol. xiii. p. 55.

Negro. Edwards's History of the West Indies.

In such a state of society what dispositions can be looked for in the people, but cruelty, treachery, and revenge? Even in the civilized nations of Europe, blessed with the lights of law, science, and religion, some of the lower orders of the community consider it as a very trivial crime to defraud their superiors; whilst almost all look up to them with stupid malevolence or rancorous envy. That a depressed people, when they get power into their hands, are revengeful and cruel, the present age affords a dreadful proof; and is it wonderful that the negroes of Africa, unacquainted with moral principles, blinded by the cruellest and most absurd superstitions, and whose customs tend to eradicate from the mind all natural affection, should sometimes display to their lordly masters of European extraction the same spirit that has been so generally displayed by the lower orders of Frenchmen to their ecclasiastics, their nobles, and the family of their murdered sovereign! When we consider that the majority of the negroes groan under the cruellest slavery, both in their own country and in every other where they are to be found in considerable numbers, it can excite no surprise that they are in general treacherous, cruel, and vindictive. Such are the caprices of their tyrants at home, that they could not preserve their own lives or the lives of their families for any length of time, but by a perpetual vigilance, which must necessarily degenerate, first into cunning, and afterwards into treachery; and it is not conceivable that habits formed in Africa should be instantly thrown off in the West Indies, where they are the property of men whom some of them must consider as a different race of beings.

But

(A) 1. A white man with a negro woman, or a negro man with a white woman, produce a mulatto, half white and half black, or of a yellow-blackish colour, with black, short, frizzled hair. 2. A white man with a mulatto woman, or a negro with a mulatto woman, produce a *quadroon*, three fourths white and one fourth black, or three fourths black and one fourth white, or of a lighter yellow than the former. The name of *cabres* is given to those who are descended from a black man and a mulatto woman, or a mulatto man and a black woman, who are three fourths black and one fourth white, and who are not so black as a negro, but blacker than a mulatto. 3. A white man with a quadroon woman, or a negro with a quadroon woman, produce a *mestizo*, seven eighths white and one eighth black, or seven eighths black and one eighth white. 4. A white man with a mestizo woman, or a negro with a mestizo woman, produce, the one almost a perfect white, the other almost a perfect black, called a *quinteroon*. This is the last gradation, there being no visible difference between the fair quinteroons and the whites; and the children of a white and quinteroon consider themselves as free from all taint of the negro race.

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But the truth is, that the ill qualities of the negroes have been greatly exaggerated. Mr Edwards, in his valuable History of the West Indies, assures us that the Mandingo negroes display such gentleness of disposition and demeanour, as would seem the result of early education and discipline, were it not that, generally speaking, they are more prone to theft than any of the African tribes. It has been supposed that this propensity, among other vices, is natural to a state of slavery, which degrades and corrupts the human mind in a deplorable manner; but why the Mandingoes should have become more vicious in this respect than the rest of the natives of Africa in the same condition of life, is a question he cannot answer.

"The circumstances which (according to the same author) distinguish the Koromantyn or Gold Coast negroes from all others, are firmness both of body and mind; a ferociousness of disposition; but withal, activity, courage, and a stubbornness, or what an ancient Roman would have deemed an elevation of soul, which prompts them to enterprises of difficulty and danger, and enables them to meet death, in its most horrible shape, with fortitude or indifference. They sometimes take to labour with great promptitude and alacrity, and have constitutions well adapted for it; for many of them have undoubtedly been slaves in Africa. But as the Gold Coast is inhabited by various tribes, which are engaged in perpetual warfare and hostility with each other, there cannot be a doubt that many of the captives taken in battle, and sold in the European settlements, were of free condition in their native country, and perhaps the owners of slaves themselves. It is not wonderful that such men should endeavour, even by means the most desperate, to regain the freedom of which they have been deprived; nor do I conceive that any further circumstances are necessary to prompt them to action, than that of being sold into captivity in a distant country. One cannot surely but lament (says our author), that a people thus naturally intrepid, should be sunk into so deplorable a state of barbarity and superstition; and that their spirits should ever be broken down by the yoke of slavery! Whatever may be alleged concerning their ferociousness and implacability in their present notions of right and wrong, I am persuaded that they possess qualities which are capable of, and well deserve, cultivation and improvement.

