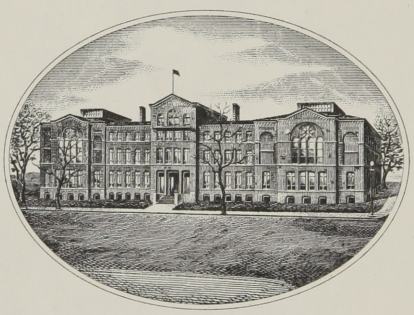
NATIONAL LIBRARY OF MEDICINE

Washington



Founded 1836

U. S. Department of Health, Education, and Welfare

Public Health Service

A

COMPENDIOUS SYSTEM

OF

ANATOMY.

IN SIX PARTS.

PART I. OSTEOLOGY.
II. OF THE MUSCLES, ETC.
III. OF THE ABDOMEN.
PART IV. OF THE THORAX.
V. OF THE BRAIN AND NERVES.
VI. OF THE SENSES.

ILLUSTRATED WITH TWELVE LARGE COPPERPLATES.

LIBRARY
SURGEON GENERAL'S OFFICE
NOV. 21 1895
167543.

EXTRACTED FROM THE American Edition OF THE ENCYCLOPÆDIA;

NOW PUBLISHING,

By THOMAS DOBSON, at the *Stone-House*, in SECOND-ſtreet, PHILADELPHIA.

APRIL——MDCCXC.

ANATOMY,

THE art of diſſecting, or artificially ſeparating and taking to pieces, the different parts of the human body, in order to an exact diſcovery of their ſituation, ſtructure, and œconomy.—The word is Greek, ανατομη; derived from ανατεμνω, to diſſect, or ſeparate by cutting.

INTRODUCTION.

§ 1. *Hiſtory of Anatomy.*

THIS art ſeems to have been very ancient; though, for a long time, known only in an imperfect manner. —The firſt men who lived muſt have ſoon acquired ſome notions of the ſtructure of their own bodies, particularly of the external parts, and of ſome even of the internal, ſuch as bones, joints, and ſinews, which are expoſed to the examination of the ſenſes in living bodies.

This rude knowledge muſt have been gradually improved, by the accidents to which the body is expoſed, by the neceſſities of life, and by the various cuſtoms, ceremonies, and ſuperſtitions, of different nations. Thus, the obſervance of bodies killed by violence, attention to wounded men, and to many diſeaſes, the various ways of putting criminals to death, the funeral ceremonies, and a variety of ſuch things, muſt have ſhown men every day more and more of themſelves; eſpecially as curioſity and ſelf-love would here urge them powerfully to obſervation and reflection.

The brute-creation having ſuch an affinity to man in outward form, motions, ſenſes, and ways of life; the generation of the ſpecies, and the effect of death upon the body, being obſerved to be ſo nearly the ſame in both; the concluſion was not only obvious, but unavoidable, that their bodies were formed nearly upon the ſame model. And the opportunities of examining the bodies of brutes were ſo eaſily procured, indeed ſo neceſſarily occurred in the common buſineſs of life, that the huntſman in making uſe of his prey, the prieſt in ſacrificing, the augur in divination, and, above all, the butcher, or thoſe who might out of curioſity attend upon his operations, muſt have been daily adding to the little ſtock of anatomical knowledge. Accordingly we find, in fact, that the South-ſea-iſlanders, who have been left to their own obſervation and reaſoning, without the aſſiſtance of letters, have yet a conſiderable ſhare of rude or wild anatomical and phyſiological knowledge. Dr Hunter informs us, that when Omai was in his muſeum with Mr Banks, though he could not explain himſelf intelligibly, they plainly ſaw that he knew the principal parts of the body, and ſomething likewiſe of their uſes; and manifeſted a great curioſity or deſire of having the functions of the internal parts of the body explained to him; particularly the relative functions of the two ſexes, which with him ſeemed to be the moſt intereſting object of the human mind.

We may further imagine, that the philoſophers of the

the moſt early ages, that is, the men of curioſity, obſervation, experience and reflection, could not overlook an inſtance of natural organization, which was ſo intereſting, and at the ſame time ſo wonderful, more eſpecially ſuch of them as applied to the ſtudy and cure of diſeaſes. We know that phyſic was a branch of philoſophy till the age of Hippocrates.

Thus the art muſt have been circumſtanced in its beginning. We ſhall next ſee from the teſtimony of hiſtorians and other writers, how it actually appeared as an art, from the time that writing was introduced among men; how it was improved and conveyed down to us through a long ſeries of ages.

Civilization, and improvements of every kind, would naturally begin in fertile countries and healthful climates, where there would be leiſure for reflection, and an appetite for amuſement. Accordingly, writing, and many other uſeful and ornamental inventions and arts, appear to have been cultivated in the eaſtern parts of Aſia long before the earlieſt times that are treated of by the Greek or other European writers; and that the arts and learning of thoſe eaſtern people were in ſubſequent times gradually communicated to adjacent countries, eſpecially by the medium of traffic. The cuſtoms, ſuperſtitions, and climate of eaſtern countries, however, appear to have been as unfavourable to practical anatomy, as they were inviting to the ſtudy of aſtronomy, geometry, poetry, and all the ſofter arts of peace.

Animal bodies there, run ſo quickly into nauſeous putrefaction, that the early inhabitants muſt have avoided ſuch offenſive employments, as anatomical inquiries, like their poſterity at this day. And, in fact, it does not appear, by the writings of the Grecians, or Jews, or Phœnicians, or of other eaſtern countries, that anatomy was particularly cultivated by any of thoſe eaſtern nations. In tracing it backwards to its infancy, we cannot go farther into antiquity than the times of the Grecian philoſophers. As an art in the ſtate of ſome cultivation, it may be ſaid to have been brought forth and bred up among them as a branch of natural knowledge.

The æra of philoſophy, as it was called, began with Thales the Mileſian being declared by a very general conſent of the people, the moſt wiſe of all the Grecians, 480 years before Chriſt. The philoſophers of his ſchool, which was called the Ionian, cultivated principally natural knowledge. Socrates, the ſeventh in ſucceſſion of their great teachers, introduced the ſtudy of morals, and was thence ſaid to bring down philoſophy from heaven, to make men truly wiſe and happy.

In the writings of his ſcholar and ſucceſſor Plato, we ſee that the philoſophers had carefully conſidered the human body, both in its organization and functions; and though they had not arrived at the knowledge of the more minute and intricate parts, which required the ſucceſſive labour and attention of many ages, they had made up very noble and comprehenſive ideas of the ſubject in general. The anatomical deſcriptions of Xenophon and Plato have had the honour of being quoted by Longinus (§ xxxii.) as ſpecimens of ſublime writing: and the extract from Plato is ſtill more remarkable for its containing the rudiments of the circulation of the blood. "The heart (ſays Plato) is the centre or knot of the blood-veſſels; the ſpring or fountain of the blood which is carried impetuouſly round; the blood is the *pabulum* or food of the fleſh; and, for the purpoſe of nouriſhment, the body is laid out into canals, like thoſe which are drawn through gardens, that the blood may be conveyed, as from a fountain, to every part of the pervious body."

Hippocrates was nearly contemporary with the great philoſophers of whom we have been ſpeaking, about 400 years before the Chriſtian æra. He is ſaid to have ſeparated the profeſſion of philoſophy and phyſic, and to have been the firſt who applied to phyſic alone as the buſineſs of his life. He is likewiſe generally ſuppoſed to be the firſt who wrote upon anatomy. We know of nothing that was written expreſsly upon the ſubject before; and the firſt anatomical diſſection which has been recorded, was made by his friend Democritus of Abdera.

If, however, we read the works of Hippocrates with impartiality, and apply his accounts of the parts to what we now know of the human body, we muſt allow his deſcriptions to be imperfect, incorrect, ſometimes extravagant, and often unintelligible, that of the bones only excepted. He ſeems to have ſtudied theſe with more ſucceſs than the other parts, and tells us that he had an opportunity of ſeeing an human ſkeleton.

From Hippocrates to Galen, who flouriſhed towards the end of the ſecond century, in the decline of the Roman empire, that is, in the ſpace of 600 years, anatomy was greatly improved; the philoſophers ſtill conſidering it as a moſt curious and intereſting branch of natural knowledge, and the phyſicians, as a principal foundation of their art. Both of them, in that interval of time, contributed daily to the common ſtock, by more accurate and extended obſervations, and by the lights of improving philoſophy.

As theſe two great men had applied very particularly to the ſtudy of animal bodies, they not only made great improvements, eſpecially in phyſiology, but raiſed the credit of natural knowledge, and ſpread it as wide as Alexander's empire.

Few of Ariſtotle's writings were made public in his lifetime. He affected to ſay that they would be unintelligible to thoſe who had not heard them explained at his lectures: and, except the uſe which Theophraſtus made of them, they were loſt to the public for above 130 years after the death of Theophraſtus; and at laſt came out defective from bad preſervation, and corrupted by men, who, without proper qualifications, preſumed to correct and ſupply what was loſt.

From the time of Theophraſtus, the ſtudy of natural knowledge at Athens was forever on the decline; and the reputation of the Lycæum and Academy was almoſt confined to the ſtudies which are ſubſervient to oratory and public ſpeaking.

The other great inſtitution for Grecian education, was at Alexandria in Egypt. The firſt Ptolemies, both from their love of literature, and to give true and permanent dignity to their empire, and to Alexander's favourite city, ſet up a grand ſchool in the palace itſelf, with a muſeum and library, which, we may ſay, has been the moſt famed in the world. Anatomy, among other ſciences, was publicly taught; and the two diſtinguiſhed anatomiſts were Eraſiſtratus the pupil and friend of Theophraſtus, and Herophilus. Their voluminous

luminous works are all loſt; but they are quoted by Galen almoſt in every page. Theſe profeſſors were probably the firſt who were authorized to diſſect human bodies; a peculiarity which marks ſtrongly the philoſophical magnanimity of the firſt Ptolemy, and fixes a great æra in the hiſtory of anatomy. And it was, no doubt, from this particular advantage which the Alexandrians had above all others, that their ſchool not only gained, but for many centuries preſerved, the firſt reputation for medical education. Ammianus Marcellinus, who lived about 650 years after the ſchools were ſet up, ſays, they were ſo famous in his time, that it was enough to ſecure credit to any phyſician, if he could ſay he had ſtudied at Alexandria.

Herophilus has been ſaid to have anatomized 700 bodies. We muſt allow for exaggeration. Nay, it was ſaid, that both he and Eraſiſtratus made it a common practice to open living bodies, that they might diſcover the more ſecret ſprings of life. But this, no doubt, was only a vulgar opinion, riſing from the prejudices of mankind; and accordingly, without any good reaſon, ſuch tales have been told of modern anatomiſts, and have been believed by the vulgar.

Among the Romans, though it is probable they had phyſicians and ſurgeons from the foundation of the city, yet we have no account of any of theſe applying themſelves to anatomy for a very long time. Archagathus was the firſt Greek phyſician eſtabliſhed in Rome, and he was baniſhed the city on account of the ſeverity of his operations.—Aſclepiades, who flouriſhed in Rome 101 years after Archagathus, in the time of Pompey, attained ſuch a high reputation as to be ranked in the ſame claſs with Hippocrates. He ſeemed to have ſome notion of the air in reſpiration acting by its weight; and in accounting for digeſtion, he ſuppoſed the food to be no farther changed than by a comminution into extremely ſmall parts, which being diſtributed to the ſeveral parts of the body, is aſſimilated to the nature of each. One Caſſius, commonly thought to be a diſciple of Aſclepiades, accounted for the right ſide of the body becoming paralytic on hurting the left ſide of the brain, in the ſame manner as has been done by the moderns, viz. by the croſſing of the nerves from the right to the left ſide of the brain.

From the time of Aſclepiades to the ſecond century, phyſicians ſeem to have been greatly encouraged at Rome; and, in the writings of Celſus, Rufus, Pliny, Cœlius, Aurelianus, and Araæteus, we find ſeveral anatomical obſervations, but moſtly very ſuperficial and inaccurate. Towards the end of the ſecond century lived Claudius Gallenus Pergamus, whoſe name is ſo well known in the medical world. He applied himſelf particularly to the ſtudy of anatomy, and did more in that way than all that went before him. He ſeems, however, to have been at a great loſs for human ſubjects to operate upon; and therefore his deſcription of the parts are moſtly taken from brute animals. His works contain the fulleſt hiſtory of anatomiſts, and the moſt complete ſyſtem of the ſcience, to be met with any where before him, or for ſeveral centuries after; ſo that a number of paſſages in them were reckoned abſolutely unintelligible for many ages, until explained by the diſcoveries of ſucceeding anatomiſts.

About the end of the fourth century, Nimeſius biſhop of Emiſſa wrote a treatiſe on the nature of man, in which it is ſaid were contained two celebrated modern diſcoveries; the one, the uſes of the bile, boaſted of by Sylvius de la Boe; and the other, the circulation of the blood. This laſt, however, is proved by Dr Friend, in his Hiſtory of phyſic, p. 229. to be falſely aſcribed to this author.

The Roman empire beginning now to be oppreſſed by the barbarians, and ſunk in groſs ſuperſtition, learning of all kinds decreaſed; and when the empire was totally overwhelmed by thoſe barbarous nations, every appearance of ſcience was almoſt extinguiſhed in Europe. The only remains of it were among the Arabians in Spain and in Aſia.—The Saracens who came into Spain, deſtroyed at firſt all the Greek books which the Vandals had ſpared: but though their government was in a conſtant ſtruggle and fluctuation during 800 years before they were driven out, they received a taſte for learning from their countrymen of the eaſt; ſeveral of their princes encouraged liberal ſtudies; public ſchools were ſet up at Cordova, Toledo, and other towns, and tranſlations of the Greeks into the Arabic were univerſally in the hands of their teachers.

Thus was the learning of the Grecians transferred to the Arabians. But though they had ſo good a foundation to build upon, this art was never improved while they were maſters of the world: for they were ſatisfied with commenting upon Galen; and ſeem to have made no diſſections of human bodies.

Abdollaliph, who was himſelf a teacher of anatomy, a man eminent in his time (at and before 1203) for his learning and curioſity; a great traveller, who had been bred at Bagdad, and had ſeen many of the great cities and principal places for ſtudy in the Saracen empire; who had a favourable opinion of original obſervation, in oppoſition to book-learning; who boldly corrected ſome of Galen's errors, and was perſuaded that many more might be detected; this man, we ſay, never made or ſaw, or ſeemed to think of a human diſſection. He diſcovered Galen's errors in the oſteology, by going to burying-grounds, with his ſtudents and others, where he examined and demonſtrated the bones; he earneſtly recommended that method of ſtudy, in preference even to the reading of Galen, and thought that many farther improvements might be made; yet he ſeemed not to have an idea that a freſh ſubject might be diſſected with that view.

Perhaps the Jewiſh tenets, which the Mahometans adopted, about uncleanlineſs and pollution, might prevent their handling dead bodies; or their opinion of what was ſuppoſed to paſs between an angel and the dead perſon, might make them think diſturbing the dead highly ſacrilegious. Such, however, as Arabian learning was, for many ages together there was hardly any other in all the weſtern countries of Europe. It was introduced by the eſtabliſhment of the Saracens in Spain in 711, and kept its ground till the reſtoration of learning in the end of the 15th century. The ſtate of anatomy in Europe, in the times of Arabian influence, may be ſeen by reading a very ſhort ſyſtem of anatomy drawn up by Mundinus, in the year 1315. It was extracted principally from what the Arabians had preſerved of Galen's doctrine; and, rude as it is, in that age, it was judged to be ſo maſterly a performance, that it was ordered by a public decree, that it ſhould be read in all the ſchools of Italy; and it actually continued

tinued to be almoſt the only book which was read upon the ſubject for above 200 years. Corteſius gives him the credit of being the great reſtorer of anatomy, and the firſt who diſſected human bodies among the moderns.

A general prejudice againſt diſſection, however, prevailed till the 16th century. The emperor Charles V. ordered a conſultation to be held by the divines of Salamanca, in order to determine whether or not it was lawful in point of conſcience to diſſect a dead body. In Muſcovy, till very lately, both anatomy and the uſe of ſkeletons were forbidden, the firſt as inhuman, and the latter as ſubſervient to witchcraft.

In the beginning of the 15th century, learning revived conſiderably in Europe, and particularly phyſic, by means of copies of the Greek authors brought from the ſack of Conſtantinople; after which the number of anatomiſts and anatomical books increaſed to a prodigious degree.—The Europeans becoming thus poſſeſſed of the antient Greek fathers of medicine, were for a long time ſo much occupied in correcting the copies they could obtain, ſtudying the meaning, and commenting upon them, that they attempted nothing of their own, eſpecially in anatomy.

And here the late Dr Hunter introduces into the annals of this art, a genius of the firſt rate, Leonardo da Vinci, who had been formerly overlooked, becauſe he was of another profeſſion, and becauſe he publiſhed nothing upon the ſubject. He is conſidered by the Doctor as by far the beſt anatomiſt and phyſiologiſt of his time; and was certainly the firſt man we know of who introduced the practice of making anatomical drawings.

Vaſſare, in his lives of the painters, ſpeaks of Leonardo thus, after telling us that he had compoſed a book of the anatomy of a horſe, for his own ſtudy: "He afterwards applied himſelf with more diligence to the human anatomy; in which ſtudy he reciprocally received and communicated aſſiſtance to Marc. Antonio della Torre, an excellent philoſopher, who then read lectures in Pavia, and wrote upon this ſubject; and who was the firſt, as I have heard, who began to illuſtrate medicine from the doctrine of Galen, and to give true light to anatomy, which till that time had been involved in clouds of darkneſs and ignorance. In this he availed himſelf exceedingly of the genius and labour of Leonardo, who made a book of ſtudies, drawn with red chalk, and touched with a pen, with great diligence, of ſuch ſubjects as he had himſelf diſſected; where he made all the bones, and to thoſe he joined, in their order, all the nerves, and covered them with the muſcles. And concerning thoſe, from part to part, he wrote remarks in letters of an ugly form, which are written by the left hand, backwards, and not to be underſtood but by thoſe who know the method of reading them; for they are not to be read without a looking-glaſs. Of theſe papers of the human anatomy, there is a great part in the poſſeſſion of M. Franceſco da Melzo, a Milaneſe gentleman, who, in the time of Leonardo, was a moſt beautiful boy, and much beloved by him, as he is now a beautiful and genteel old man, who reads thoſe writings, and carefully preſerves them, as precious relicts, together with the portrait of Leonardo, of happy memory. It appears impoſſible that that divine ſpirit ſhould reaſon ſo well upon the arteries, and muſcles, and nerves, and veins; and with ſuch diligence of every thing, &c. &c."

Thoſe very drawings and the writings are happily found to be preſerved in his Britannic Majeſty's great collection of original drawings, where the Doctor was permitted to examine them; and his ſentiments upon the occaſion he thus expreſſes: "I expected to ſee little more than ſuch deſigns in anatomy, as might be uſeful to a painter in his own profeſſion; but I ſaw, and indeed with aſtoniſhment, that Leonardo had been a general and a deep ſtudent. When I conſider what pains he has taken upon every part of the body, the ſuperiority of his univerſal genius, his particular excellence in mechanics and hydraulics, and the attention with which ſuch a man would examine and ſee objects which he was to draw, I am fully perſuaded that Leonardo was the beſt anatomiſt at that time in the world. We muſt give the 15th century the credit of Leonardo's anatomical ſtudies, as he was 55 years of age at the cloſe of that century."

In the beginning of the 16th century, Achillinus and Benedictus, but particularly Berengarius and Maſſa, followed out the improvement of anatomy in Italy, where they taught it, and publiſhed upon the ſubject. Theſe firſt improvers made ſome diſcoveries from their own diſſections: but it is not ſurpriſing that they ſhould have been diffident of themſelves, and have followed Galen almoſt blindly, when his authority had been ſo long eſtabliſhed, and when the enthuſiaſm for Greek authors was riſing to ſuch a pitch.