"Very different from the Koromantyns are the negroes imported from the Bight of Benin, and known in the West Indies by the name of Eboes. So great is their constitutional timidity and despondency of mind as to occasion them very frequently to seek, in a voluntary death, a refuge from their own melancholy reflections. They require therefore the gentlest and mildest treatment to reconcile them to their situation; but if their confidence be once obtained, they manifest as great fidelity, affection, and gratitude, as can reasonably be expected from men in a state of slavery. The females of this nation are better labourers than the men, probably from having been more hardly treated in Africa.

"The natives of Whidah, who, in the West Indies, are generally called *Papaws*, are unquestionably the most docile and best-disposed slaves that are imported from any part of Africa. Without the fierce and savage manners of the Koromantyn negroes, they are also happily exempt from the timid and desponding temper of the Eboes. The cheerful acquiescence with which these people apply to the labours of the field, and their constitutional aptitude for such employment, arise, without doubt, from the great attention paid to agriculture in their native country. Bosman speaks with rapture of the improved state of the soil, the number of villages, and the industry, riches, and obliging manners of the natives. He observes, however, that they are much greater thieves than those of the Gold Coast, and very unlike them in another respect, namely, in the dread of pain, and the apprehension of death. They are, says he, so very apprehensive of death, that they are unwilling to hear it mentioned, for fear *that* alone should hasten their end; and no man dares to speak of death in the presence of the king, or any great man, under the penalty of suffering it himself, as a punishment for his presumption. He relates further, that they are addicted to gaming beyond any people of Africa. All these propensities are observable in the character of the Papaws in a state of slavery in the West Indies. That punishment which excites the Koromantyn to rebel, and drives the Ebo negro to suicide, is received by the Papaws as the chastisement of legal authority, to which it is their duty to submit patiently. The case seems to be, that the generality of these people are in a state of absolute slavery in Africa, and, having been habituated to a life of labour, they submit to a change of situation with little reluctance."

Having recited such observations as occurred to him on contemplating the various tribes of negroes from each other, Mr Edwards thus estimates their general character, influenced as they are by circumstances which soon efface the native and original impressions which distinguish one nation from another when newly imported into the West Indies.

"Notwithstanding what has been related of the firmness and courage of the natives of the Gold Coast, it is certain that the negroes in general in our islands (such of them at least as have been any length of time in a state of servitude) are of a distrustful and cowardly disposition. So degrading is the nature of slavery, that fortitude of mind is lost as free agency is restrained. To the same cause probably must be imputed their propensity to conceal or violate the truth; which is so general, that the vice of falsehood is one of the most prominent features in their character. If a negro is asked even an indifferent question by his master, he seldom gives an immediate reply; but, affecting not to understand what is said, compels a repetition of the question, that he may have time to consider, not what is the true answer, but what is the most politic one for him to give. The proneness observable in many of them to the vice of theft has already been noticed; and I am afraid (says our author), that evil communication makes it almost general. It is no easy matter, I confess, to discriminate those circumstances which are the result of proximate causes, from those which are the effects of national customs and early habits in savage life; but I am afraid that cowardice and dissimulation have been the properties of slavery in all ages, and will continue to be so to the end of the world. It is a situation that necessarily suppresses many of the best affections of the human heart.