Soon after this, we may ſay about the year 1540, the great Veſalius appeared. He was ſtudious, laborious, and ambitious. From Bruſſels, the place of his birth, he went to Louvain, and thence to Paris, where anatomy was not yet making a conſiderable figure, and then to Louvain to teach; from which place, very fortunately for his reputation, he was called to Italy, where he met with every opportunity that ſuch a genius for anatomy could deſire, that is, books, ſubjects, and excellent draughtſmen. He was equally laborious in reading the ancients, and in diſſecting bodies. And in making the compariſon, he could not but ſee, that there was great room for improvement, and that many of Galen's deſcriptions were erroneous. When he was but a young man, he publiſhed a noble ſyſtem of anatomy, illuſtrated with a great number of elegant figures.—In this work he found ſo many occaſions of correcting Galen, that his contemporaries, partial to antiquity, and jealous of his reputation, complained that he carried his turn for improvement and criticiſms to licentiouſneſs. The ſpirit of oppoſition and emulation was preſently rouſed; and Sylvius in France, Columbus, Fallopius, and Euſtachius in Italy, who were all in high anatomical reputation about the middle of this 16th century, endeavoured to defend Galen at the expence of Veſalius. In their diſputes they made their appeals to the human body: and thus in a few years the art was greatly improved. And Veſalius being detected in the very fault which he condemned in Galen, to wit, deſcribing from the diſſections of brutes, and not of the human body, it expoſed ſo fully that blunder of the older anatomiſts, that in ſucceeding times there has been little reaſon for ſuch complaint.—Beſides the above, he publiſhed ſeveral other anatomical treatiſes. He has been particularly ſerviceable by impoſing

poſing names on the muſcles, moſt of which are retained to this day. Formerly they were diſtinguiſhed by numbers, which were differently applied by almoſt every author.

In 1561, Gabriel Fallopius, profeſſor of anatomy at Padua, publiſhed a treatiſe of anatomy under the title of *Obſervationes Anatomicæ*. This was deſigned as a ſupplement to Veſalius; many of whoſe deſcriptions he corrects, though he always makes mention of him in an honourable manner. Fallopius made many great diſcoveries, and his book is well worth the peruſal of every anatomiſt.

In 1563, Bartholomæus Euſtachius publiſhed his *Opuſcula Anatomica* at Venice, which have ever ſince been juſtly admired for the exactneſs of the deſcriptions, and the diſcoveries contained in them. He publiſhed afterwards ſome other pieces, in which there is little of anatomy; but never publiſhed the great work he had promiſed, which was to be adorned with copperplates repreſenting all the parts of the human body. Theſe plates, after lying buried in an old cabinet for upwards of 150 years, were at laſt diſcovered and publiſhed in the year 1714, by Lanciſi the pope's phyſician; who added a ſhort explicatory text, becauſe Euſtachius's own writing could not be found.

From this time the ſtudy of anatomy gradually diffuſed itſelf over Europe; inſomuch that for the laſt hundred years it has been daily improving by the labour of a number of profeſſed anatomiſts almoſt in every country of Europe.

We may form a judgment about the ſtate of anatomy even in Italy, in the beginning of the 17th century, from the information of Corteſius. He had been profeſſor of anatomy at Bologna, and was then profeſſor of medicine at Maſſana; where, though he had a great deſire to improve himſelf in the art, and to finiſh a treatiſe which he had begun on practical anatomy, in 24 years he could twice only procure an opportunity of diſſecting a human body, and then it was with difficulties and in hurry; whereas he had expected to have done ſo, he ſays, *once every year, according to the cuſtom in the famous academies of Italy*.

In the very end of the 16th century, the great Harvey, as was the cuſtom of the times, went to Italy to ſtudy medicine; for Italy was ſtill the favourite ſeat of the arts: And in the very beginning of the 17th century, ſoon after Harvey's return to England, his maſter in anatomy, Fabricius ab Aquapendente, publiſhed an account of the valves in the veins, which he had diſcovered many years before, and no doubt taught in his lectures when Harvey attended him.

This diſcovery evidently affected the eſtabliſhed doctrine of all ages, that the veins carried the blood from the liver to all parts of the body for nouriſhment. It ſet Harvey to work upon the uſe of the heart and vaſcular ſyſtems in animals; and in the courſe of ſome years he was ſo happy as to diſcover, and to prove beyond all poſſibility of doubt, the *circulation of the blood*. He taught his new doctrine in his lectures about the year 1616, and printed it in 1628.

It was by far the moſt important ſtep that had been made in the knowledge of animal bodies in any age. It not only reflected uſeful lights upon what had been already found out in anatomy, but alſo pointed out the means of further inveſtigation. And accordingly we ſee, that from Harvey to the preſent time, anatomy has been ſo much improved, that we may reaſonably queſtion if the ancients have been further outdone by the moderns in any other branch of knowledge. From one day to another there has been a conſtant ſucceſſion of diſcoveries, relating either to the ſtructure or functions of our body; and new anatomical proceſſes, both of inveſtigation and demonſtration, have been daily invented. Many parts of the body, which were not known in Harvey's time, have ſince then been brought to light: and of thoſe which were known, the internal compoſition and functions remained unexplained; and indeed muſt have remained unexplicable without the knowledge of the circulation.

Harvey's doctrine at firſt met with conſiderable oppoſition; but in the ſpace of about 20 years it was ſo generally and ſo warmly embraced, that it was imagined every thing in phyſic would be explained. But time and experience have taught us, that we ſtill are, and probably muſt long continue to be, very ignorant; and that in the ſtudy of the human body, and of its diſeaſes, there will always be an extenſive field for the exerciſe of ſagacity.

After the diſcovery and knowledge of the circulation of the blood, the next queſtion would naturally have been about the paſſage and route of the nutritious part of the food or chyle from the bowels to the blood-veſſels: And, by good fortune, in a few years after Harvey had made his diſcovery, Aſellius, an Italian phyſician, found out the lacteals, or veſſels which carry the chyle from the inteſtines; and printed his account of them, with coloured prints, in the year 1627, the very year before Harvey's book came out.

For a number of years after theſe two publications, the anatomiſts in all parts of Europe were daily opening living dogs, either to ſee the lacteals or to obſerve the phenomena of the circulation. In making an experiment of this kind, Pecquet in France was fortunate enough to diſcover the thoracic duct, or common trunk of all the lacteals, which conveys the chyle into the ſubclavian vein. He printed his diſcovery in the year 1651. And now the lacteals having been traced from the inteſtines to the thoracic duct, and that duct having been traced to its termination in a blood-veſſel, the paſſage of the chyle was completely made out.

The ſame practice of opening living animals furniſhed occaſions of diſcovering the lymphatic veſſels. This good fortune fell to the lot of Rudbec firſt, a young Swediſh anatomiſt; and then to Thomas Bartholine, a Daniſh anatomiſt, who was the firſt who appeared in print upon the lymphatics. His book came out in the year 1653, that is two years after that of Pecquet. And then it was very evident that they had been ſeen before by Dr Higmore and others, who had miſtaken them for lacteals. But none of the anatomiſts of thoſe times could make out the origin of the lymphatics, and none of the phyſiologiſts could give a ſatisfactory account of their uſe.

The circulation of the blood and the paſſage of the chyle having been ſatisfactorily traced out in full-grown animals, the anatomiſts were naturally led next to conſider how theſe animal proceſſes were carried on in the child while in the womb of the mother. Accordingly the male and female organs, the appearances and contents of the pregnant uterus, the incubated egg, and every

every phenomenon which could illuſtrate generation, became the favourite ſubject, for about 30 years, with the principal anatomiſts of Europe.

Thus it would appear to have been in theory: but Dr Hunter believes, that in fact, as Harvey's maſter Fabricius laid the foundation for the diſcovery of the circulation of the blood by teaching him the valves of the veins, and thereby inviting him to conſider that ſubject; ſo Fabricius by his lectures, and by his elegant work *De formato fœtu, et de formatione ovi et pulli*, probably made that likewiſe a favourite ſubject with Dr Harvey. But whether he took up the ſubject of generation in conſequence of his diſcovery of the circulation, or was led to it by his honoured maſter Fabricius, he ſpent a great deal of his time in the inquiry; and publiſhed his obſervations in a book *De generatione animalium*, in the year 1651, that is ſix years before his death.

In a few years after this, Swammerdam, Van Horn, Steno, and De Graaf, excited great attention to the ſubject of generation, by their ſuppoſed diſcovery that the females of viviparous animals have ovaria, that is, cluſters of eggs in their loins, like oviparous animals; which, when impregnated by the male, are conveyed into the uterus: ſo that a child is produced from an egg as well as a chick; with this difference, that one is hatched within, and the other without, the body of the mother.

Malpighi, a great Italian genius, ſome time after, made conſiderable advances upon the ſubject of generation. He had the good fortune to be the firſt who uſed magnifying glaſſes with addreſs in tracing the firſt appearances in the formation of animals. He likewiſe made many other obſervations and improvements in the *minutiæ* of anatomy by his microſcopical labours, and by cultivating comparative anatomy.

This diſtinguiſhed anatomiſt gave the firſt public ſpecimen of his abilities, by printing a diſſertation on the lungs *anno* 1661; a period ſo remarkable for the ſtudy of nature, that it would be injuſtice to paſs it without particular notice.

At the ſame time flouriſhed Laurentius Bellinus at Florence, and was the firſt who introduced mathematical reaſoning in phyſic. In 1662, Simon Pauli publiſhed a treatiſe *De albandis oſſibus*. He had long been admired for the white ſkeletons he prepared; and at laſt diſcovered his method, which was by expoſing the bones all winter to the weather.

Johannes Swammerdam of Amſterdam alſo publiſhed ſome anatomical treatiſes; but was moſt remarkable for his knowledge of preſerving the parts of bodies entire for many years, by injecting their veſſels. He alſo publiſhed a treatiſe on reſpiration; wherein he mentioned his having figures of all the parts of the body as big as the life, cut in copper, which he deſigned to publiſh, with a complete ſyſtem of anatomy. Theſe, however, were never made public by Swammerdam; but, in 1683, Gothofridus Bidloo, profeſſor of anatomy at Leyden, publiſhed a work intitled *Anatomia corporis humani*, where all the parts were delineated in very large plates almoſt as big as the life. Mr Cowper, an Engliſh ſurgeon, bought 300 copies of theſe figures; and in 1698, publiſhed them with an Engliſh text, quite different from Bidloo's Latin one; to which were added letters in Bidloo's figures, and ſome few figures of Mr Cowper's own. To this work Cowper's name was prefixed, without the leaſt mention of Bidloo, except on purpoſe to confute him. Bidloo immediately publiſhed a very ill-natured pamphlet, called *Gulielmus Cowperus citatus coram tribunali*; appealing to the Royal Society, how far Cowper ought to be puniſhed as a plagiary of the worſt kind, and endeavouring to prove him an ignorant deceitful fellow. Cowper anſwered him in his own ſtyle, in a pamphlet called his *Vindiciæ*; endeavouring to prove, either that Bidloo did not underſtand his own tables, or that they were none of his. It was even alleged that thoſe were the tables promiſed by Swammerdam, and which Bidloo had got from his widow. This, however, appears to have been only an invidious ſurmiſe, there being unqueſtionable evidence that they were really the performance of Bidloo.

Soon after, Iſbrandus Diembroeck, profeſſor of anatomy at Utrecht, began to appear as an author. His work contained very little original; but he was at great pains to collect from others whatever was valuable in their writings, and his ſyſtem was the common ſtandard among anatomical ſtudents for many years.

About the ſame time, Antonius Liewenhoeck of Delft, improved conſiderably on Malpighi's uſe of microſcopes. Theſe two authors took up anatomy where others had dropt it; and, by this new art, they brought a number of amazing things to light. They diſcovered the red globules of the blood; they were enabled to ſee the actual circulation of the blood in the tranſparent parts of living animals, and could meaſure the velocity of its motion; they diſcovered that the arteries and veins had no intermediate cells or ſpungy ſubſtance, as Harvey and all the preceding anatomiſts had ſuppoſed, but communicated one with the other by a continuation of the ſame tube.

Liewenhoeck was in great fame likewiſe for his diſcovery of the animalcula in the ſemen. Indeed there was ſcarcely a part of the body, ſolid or fluid, which eſcaped his examination; and he almoſt every where found, that what appeared to the naked eye to be rude undigeſted matter, was in reality a beautiful and regular compound.

After this period, Nuck added to our knowledge of the abſorbent ſyſtem already mentioned, by his injections of the lymphatic glands; Ruyſch, by his deſcription of the valves of the lymphatic veſſels; and Dr Meckel, by his accurate account of the whole ſyſtem, and by tracing thoſe veſſels in many parts where they had not before been deſcribed.

Beſides theſe authors, Drs Hunter and Monro have called the attention of the public to this part of anatomy, in their controverſy concerning the diſcovery of the office of the lymphatics.

When the lymphatic veſſels were firſt ſeen and traced into the thoracic duct, it was natural for anatomiſts to ſuſpect, that as the lacteals abſorbed from the cavity of the inteſtines, the lymphatics, which are ſimilar in figure and ſtructure, might poſſibly do the ſame office with reſpect to other parts of the body: and accordingly, Dr Gliſſon, who wrote in 1654, ſuppoſes theſe veſſels aroſe from cavities, and that their uſe was to abſorb; and Frederic Hoffman has very explicitly laid down the doctrine of the lymphatic veſſels being a ſyſtem of abſorbents. But anatomiſts in general have been of a contrary opinion; for, from experiments, particularly

ticularly ſuch as were made by injections, they have been perſuaded that the lymphatic veſſels did not ariſe from cavities, and did not abſorb, but were merely continuations from ſmall arteries. The doctrine, therefore, that the lymphatics, like the lacteals, were abſorbents, as had been ſuggeſted by Gliſſon and by Hoffman, has been revived by Dr Hunter and Dr Monro, who have controverted the experiments of their predeceſſors in anatomy, and have endeavoured to prove that the lymphatic veſſels are not continued from arteries, but are abſorbents.

To this doctrine, however, ſeveral objections have been ſtarted, particularly by Haller (Elm. Phyſ. l. 24. § 2, 3.); and it has been found, that before the doctrine of the lymphatics being a ſyſtem of abſorbents can be eſtabliſhed, it muſt firſt be determined whether this ſyſtem is to be found in other animals beſides man and quadrupeds. Mr Hewſon claims the merit of having proved the affirmative of this queſtion, by diſcovering the lymphatic ſyſtem in birds, fiſh, and amphibious animals. See *Phil. Tranſ.* vol. lviii. and lxix.—And latterly, Mr Cruikſkank has traced the ramifications of that ſyſtem in almoſt every part of the body; and from his diſſections, figures have been made and lately publiſhed to the world. To Mr Sheldon alſo we are much indebted for his illuſtration of this ſyſtem, which promiſes to give great ſatisfaction, but of which only a part has yet been publiſhed.

The gravid uterus is a ſubject likewiſe which has received conſiderable improvements, particularly relating to one very important diſcovery; viz. that the internal membrane of the uterus, which Dr Hunter has named *decidua*, conſtitutes the exterior part of the ſecundines or after-birth, and ſeparates from the reſt of the uterus every time that a woman either bears a child or ſuffers a miſcarriage. This diſcovery includes another, to wit, that the placenta is partly made up of an excreſcence or efflorescence from the uterus itſelf.

Theſe diſcoveries are of the utmoſt conſequence, both in the phyſiological queſtion about the connection between the mother and child, and likewiſe in explaining the phenomena of births and abortions, as well as in regulating obſtetrical practice.

The anatomiſts of this century have improved anatomy, and have made the ſtudy of it much more eaſy, by giving us more correct as well as more numerous figures. It is amazing to think of what has been done in that time. We have had four large folio books of figures of the bones, viz. Cheſelden's, Albinus's, Sue's and Trew's. Of the muſcles, we have had two large folios; one from Cowper, which is elegant; and one from Albinus, which, from the accuracy and labour of the work, we may ſuppoſe will never be outdone. Of the blood-veſſels we have a large folio from Dr Haller. We have had one upon the nerves from Dr. Meckel, and another by Dr Monro junior. We have had Albinus's, Roederer's, Jenty's, and Hunter's works upon the pregnant uterus; Weitbrecht and Leber on the joints and freſh bones; Soemerring on the brain; Zin on the eye; Cotunnius, Mekel junior, &c. on the ear; Walterus on the nerves of the thorax and abdomen; Dr Monro on the burſæ mucoſæ, &c.

It would be endleſs to mention the anatomical figures that have been publiſhed in this century, of particular and ſmaller parts of the body, by Morgagni, Ruyſch, Valſalva, Sanctorini, Heiſter, Vater, Cant, Zimmerman, Walterus, and others.

Thoſe elegant plates of the brain, however, juſt publiſhed by M. Vicq. d'Azyr, muſt not paſs without notice, eſpecially as they form part of an univerſal ſyſtem of anatomy and phyſiology, both human and comparative, propoſed to be executed in the ſame ſplendid ſtyle. Upon the brain alone 19 folio plates are employed; of which ſeveral are coloured. The figures are delineated with accuracy and clearneſs; but the colouring is rather beautiful than correct. Such parts of this work as may be publiſhed, cannot fail to be equally acceptable to the anatomiſt and the philoſopher; but the entire deſign is apparently too extenſive to be accompliſhed within the period of a ſingle life. In Great Britain, alſo, a very great anatomical work is carrying on by Andrew Bell, F. S. A. S. engraver to his Royal Highneſs the Prince of Wales, with the approbation of Dr Monro, and under the inſpection of his very ingenious aſſiſtant Mr Fyfe. It is to compoſe a complete illuſtration, both general and particular, of the human body, by a ſelection from the beſt plates of all the greateſt anatomiſts, as well foreign as Britiſh, exhibiting the lateſt diſcoveries in the ſcience, and accompanied with copious explanations. The whole number of plates mentioned in the Proſpectus is 240, of which 152 are already done; all in royal folio.

To the foreign treatiſes already mentioned may be added thoſe recently publiſhed by Sabbatier and Plenck on anatomy in general. In Great-Britain, the writings of Keil, Douglas, Cheſelden, the firſt Monro, Winſlow, &c. are too well known to need deſcription. The laſt of theſe uſed to be recommended as a ſtandard for the ſtudents of anatomy: but it has of late given place to a more accurate and comprehenſive ſyſtem, in three volumes, publiſhed by Mr Elliot of Edinburgh, upon a plan approved of by Dr Monro, and executed by Mr Fyfe. Dr Simmons of London has alſo obliged the world with an excellent ſyſtem of anatomy; and another work, under the title of "Elements of Anatomy and the Animal Oeconomy: in which the ſubjects are treated with uncommon elegance and perſpicuity.

In the latter part of the laſt century, anatomy made two great ſteps, by the invention of injections, and the method of making what we commonly call *preparations*. Theſe two modern arts have really been of infinite uſe to anatomy; and beſides have introduced an elegance into our adminiſtrations, which in former times could not have been ſuppoſed to be poſſible. They aroſe in Holland under Swammerdam and Ruyſch, and afterwards in England under Cowper, St. André, and others, where they have been greatly improved.

The anatomiſts of former ages had no other knowledge of the blood-veſſels, than what they were able to collect from laborious diſſections, and from examining the ſmaller branches of them, upon ſome lucky occaſion, when they were found more than commonly loaded with red blood. But filling the vaſcular ſyſtem with a bright coloured wax, enables us to trace the large veſſels with great eaſe, renders the ſmaller much more conſpicuous, and makes thouſands of the very minute

ones

ones viſible, which from their delicacy, and the tranſparency of their natural contents, are otherwiſe imperceptible.

The modern art of corroding the fleſhy parts with a menſtruum, and of leaving the moulded wax entire, is ſo exceedingly uſeful, and at the ſame time ſo ornamental, that it does great honour to the ingenious inventor Dr Nicholls.

The wax-work art of the moderns might deſerve notice in any hiſtory of anatomy, if the maſters in that way had not been ſo careleſs in their imitation. Many of the wax-figures are ſo tawdry with a ſhow of unnatural colours, and ſo very incorrect in the circumſtances of figure, ſituation, and the like, that though they ſtrike a vulgar eye with admiration, they muſt appear ridiculous to an anatomiſt. But thoſe figures which are caſt in wax, plaſter, or lead, from the real ſubject, and which of late years have been frequently made, are, of courſe, very correct in all the principal parts, and may be conſidered as no inſignificant acquiſition to modern anatomy. The proper, or principal uſe of this art is, to preſerve a very perfect likeneſs of ſuch ſubjects as we but ſeldom can meet with, or cannot well preſerve in a natural ſtate; a ſubject in pregnancy, for example.

The modern improved methods of preſerving animal bodies, or parts of them, has been of the greateſt ſervice to anatomy; eſpecially in ſaving the time and labour of the anatomiſt in the nicer diſſections of the ſmall parts of the body. For now, whatever he has prepared with care, he can preſerve; and the object is ready to be ſeen at any time. And in the ſame manner he can preſerve anatomical curioſities, or rarities of every kind; ſuch as, parts that are uncommonly formed; parts that are diſeaſed; the parts of the pregnant uterus and its contents. Large collections of ſuch curioſities, which modern anatomiſts are ſtriving almoſt every where to procure, are of infinite ſervice to the art, eſpecially in the hands of teachers. They give ſtudents clear ideas about many things which it is very eſſential to know, and yet which it is impoſſible that a teacher ſhould be able to ſhow otherwiſe, were he ever ſo well ſupplied with freſh ſubjects.

§ 2. *View of the Subject in general, and Plan of the following Treatiſe.*

THE etymology of the word *anatomy*, as above given, implies ſimply *diſſection*; but by this term ſomething more is uſually underſtood.

It is every day made uſe of to expreſs a knowledge of the human body; and a perſon who is ſaid to underſtand anatomy, is ſuppoſed to be converſant with the ſtructure and arrangement of the different ſolid parts of the body.

It is commonly divided into *Anatomy*, properly ſo called; and *Comparative* Anatomy: the firſt of theſe is confined ſolely to the human body; the latter includes all animals, ſo far as a knowledge of their ſtructure may tend to perfect our ideas of the human body. See COMPARATIVE *Anatomy*.

The term *anatomy* may alſo have another and more extenſive ſignification: it may be employed to expreſs not only a knowledge of the ſtructure and diſpoſition of the parts but likewiſe of their œconomy and uſe. Conſidered in this light, it will ſeldom fail to excite the curioſity of people of taſte, as a branch of philoſophy; ſince, if it is pleaſing to be acquainted with the ſtructure of the body, it is certainly more ſo to diſcover all the ſprings which give life and motion to the machine, and to obſerve the admirable mechaniſm by which ſo many different functions are executed.

Aſtronomy and anatomy, as Dr Hunter, after Fontenelle, obſerves, are the ſtudies which preſent us with the moſt ſtriking view of the two greateſt attributes of the Supreme Being. The firſt of theſe fills the mind with the idea of his immenſity, in the largeneſs, diſtances, and number of the heavenly bodies; the laſt, aſtoniſhes with his intelligence and art in the variety and delicacy of animal mechaniſm.

The human body has been commonly enough known by the name of *microcoſmus*, or the little world; as if it did not differ ſo much from the univerſal ſyſtem of nature in the ſymmetry and number of its parts as in their ſize.

Galen's excellent treatiſe *De uſu partium*, was compoſed as a proſe hymn to the Creator; and abounds with as irreſiſtible proofs of a ſupreme Cauſe and governing Providence, as we find in modern phyſico-theology. And Cicero dwells more on the ſtructure and œconomy of animals than on all the productions of nature beſides, when he wants to prove the exiſtence of the gods from the order and beauty of the univerſe. He there takes a ſurvey of the body of man in a moſt elegant ſynopſis of anatomy, and concludes thus: "Quibus rebus expoſitis, ſatis docuiſſe videor, hominis natura, quanto omnes anteiret animantes. Ex quo debet intelligi, nec figuram ſitumque membrorum, nec ingenii mentiſque vim talem effici potuiſſe fortuna."

The ſatisfaction of mind which ariſes from the ſtudy of anatomy, and the influence which it muſt naturally have upon our minds as philoſophers, cannot be better conveyed than by the following paſſage from the ſame author: "Quæ contuens animus, accepit ab his cognitionem deorem, ex qua oritur pietas: cui conjuncta juſtitia eſt, reliquæque virtutes: ex quibus vita beata exſiſtit, par et ſimiles deorum, nulla alia re niſi immortalitate, quæ nihil ad bene vivendum pertinet, cedens cœleſtibus."

It would be endleſs to quote the animated paſſages of this ſort which are to be found in the phyſicians, philoſophers, and theologiſts, who have conſidered the ſtructure and functions of animals with a view towards the Creator. It is a view which muſt ſtrike one with a moſt awful conviction. Who can know and conſider the thouſand evident proofs of the aſtoniſhing art of the Creator, in forming and ſuſtaining an animal body ſuch as ours, without feeling the moſt pleaſant enthuſiaſm? Can we ſeriouſly reflect upon this awful ſubject, without being almoſt loſt in adoration? without longing for another life after this, in which we may be gratified with the higheſt enjoyment, which our faculties and nature ſeem capable of, the ſeeing and comprehending the whole plan of the Creator, in forming the univerſe and in directing all its operations?

But the more immediate purpoſes of anatomy concern thoſe who are to be the guardians of health, as this ſtudy is neceſſary to lay a foundation for all the branches of medicine. The more we know of our fabric, the more reaſon we have to believe, that if our ſenſes were more acute, and our judgment more enlarged,

ged, we ſhould be able to trace many ſprings of life which are now hidden from us: by the ſame ſagacity we ſhould diſcover the true cauſes and nature of diſeaſes; and thereby be enabled to reſtore the health of many, who are now, from our more confined knowledge, ſaid to labour under incurable diſorders. By ſuch an intimate acquaintance with the œconomy of our bodies, we ſhould diſcover even the ſeeds of diſeaſes, and deſtroy them before they had taken root in the conſtitution.

That anatomy is the very baſis of ſurgery every body allows. It is diſſection alone that can teach us, where we may cut the living body with freedom and diſpatch; and where we may venture with great circumſpection and delicacy; and where we muſt not, upon any account, attempt it. This informs the *head*, gives dexterity to the *hand*, and familiarizes the *heart* with a ſort of neceſſary inhumanity, the uſe of cutting-inſtruments upon our fellow-creatures.

Beſides the knowledge of our body, through all the variety of its *ſtructure* and *operations* in a *ſound* ſtate, it is by anatomy only that we can arrive at the knowledge of the true nature of moſt of the diſeaſes which afflict humanity. The ſymptoms of many diſorders are often equivocal; and diſeaſes themſelves are thence frequently miſtaken, even by ſenſible, experienced, and attentive phyſicians. But by anatomical examination after death, we can with certainty find out the miſtake, and learn to avoid it in any ſimilar caſe.

This uſe of anatomy has been ſo generally adopted by the moderns, that the caſes already publiſhed are almoſt innumerable: Mangetus, Morgagni, indeed many of the beſt modern writings in phyſic, are full of them. And if we look among the phyſicians of the beſt character, and obſerve thoſe who have the *art* itſelf, rather than the *craft* of the profeſſion at heart; we ſhall find them conſtantly taking pains to procure leave to examine the bodies of their patients after death.

After having conſidered the riſe and progreſs of anatomy; the various diſcoveries that have been made in it, from time to time; the great number of diligent obſervers who have applied themſelves to this art; and the importance of the ſtudy, not only for the prevention and cure of diſeaſes, but in furniſhing the livelieſt proofs of divine wiſdom; the following queſtions ſeem naturally to ariſe: For what purpoſe is there ſuch a variety of parts in the human body? Why ſuch a complication of nice and tender machinery? Why was there not rather a more ſimple, leſs delicate, and leſs expenſive frame (A)?

In order to acquire a ſatisfactory general idea of this ſubject, and find a ſolution of all ſuch queſtions, let us, in our imaginations, *make* a man: in other words let us ſuppoſe that the *mind*, or immaterial part, is to be placed in a corporeal fabric, in order to hold a correſpondence with other material beings by the intervention of the body; and then conſider, *a priori*, what will be wanted for her accommodation. In this inquiry, we ſhall plainly ſee the neceſſity or advantage, and therefore the final cauſe, of moſt of the parts which we actually find in the human body. And if we conſider that, in order to anſwer ſome of the requiſites, human wit and invention would be very inſufficient; we need not be ſurpriſed if we meet with ſome parts of the body whoſe uſe we cannot yet perceive, and with ſome operations and functions which we cannot explain. We can ſee that the whole bears the moſt ſtriking characters of excelling wiſdom and ingenuity: but the imperfect ſenſes and capacity of *man* cannot pretend to reach every part of a machine, which nothing leſs than the intelligence and power of the *Supreme Being* could contrive and execute.

Firſt, then, the *mind*, the thinking, immaterial agent, muſt be provided with a place of immediate reſidence, which ſhall have all the requiſites for the union of ſpirit and body; accordingly ſhe is provided with the *brain*, where ſhe dwells as governor and ſuperintendant of the whole fabric.

In the next place, as ſhe is to hold a correſpondence with all the material beings around her, ſhe muſt be ſupplied with organs fitted to receive the different kinds of impreſſions which they will make. In fact, therefore, we ſee that ſhe is provided with the organs of ſenſe, as we call them: the eye is adapted to light; the ear to ſound; the noſe to ſmell; the mouth to taſte; and the ſkin to touch.

Further: She muſt be furniſhed with organs of communication between herſelf in the brain and thoſe organs of ſenſe, to give her information of all the impreſſions that are made upon them: and ſhe muſt have organs between herſelf in the brain and every other part of the body, fitted to convey her commands and influence over the whole. For theſe purpoſes the nerves are actually given. They are chords, which riſe from the brain, the immediate reſidence of the mind, and diſperſe themſelves in branches through all parts of the body. They convey all the different kinds of ſenſations to the mind, in the brain; and likewiſe carry out from thence all her commands or influence to the other parts of the body. They are intended to be occaſional monitors againſt all ſuch impreſſions as might endanger the well-being of the whole, or of any particular part; which vindicates the Creator of all things, in having actually ſubjected us to thoſe many diſagreeable and painful ſenſations which we are expoſed to from a thouſand accidents in life.

Moreover, the mind, in this corporeal ſyſtem, muſt be endued with the power of moving from place to place, that ſhe may have intercourſe with a variety of objects; that ſhe may fly from ſuch as are diſagreeable, dangerous or hurtful, and purſue ſuch as are pleaſant or uſeful to her. And accordingly ſhe is furniſhed with limbs, and with muſcles and tendons, the inſtruments of motion, which are found in every part of the fabric where motion is neceſſary.

But to ſupport, to give firmneſs and ſhape to the fabric; to keep the ſofter parts in their proper places; to give fixed points for, and the proper direction to its motions, as well as to protect ſome of the more important and tender organs from external injuries; there

(A) The following beautiful repreſentation is taken from the late Dr Hunter's *Introductory Lecture in Anatomy*.

there muſt be ſome firm prop-work interwoven through the whole. And, in fact, for ſuch purpoſes the bones are given.

The prop-work muſt not be made into one rigid fabric, for that would prevent motion. Therefore there are a number of bones.

Theſe pieces muſt all be firmly bound together, to prevent their diſlocation. And this end is perfectly well anſwered by the ligaments.

The extremities of theſe bony pieces, where they move and rub upon one another, muſt have ſmooth and ſlippery ſurfaces for eaſy motion. This is moſt happily provided for, by the cartilages and mucus of the joints.

The interſtices of all thoſe parts muſt be filled up with ſome ſoft and ductile matter, which ſhall keep them in their places, unite them, and at the ſame time allow them to move a little upon one another. And theſe purpoſes are anſwered by the cellular membrane or adipoſe ſubſtance.

There muſt be an outward covering over the whole apparatus, both to give it compactneſs and to defend it from a thouſand injuries: which, in fact, are the very purpoſes of the ſkin and other integuments.

Laſtly, the mind being formed for ſociety and intercourſe with beings of her own kind, ſhe muſt be endued with powers of expreſſing and communicating her thoughts by ſome ſenſible marks or ſigns; which ſhall be both eaſy to herſelf, and admit of great variety; and accordingly ſhe is provided with the organs and faculty of ſpeech, by which ſhe can throw out ſigns with amazing facility, and vary them without end.

Thus we have built up an animal body which would ſeem to be pretty complete: but as it is the nature of matter to be altered and worked upon by matter; ſo in a very little time ſuch a living creature muſt be deſtroyed, if there is no proviſion for repairing the injuries which ſhe muſt commit upon herſelf, and thoſe which ſhe muſt be expoſed to from without. Therefore a treaſure of blood is actually provided in the heart and vaſcular ſyſtem, full of nutritious and healing particles, fluid enough to penetrate into the minuteſt parts of the animal; impelled by the heart, and conveyed by the arteries, it waſhes every part, builds up what was broken down, and ſweeps away the old and uſeleſs materials. Hence we ſee the neceſſity or advantage of the heart and arterial ſyſtem.

What more there was of this blood than enough to repair the preſent damages of the machine, muſt not be loſt, but ſhould be returned again to the heart; and for this purpoſe the venous ſyſtem is actually provided. Theſe requiſites in the animal explain, *a priori*, the circulation of the blood.

The old materials which were become uſeleſs, and are ſwept off by the current of blood, muſt be ſeparated and thrown out of the ſyſtem. Therefore glands, the organs of Secretion, are given for ſtraining whatever is redundant, vapid, or noxious, from the maſs of blood; and when ſtrained, they are thrown out by emunctories, called organs of Excretion.

But now, as the machine muſt be conſtantly wearing, the reparation muſt be carried on without intermiſſion, and the ſtrainers muſt always be employed. Therefore there is actually a perpetual circulation of the blood, and the ſecretions are always going on.

Even all this proviſion, however, would not be ſufficient; for that ſtore of blood would ſoon be conſumed, and the fabric would break down, if there were not a proviſion made for freſh ſupplies. Theſe we obſerve, in fact, are profuſely ſcattered round her in the animal and vegetable kingdoms; and ſhe is furniſhed with hands, the fitteſt inſtruments that could have been contrived, for gathering them, and for preparing them in a variety of ways for the mouth.

But theſe ſupplies, which we call food, muſt be conſiderably changed; they muſt be converted into blood. Therefore ſhe is provided with teeth for cutting and bruiſing the food, and with a ſtomach for melting it down: In ſhort, with all the organs ſubſervient to digeſtion.—The finer parts of the aliments only can be uſeful in the conſtitution: theſe muſt be taken up and conveyed into the blood, and the dregs muſt be thrown off. With this view the inteſtinal canal is actually given. It ſeparates the nutritious part, which we call *chyle*, to be conveyed into the blood by the ſyſtem of abſorbent veſſels; and the fæces paſs downwards, to be conducted out of the body.

Now we have got our animal not only furniſhed with what is wanted for its immediate exiſtence, but alſo with the powers of protracting that exiſtence to an indefinite length of time. But its duration, we may preſume, muſt neceſſarily be limited: for as it is nouriſhed, grows, and is raiſed up to its full ſtrength and utmoſt perfection; ſo it muſt, in time, in common with all material beings, begin to decay, and then hurry on to final ruin. Hence we ſee the neceſſity of a ſcheme for renovation. Accordingly wiſe Providence, to perpetuate, as well as preſerve his work, beſides giving a ſtrong appetite for life and ſelf-preſervation, has made animals male and female, and given them ſuch organs and paſſions as will ſecure the propagation of the ſpecies to the end of time.

Thus we ſee, that by the very imperfect ſurvey which human reaſon is able to take of this ſubject, the animal man muſt neceſſarily be complex in his corporeal ſyſtem, and in its operations.

He muſt have one great and general ſyſtem, the vaſcular, branching through the whole for circulation: Another, the nervous, with its appendages the organs of ſenſe, for every kind of feeling: And a third, for the union and connection of all thoſe parts.

Beſides theſe primary and general ſyſtems, he requires others which may be more local or confined: One for ſtrength, ſupport, and protection; the bony compages: Another for the requiſite motions of the parts among themſelves, as well as for moving from place to place; the muſcular part of the body: Another to prepare nouriſhment for the daily recruit of the body; the digeſtive organs: And one for propagating the ſpecies; the organs of generation.

And in taking this general ſurvey of what would appear, *a priori*, to be neceſſary for adapting an animal to the ſituations of life, we obſerve, with great ſatisfaction, that man is accordingly made of ſuch ſyſtems, and for ſuch purpoſes. He has them all; and he has nothing more, except the organs of reſpiration. Breathing it ſeemed difficult to account for *a priori*: we only knew it to be in fact eſſentially neceſſary to life. Notwithſtanding this, when we ſaw all the other parts of the body, and their functions, ſo well ac-

counted for, and ſo wiſely adapted to their ſeveral purpoſes, there could be no doubt that reſpiration was ſo likewiſe: And accordingly, the diſcoveries of Dr Prieſtley have lately thrown light upon this function alſo, as will be ſhown in its proper place.

Of all the different ſyſtems in the human body, the uſe and neceſſity are not more apparent, than the wiſdom and contrivance which has been exerted in putting them all into the moſt compact and convenient form: in diſpoſing them ſo, that they ſhall mutually receive, and give helps to one another; and that all, or many of the parts, ſhall not only anſwer their principal end or purpoſe, but operate ſucceſsfully and uſefully in a variety of ſecondary ways.

If we conſider the whole animal machine in this light, and compare it with any machine in which human art has exerted its utmoſt; ſuppoſe the beſt conſtructed ſhip that ever was built, we ſhall be convinced beyond the poſſibility of doubt, that there are intelligence and power far ſurpaſſing what humanity can boaſt of.

One ſuperiority in the natural machine is peculiarly ſtriking.—In machines of human contrivance or art, there is no internal power, no principle in the machine itſelf, by which it can alter and accommodate itſelf to any injury which it may ſuffer, or make up any injury which admits of repair. But in the natural machine, the animal body, this is moſt wonderfully provided for, by internal powers in the machine itſelf; many of which are not more certain and obvious in their effects, than they are above all human comprehenſion as to the manner and means of their operation. Thus, a wound heals up of itſelf; a broken bone is made firm again by a callus; a dead part is ſeparated and thrown off; noxious juices are driven out by ſome of the emunctories; a redundancy is removed by ſome ſpontaneous bleeding; a bleeding naturally ſtops of itſelf; and a great loſs of blood, from any cauſe, is in ſome meaſure compenſated, by a contracting power in the vaſcular ſyſtem, which accommodates the capacity of the veſſels to the quantity contained. The ſtomach gives information when the ſupplies have been expended; repreſents, with great exactneſs, the quantity and the quality of what is wanted in the preſent ſtate of the machine; and in proportion as ſhe meets with neglect, riſes in her demand, urges her petition in a louder tone, and with more forcible arguments. For its protection, an animal body reſiſts heat and cold in a very wonderful manner, and preſerves an equal temperature in a burning and in a freezing atmoſphere.

A farther excellence or ſuperiority in the natural machine, if poſſible, ſtill more aſtoniſhing, more beyond all human comprehenſion, than what we have been ſpeaking of, is the following. Beſides thoſe internal powers of ſelf-preſervation in each individual, when two of them co-operate, or act in concert, they are endued with powers of making other animals or machines like themſelves, which again are poſſeſſed of the ſame powers of producing others, and ſo of multiplying the ſpecies without end.

Theſe are powers which mock all human invention or imitation. They are characteriſtics of the divine Architect.

Having premiſed this general account of the ſubject, we ſhall next conſider the method to be obſerved in treating it.

The ſtudy of the *human* body, as already noticed, is commonly divided into two parts. The firſt, which is called *Anatomy*, relates to the matter and ſtructure of its parts; the ſecond, called *Phyſiology* and *Animal œconomy*, relates to the principles and laws of its internal operations and functions.

As the body is a compound of ſolids and fluids, *Anatomy* is divided into,

1. The Anatomy of the ſolids, and
2. The Anatomy of the fluids.

I. The SOLIDS, by which we mean all parts of our body, which are not fluid, are generally divided into two claſſes, viz.

1. The hard ſolids or bones. This part of anatomy is called *Oſteology*; which ſignifies the doctrine of the bones.

2. The ſofter ſolids; which part is called *Sarcology*, viz. the doctrine of fleſh.

This diviſion of the ſolids, we may obſerve, has probably taken its origin from the vulgar obſervation, that the body is made of bone and fleſh. And as there are many different kinds of what are called ſoft or fleſhy parts, Sarcology is ſubdivided into,

(1.) *Angeiology*, or the doctrine of veſſels; by which is commonly underſtood *blood-veſſels*:
(2.) *Adenology*, of glands:
(3.) *Neurology*, of nerves:
(4.) *Myology*, of muſcles: and,
(5.) *Splanchnology*, of the viſcera or bowels. There is, beſides, that part which treats of the organs of ſenſe and of the integuments.

This diviſion of the ſolids has been here mentioned, rather for the ſake of explaining ſo many words, which are conſtantly uſed by anatomiſts, than for its importance or accuracy. For beſides many other objections that might be urged, there are in the body three ſpecies of ſolids, viz. griſtle or cartilage, hair, and nails; which are of an intermediate nature between bone and fleſh; and therefore cannot ſo properly be brought into the oſteology or the ſarcology. The cartilages were claſſed with the bones; becauſe the greateſt number of them are appendages to bones: and for the like reaſon the hair and the nails were claſſed with the integuments.

II. The FLUIDS of the human body may be divided into *three* kinds, which Dr Hunter calls the *crude*, the *general* or *perfect*, and the *local* or *ſecreted fluid*.