heart.—If it calls forth any latent virtues, they are those of sympathy and compassion towards persons in the same condition of life; and accordingly we find that the negroes in general are strongly attached to their countrymen, but above all, to such of their companions as came in the same ship with them from Africa. This is a striking circumstance: the term *shipmate* is understood among them as signifying a relationship of the most endearing nature; perhaps as recalling the time when the sufferers were cut off together from their common country and kindred, and awakening reciprocal sympathy from the remembrance of mutual affliction. But their benevolence, with a very few exceptions, extends no further. The softer virtues are seldom found in the bosom of the enslaved African. Give him sufficient authority and he becomes the most remorseless of tyrants. Of all the degrees of wretchedness endured by the sons of men, the greatest, assuredly, is the misery which is felt by those who are unhappily doomed to be the slaves of slaves; a most unnatural relation, which sometimes takes place in the sugar plantations. The same observation may be made concerning their conduct towards the animal creation. Their treatment of cattle under their direction is brutal beyond belief. Even the useful and social qualities of the dog secure to him no kind usage from an African master. One of the most pleasing traits in their character is the respect and attention which they pay to their aged countrymen. The whole body of negroes on a plantation must be reduced to a deplorable state of wretchedness, if, at any time, they suffer their aged companions to want the common necessaries of life, or even many of its comforts, as far as they can procure them. They seem to be actuated on these occasions by a kind of involuntary impulse, operating as a primitive law of nature, which scorns to wait the cold dictates of reason: among them, it is the exercise of a common duty, which courts no observation, and looks for no applause."

As the colour, and features, and moral qualities of the negroes may be thus easily accounted for by the influence of climate and the modes of savage life, so there is good reason to believe that their intellectual endowments are equal to those of the whites who have been found in the same circumstances. Of those imitative arts in which perfection can be attained only in an improved state of society, it is natural to suppose that they have but little knowledge; but the fabric and colours of the Guinea cloths are a proof of their native ingenuity. In the West Indies many of them are expert carpenters, some watchmakers, and one or two have successfully practised physic; whilst others have figured both in Latin and in English poetry, so that we cannot doubt but that "God who made the world, hath made of one blood all nations of men," and animated them with minds equally rational.

NEGROLAND, or NIGRITIA, a country of Africa, lying next to Guinea towards the north, and extending from 18° of west to 23° of east longitude, and from 9° to 20° of north latitude. On the north it is bounded by Zara or the Desert; on the east, by countries unknown; on the south, by Guinea; and on the west, by the Atlantic Ocean; and is watered by the great river Niger or Senegal, which runs through it from east to west. The Europeans have settlements on the coasts of this country, especially near the mouths of the Niger and Gambia, which last is supposed to be a branch of the former. A great many nations inhabit the banks of the rivers; some Pagans, some Mohammedans, of different languages, and independent of one another. The country is fruitful, especially along the rivers; abounding in rice, Guinea grain, and Indian corn, where it is cultivated; and with cocoa-nuts, plantains, pulse, palm-trees, and tropical fruits; nor is it destitute of cattle, and a variety of other animals, particularly such as abound in Guinea. See GUINEA.

Negroland is fertilized by the overflowing of its rivers the Senegal and Gambia, as Egypt is by the Nile. It hath not yet been ascertained whether the Gambia is a branch of the Senegal or not. As far as the Europeans have penetrated up the country, they appear to be distinct; and the Mundingo Negroes report that the Gambia has a different origin. The entrance into the Niger or Senegal river is narrow and somewhat difficult, by reason of its immoveable bar and sandy shoals, as well as the several islands at the mouth of it, and the several canals and marshes that clog it: but after sailing up eight or ten leagues, it is found broad and deep, and fit to carry large vessels; and, excepting about five or six leagues on each side above the mouth, which is sandy and barren ground, the banks are covered with stately trees and villages, and the country in general is fertile and well watered; for, like the Nile, this river overflows its banks for many leagues, and enriches the land to a great degree, though, for want of skill, the inhabitants do not reap the advantages which they might obtain from its fertility. The people on both sides of the river live as near to it as they can, and feed great herds of cattle, sowing large and small millet, the former of which is called by us *Turkey wheat*, in great quantities, and with great increase. If the river fails of overflowing at its usual season, a great scarcity ensues in the adjacent country; and, even when it overflows regularly, it breeds such vast flights of grasshoppers and insects, as quite darken the air, and frequently devour all the product of the earth: in which case the people kill those insects and eat them; which they do either by pounding in leathern bags, and then boiling them in milk, or, which is reckoned the more delicious method, by frying or broiling them over a light blaze in a frying-pan full of holes. Thus the legs and wings of the insects are burnt off, and the rest of the body is sufficiently roasted to be eaten as a dainty, which they look upon to be very wholesome and nourishing.