1. By the *crude* fluid is meant the chyle, and whatever is abſorbed at the ſurfaces of the body; in other words, what is recently taken into the body, and is not yet mixed with or converted into blood.

2. The *general* or *perfect* fluid is the blood itſelf; to wit, what is contained in the heart, arteries, and veins, and is going on in the round of the circulation.

3. The *local* or *ſecreted*, are thoſe fluids peculiar to particular parts of the body, which are ſtrained off from the blood, and yet are very different in their properties from the blood. They are commonly called *ſecretions*; and ſome are uſeful, others excrementitious.

In treating of the *Phyſiology*, it is very difficult to ſay what plan ſhould be followed; for every method which has been yet propoſed, is attended with manifeſt inconvenience.

convenience. The powers and operations of the machine have ſuch a dependence upon one another, ſuch connections and reciprocal influence, that they cannot well be underſtood or explained ſeparately. In this ſenſe our body may be compared to a circular chain of powers, in which nothing is firſt or laſt, nothing ſolitary or independent; ſo that wherever we begin, we find that there is ſomething preceding which we ought to have known. If we begin with the brain and the nerves, for example, we ſhall find that theſe cannot exiſt, even in idea, without the heart: if we ſet out with the heart and vaſcular ſyſtem, we ſhall preſently be ſenſible, that the brain and nerves muſt be ſuppoſed: or, ſhould we take up the mouth, and follow the courſe of the aliment, we ſhould ſee that the very firſt organ which preſents itſelf, ſuppoſed the exiſtence of both the heart and brain: Wherefore we ſhall incorporate the Phyſiology with the Anatomy, by attempting to explain the functions after we have demonſtrated the organs.

PART I. OSTEOLOGY.

WE begin with the bones, which may be conſidered as the great ſupport of the body, tending to give it ſhape and firmneſs.—But before we enter into the detail of each particular bone, it will be neceſſary to deſcribe their compoſition and connections, and to explain the nature of the different parts which have an immediate relation to them; as the cartilages, ligaments, perioſteum, marrow, and ſynovial glands.

SECT. I. *Of the Bones in general, with their Appendages*, &c.

1 Of the compoſition of the bones.

THE bones are of a firm and hard (B) ſubſtance, of a white colour, and perfectly inſenſible. They are the moſt compact and ſolid parts of the body, and ſerve for the attachment and ſupport of all the other parts.

Three different ſubſtances are uſually diſtinguiſhed in them; their exterior or bony part, properly ſo called; their ſpongy cells; and their reticular ſubſtance. The firſt of theſe is formed of many laminæ or plates, compoſing a firm hard ſubſtance—The ſpongy or cellular part is ſo called on account of its reſemblance to a ſponge, from the little cells which compoſe it. This ſubſtance forms almoſt the whole of the extremities of cylindrical bones. The reticular part is compoſed of fibres, which croſs each other in different directions. This net-work forms the internal ſurface of thoſe bones which have cavities.

The flat bones, as thoſe of the head, are compoſed only of the laminæ and the cellular ſubſtance. This laſt is uſually found in the middle of the bone dividing it into two plates, and is there called *diploë*.

Gagliardi, who pretended to have diſcovered an infinite number of claviculi (C), or bony proceſſes, which he deſcribes as traverſing the laminæ to unite them together, has endeavoured to ſupport this pretended diſcovery by the analogy of bones to the bark of trees, in which certain woody nails have been remarked; but this opinion ſeems to be altogether fanciful.

Some writers have ſuppoſed, that the bones are formed by layers of the perioſteum, which gradually oſſify, in the ſame manner as the timber is formed in trees by the hardening of the white ſubſtance that is found between the inner bark and the wood. M. Duhamel, who has adopted this opinion, fed different animals with madder and their ordinary food alternately during a certain time; and he aſſerts, that in diſſecting their bones, he conſtantly obſerved diſtinct layers of red and white, which correſponded with the length of time they had lived on madder or their uſual aliment. But it has ſince been proved by Detleff, that M. Duhamel's experiments were inaccurate, and that neither the perioſteum nor the cartilages are tinged by the uſe of madder, which is known to affect the bones only.

We uſually conſider in a bone, its body and its extremities. The ancients gave the name of diaphyſis to the body or middle part, and divided the extremities into apophyſis and epiphyſis. An apophyſis, or proceſs, as it is more commonly called, is an eminence continued from the body of the bone, whereas an epiphyſis is at firſt a ſort of appendage to the bone, by means of an intermediate cartilage. Many epiphyſes, which appear as diſtinct bones in the fœtus, afterwards become apophyſes; for they are at length ſo completely united to the body of the bone as not to be diſtinguiſhable from it in the adult ſtate. It is not unuſual, however, at the age of 18 and even 20 years, to find the extremities of bones ſtill in the ſtate of epiphyſis.

The names given to the proceſſes of bones are expreſſive of their ſhape, ſize, or uſe; thus if a proceſs is large and of a ſpherical form, it is called *caput*, or *head*; if the head is flatted, it is termed *condyle*. Some proceſſes, from their reſemblance to a ſtiletto, a breaſt, or the beak of a crow, are called *ſtyloid*, *maſtoid*, or *coracoid*: others are ſtyled *ridges* or *ſpines*. The two proceſſes of the os femoris derive their name of *trochanters* from their uſe.

A bone has its cavities as well as proceſſes. Theſe cavities either extend quite through its ſubſtance, or appear only as depreſſions. The former are called *foramina* or *holes*, and theſe foramina are ſometimes termed *canals* or *conduits*, according to their form and extent. Of the depreſſions, ſome are uſeful in articulation. Theſe are called *cotyloid* when they are deep, as is the caſe with the os innominatum, where it receives the head of the os femoris; or *glenoid* when they are ſuperficial, as in the ſcapula, where it receives the os humeri. Of the depreſſions that are not deſigned for

(B) Mr Scheele has lately diſcovered that bones contain the phoſphoric acid united with calcareous earth; and that to this combination they owe their firmneſs.

(C) In his *Anat. oſſium nov. invent. illuſtrat.* he deſcribes four kinds of theſe claviculi or nails, viz. the perpendicular, oblique, headed, and crooked.

Osteology. for articulation, those which have small apertures are called *sinuses*; others that are large, and not equally surrounded by high brims, are styled *fossæ*; such as are long and narrow, *furrows*; or if broad and superficial without brims, *sinuosities*. Some are called *digital impressions*, from their resemblance to the traces of a finger on soft bodies.

2 Connection of the bones.

We shall abridge this article, which is exceedingly diffuse in the generality of anatomical books, and will endeavour to describe it with all the clearness it will allow.

The bones composing the skeleton are so constructed, that the end of every bone is perfectly adapted to the extremity of that with which it is connected, and this connection forms what is called their *articulation*.

Articulation is divided into *diarthrosis*, *synarthrosis*, and *amphiarthrosis*, or moveable, immovable, and mixed articulation. Each of the two first has its subdivisions. Thus the *Diarthrosis*, or moveable articulation, includes, 1. The enarthrosis, as it is called, when a large head is admitted into a deep cavity, as in the articulation of the os femoris with the os innominatum. 2. Arthrodia, when a round head is articulated with a superficial cavity, as is the case of the os humeri and scapula. 3. Ginglimus, or hinge-like articulation, as in the connection of the thigh-bone with the tibia. The enarthrosis and arthrodia allow of motion to all sides; the ginglimus only of flexion and extension.

The *synarthrosis*, or immoveable articulation, includes, 1. The suture, when the two bones are indented into each other, as is the case with the parietal bones. 2. Gomphosis, when one bone is fixed into another, in the manner the teeth are placed in their sockets.

The term *amphiarthrosis* is applied to those articulations which partake both of the synarthrosis and diarthrosis, as is the case with the bones of the vertebræ, which are capable of motion in a certain degree, although they are firmly connected together by intermediate cartilages.

What is called *symphysis* is the union of two bones into one; as in the lower jaw, for instance, which in the fœtus consists of two distinct bones, but becomes one in a more advanced age, by the ossification of the uniting cartilage.

When bones are thus joined by the means of cartilages, the union is styled *synchondrosis*; when by ligaments, *syneurosis*.

3 Of the Cartilages.

Cartilages are white, solid, smooth, and elastic substances, between the hardness of bones and ligaments, and seemingly of a fibrous texture. We are not able to trace any vessels into their substance by injection, nor are they ever found tinged in animals that have been fed with madder.

They may be distinguished into, 1st, Those which are connected with the bones; and, 2dly, Those which belong to other parts of the body. The first serve either to cover the ends and cavities of bones intended for motion, as in the articulations, where by their smoothness they facilitate motions, which the bones alone could not execute with so much freedom; or they serve to unite bones together, as in the symphysis pubis, or to lengthen them, as in the ribs.

Many of them ossifying as we advance in life, their number is less in the adult than in the fœtus, and of course there are fewer bones in the old than in the young subject. Osteology.

Of the second class of cartilages, or those belonging to the soft parts, we have instances in the larynx, where we find them useful in the formation of the voice, and for the attachment of muscles.

4 Of the Periosteum.

The periosteum is a fine membrane of a compact cellular texture, reflected from one joint to another, and serving as a common covering to the bones. It has sanguiferous and lymphatic vessels, and is supplied with nerves from the neighbouring parts. It adheres very firmly to their surface, and by its smoothness facilitates the motion of muscles. It likewise supports the vessels that go to be distributed through the substance of the bones, and may serve to strengthen the articulations. At the extremities of bones, where it is found covering a cartilage, it has by some been improperly considered as a distinct membrane, and named *perichondrium*. This, in its use and structure, resembles the periosteum. Where it covers the bones of the skull, it has gotten the name of *pericranium*.

The periosteum is not a production of the dura mater, as the ancients, and after them Havers, imagined; nor are the bones formed by the ossification of this membrane, at least when it is in a sound state, as some late writers have supposed.

The periosteum is deficient in the teeth above the sockets, and in those parts of bones to which ligaments or tendons are attached.

5 Of the Marrow.

The marrow is a fat oily substance, filling the cavities of bones. In the great cavities of long bones it is of a much firmer consistence than in the cells of their spongy part. In the former it inclines somewhat to a yellowish tinge, and is of the consistence of fat; in the latter it is more fluid, and of a red colour. This difference in colour and consistence is owing to accidental causes; both kinds are of the same nature, and may both be described under the common name of marrow, though some writers give the name only to the fat-like substance, and call the other the medullary juice.

The marrow is contained in a very fine and transparent membrane, which is supplied with a great number of blood vessels, chiefly from the periosteum. This membrana medullaris adheres to the inner surface of the bones, and furnishes an infinite number of minute bags or vesicles for inclosing the marrow, which is likewise supported in the cavities of the bones by the long filaments of their reticular substance.

Besides the vessels from the periosteum, the membrana medullaris is furnished with others, which in the long bones may be seen passing in near the extremities of the bone, and sending off numerous branches that ramify through all the vesicles of this membrane.

The bones, and the cells containing the marrow, are likewise furnished with lymphatics. By their means, the marrow, like the fat, may be taken up in a greater quantity than it is secreted; and hence it is that so little are found in the bones of those who die of lingering diseases.

It is still a matter of controversy, Whether the marrow is sensible or not? We are certainly not able to trace any nerves to it; and from this circumstance, and its analogy to fat, Haller has ventured to consider it as insensible. On the other hand, Duverney asserts, that

Osteology.

that an injury done to this substance in a living animal was attended with great pain. In this dispute physiologists do not seem to have sufficiently discriminated between the marrow itself and the membranous cells in which it is contained. The former, like the fat, being nothing more than a secreted, and of course an inorganized, matter, may with propriety be ranked among the insensible parts, as much as inspissated mucus or any other secreted matter in the body; whereas the membrana medullaris being vascular, though it possesses but an obscure degree of feeling in a sound state, is not perfectly insensible.

The marrow was formerly supposed to be intended for the nourishment and renewal of the bones; but this doctrine is now pretty generally and deservedly exploded. It seems probable that the marrow is to the bones what fat is to the soft parts. They both serve for some important purposes in the animal œconomy; but their particular use has never yet been clearly ascertained. The marrow, from the transudation of the oil through the bones of a skeleton, is supposed to diminish their brittleness; and Havers, who has written professedly on the bones, describes the canals by which the marrow is conveyed through every part of their substance, and divides them into longitudinal and transverse ones. He speaks of the first as extending through the whole length of the bone; and of the latter, as the passages by which the longitudinal ones communicate with each other. The similarity of these to the large cancelli in burnt bones, and the transudation of the oil through the bones of the skeleton, seems to prove that some such passages do actually exist.

6 Synovial Glands.

The synovial glands are small bodies (D), supposed to be of a glandular structure, and exceedingly vascular, secreting a fluid of a clear mucilaginous nature, which serves to lubricate the joints. They are placed in small cavities in the articulations, so as to be capable of being gently compressed by the motion of the joint, which expresses their juice in proportion to the degree of friction. When the synovia is wanting, or is of too thick a consistence, the joint becomes stiff and incapable of flexion or extension. This is what is termed *anchylosis*.

7 Of the Ligaments.

Ligaments are white, glistening, inelastic bands, of a compact substance, more or less broad or thick, and serving to connect the bones together. They are distinguished by different names adapted to their different forms and uses. Those of the joints are called either round or bursal. The round ligaments are white, tendinous, and inelastic. They are strong and flexible, and are found only in the joint of the knee, and in the articulation of the os femoris with the os innominatum. The bursal, or capsular ligaments, surround the whole joint like a purse, and are to be found in the articulations which allow motion every way, as in the articulation of the arm with the scapula.

8 Of the Bursæ mucosæ.

Of those sacs called *Bursæ mucosæ*, a few were known to former anatomists, but by much the greater number have been since discovered by Dr Monro (E), who observes, that they are to be met with in the extremities of the body only; that many of them are placed entirely on the inner sides of the tendons, between these and the bones. Many others cover not only the inner, but the outer sides of the tendons, or are interposed between the tendons and external parts, as well as between those and the bones.

Some are situated between the tendons and external parts only or chiefly, some between contiguous tendons, or between the tendons or the ligaments and the joints. A few such sacs are observed where the processes of bones play upon the ligaments, or where one bone plays upon another. Where two or more tendons are contiguous, and afterwards separate from each other, we generally find a common bursa divided into branches, with which it communicates; and a few bursæ of contiguous tendons communicate with each other.—Some, in healthy children, communicate with the cavities of the joints; and in many old people he has seen such communications formed by use or worn by friction, independent of disease.

Their proper membrane is thin and transparent, but very dense, and capable of confining air or any other fluid. It is joined to the neighbouring parts by the common cellular substance. Between the bursa and the hard substance of bone, a thin layer of cartilage or of tough membrane is very generally interposed. To the cellular substance on the outside of the bursa, the adipose substance is connected; except where the bursa covers a tendon, cartilage, or bone, much exposed to pressure or friction.

In several places a mass of fat, covered with the continuation of the membrane of the bursa, projects into its cavity. The edges of this are divided into fringes.

The inner side of the membrane is smooth, and is extremely slippery from the liquor secreted in it.

9 Their structure compared with that of the capsular ligaments of the joint

The structure of the bursæ bears a strong resemblance to the capsular ligaments of the joints. 1. The inner layer of the ligament, like that of the bursæ, is thin and dense. 2. It is connected to the external ligaments by the common cellular substance. 3. Between it and the bones, layers of cartilage, or the articular cartilages, are interposed. 4. At the sides of the joints, where it is not subjected to violent pressure and friction, the adipose substance is connected with the cellular membrane. 5. Within the cavities of the joints we observe masses of fat projecting, covered with similar blood-vessels, and with similar fimbriæ hanging from their edges. 6. In the knee the upper part of such a mass of fat forms what has been called the *mucilaginous gland of the joint*, and the under part projects into the bursa behind the ligament which ties the patella to the tibia. 7. The liquor which lubricates the bursæ has the same colour, consistence, and properties as that of the joints, and both are affected in the same manner by heat, mineral acids, and ardent spirits. 8. In some places the bursæ constantly communicate with the cavities of the joints, in others they generally do so; from which we may infer a sameness of structure.

When we examine the fimbriæ common to the fatty bodies of the joints and bursæ, and which have been supposed to be the ducts of glands lodged within the masses

(D) It is now much doubted, however, whether the appearances in the joints, which are usually called *glands*, are any thing more than assemblages of fat.

(E) See *Description of the Bursæ Mucosæ*, &c.

Osteology.

masses of fat, we are not able to discover any glandular appearance within them. And although we observe many vessels dispersed upon the membranes of the fatty bodies and fimbriæ; and that we cannot doubt that these fimbriæ consist of ducts which contain a lubricating liquor, and can even press such a liquor from them; yet their cavities and orifices are so minute, that they are not discoverable even by the assistance of magnifying-glasses. These fimbriæ appear, therefore, to be ducts like those of the urethra, which prepare a mucilaginous liquor without the assistance of any knotty or glandular organ.

Upon the whole, the synovia seems to be furnished by invisible exhalent arteries by the ducts of the fimbriæ, and by oil exuding from the adipose follicles by passages not yet discovered.

10 Of the Skeleton.

The word *skeleton*, which by its etymology implies simply a dry preparation, is usually applied to an assemblage of all the bones of an animal united together in their natural order. It is said to be a natural skeleton, when the bones are connected together by their own proper ligaments; and an artificial one, when they are joined by any other substance, as wire, &c.

The skeleton is generally divided into the head, trunk, and extremities. The first division includes the bones of the cranium and face. The bones of the trunk are the spine, ribs, sternum, and bones of the pelvis.

The upper extremity on each side consists of the two bones of the shoulder, viz. the scapula and clavicle; the bone of the arm, or os humeri; the bones of the fore-arm, and those of the hand.

The lower extremity on each side of the trunk consists of the thigh-bone and the bones of the leg and foot.

Sect. II. *Of the Bones of the Head.*

The head is of a roundish figure, and somewhat oval (F). Its greatest diameter is from the forehead to the occiput; its upper part is called *vertex*, or crown of the head; its anterior or fore-part the face; and the upper part of this *sinciput*, or forehead; its sides the temples; its posterior, or hind-part, the *occiput*; and its inferior part the *basis*.

The bones of the head may be divided into those of the cranium and face.

§ 1. *Bones of the Cranium and Face.*

There are eight bones of the cranium, viz. the coronal bone, or os frontis; the two parietal bones, or ossa bregmatis; the os occipitis; the two temporal bones; the sphenoid bone; and the os ethmoides, or cribriforme.

11. Of these, only the os occipitis and ossa bregmatis are considered as proper to the cranium; the rest being common both to the cranium and face.

These bones are all harder at their surface than in their middle; and on this account they are divided into two tables, and a middle spongy substance called *diploë*.

12 Of the Os Frontis.

In this, as in all the other bones, we shall consider its figure, structure, processes, depressions, and cavities; and the manner in which it is articulated with the other bones.

The os frontis has some resemblance in shape to the shell of the cockle. Externally it is convex, its concave side being turned towards the brain. This bone, in the places where it is united to the temporal bones, is very thin, and has there no diplöe. It is likewise exceedingly thin in that part of the orbit of the eye which is nearest to the nose. Hence it is, that a wound in the eye, by a sword or any other pointed instrument, is sometimes productive of immediate death. In these cases, the sword passing through the weak part of the bone, penetrates the brain, and divides the nerves at their origin; or perhaps opens some blood-vessel, the consequences of which are soon fatal.

We observe on the exterior surface of this bone five apophyses or processes, which are easily to be distinguished. One of these is placed at the bottom and narrowest part of the bone, and is called the nasal process, from its supporting the upper end of the bones of the nose. The four others are called angular or orbitar processes. They assist to form the orbits, which are the cavities on which the eyes are placed. In each of these orbits there are two processes, one at the interior or great angle, and the other at the exterior or little angle of the orbit. They are called the angular processes. Between these a ridge is extended in form of an arch, and on this the eye-brows are placed. It is called the orbitar or superciliary ridge, and in some measure covers and defends the globe of the eye. There is a hole in this for the passage of the frontal vessels and nerves. This arch is interrupted near the nose by a small pit, in which the tendon of the musculus obliquus major of the eye is fixed. From the under part of each superciliary ridge a thin plate runs a considerable way backwards, and has the name of *orbitar*; the external and fore-part of this plate forms a sinuosity for lodging the lacrymal gland. Between the orbitar plates there is a large discontinuation of the bone, which is filled up by the cribriform part of the os ethmoides.

On examining the inner surface of this bone at its under and middle part, we observe an elevation in form of a ridge, which has been called the *spinous process*; it ascends for some way, dividing the bone into two considerable fossæ, in which the anterior lobes of the brain are placed. To a narrow furrow in this ridge is attached the extremity of the falx, as the membrane is called, which divides the brain into two hemispheres. The furrow becoming gradually wider, is continued to the upper and back part of the bone. It has the falx fixed

(F) The bones of the fœtus being perfectly distinct, and the muscles in young persons not acting much, the shape of the head has been supposed to depend much on the management of children when very young. Vesalius, who has remarked the difference in people of different nations, observes, for instance, that the head of a Turk is conical, from the early use of the turban; whilst that of an Englishman is flattened by the chin-stay. Some of the latest physiologists suppose, with good reason, that this difference is chiefly owing to certain natural causes with which we are as yet unacquainted.

Osteology.

fixed to it, and part of the longitudinal sinus lodged in it. Besides the two fossæ, there are many depressions, which appear like digital impressions, and owe their formation to the prominent circumvolutions of the brain.

In the fœtus, the forehead is composed of two distinct bones; so that in them the sagittal suture reaches from the os occipitis to the nose. This bone is almost every where composed of two tables and a diplöe. These two tables separating from each other under the eyes, form two cavities, one on each side of the face, called the frontal sinuses. These sinuses are lined with a soft membrane, called *membrana pituitaria*. In these sinuses a mucus is secreted, which is constantly passing through two small holes into the nostrils, which it serves to moisten.

The os frontis is joined by suture to many of the bones of the head, viz. to the parietal, maxillary, and temporal bones; to the os ethmoides; os sphenoides; os unguis; and ossa nasi. The suture which connects it with the parietal bones is called the *coronal suture*.

13 Of the parietal bones

The parietal bones are two in number; they are very thin, and even transparent in some places. The particular figure of each of these bones is that of an irregular square, bordered with indentations through its whole circumference, except at its lower part. It will be easily conceived, that these bones which compose the superior and lateral parts of the cranium, and cover the greatest part of the brain, form a kind of vault. On their inner surface we observe the marks of the vessels of the dura mater; and at their upper edge the groove for the superior longitudinal sinus.

The ossa parietalia are joined to each other by the sagittal suture; to the os sphenoides and ossa temporum by the squamous suture; to the os occipitis by the lambdoidal suture (G), so called from its resemblance to the Greek letter lambda; and to the os frontis by the coronal suture.

In the fœtus, the parietal bones are separated from the middle of the divided os frontis by a portion of the cranium then unossified.

14 Of the occipital bone

The occipital bone forms the posterior and inferior parts of the skull; it approaches nearly to the shape of a lozenge, and is indented throughout three parts of its circumference.

There is a considerable hole in the inferior portion of this bone, called the *foramen magnum*, through which the medulla oblongata passes into the spine.—The nervi accessorii, and vertebral arteries, likewise pass through it. Behind the condyles are two holes for the passage of cervical veins into the lateral sinuses; and above them are two others for the passage of the eighth pair and accessory nerves out of the head. At the sides, and a little on the anterior part of the foramen magnum, are two processes, called the condyles, one on each side; they are of an oval figure, and are covered with cartilage.

The external surface of this bone has a large transverse arched ridge, under which the bone is very irregular, where it affords attachment to several muscles. On examining its inner surface, we may observe two ridges in form of a cross; one ascending from near the foramen magnum to the top of the bone; the upper end of this in which the falx is fixed, is hollow, for lodging the superior longitudinal sinus, and the under end has the third process of the dura mater fixed to it. The other ridge, which runs horizontally, is likewise hollow for containing the lateral sinuses. Four fossæ are formed by the cross, two above and two below. In the former are placed the posterior lobes of the brain, and in the latter the lobes of the cerebellum.

Osteology.

At the basis of the cranium, we observe the cuneiform process (which is the name given to the great apophysis at the fore part of this bone); it serves for the reception of the medulla oblongata.

The os occipitis is of greater strength and thickness than either of the other bones of the head, though irregularly so; at its inferior part, where it is thinnest, it is covered by a great number of muscles.

This bone, from its situation, being more liable to be injured by falls, than any other bone of the head, nature has wisely given it the greatest strength at its upper part, where it is most exposed to danger.

It is joined to the parietal bones by the lambdoidal suture, and to the ossa temporum, by the additamentum of the temporal suture. It is likewise connected to the os sphenoides by the cuneiform process. It is by means of the os occipitis that the head is united to the trunk, the two condyles of this bone being connected to the superior oblique processes of the first vertebra of the neck.

15 Of the temporal bones

There are two temporal bones, one on each side.—We may distinguish in them two parts; one of which is called the *squamous* or *scaly part*, and the other *pars petrosa* from its hardness. This last is shaped like a pyramid.

Each of these divisions affords processes and cavities: externally there are three processes; one anterior, called the zygomatic process; one posterior, called the *mastoid* or *mamillary process*, from its resemblance to a nipple; and one inferior, called the *styloid process*, because it is shaped like a stiletto, or dagger.

The cavities are, 1. The meatus auditorius externus. 2. A large fossa which serves for the articulation of the lower jaw; it is before the meatus auditorius, and immediately under the zygomatic process. 3. The stylo-mastoid hole, so called from its situation between the styloid and mastoid processes; it is likewise styled the aquæduct of Fallopius, and affords a passage to the portio dura of the auditory, or seventh pair of nerves. 4. Below, and on the fore-part of the last foramen, we observe part of the jugular fossa, in which the beginning of the internal jugular vein is lodged. Anterior and superior to this fossa is the orifice of a foramen, through which passes the carotid artery. This foramen runs first upwards and then forwards, forming a kind of elbow, and terminates at the end of the os petrosum.—At this part of each temporal bone, we may observe the opening of the Eustachian tube, a canal which passes from the ear to the back part of the nose.

In examining the internal surface of these bones, we may remark the triangular figure of their petrous part which separates two fossæ; one superior and anterior; the other inferior and posterior: the latter of these composes part of the fossa, in which the cerebellum is

(G) The lambdoidal suture is sometimes very irregular, being composed of many small sutures, which surround so many little bones called *ossa triquetra*, though perhaps improperly, as they are not always triangular.

Osteology. placed; and the former, a portion of the leaſt foſſa for the baſis of the brain. On the poſterior ſide of the pars petroſa, we obſerve the meatus auditorus internus, into which enters the double nerve of the ſeventh pair. On the under ſide of this proceſs, part of a hole appears, which is common to the temporal and occipital bones; through it the lateral ſinus, the eighth pair, and acceſſory nerves, paſs out of the head.

The pars petroſa contains ſeveral little bones called the bones of the ear; which, as they do not enter into the formation of the cranium, ſhall be deſcribed when we are treating of the organs of hearing.

The oſſa temporum are joined to the oſſa malarum, by the zygomatic ſutures; to the parietal bones, by the ſquamous ſutures; to the os occipitis, by the lambdoidal ſuture; and to the ſphenoid bone, by the ſuture of that name.

16 Of the os ſphenoides.

This bone, from its ſituation amidſt the other bones of the head, has ſometimes been called *cuneiforme*. It is of a very irregular figure, and has been compared to a bat with its wings extended.

It is commonly divided into its middle part or body, and its ſides or wings.

The fore part of the body has a ſpine or ridge, which makes part of the ſeptum narium. The upper part of each wing forms a ſhare of the temple. The fore part of this belongs to the orbit; while the under and back part, termed *ſpinous proceſs*, is lodged in the baſe of the ſkull at the point of the pars petroſa. But two of the moſt remarkable proceſſes are the ptergoid or aliform, one on each ſide of the body of the bone, and at no great diſtance from it. Each of theſe proceſſes is divided into two wings, and of theſe the exterior one is the wideſt. The other terminates in a hook-like proceſs.

The internal ſurface of this bone affords three foſſæ. Two of theſe are formed by the wings of the bone, and make a part of the leſſer foſſæ of the baſis of the cranium. The third, which is ſmaller, is on the top of the body of the bone; and is called *ſella turcica*, from its reſemblance to a Turkiſh ſaddle. This foſſa, in which the pituitary gland is placed, has poſteriorly and anteriorly proceſſes called the *clinoid proceſſes*.

There are twelve holes in this bone, viz. ſix on each ſide. The firſt is the paſſage of the optic nerve and ocular artery; the ſecond, or large ſlit, tranſmits the third, fourth, ſixth, and firſt part of the fifth pair of nerves with the ocular vein; the third hole gives paſſage to the ſecond branch of the fifth pair; and the fourth hole to the third branch of the fifth pair of nerves. The fifth hole is the paſſage of the artery of the dura mater. The ſixth hole is ſituated above the ptergoid proceſs of the ſphenoid bone; through it a reflected branch of the ſecond part of the fifth pair paſſes.

Within the ſubſtance of the os ſphenoides there are two ſinuſes ſeparated by a bony plate. They are lined with the pituitary membrane; and, like the frontal ſinuſes, ſeparate a mucus which paſſes into the noſtrils.

The os ſphenoides is joined to all the bones of the cranium; and likewiſe to the oſſa maxillaria, oſſa malarum, oſſa palati, and vomer.

This bone makes part of the baſis of the ſkull, aſſiſts in forming the orbits, and affords attachment to ſeveral muſcles.

The os ethmoides is ſituated at the fore part of the baſis of the cranium, and is of a very irregular figure. From the great number of holes with which it is pierced, it is ſometimes called *os cribriforme* or ſieve-like bone.

Osteology. 17 Of the os ethmoides or cribriforme.

It conſiſts of a middle part and two ſides. The middle part is formed of a thin bony plate, in which are an infinite number of holes that afford a paſſage to filaments of the olfactory nerve. From the middle of this plate, both on the outſide and from within, there riſes up a proceſs, which may be eaſily diſtinguiſhed. The inner one is called *criſta galli*, from its ſuppoſed reſemblance to a cock's comb. To this proceſs the falx of the dura mater is attached. The exterior proceſs, which has the ſame common baſis as the criſta galli, is a fine lamella which is united to the vomer; and divides the cavity of the noſtrils, though unequally, it being generally a little inclined to one ſide.

The lateral parts of this bone are compoſed of a cellular ſubſtance; and theſe cells are ſo very intricate, that their figure or number cannot be deſcribed. Many writers have on this account called this part of the bone the *labyrinth*. Theſe cells are externally covered with a very thin bony lamella. This part of the bone is called the *os planum*, and forms part of the orbit.

The different cells of this bone, which are numerous, and which are every where lined with the pituitary membrane, evidently ſerve to enlarge the cavity of the noſe, in which the organ of ſmelling reſides.

This bone is joined to the os ſphenoides, os frontis, oſſa maxillaria, oſſa palati, oſſa naſi, oſſa unguis, and vomer.

The ancients, who conſidered the brain as the ſeat of all the humours, imagined that this viſcus diſcharged its redundant moiſture through the holes of the ethmoid bone. And the vulgar ſtill think, that abſceſſes of the brain diſcharge themſelves through the mouth and ears, and that ſnuff is liable to get into the head; but neither ſnuff nor the matter of an abſceſs are more capable of paſſing through the cribriform bone, than the ſeroſity which they ſuppoſed was diſcharged through it in a common cold.—All the holes of the ethmoid bone are filled up with the branches of the olfactory nerve. Its inner part is likewiſe covered with the dura mater, and its cells are every where lined with the pituitary membrane; ſo that neither matter nor any other fluid can poſſibly paſs through this bone either externally or internally. Matter is indeed ſometimes diſcharged through the noſtrils; but the ſeat of the diſeaſe is in the ſinuſes of the noſe, and not in the brain; and impoſthumations are obſerved to take place in the ear, which ſuppurate and diſcharge themſelves externally.

Before we leave the bones of the head, we wiſh to make ſome general obſervations on its ſtructure and figure.—As the cranium might have been compoſed of a ſingle bone, the articulation of its ſeveral bones being abſolutely without motion, it may be aſked perhaps, Why ſuch a multiplicity of bones, and ſo great number of ſutures? Many advantages may poſſibly ariſe from this plurality of bones and ſutures, which may not yet have been obſerved. We are able, however, to point out many uſeful ends, which could only be accompliſhed by this peculiarity of ſtructure.—In this, as in all the other works of nature, the great wiſdom of the Creator is evinced, and cannot fail to excite our admiration and gratitude.

The cranium, by being divided into ſeveral bones, grows much faſter and with greater facility, than if it

was

Osteology.

was compoſed of one piece only. In the fœtus, the bones, as we have before obſerved, are perfectly diſtinct from each other. The oſſification begins in the middle of each bone, and proceeds gradually to the circumference. Hence the oſſification, and of courſe the increaſe of the head, is carried on from an infinite number of points at the ſame time, and the bones conſequently approach each other in the ſame proportion. To illuſtrate this doctrine more clearly, if it can want further illuſtration, ſuppoſe it neceſſary for the parietal bones which compoſe the upper part of the head, to extend their oſſification, and form the fore part of the head likewiſe.—Is it not evident, that this proceſs would be much more tedious than it is now, when the os frontis and the parietal bones are both growing at the ſame time? Hence it happens, that the heads of young people, in which the bones begin to touch each other, increaſe ſlowly; and that the proportionate increaſe of the volume of the head is greater in three months in the fœtus, than it is perhaps in twenty-four months at the age of fourteen or fifteen years.

The ſutures, excluſive of their advantage in ſuſpending the proceſſes of the dura mater, are evidenly of great utility in preventing the too great extent of fractures of the ſkull.—Suppoſe, for inſtance, that by a fall or blow, one of the bones of the cranium becomes fractured. The fiſſure, which in a head compoſed of only one bone, would be liable to extend itſelf through the whole of it, is checked, and ſometimes perhaps ſtopped by the firſt ſuture it meets, and the effects of the injury are confined to the bone on which the blow was received. Ruyſch indeed, and ſome others, will not allow the ſutures to be of any ſuch uſe; but caſes have been met with where they ſeemed to have had this effect, and in young ſubjects their utility in this reſpect muſt be ſtill more obvious.

The ſpherical ſhape of the head ſeems likewiſe to render it more capable of reſiſting external violence than any other ſhape would do. In a vault, the parts mutually ſupport and ſtrengthen each other, and this happens in the cranium.

§ 2. *Proper Bones of the Face.*

18 Of the bones of the face.

THE face, which conſiſts of a great number of bones, is commonly divided into the upper and lower jaws. The upper jaw conſiſts of thirteen bones, excluſive of the teeth. Of theſe, ſix are placed on each ſide of the maxilla ſuperior, and one in the middle.

The bones, which are in pairs, are the oſſa malarum, oſſa maxillaria, oſſa naſi, oſſa unguis, oſſa palati, and oſſa ſpongioſa inferiora. The ſingle bone is the vomer.

19 Of the oſſa malarum.

Theſe are the prominent ſquare bones which are placed under the eyes, forming part of the orbits and the upper part of the cheeks. Each of them affords three ſurfaces; one exterior and a little convex; a ſecond ſuperior and concave, forming the inferior part and ſides of the orbit; and a third poſterior, irregular, and hollowed for the lodgement of the lower part of the temporal muſcle.

The angles of each bone form four proceſſes, two of which may be called *orbitar proceſſes*; of theſe the upper one is joined by ſuture to the os frontis, and that below to the maxillary bone. The third is connected with the os ſphenoides by means of the tranſverſe ſuture; and the fourth is joined to the zygomatic proceſs of the temporal bone, with which it forms the zygoma. Osteology.

20 Of the oſſa maxillaria ſuperiora.

Theſe bones, which are of a very irregular figure, are ſo called becauſe they form the moſt conſiderable portion of the upper jaw. They are two in number, and generally remain diſtinct through life.

Of the many proceſſes which are to be ſeen on theſe bones, and which are connected with the bones of the face and ſkull, we ſhall deſcribe only the moſt remarkable.

One of theſe proceſſes is at the upper and fore part of the bone, making part of the ſide of the noſe, and called the *naſal proceſs*. Another forms a kind of circular ſweep at the inferior part of the bone, in which are the alveoli or ſockets for the teeth: this is called the *alveolar proceſs*. A third proceſs is united to the os malæ on each ſide. Between this and the naſal proceſs there is a thin plate, which forms a ſhare of the orbit, and lies over a paſſage for the ſuperior maxillary veſſels and nerves.—The alveolar proceſs has poſteriorly a conſiderable tuberoſity on its internal ſurface, called the *maxillary tuberoſity*.

Behind the alveolar proceſs we obſerve two horizontal lamellæ, which uniting together, form a part of the roof of the mouth, and divide it from the noſe. The hollowneſs of the roof of the mouth is owing to this partition's being ſeated ſomewhat higher than the alveolar proceſs.—At the fore part of the horizontal lamellæ there is a hole called *foramen inciſivum*, through which ſmall blood-veſſels and nerves go between the mouth and noſe.

In viewing theſe bones internally, we obſerve a foſſa in the inferior portion of the naſal proceſs, which, with the os unguis and os ſpongioſum inferius, forms a paſſage for the lachrymal duct.

Where theſe two bones are united to each other, they project ſomewhat upwards and forwards, leaving between them a furrow, into which the lower portion of the ſeptum naſi is admitted.

Each of theſe bones being hollow, a conſiderable ſinus is formed under its orbitar part. This cavity, which is uſually named after Highmore, though it was deſcribed by Fallopius and others before his time, is lined with the pituitary membrane. It is intended for the ſame purpoſes as the other ſinuſes of the noſe, and opens into the noſtrils.

The oſſa maxillaria are connected with the greater part of the bones of the face and cranium, and aſſiſt in forming not only the cheeks, but likewiſe the palate, noſe, and orbits.

21 Of the oſſa naſi.

The oſſa naſi form two irregular ſquares. They are thicker and narrower above than below. Externally they are ſomewhat convex, and internally ſlightly concave. Theſe bones conſtitute the upper part of the noſe. At their fore part they are united to each other, above to the os frontis, by their ſides to the oſſa maxillaria ſuperiora, poſteriorly and interiorly to the ſeptum narium, and below to the cartilages that compoſe the reſt of the noſtrils.

22 Of the oſſa unguis.

Theſe little tranſparent bones owe their name to their ſuppoſed reſemblance to a finger-nail. Sometimes they are called *oſſa lachrymalia*, from their concurring with the naſal proceſs of each maxillary bone in forming a lodgement for the lachrymal ſac and duct.

Osteology.

The ossa unguis are of an irregular figure. Their external surface consists of two smooth parts, divided by a middle ridge. One of these parts, which is concave and nearest to the nose, serves to support the lachrymal sac and part of the lachrymal duct. The other, which is flat, forms a small part of the orbit.

Each of these bones is connected with the os frontis, os ethmoides, and os maxillare superius.

23 Of the ossa palati.

These bones, which are situated at the back part of the roof of the mouth, between the os sphenoides and the ossa maxillaria superiora, are of a very irregular shape, and serve to form the nasal and maxillary fossa, and a small portion of the orbit. Where they are united to each other, they rise up into a spine on their internal surface. This spine appears to be a continuation of that of the superior maxillary bones, and helps to form the septum narium.

These bones are joined to the ossa maxillaria superiora, os ethmoides, os sphenoides, and vomer.

24 Of the vomer.

This bone derives its name from its resemblance to a ploughshare. It is a long and flat bone, somewhat thicker at its back than at its fore part. At its upper part we observe a furrow extending through its whole length. The posterior and largest part of this furrow receives a process of the sphenoid bone. From this the furrow advances forwards, and becoming narrower and shallower, receives some part of the nasal lamella ethmoidea; the rest serves to support the middle cartilage of the nose.

The inferior portion of this bone is placed on the nasal spine of the maxillary and palate bones, which we mentioned in our description of the ossa palati.

The vomer is united to the os sphenoides, os ethmoides, ossa maxillaria superiora, and ossa palati. It forms part of the septum narium, by dividing the back part of the nose into two nostrils.

25 Of the ossa spongiosa inferiora.

The parts which are usually described by this name, do not seem to deserve to be distinguished as distinct bones, except in young subjects. They consist of a spongy lamella in each nostril, which is united to the spongy lamina of the ethmoid bone, of which they are by some considered as a part.

Each of these lamellæ is longest from behind forwards; with its convex surface turned towards the septum narium, and its concave part towards the maxillary bone, covering the opening of the lachrymal duct into the nose.

These bones are covered with the pituitary membrane; and, besides their connection with the ethmoid bone, are joined to the ossa maxillaria superiora, ossa palati, and ossa unguis.

26 Of the maxilla inferior.

The maxilla inferior, or lower jaw, which in its shape resembles a horse-shoe, consists of two distinct bones in the fœtus; but these unite together soon after birth, so as to form only one bone. The upper edge of this bone, like the os maxillare superius, has an alveolar process, furnished with sockets for the teeth.