To the east, north-east, and south-east of the island of Senegal, the country, as far as it is known, is over-run with woods and marshes; the Senegal, Gambia, and Sherbro, which are looked upon by some as branches of one immense river, passing through it in their way to the Atlantic Ocean. During the rainy months, which begin in July, and continue to October, they lay the whole country under water; and indeed the sudden rise of these rivers is incredible to such as are not acquainted with the violent rains that fall between the tropics. At Galam, 900 miles from the mouth of the Senegal, the waters rise 150 feet perpendicular from the bed of the river. At the island of Senegal, the river rises gradually, during the rainy season, Negropont. ſeaſon, above 20 feet perpendicular over part of that flat coaſt; which of itſelf ſo freſhens the water, that ſhips lying at anchor, at the diſtance of three leagues from its mouth, generally make uſe of it, and fill their water there for their voyage home. When the rains are at an end, which ſoon happens in October, the intenſe heat of the ſun uſually dries up thoſe ſtagnating waters which lie on the higher parts, and the remainder form lakes and marſhes, in which are found all ſorts of dead animals. At laſt, thoſe too are quite dried up; and then the effluvia that ariſe are almoſt quite inſupportable. At this ſeaſon the winds blow ſo hot from the land, that they may be compared to the heat proceeding from the mouth of an oven, and they bring with them an intolerable ſmell. The wolves, tigers, lions, and other wild beaſts, then reſort to the river, ſteeping their body under water, and only their ſnout above it for the ſake of breathing. The birds ſoar to an immenſe height in the air, and fly a vaſt way over the ſea, where they continue till the wind changes, and comes from the weſt.

Negroes White. See Heliophobi and Albino.

NEGROMANCY. See Necromancy.

NEGROPONT, anciently *Eubœa*, an iſland of the Archipelago, ſtretching along the eaſtern coaſt of Achaia or Livadia, from which it is ſeparated by a narrow channel called the *Euripus*. This ſtrait is ſo narrow, that the iſland is joined to the continent by a bridge thrown over it; and here, it is thought, there was formerly an iſthmus. The irregularity of the tides in the Euripus hath from the remoteſt antiquity been very remarkable, and this irregularity is found to be connected with the age of the moon. From the three laſt days of the old moon to the eighth day of the new moon, and from the 14th to the 20th day incluſive, they are regular; but on the other days they are irregular, flowing 12, 13, or 14 times in the ſpace of 24 hours, and ebbing as often. The iſland is 90 miles long and 25 broad in the wideſt part; and produces corn, oil, fruit, and cattle, in great abundance. The only place in the iſland worth notice is the capital, which is alſo called *Negropont;* and which is walled, and contains about 15,000 inhabitants; but the Chriſtians are ſaid to be much more numerous than the Turks. The captain baſhaw, or admiral of Turkey, who is alſo governor of the city, the iſland, and the adjacent continent of Greece, reſides here; and the harbour, which is very ſafe and ſpacious, is ſeldom without a fleet of galleys, ready to be put to ſea againſt the pirates and the Malteſe. A part of the bridge between the city and the coaſt of Greece, conſiſts of a drawbidge no longer than juſt to let a galley paſs through. Negropont.

END OF THE TWELFTH VOLUME.

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