On each side, the posterior part of the bone rises almost perpendicularly into two processes. The highest of these, called the coronoid process, is pointed and thin, and serves for the insertion of the temporal muscle. The other, or condyloid process, as it is called, is shorter and thicker, and ends in an oblong rounded head, which is received into a fossa of the temporal bone, and is formed for a moveable articulation with the cranium. This joint is furnished with a moveable cartilage. At the bottom of each coronoid process, on its inner part, we observe a foramen extending under the roots of all the teeth, and terminating at the outer surface of the bone near the chin. Each of these canals transmits an artery, vein, and nerve, from which branches are sent off to the teeth.

Osteology.

The lower jaw is capable of a great variety of motion. By sliding the condyles from the cavity towards the eminences on each side, we bring it horizontally forwards, as in biting; or we may bring the condyles only forward, and tilt the rest of the jaw backward, as in opening the mouth. We are likewise able to slide the condyles alternately backwards and forwards from the cavity to the eminence, and *vice versa*, as in grinding the teeth. The cartilages, by adapting themselves to the different inequalities in these several motions of the jaw, serve to secure the articulation, and to prevent any injuries from friction.

The alveolar processes are composed of an outer and inner bony plate, united together by thin partitions, which at the fore part of the jaw divide the processes into as many sockets as there are teeth. But at the back part of the jaw, where the teeth have more than one root, we find a distinct cell for each root. In both jaws these processes begin to be formed with the teeth; they likewise accompany them in their growth, and gradually disappear when the teeth are removed.

§ 3. *Of the Teeth.*

27 Of the teeth.

The teeth are bones of a particular structure, formed for the purposes of mastication and the articulation of the voice. It will be necessary to consider their composition and figure, their number and arrangement, and the time and order in which they appear.

In each tooth we may distinguish a body, a neck, and a root or fangs.

The body of the tooth is that part which appears above the gums. The root is fixed into the socket, and the neck is the middle part between the two.

The teeth are composed of two substances, viz. enamel and bone. The enamel, or the vitreous or cortical part of the tooth, is a white and very hard and compact substance peculiar to the teeth, and appears fibrous or striated when broken. This substance is thickest on the grinding surface, and becoming gradually thinner, terminates insensibly at the neck of the tooth. Ruysch * affirmed, that he could trace the arteries into the hardest part of the teeth; Liewenhoeck † suspected the fibres of the enamel to be so many vessels; and Monro ‡ says, he has frequently injected the vessels of the teeth in children, so as to make the inside of the cortex appear perfectly red. But it is certain, that it is not tinged by a madder diet, and that no injection will ever reach it, so that it has no appearance of being vascular **.

* *Thesaur* 10. no. 27.
† *Arcan. Natur. continuat. Epistol.*
‡ *Anat. of the Human Bones.*
** *Hunter on the Teeth.*

The bony part, which composes the inner substance of the body, neck, and root of the tooth, resembles other bones in its structure, but it is much harder than the most compact part of bones in general. As a tooth when once formed receives no tinge from a madder diet, and as the minutest injections do not penetrate into its substance, this part of the tooth has, like the enamel, been supposed not to be vascular. But when we consider that the fangs of a tooth are invested

by

Osteology. by a periosteum, and that the swellings of these fangs are analogous to the swellings of other bones, we may reasonably conclude, that there is a similiarity of structure; and that this bony part has a circulation through its substance, although from its hardness we are unable to demonstrate its vessels.

In each tooth we find an inner cavity, into which enter an artery, vein, and nerve. This cavity begins by a small opening, and becoming larger, terminates in the body of the tooth. In advanced life this hole sometimes closes, and the tooth is of course rendered insensible.

The periosteum surrounds the teeth from their fangs to a little beyond their bony sockets, where we find it adhering to the gums. This membrane, while it incloses the teeth, serves at the same time to line the sockets, so that it may be considered as common to both.

The teeth are likewise secured in their sockets by means of the gums; a red, vascular, firm, and elastic substance, that possesses but little sensibility. In the gums of infants we find a hard ridge extending through their whole length, but no such ridge is to be seen in old people who have lost their teeth.

The number of the teeth in both jaws at full maturity, usually varies from twenty-eight to thirty-two. They are commonly divided into three classes, viz. incisores, canini, and grinders or molares (H). The incisores are the four teeth in the fore part of each jaw. They have each of them two surfaces; one anterior and convex, the other posterior and slightly concave, both of which terminate in a sharp edge. They are called *incisores* from their use in dividing the food. They are usually broader and thicker in the upper than in the under jaw; and, by being placed somewhat obliquely, generally fall over the latter.

The canini derive their name from their resemblance to a dog's tusks, being the longest of all the teeth. We find one on each side of the incisores, so that there are two canini in each jaw. Their fang resembles that of the incisores, but is much larger; and in their shape they appear like an incisor with its edge worn off, so as to terminate in a narrow point.

These teeth not being calculated for cutting and dividing the food like the incisores, or for grinding it like the molares, seem to be intended for laying hold of substances (1).

The molares or grinders, of which there are ten in each jaw, are so called, because from their shape and size they are fitted for grinding the food. Each of the incisores and canini is furnished only with one fang; but in the molares of the under jaw we constantly find two fangs, and in those of the upper jaw three fangs. These fangs are sometimes separated into two points, and each of these points has sometimes been described as a distinct fang.

The two first of the molares, or those nearest to the canine teeth on each side, differ from the other three, and are with great propriety named *bicuspides* by Mr Hunter. They have sometimes only one root, and seem to be of a middle nature between the incisores and the larger molares. The two next are much larger. The fifth or last grinder on each side is smaller and shorter than the rest; and from its not cutting the gum till after the age of twenty, and sometimes not till much later in life, is called *dens sapientiæ*. Osteology.

There is in the structure and arrangement of all these teeth an art which cannot be sufficiently admired. To understand it properly, it will be necessary to consider the under jaw as a kind of lever, with its fixed points at its articulations with the temporal bones:—it will be right to observe, too, that its powers arise from its different muscles, but in elevation chiefly from the temporalis and masseter; and that the aliment constitutes the object of resistance. It will appear, then, that the molares, by being placed nearest the centre of motion, are calculated to press with a much greater force than the other teeth, independent of their grinding powers which they possess by means of the pterygoid muscles; and that it is for this reason we put between them any hard body we wish to break.

The canini and incisores are placed farther from this point, and of course cannot exert so much force; but they are made for cutting and tearing the food, and this form seems to make amends for their deficiency in strength.

There are examples of children who have come into the world with two, three, and even four teeth; but these examples are very rare; and it is seldom before the seventh, eighth, or ninth month after birth, that the incisores, which are the first formed, begin to pass through the gum. The symptoms of dentition, however, in consequence of irritation from the teeth, frequently take place in the fourth or fifth month.—About the twentieth or twenty-fourth month, the canini and two molares make their appearance.

The dangerous symptoms that sometimes accompany dentition, are owing to the pressure of the teeth on the gum, which they irritate so as to excite pain and inflammation. This irritation seems to occasion a gradual wasting of the gum at the part, till at length the tooth makes its appearance.

The symptoms are more or less alarming, in proportion to the resistance which the gum affords to the teeth, and according to the number of teeth which may chance to seek a passage at the same time. Were they all to appear at once, children would fall victims to the pain and excessive irritation; but Nature has so very wisely disposed them, that they usually appear one after the other, with some distance of time between each. The first incisor that appears is generally in the lower jaw, and is followed by one in the upper

(H) Mr Hunter has thought proper to vary this division. He retains the old name of *incisores* to the four fore teeth, but he distinguishes the canine teeth by the name of the *cuspidati*. The two teeth which are next to these, and which have been usually ranked with the molares, he calls the *bicuspides*; and he gives the name of *grinders* only to the three last teeth on each side.

(1) Mr Hunter remarks of these teeth, that we may trace in them a similiarity in shape, situation, and use, from the most imperfectly carnivorous animal, which we believe to be the human species, to the lion, which is the most perfectly carnivorous.

Osteology. per jaw. Sometimes the canini, but more commonly one of the molares, begins to pass through the gum first.

These 20 teeth, viz. eight incisores, four canini, and eight molares, are called *temporary* or *milk teeth*, because they are all shed between the age of seven and 14, and are succeeded by what are called the *permanent* or *adult teeth*. The latter are of a firmer texture, and have larger fangs.

These adult teeth being placed in a distinct set of alveoli, the upper sockets gradually disappear, as the under ones increase in size, till at length the temporary, or upper teeth, having no longer any support, consequently fall out.

To these 20 teeth, which succeed the temporary ones, 12 others are afterwards added, viz. three molares on each side in both jaws: and in order to make room for this addition, we find that the jaws gradually lengthen in proportion to the growth of the teeth; so that with 20 teeth, they seem to be as completely filled as they are afterwards with 32. This is the reason why the face is rounder and flatter in children than in adults.

With regard to the formation of the teeth, we may observe, that in a fœtus of four months, the alveolar process appears only as a shallow longitudinal groove, divided by minute ridges into a number of intermediate depressions; in each of which we find a small pulpy substance, surrounded by a vascular membrane. This pulp gradually ossifies, and its lower part is lengthened out to form the fang. When the bony part of the tooth is formed, its surface begins to be incrusted with the enamel. How the latter is formed and deposited, we are not yet able to determine.

The rudiments of some of the adult teeth begin to be formed at a very early period, for the pulp of one of the incisores may generally be perceived in a fœtus of eight months, and the ossification begins in it soon after birth. The first bicuspis begins to ossify about the fifth or sixth, and the second about the seventh year. The first adult grinder cuts the gum about the 12th, the second about the 18th, and the third, or *dens sapientiæ*, usually between the 20th and 30th year.

The teeth, like other bones, are liable to be affected by disease. Their removal is likewise the natural consequences of old age; for as we advance in life, the alveoli fill up, and the teeth, especially the incisores, fall out. When this happens, the chin projects forward, and the face is much shortened.

§ 4. *Of the Os Hyoides.* (K)

28. The os hyoides, which is placed at the root of the tongue, was so called by the ancients on account of its supposed resemblance to the Greek letter υ.

It will be necessary to distinguish in it, its body, horns, and appendices.

The body, which is the middle and broadest part of the bone, is so placed that it may be easily felt at the fore part of the throat. Anteriorly it is irregularly convex, and its inner surface is unequally concave. Its cornua, or horns, which are flat and a little bent, being much longer than the body part, may be described as forming the sides of the υ. The appendices, or little horns, as they are called by M. Winslow, and some other writers, are two processes which rise up from the articulations of the cornua with the body, and are usually connected with the styloid process on each side by means of a ligament. Osteology.

The uses of this bone are to support the tongue, and afford attachment to a great number of muscles; some of which perform the motions of the tongue, while others act on the larynx and fauces.

Sect. III. *Of the Bones of the Trunk.*

The trunk of the skeleton consists of the spine, the thorax, and the pelvis. 29.

§ 1. *Of the Spine.*

The spine is composed of a great number of bones called *vertebæ*, forming a long bony column, in figure not much unlike the letter *f*. This column, which extends from the head to the lower part of the body, may be said to consist of two irregular and unequal pyramids, united to each other in that part of the loins where the last lumbar vertebra joins the os sacrum. 30.

The vertebræ of the upper and longest pyramid are called *true vertebræ*, in contradistinction to those of the lowermost pyramid, which, from their being immoveable in the adult, are styled *false vertebræ*. It is upon the bones of the spine that the body turns; and it is to this circumstance they owe their name, which is derived from the Latin verb *vertere*, to return.

The true vertebræ are divided into three classes of cervical, darsal, and lumbar vertebræ.—The false vertebræ consist of the os sacrum and os coccygis.

In each vertebra, as in other bones, it will be necessary to remark the body of the bone, its processes, and cavities.

The body, which is convex before, and concave behind, where it assists in forming the cavity of the spine, may be compared to part of a cylinder cut off transversely.

Each vertebra affords seven processes. The first is at the back part of the vertebra, and from its shape and direction is named the *spinous process*. On each side of this are two others, which, from their situation with respect to the spine, are called *transverse processes*. The four others are styled *oblique* or *articular processes*. They are much smaller than the spinous or transverse ones. Two of them are placed on the upper, and two on the lower part of each vertebra, rising from near the basis of each transverse process. They have gotten the name of *oblique processes*, from their situation with respect to the processes with which they are articulated; and they are sometimes styled *articular processes*, from the manner in which they are articulated with each other; the two superior processes of one vertebra being articulated with

(K) This bone is very seldom preserved with the skeleton, and cannot be included among the bones of the head, or any other division of the skeleton. Thomas Bartholin has perhaps very properly described it among parts contained in the mouth; but the generality of anatomical writers have placed it, as it is here, after the bones of the face.

Osteology. with the two inferior processes of the vertebra above it. Each of these processes is covered with cartilage at its articulation, and their articulations with each other are by a species of ginglimus.

In each vertebra, between its body and its processes, we find a hole large enough to admit a finger. These holes or foramina, correspond with each other through all the vertebræ, and form the long bony channel in which the spinal marrow is placed. We may likewise observe four notches in each vertebra. Two of these notches are at the upper, and two at the lower part of the bone, between the oblique processes and the body of the vertebra. Each of these notches meeting with a similar opening in the vertebra above or below it, forms a foramen for the passage of blood-vessels, and of the nerves out of the spine.

The bones of the spine are united together by means of a substance, which in young subjects appears to be of a ligamentous, but in adults more of a cartilaginous nature. This intervertebral substance, which forms a kind of partition between the several vertebræ, is thicker and more flexible between the lumbar vertebræ than in the other parts of the spine, the most considerable motions of the trunk being performed on those vertebræ. This substance being very elastic, the extension and flexion of the body, and its motion backwards and forwards, or to either side, are performed with great facility. This elasticity seems to be the reason why people who have been long standing, or have carried a considerable weight, are found to be shorter than when they have been long in bed. In the two first instances the intervertebral cartilages (as they are usually called) are evidently more exposed to compression than when we are in bed in an horizontal posture.

In advanced life these cartilages become shrivelled, and of course lose much of their elasticity. This may serve to account for the decrease in stature and the stooping forward which are usually to be observed in old people.

Besides the connection of the several vertebræ by means of this intervertebral substance, there are likewise many strong ligaments, both external and internal, which unite the bones of the spine to each other. Their union is also strengthened by a variety of strong muscles that cover and surround the spine.

The bones of the spine are found to diminish in density, and to be less firm in their texture in proportion as they increase in bulk; so that the lowermost vertebræ, though the largest, are not so heavy in proportion as the upper ones. By this means the size of these bones is increased without adding to their weight: a circumstance of no little importance in a part like the spine, which, besides flexibility and suppleness, seems to require lightness as one of its essential properties.

In very young children, each vertebra consists of three bony pieces united by cartilages which afterwards ossify.

31 Vertebræ of the neck. There are seven vertebræ of the neck—they are of a firmer texture than the other bones of the spine. Their transverse processes are forked for the lodgment of muscles, and at the bottom of each we observe a foramen, through which pass the cervical artery and vein. The first and second of these vertebræ must be described more particularly. The first approaches almost to an oval shape—On its superior surface it has two cavities which admit the condyles of the occipital bone with which it is articulated. This vertebra, which is called *atlas* from its supporting the head, cannot well be described as having either body or spinous process, being a kind of bony ring. Anteriorly, where it is articulated to the odontoid process of the second vertebra, it is very thin. On its upper surface it has two cavities which admit the condyles of the occipital bone. By this connection the head is allowed to move forwards and backwards, but has very little motion in any other direction. Osteology.

The second vertebra has gotten the name of *dentata*, from its having, at its upper and anterior part, a process called the *odontoid* or *tooth-like process*, which is articulated with the atlas, to which this second vertebra may be said to serve as an axis. This odontoid process is of a cylindrical shape, somewhat flattened, however, anteriorly and posteriorly. At its fore-part where it is received by the atlas, we may observe a smooth, convex, articulating surface. It is by means of this articulation that the head performs its rotatory motion, the atlas in that case moving upon this odontoid process as upon a pivot. But when this motion is in any considerable degree, or, in other words, when the head moves much either to the right or left, all the cervical vertebræ seem to assist, otherwise the spinal marrow would be in danger of being divided transversely by the first vertebra.

32 Vertebræ of the back. The spinous process of each of the cervical vertebræ is shorter, and their articular processes more oblique, than in the other bones of the spine.

These 12 vertebræ are of a middle size between those of the neck and loins. At their sides we may observe two depressions, one at the upper and the other at the lower part of the body of each vertebræ; which uniting with similar depressions in the vertebræ above and below, form articulating surfaces, covered with cartilages, for receiving the heads of the ribs; and at the fore-part of their transverse process (excepting the two last) we find an articulating surface for receiving the tuberosity of the ribs.

33 Lumbar vertebræ. These five vertebræ differ only from those of the back in their being larger, and in having their spinous processes at a greater distance from each other. The most considerable motions of the trunk are made on these vertebræ; and these motions could not be performed with so much ease, were the processes placed nearer to each other.

34 Os sacrum. The os sacrum, which is composed of five or six pieces in young subjects, becomes one bone in more advanced age.

It is nearly of a triangular figure, its inferior portion being bent a little forwards. Its superior part has two oblique processes which are articulated with the last of the lumbar vertebræ; and it has likewise commonly three small spinous processes, which gradually become shorter, so that the lowermost is not so long as the second, nor the second as the uppermost. Its transverse processes are formed into one oblong process, which becomes gradually smaller as it descends. Its concave or anterior side is usually smooth, but its posterior convex side has many prominences (the most remarkable of which are the spinous processes just now mentioned), which are filled up and covered with the muscular and tendinous parts behind.

This

Osteology. This bone has five pair of holes, which afford a paſſage to blood-veſſels, and likewiſe to the nerves that are derived from the ſpinal marrow, which is continued even here, being lodged in a triangular cavity, that becomes ſmaller as it deſcends, and at length terminates obliquely at the lower part of this bone. Below the third diviſion of the os ſacrum, this canal is not completely bony as in the reſt of the ſpine, being ſecured at its back part only by a very ſtrong membrane, ſo that a wound at this part muſt be extremely dangerous.

The os ſacrum is united laterally to the oſſa innominata or hip-bones, and below to the coccyx.

35 Os coccyx. The coccyx, which, like the os ſacrum, is in young people made up of three or four diſtinct parts, uſually becomes one bone in the adult ſtate.

It ſerves to ſupport the inteſtinum rectum; and, by its being capable of ſome degree of motion at its articulation with the ſacrum, and being like that bone bent forwards, we are enabled to ſit with eaſe.

This bone is nearly of a triangular ſhape, being broadeſt at its upper part, and from thence growing narrower to its apex, where it is not bigger than the little finger.

It has got its name from its ſuppoſed reſemblance to a cuckow's beak. It differs greatly from the vertebræ, being commonly without any proceſſes, and having no cavity for the ſpinal marrow, or foramina for the tranſmiſſion of nerves.

The ſpine, of which we have now finiſhed the anatomical deſcription, is deſtined for many great and important uſes. The medulla ſpinalis is lodged in its bony canal ſecure from external injury. It ſerves as a defence to the abdominal and thoracic viſcera, and at the ſame time ſupports the head, and gives a general firmneſs to the whole trunk.

We have before compared it to the letter *ſ*, and its different turns will be found to render it not very unlike the figure of that letter.—In the neck we ſee it projecting ſomewhat forward to ſupport the head, which without this aſſiſtance would require a great number of muſcles.—Lower down, in the thorax, we find it taking a curved direction backwards, and of courſe increaſing the cavity of the cheſt. After this, in the loins, it again projects forwards in a direction with the centre of gravity, by which means we are eaſily enabled to keep the body in an erect poſture, for otherwiſe we ſhould be liable to fall forward. Towards its inferior extremity, however, it again recedes backward, and thus aſſiſts in forming the pelvis, the name given to the cavity in which the urinary bladder, inteſtinum rectum, and other viſcera are placed.

If this bony column had been formed only of one piece, it would have been much more eaſily fractured than it is now: and by confining the trunk to a ſtiff ſituation, a variety of motions would have been altogether prevented, which are now performed with eaſe by the great number of bones of which it is compoſed.

It is firm, and yet to this firmneſs there is added a perfect flexibility. If it be required to carry a load upon the head, the neck becomes ſtiff with the aſſiſtance of its muſcles, and accommodates itſelf to the load, as if it was compoſed only of one bone—In ſtooping likewiſe, or in turning to either ſide, the ſpine turns itſelf in every direction, as if all its bones were ſeparated from each other. Osteology.

In a part of the body, like the ſpine, that is made up of ſo great a number of bones, and intended for ſuch a variety of motion, there muſt be a greater danger of diſlocation than fracture; but we ſhall find, that this is very wiſely guarded againſt in every direction by the proceſſes belonging to each vertebra, and by the ligaments, cartilages, &c. by which theſe bones are connected with each other.

§ 2. *Of the Bones of the Thorax.* 36

The thorax, or cheſt, is compoſed of many bones, *viz.* the ſternum which is placed at its anterior part, twelve ribs on each ſide which make up its lateral parts, and the dorſal vertebræ which conſtitute its poſterior part. Theſe laſt have been already deſcribed.

37 Of the ſternum. The ſternum is the long bone which extends itſelf from the upper to the lower part of the breaſt anteriorly, and to which the ribs and the clavicles are articulated.

In children it is compoſed of ſeveral bones united by cartilages; but as we advance in life, moſt of theſe cartilages oſſify, and the ſternum in the adult ſtate is found to conſiſt only of three pieces, and ſometimes become one bone. It is however generally deſcribed as being compoſed of three parts—one ſuperior, which is broad, thick, and ſhort; and one in the middle, which is thinner, narrower, and longer than the other.

It terminates at its lower part by a third piece, which is called the *xyphoid*, or *ſword-like cartilage*, from its ſuppoſed reſemblance to the blade of a ſword, and becauſe in young ſubjects it is commonly in a cartilaginous ſtate.

We have already obſerved, that this bone is articulated with the clavicle on each ſide. It is likewiſe joined to the fourteen true ribs, *viz.* ſeven on its right and ſeven on its left ſide.

38 Of the ribs. The ribs are bones ſhaped like a bow, forming the ſides of the cheſt. There are twelve on each ſide. They are diſtinguiſhed into true and falſe ribs: The ſeven upper ribs which are articulated to the ſternum are called *true ribs*, and the five lower ones that are not immediately attached to that bone are called *falſe ribs*.

On the inferior and interior ſurface of each rib, we obſerve a ſinuoſity for the lodgment of an artery, vein, and nerve.

The ribs are not bony through their whole length, their anterior part being cartilaginous. They are articulated with the vertebræ and ſternum. Every rib (or at leaſt the greater number of them) has at its poſterior part two proceſſes; one at its extremity called the head of the rib, by means of which it is articulated with the body of two vertebræ; and another, called its tuberoſity, by which it is articulated with the tranſverſe proceſs of the loweſt of theſe two vertebræ. The firſt rib is not articulated by its extremity to two vertebræ, being ſimply attached to the upper part of the firſt vertebra of the back. The ſeven ſuperior or true ribs are articulated anteriorly with the ſternum by their cartilages; but the falſe ribs are ſupported in a different manner—the eighth, which is the firſt of theſe ribs, being

Osteology. being attached by its cartilage to the seventh; the ninth to the eighth, &c.

The two lowermost ribs differ likewise from all the rest in the following particulars: They are articulated only with the body of the vertebra, and not with a transverse process; and anteriorly, their cartilage is loose, not being attached to the cartilages of the other ribs; and this seems to be, because the most considerable motions of the trunk are not performed on the lumbar vertebræ alone, but likewise on the two last vertebræ of the back; so that if these two ribs had been confined at the fore part like the other ribs, and had been likewise articulated with the bodies of two vertebræ, and with the transverse processes, the motion of the two last vertebræ, and consequently of the whole trunk, would have been impeded.

The ribs help to form the cavity of the thorax; they afford attachment to different muscles; they are useful in respiration; and they serve as a security to the heart and lungs.

39. ### § 3. *Of the Bones of the Pelvis.*

THE pelvis is composed of the os sacrum, os coccygis, and two ossa innominata. The two first of these bones were included in the account of the spine, to which they more properly belong.

In children, each os innominatum is composed of three distinct bones; but as we advance in life the intermediate cartilages gradually ossify, and the marks of the original separation disappear, so that they become one irregular bone; still however continuing to retain the names of ilium, ischium, and pubis, by which their divisions were originally distinguished, and to be described as three different bones by the generality of anatomists. The os ilium forms the upper and most considerable part of the bone, the os ischium its lower and posterior portion, and the os pubis its fore part.

40 Os ilium. The os ilium or haunch bone, is articulated posteriorly to the os sacrum by a firm cartilaginous substance, and is united to the os pubis before and to the os ischium below. Its superior portion is thin, and terminates in a ridge called the crista or spine of the ilium, and more commonly known by the name of the haunch. This christa rises up like an arch; being turned somewhat outwards, so as to resemble the wings of a phaeton.

Externally this bone is unequally prominent and hollowed for the lodgement of muscles; internally we find it smooth and concave. At its lower part there is a considerable ridge on its inner surface. This ridge extends from the os sacrum, and corresponds with a similar prominence both on that bone and the ischium; forms with the inner part of the ossa pubis what in midwifery is termed the brim of the pelvis.

The crista, or spine, which at first is an epiphysis, has two considerable tuberosities; one anteriorly, and the other posteriorly, which is the largest of the two: These, from their projecting more than the parts of the bone below them, have gotten the name of spinal processes. From the anterior spinous process, the sartorious and tensor vagina femoris muscles have their origin; and below the posterior process we observe a considerable niche in the bone, which, in the recent subject, is formed into a large foramen, by means of a strong ligament that is stretched over its lower part from the os sacrum to the sharp-pointed process of the ischium. This hole affords a passage to the great sciatic nerve, and to the posterior crural vessels under the pyriform muscle, part of which likewise passes out here. Osteology

41 Os ischii. The os ischium, or hip-bone, which is of a very irregular figure, constitutes the lower lateral parts of the pelvis, and is commonly divided into its body, tuberosity, and ramus. The body forms the lower and most considerable portion of the acetabulum, and sends a sharp-pointed process backwards, called the spine of the ischium. To this process the ligament adheres, which was just now spoken of, as forming a foramen for the passage of the sciatic nerve.—The tuberosity, which is the lowest part of the trunk, and supports us when we sit, is large and irregular, affording origin to several muscles. From this tuberosity we find the bone becoming thinner and narrower. This part, which has the name of ramus or branch, passes forwards and upwards, and concurs with the ramus of the os pubis, to form a large hole called the *foramen magnum ischii*, or *thyroideum*, as it is sometimes named, from its resemblance to a door or shield. This hole, which in the recent subject is closed by a strong membrane called the obturator ligament, affords through its whole circumference attachment to muscles. At its upper part where we observe a niche in the bone, it gives passage to the obturator vessels and nerves, which go to the inner part of the thigh. Nature seems every where to avoid an unnecessary weight of bone, and this foramen, no doubt, serves to lighten the bones of the pelvis.

42 Os pubis. The os pubis or share-bone, which with its fellow forms the fore-part of the pelvis, is the smallest division of the os innominatum. It is united to its fellow by means of a strong cartilage, which forms what is called the symphysis pubis.

In each os pubis we may distinguish the body of the bone, its angle, and ramus. The body or outer part is united to the os ilium. The angle comes forward to form the symphysis, and the ramus is a thin process which unites with the ramus of the ischium, to form the foramen thyroideum.

The three bones we have described as composing each os innominatum, all assist in forming the acetabulum, in which the head of the os femoris is received.

This cavity is every where lined with a smooth cartilage, excepting at its inner part, where we may observe a little fossa, in which are lodged the mucilaginous glands of the joint. We may likewise notice the pit or depression made by the round ligament, as it is improperly called, which, by adhering to this cavity and to the head of the thigh-bone, helps to secure the latter in the socket.

These bones, which are united to each other and to the spine by many very strong ligaments, serve to support the trunk, and to connect it with the lower extremities; and at the same time to form the pelvis or bason, in which are lodged the intestines and urinary bladder, and in women the uterus; so that the study of this part of osteology is of the utmost importance in midwifery.

It is worthy of observation, that in women the os sacrum is usually shorter, broader, and more hollowed, the ossa ilia more expanded, and the inferior opening of the pelvis larger than in men.

Osteology.

Sect. IV. *Of the Extremities.*

43. These parts of the ſkeleton conſiſt of the upper extremity and the lower.

§ 1. *Of the* Upper Extremity.

44. This conſiſts of the ſhoulder, the arm, and the hand.

1. Of the Shoulder.

45. The ſhoulder conſiſts of two bones, the clavicula and the ſcapula.

46 Of the clavicula. The former, which is ſo named from its reſemblance to the key in uſe amongſt the ancients, is a little curved at both its extremities like an italic *ſ*. It is likewiſe called *jugulum*, or collar-bone, from its ſituation. It is about the ſize of the little finger, but longer, and being of a very ſpongy ſubſtance is very liable to be fractured. In this, as in other long bones, we may diſtinguiſh a body and two extremities. The body is rather flattened than rounded. The anterior extremity is formed into a ſlightly convex head, which is nearly of a triangular ſhape. The inferior ſurface of the head is articulated with the ſternum. The poſterior extremity, which is flatter and broader than the other, is connected to a proceſs of the ſcapula, called *acromion*. Both theſe articulations are ſecured by ligaments, and in that with the ſternum we meet with a moveable cartilage, to prevent any injury from friction.

The clavicle ſerves to regulate the motions of the ſcapula, by preventing it from being brought too much forwards, or carried too far backwards. It affords origin to ſeveral muſcles, and helps to cover and protect the ſubclavian veſſels, which derive their name from their ſituation under this bone.

47 Of the ſcapula. The ſcapula, or ſhoulder-blade, which is nearly of a triangular ſhape, is fixed to the poſterior part of the true ribs, ſomewhat in the manner of a buckler. It is of a very unequal thickneſs, and, like all other broad, flat bones, is ſomewhat cellular. Exteriorly it is convex, and interiorly concave, to accommodate itſelf to the convexity of the ribs. We obſerve in this bone three unequal ſides, which are thicker and ſtronger than the body of the bone, and are therefore termed its *coſtæ*. The largeſt of the three, called alſo the baſis, is turned towards the vertebræ. Another, which is leſs than the former, is below this; and the third, which is the leaſt of the three, is at the upper part of the bone. Externally the bone is elevated into a conſiderable ſpine, which riſing ſmall at the baſis of the ſcapula, becomes gradually higher and broader, and divides the outer ſurface of the bone into two foſſæ. The ſuperior of theſe, which is the ſmalleſt, ſerves to lodge the ſupra ſpinatus muſcle; and the inferior foſſa, which is much larger than the other, gives origin to the infra ſpinatus. This ſpine terminates in a broad and flat proceſs at the top of the ſhoulder, called the *proceſſus acromion*, to which the clavicle is articulated. This proceſs is hollowed at its lower part to allow a paſſage to the ſupra and infra ſpinati muſcles. The ſcapula has likewiſe another conſiderable proceſs at its upper part, which, from its reſemblance to the beak of a bird, is called the *coracoid proceſs*. From the outer ſide of this coracoid proceſs, a ſtrong ligament paſſes to the proceſſus acromion, which prevents a luxation of the os humeri upwards. A third proceſs begins by a narrow neck, and ends in a cavity called *glenoid*, for the connection of the os humeri. Oſteology.

The ſcapula is articulated with the clavicle and os humeri, to which laſt it ſerves as a fulcrum; and by varying its poſition it affords a greater ſcope to the bones of the arm in their different motions. It likewiſe gives origin to ſeveral muſcles, and poſteriorly ſerves as a defence to the trunk.

2. Bones of the Arm.

48. The arm is commonly divided into two parts, which are articulated to each other at the elbow. The upper part retains the name of arm, properly ſo called, and the lower part is uſually called the fore arm.

49. The arm is compoſed of a ſingle bone called *os humeri*. This bone, which is almoſt of a cylindrical ſhape, may be divided into its body and its extremities.

The upper extremity begins by a large, round ſmooth head, which is admitted into the glenoid cavity of the ſcapula. On the upper and fore part of the bone there is a groove for lodging the long head of the biceps muſcle of the arm; and on each ſide of the groove, at the upper end of the bone, there is a tubercle to which the ſpinata muſcles are fixed.

The lower extremity has ſeveral proceſſes and cavities. The principal proceſſes are its two condyles, one exterior and the other interior, and of theſe the laſt is the largeſt. Between theſe two we obſerve two lateral protuberances, which, together with a middle cavity, form as it were a kind of pully upon which the motions of the fore-arm are chiefly performed. At each ſide of the condyles, as well exteriorly as interiorly, there is another eminence which gives origin to ſeveral muſcles of the hand and fingers. Poſteriorly and ſuperiorly, ſpeaking with reſpect to the condyles, we obſerve a deep foſſa which receives a conſiderable proceſs of the ulna; and anteriorly and oppoſite to this foſſa, we obſerve another, which is much leſs and receives another proceſs of the ſame bone.

The body of the bone has at its upper and anterior part a furrow which begins from behind the head of the bone, and ſerves to lodge the tendon of a muſcle. The body of the os humeri is hollow through its whole length, and, like all other long bones, has its marrow.

This bone is articulated at its upper part to the ſcapula. This articulation, which allows motion every way, is ſurrounded by a capſular ligament; that is ſometimes torn in luxation, and becomes an obſtacle to the eaſy reduction of the bone. Its lower extremity is articulated with the bones of the fore-arm.

50 Of the fore-arm. The fore-arm is compoſed of of two bones, the ulna and radius.

51 Of the ulna. The ulna or elbow-bone is much leſs than the os humeri, and becomes gradually ſmaller as it deſcends to the wriſt. At its upper part it has two proceſſes and two cavities. Of the two proceſſes, the largeſt, which is ſituated poſteriorly, and called the *olecranon*, is admitted into the poſterior foſſa of the os humeri. The other proceſs is placed anteriorly, and is called the *coronoid proceſs*. In bending the arm it enters into the anterior foſſa of the os humeri. This proceſs being

Osteology.

being much ſmaller than the other, permits the fore-arm to bend inwards; whereas the olecranon, which is ſhaped like a hook, reaches the bottom of its foſſa in the os humeri as ſoon as the arm becomes ſtraight, and will not permit the fore-arm to be bent backwards. The ligaments likewiſe oppoſe this motion.

Between the two proceſſes we have deſcribed, there is a conſiderable cavity called the ſygmoid cavity, divided into two foſſæ by a ſmall eminence, which paſſes from one proceſs to the other; it is by means of this cavity and the two proceſſes, that the ulna is articulated with the os humeri by ginglimus.

At the bottom of the coronoid proceſs interiorly, there is a ſmall ſygmoid cavity, which ſerves for the articulation of the ulna with the radius.

The body of the ulna is of a triangular ſhape: Its lower extremity terminates by a ſmall head and a little ſtyloid proceſs. The ulna is articulated above to the os humeri—both above and below to the radius, and to the wriſt at its lower extremity. All theſe articulations are ſecured by means of ligaments. The chief uſe of this bone ſeems to be to ſupport and regulate the motions of the radius.

52 Of the radius.

The radius, which is ſo named from its ſuppoſed reſemblance to the ſpoke of a wheel, is placed at the inſide of the fore-arm. It is ſomewhat larger than the ulna, but not quite ſo long as that bone. Its upper part is cylindrical, hollowed ſuperiorly to receive the outer condyle of the os humeri. Laterally it is admitted into the little ſygmoid cavity of the ulna, and the cylindrical part of the bone turns in this cavity in the motions of pronation and ſupination (1). This bone follows the ulna in flexion and extenſion, and may likewiſe be moved round its axis in any direction. The lower extremity of the radius is much larger and ſtronger than its upper part; the ulna, on the contrary, is ſmaller and weaker below than above; ſo that they ſerve to ſupply each others deficiencies in both thoſe parts.

On the external ſide of this bone, we obſerve a ſmall cavity which is deſtined to receive the lower end of the ulna; and its lower extremity is formed into a large cavity, by means of which it is articulated with the bones of the wriſt, and on this account it is ſometimes called *manubrium manus*. It ſupports the two firſt bones of the wriſt on the ſide of the thumb, whereas the ulna is articulated with that bone of the wriſt which correſponds with the little finger.

Through the whole length both of this bone and the ulna, a ridge is obſerved, which affords attachment to an interoſſeous ligament. This ligament fills up the ſpace between the two bones.

53

3. Bones of the Hand.

54 Of the carpus.

The carpus or wriſt conſiſts of eight ſmall bones of an irregular ſhape, and diſpoſed in two unequal rows. Thoſe of the upper row are articulated with the bones of the fore-arm, and thoſe of the lower one with the metacarpus.

The ancient anatomiſts deſcribed theſe bones numerically; Lyſerus ſeems to have been the firſt who gave to each of them a particular name. The names he adopted are founded on the figure of the bones, and are now pretty generally received, except the firſt, which inſtead of κοτυλοειδὲς (the name given to it by Lyſerus, on account of its ſinus that admits a part of the os magnum), has by later writers been named *Scaphoides* or *Naviculare*. This, which is the outermoſt of the upper row (conſidering the thumb as the outer ſide of the hand), is articulated with the radius; on its inner ſide it is connected with the os lunare, and below to the trapezium and trapezoides. Next to this is a ſmaller bone, called the *os lunare*: becauſe its outer ſide, which is connected with the ſcaphoides, is ſhaped like a creſcent. This is likewiſe articulated with the radius. On its inner ſide it joins the os cuneiforme, and anteriorly, the os magnum and os unciforme.

Osteology.

The os cuneiform, which is the third bone in the upper row, is compared to a wedge, from its being broader above, at the back of the hand, than it is below. Poſteriorly it is articulated with the ulna, and anteriorly with the os unciforme.

Theſe three bones form an oblong articulating ſurface, covered by cartilage, by which the hand is connected with the fore-arm.

The os piſiforme, or pea-like bone, which is ſmaller than the three juſt now deſcribed, though generally claſſed with the bones of the upper row, does not properly belong to either ſeries, being placed on the under ſurface of the os cuneiforme, ſo as to project into the palm of the hand. The four bones of the ſecond row correſpond with the bones of the thumb and fingers; the firſt, ſecond, and fourth, are from their ſhapes named *trapezium*, *trapezoides*, and *unciforme*; the third, from its being the largeſt bone of the carpus, is ſtyled *os magnum*.

All theſe bones are convex towards the back, and ſlightly concave towards the palm of the hand; their articulating ſurfaces are covered with cartilages, and ſecured by many ſtrong ligaments, particularly by two ligamentous expanſions, called the external and internal annular ligaments of the wriſt. The former extends in an oblique direction from the os piſiforme to the ſtyloid proceſs of the radius, and is an inch and an half in breadth; the latter or internal annular ligament is ſtretched from the os piſiforme and os unciforme, to the os ſcaphoides and trapezium. Theſe annular ligaments likewiſe ſerve to bind down the tendons of the wriſt and fingers.

55 Of the metacarpus.

The metacarpus conſiſts of four bones, which ſupport the fingers; externally they are a little convex, and internally ſomewhat concave, where they form the palm of the hand. They are hollow, and of a cylindrical ſhape.

At each extremity they are a little hollowed for their articulation; ſuperiorly with the bones of the carpus, and inferiorly with the firſt phalanx of the fingers, in the ſame manner as the ſeveral phalanges of the fingers are articulated with each other.

56 Of the fingers.

The five fingers of each hand are compoſed of fifteen bones, diſpoſed in three ranks called phalanges: The bones of the firſt phalanx, which are articulated with

(1) The motions of pronation and ſupination may be eaſily deſcribed. If the palm of the hand, for inſtance, is placed on the ſurface of a table, the hand may be ſaid to be in a ſtate of pronation; but if the back part of the hand is turned towards the table, the hand will be then in a ſtate of ſupination.

Osteology. the metacarpus, are the largeſt, and thoſe of the laſt phalanx the ſmalleſt. All theſe bones are larger at their extremities than in their middle part.

We obſerve at the extremities of the bones of the carpus, metacarpus, and fingers, ſeveral inequalities that ſerve for their articulation with each other; and theſe articulations are ſtrengthened by means of the ligaments which ſurround them.

It will be eaſily underſtood that this multiplicity of bones in the hand (for there are 27 in each hand) is eſſential to the different motions we wiſh to perform. If each finger was compoſed only of one bone inſtead of three, it would be impoſſible for us to graſp any thing.

57 § 2. *Of the* LOWER EXTREMITIES.

Each lower extremity is divided into four parts, viz. the os femoris, or thigh bone: the rotula, or knee-pan; the leg and the foot.

1. Of the Thigh.

58 Of the os femoris. The thigh is compoſed only of this bone, which is the largeſt and ſtrongeſt we have. It will be neceſſary to diſtinguiſh its body and extremities: Its body, which is of a cylindrical ſhape, is convex before and concave behind, where it ſerves to lodge ſeveral muſcles.

Throughout two-thirds of its length we obſerve a ridge called *linea aſpera*, which originates from the trochanters, and after running for ſome way downwards, divides into two branches, that terminate in the tuberoſities at the lower extremity of the bone.

At its upper extremity we muſt deſcribe the neck and ſmooth head of the bone, and likewiſe two conſiderable proceſſes: The head, which forms the greater portion of a ſphere unequally divided, is turned inwards, and received into the great cotyloid cavity of the os innominatum. At this part of the bone there is a little foſſa to be obſerved, to which the round ligament is attached, and which we have already deſcribed as tending to ſecure the head of this bone in the great acetabulum. The neck is almoſt horizontal, conſidered with reſpect to its ſituation with the body of the bone. Of the two proceſſes, the external one, which is the largeſt, is called trochanter major; and the other, which is placed on the inſide of the bone, trochanter minor. They both afford attachment to muſcles. The articulation of the os femoris with the trunk is ſtrengthened by means of a capſular ligament, which adheres every where round the edge of the great cotyloid cavity of the os innominatum, and ſurrounds the head of the bone.

The os femoris moves upon the trunk in every direction.

At the lower extremity of the bone are two proceſſes called the condyles, and an intermediate ſmooth cavity, by means of which it is articulated with the leg by ginglimus.

All round the under end of the bone there is an irregular ſurface where the capſular ligament of the joint has its origin, and where blood-veſſels go into the ſubſtance of the bone.

Between the condyles there is a cavity poſteriorly, in which the blood-veſſels and nerves are placed, ſecure from the compreſſion to which they would otherwiſe be expoſed in the action of bending the leg, and which would not fail to be hurtful.

At the ſide of each condyle externally, there is a tuberoſity, from whence the lateral ligaments originate, which are extended down to the tibia. Osteology.

A ligament likewiſe ariſes from each condyle poſteriorly. One of theſe ligaments paſſes from the right to the left, and the other from the left to the right, ſo that they interſect each other, and for that reaſon are called the *croſs ligaments*.

The lateral ligaments prevent the motion of the leg upon the thigh to the right or left; and the croſs ligaments, which are alſo attached to the tibia, prevent the latter from being brought forwards.

In new-born children all the proceſſes of this bone are cartilaginous.

2. The Rotula, or Knee-pan.

59 Of the rotula. The rotula, patella, or knee-pan, as it is differently called, is a flat bone about four or five inches in circumference, and is placed at the fore-part of the joint of the knee. In its ſhape it is ſomewhat like the common figure of the heart, with its point downwards.

It is thinner at its edge than in its middle part; at its fore-part it is ſmooth and ſomewhat convex; its poſterior ſurface, which is more unequal, affords an elevation in the middle which is admitted between the two condyles of the os femoris.

This bone is retained in its proper ſituation by a ſtrong ligament which every where ſurrounds it, and adheres both to the tibia and os femoris; it is likewiſe firmly connected with the tibia by means of a ſtrong tendinous ligament of an inch in breadth, and upwards of two inches in length, which adheres to the lower part of the patella, and to the tuberoſity at the upper end of the tibia. On account of this connection, it is very properly conſidered as an appendage to the tibia, which it follows in all its motions, ſo as to be to it what the olecranon is to the ulna. There is this difference, however, that the olecranon is a fixed proceſs; whereas the patella is moveable, being capable of ſliding from above downwards and from below upwards. This mobility is eſſential to the rotatory motion of the leg.

In very young children this bone is entirely cartilaginous.

The principal uſe of the patella ſeems to be to defend the articulation of the knee from external injury; it likewiſe tends to increaſe the power of the extenſor muſcles of the leg, by removing their direction farther from the centre of motion in the manner of a pulley.

3. Of the Leg.

60

The leg is compoſed of two bones: Of theſe the inner one, which is the largeſt, is called tibia; the other is much ſmaller, and named fibula.

61 Of the tibia. The tibia, which is ſo called from its reſemblance to the muſical pipe of the ancients, has three ſurfaces, and is not very unlike a triangular priſm. Its poſterior ſurface is the broadeſt; anteriorly it has a conſiderable ridge called the ſhin, between which and the ſkin there are no muſcles. At the upper extremity of this bone are two ſurfaces, a little concave, and ſeparated from each other by an an intermediate elevation. The two little cavities receive the condyles of the os femoris, and the eminence between them is admitted into the cavity which we ſpoke of as being between the two condyles; ſo that this articulation affords a ſpecimen of the complete

Osteology. plete ginglimus. Under the external edge of the upper end of this bone is a circular flat ſurface, which receives the head of the fibula.

At the lower and inner portion of the tibia, we obſerve a conſiderable proceſs called *malleolus internus*. The baſis of the bone terminates in a large tranverſe cavity, by which it is articulated with the uppermoſt bone of the foot. It has likewiſe another cavity at its lower end and outer ſide, which is ſomewhat oblong, and receives the lower end of the fibula.

62 The tibia is hollow through its whole length.

Of the fibula. The fibula is a ſmall long bone ſituated on the outſide of the tibia. Its ſuperior extremity does not reach quite ſo high as the upper part of the tibia, but its lower end deſcends ſomewhat lower. Both above and below, it is articulated with the tibia by means of the lateral cavities we noticed in our deſcription of that bone.

Its lower extremity is ſtretched out into a coronoid proceſs, which is flattened at its inſide, and is convex externally, forming what is called the *malleolus externus*, or *outer ancle*. This is rather lower than the malleolus internus of the tibia.

The body of this bone, which is irregularly triangular, is a little hollow at its internal ſurface, which is turned towards the tibia; and it affords like that bone, through its whole length, attachment to a ligament, which from its ſituation is called the interoſſeous ligament.

63 ## 4. Of the Foot.

64 The foot conſiſts of the tarſus, metatarſus, and toes.

Of the tarſus. The tarſus is compoſed of ſeven bones, viz. the aſtragalus, os calcis, os naviculare, os cuboides, and three others called cuneiform bones.

65 Of the aſtragalus. The aſtragalus is a large bone with which both the tibia and fibula are articulated. It is the uppermoſt bone of the foot; it has ſeveral ſurfaces to be conſidered; its upper, and ſomewhat poſterior part, which is ſmooth and convex, is admitted into the cavity of the tibia. Its lateral parts are connected with the malleoli of the two bones of the leg; below, it is articulated with the os calcis, and its anterior ſurface is received by the os naviculare. All theſe articulations are ſecured by means of ligaments.

66 Of the os calcis. The os calcis, or calcaneum, which is of a very irregular figure, is the largeſt bone of the foot. Behind, it is formed into a conſiderable tuberoſity called the heel; without this tuberoſity, which ſupports us in an erect poſture, and when we walk, we ſhould be liable to fall backwards.

On the internal ſurface of this bone, we obſerve a conſiderable ſinuoſity, which affords a paſſage to the tendon of a muſcle: and to the poſterior part of the os calcis, a ſtrong tendinous cord called *tendo achillis* (M) is attached, which is formed by the tendons of ſeveral muſcles united together. The articulation of this with the other bones is ſecured by means of ligaments.

67 Of the os naviculare. The os naviculare, or ſcaphoides, (for theſe two terms have the ſame ſignification), is ſo called on account of its reſemblance to a little bark. At its poſterior part, which is concave, it receives the aſtragalus; anteriorly it is articulated with the cuneiform bones, and laterally is is connected with the os cuboides.

Osteology 68 Of the os cuboides. The os cuboides forms an irregular cube. Poſteriorly it is articulated with the os calcis; anteriorly it ſupports the two laſt bones of the metatarſus, and laterally it joins the third cuneiform bone and the os naviculare.

69 Of the oſſ cuneiformia. Each of the oſſa cuneiformia, which are three in number, reſembles a wedge, and from this ſimilitude their name is derived. They are placed next to the metatarſus by the ſides of each other, and are uſually diſtinguiſhed into *os cuneiforme externum*, *medium* or *minimum*, and *internum* or *maximum*. The ſuperior ſurface of theſe bones, from their wedge-like ſhape, is broader than that which is below, where they help to form the ſole of the foot; poſteriorly they are united to the os naviculare, and anteriorly they ſupport the three firſt metatarſal bones.

When theſe ſeven bones compoſing the tarſus are viewed together in the ſkeleton, they appear convex above, where they help to form the upper part of the foot; and concave underneath, where they form the hollow of the foot, in which the veſſels, tendons, and nerves of the foot are placed ſecure from preſſure.

They are united to each other by very ſtrong ligaments, and their articulation with the foot is ſecured by a capſular and two lateral ligaments; each of the latter is covered by an annular ligament of conſiderable breadth and thickneſs, which ſerves to bind down the tendons of the foot, and at the ſame time to ſtrengthen the articulation.

The os cuneiforme externum is joined laterally to the os cuboides.

Theſe bones complete our account of the tarſus. Though what we have ſaid of this part of the oſteology has been very ſimple and conciſe, yet many readers may not clearly underſtand it: but if they will be pleaſed to view theſe bones in their proper ſituation in the ſkeleton, all that we have ſaid of them will be eaſily underſtood.

70 Of the n tatarſus. The metatarſus is made up of five bones, whereas the metacarpus conſiſts only of four. The cauſe of this difference is, that in the hand the laſt bone of the thumb is not included among the metacarpal bones; whereas in the foot the great toe has only two bones. The firſt of theſe bones ſupports the great toe and is much larger than the reſt, which nearly reſemble each other in ſize.

Theſe bones are articulated by one extremity with the cuneiform bones and the os cuboides, and by their other end with the toes.

71 Of the t Each of the toes, like the fingers, conſiſts of three bones, except the great toe, which is formed of two bones. Thoſe of the other four are diſtinguiſhed into three phalanges. Although the toes are more confined in their motion than the fingers, yet they appear to be perfectly fitted for the purpoſes they are deſigned for. In walking, the toes bring the centre of gravity perpendicular to the advanced foot; and as the ſoles of the foot are naturally concave, we can at pleaſure increaſe this concavity, and form a kind of vault, which adjuſts itſelf to the different inequalities that occur

(M) This tendon is ſometimes ruptured by jumping, dancing, or other violent efforts.

Osteology. cur to us in walking; and which, without this mode of arrangement, would incommode us exceedingly, especially when bare-footed.

§ 4. *Of the Ossa* SESAMOIDEA.

BESIDES the bones we have already described, there are several small ones that are met with only in the adult skeleton, and in persons who are advanced in life; which, from their supposed general resemblance to the seeds of the sesamum, are called *ossa sesamoidea*. They are commonly to be seen at the first joint of the great toe, and sometimes at the joints of the thumb; they are likewise now and then to be found at the lower extremity of the fibula, upon the condyles of the thigh-bone, under the os cuboides of the tarsus, and in other parts of the body. Their size and number seem constantly to be increased by age and hard labour; and as they are generally found in situations where tendons and ligaments are most exposed to the action of muscles, they are now generally considered as ossified portions of ligaments or tendons.

The upper surface of these bones is usually convex, and adherent to the tendon that covers it; the side which is next to the joint is smooth and flat. Though their formation is accidental, yet they seem to be of some use, by raising the tendons farther from the centre of motion, and consequently increasing the power of the muscles. In the great toe and thumb they are likewise useful, by forming a groove for the flexor tendons.

EXPLANATION OF THE PLATES OF OSTEOLOGY.

PLATE XIX.

FIG. 1. A Front-view of the MALE SKELETON.

A, The os frontis. B, The os parietale. C, The coronal suture. D, The squamous part of the temporal bones. E, The squamous suture. F, The zygoma. G, The mastoid process. H, The temporal process of the sphenoid bone. I, The orbit. K, The os malæ. L, The os maxillare superius. M, Its nasal process. N, The ossa nasi. O, The os unguis. P, The maxilla inferior. Q, The teeth, which are sixteen in number in each jaw. R, The seven cervical vertebræ, with their intermediate cartilages. S, Their tranverse processes. T, The twelve dorsal vertebræ, with their intermediate cartilages. U, The five lumbar vertebræ. V, Their tranverse processes. W, The upper part of the os sacrum. X, Its lateral parts. The holes seen on its fore part are the passages of the undermost spinal nerves and small vessels. Opposite to the holes, the marks of the original divisions of the bone are seen. Y, The os ilium. Z, Its crest or spine. a, The anterior spinous processes. b, The brim of the pelvis. c, The ischiatic niche. d, The os ischium. e, Its tuberosity. f, Its spinous process. g, Its crus. h, The foramen thyroideum. i, The os pubis. k, The symphysis pubis. l, The crus pubis. m, The acetabulum. n, The seventh or last true rib. o, The twelfth or last false rib. p, The upper end of the sternum. q, The middle piece. r, The under end, or cartilage ensiformis. s, The clavicle. t, The internal surface of the scapula. u, Its acromion. v, Its coracoid process. w, Its cervix. x, The glenoid cavity. y, The os humeri. z, Its head, which is connected to the glenoid cavity. 1, Its external tubercle. 2, Its internal tubercle. 3, The groove for lodging the long head of the biceps muscle of the arm. 4, The internal condyle. 5, The external condyle. Between 4 and 5, the trochlea. 6, The radius. 7, Its head. 8, Its tubercle. 9, The ulna. 10, Its coronoid process. 11, 12, 13, 14, 15, 16, 17, 18, The carpus; composed of os naviculare, os lunare, os cuneiforme, os pisiforme, os trapezium, os trapezoides, os magnum, os unciforme. 19, The five bones of the metacarpus. 20, The two bones of the thumb. 21, The three bones of each of the fingers. 22, The os femoris. 23, Its head. 24, Its cervix. 25, The trochanter major. 26, The trochanter minor. 27, The internal condyle. 28, The external condyle. 29, The rotula. 30, The tibia. 31, Its head. 32, Its tubercle. 33, Its spine. 34, The malleolus internus. 35, The fibula. 36, Its head. 37, The malleolus externus. The tarsus is composed of, 38, The astragalus; 39, The os calcis; 40, The os naviculare; 41, Three ossa cuneiformia, and the os cuboides, which is not seen in this figure. 42, The five bones of the metatarsus. 43, The two bones of the great toe. 44, The three bones of each of the small toes.

FIG. 2. A Front-view of the SKULL.

A, The os frontis. B, The lateral part of the os frontis, which gives origin to part of the temporal muscle. C, The superciliary ridge. D, The superciliary hole through which the frontal vessels and nerves pass. EE, The orbitar processes. F, The middle of the transverse suture. G, The upper part of the orbit. H, The foramen opticum. I, The foramen lacerum. K, The inferior orbitar fissure. L, The os unguis. M, The ossa nasi. N, The os maxillare superius. O, Its nasal process. P, The external orbitar hole through which the superior maxillary vessels and nerves pass. Q, The os malæ. R, A passage for small vessels into, or out of, the orbit. S, The under part of the left nostril. T, The septum narium. U, The os spongiosum superius. V, The os spongiosum inferius. W, The edge of the alveoli, or spongy sockets, for the teeth. X, The maxilla inferior. Y, The passage for the inferior maxillary vessels and nerves.

FIG. 3. A Side-view of the SKULL.

A, The os frontis. B, The coronal suture. C, The os parietale. D, An arched ridge which gives origin to the temporal muscle. E, The squamous suture. F, The squamous part of the temporal bone; and, farther forwards, the temporal process of the sphenoid bone. G, The zygomatic process of the temporal bone. H, The zygomatic suture. I, The mastoid process of the temporal bone. K, The meatus auditorius externus. L, The orbitar plate of the frontal bone, under which is seen the tranverse suture. M, The pars plana of the ethmoid bone. N, The os unguis. O, The right os nasi. P, The superior maxillary bone. Q, Its nasal process. R, The two dentes incisores. S, The dens caninus. T, The two small molares, U, The three large molares. V, The os malæ. W, The lower jaw. X, Its angle. Y, The coronoid

ANATOMY

Scot Phila.

ANATOMY

Fig 1

Fig 2

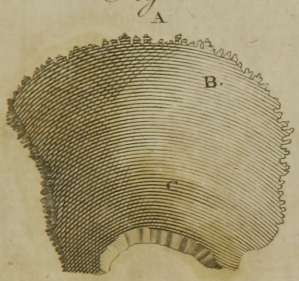


Fig 3

Fig 4

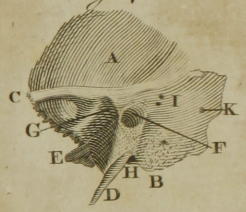


Fig 5

Fig 6

Fig 7

Fig 8

Fig 9

Fig 10

Fig 11

Fig 12

Fig 13

Fig 14

Fig 15

Fig 16

Fig 17

Fig 18

Fig 19

Fig 20

Fig

Fig 2

R. Scot Sculp. Phila

Osteology. coronoid proceſs. Z, The condyloid proceſs, by which the jaw is articulated with the temporal bone.

FIG. 4. The poſterior and right Side of the SKULL.

A, The os frontis. B B, The oſſa parietalia. C, The ſagittal ſuture. D, The parietal hole, through which a ſmall vein runs to the ſuperior longitudinal ſinus. E, The lambdoid ſuture. F F, Oſſa triquetra. G, The os occipitis. H, The ſquamous part of the temporal bone. I, The maſtoid proceſs. K, The zygoma. L, The os malæ. M, The temporal part of the ſphenoid bone. N, The ſuperior maxillary bone and teeth.

FIG. 5. The external Surface of the Os FRONTIS.

A, The convex part. B, Part of the temporal foſſa. C, The external angular proceſs. D, The internal angular proceſs. E, The naſal proceſs. F, The ſuperciliary arch. G, The ſuperciliary hole. H, The orbitar plate.

FIG. 6. The Interior Surface of the Os FRONTIS.

A A, The ſerrated edge which aſſiſts to form the coronal ſuture. B, The external angular proceſs. C, The internal angular proceſs. D, The naſal proceſs. E, The orbitar plate. F, The cells which correſpond with thoſe of the ethmoid bone. G, The paſſage from the frontal ſinus. H, The opening which receives the cribriform plate of the ethmoid bone. I, The cavity which lodges the fore part of the brain. K, The ſpine to which the falx is fixed. L, The groove which lodges the ſuperior longitudinal ſinus.

PLATE XX.

FIG. 1. A Back-view of the SKELETON.

A A, The oſſa parietalia. B, The ſagittal ſuture. C, The lambdoid ſuture. D, The occipital bone. E, The ſquamous ſuture. F, The maſtoid proceſs of the temporal bone. G, The os malæ. H, The palate plates of the ſuperior maxillary bones. I, The maxilla inferior. K, The teeth of both jaws. L, The ſeven cervical vertebræ. M, Their ſpinous proceſſes. N, Their tranſverſe and oblique proceſſes. O, The laſt of the twelve dorſal vertebræ. P, The fifth or laſt lumbar vertebra. Q, The tranſverſe proceſſes. R, The oblique proceſſes. S, The ſpinous proceſſes. T, The upper part of the os ſacrum. U, The poſterior holes which tranſmit ſmall blood-veſſels and nerves. V, The under part of the os ſacrum which is covered by a membrane. W, The os coccygis. X, The os ilium. Y, Its ſpine or creſt. Z, The iſchiatic niche. a, The os iſchium. b, Its tuberoſity. c, Its ſpine. d, The os pubis. e, The foramen hydroideum. f, The ſeventh or laſt true rib. g, The twelfth or laſt falſe rib. h, The clavicle. i, the ſcapula. k, Its ſpine. l, Its acromion. m, Its cervix. n, Its ſuperior coſta. o, Its poſterior coſta. p, Its inferior coſta. q, The os humeri. r. The radius. s, The ulna. t, Its oleclarnon. u, All the bones of the carpus, excepting the os piſiforme, which is ſeen in Plate XIX. fig. 1. v, The five bones of the matacarpus. w, The two bones of the thumb. x, The three bones of each of the fingers. y, The two ſeſamoid bones at the root of the left thumb. z, The os femoris. 1, The trochanter major. 2, The trochanter minor. 3, The linea aſpera. 4, The internal condyle. 5, The external condyle. 6 6, The ſimilunar cartilages. 7, The tibia. 8, The malleolus internus. 9, The fibula. 10, The mallelous externus. 11. The tarſus. 12, The metatarſus. 13, The toes. Osteology.

FIG. 2. The External Surface of the Left Os PARIETALE.

A, The convex ſmooth ſurface. B, The parietal hole. C, An arch made by the beginning of the temporal muſcle.

FIG. 3. The Internal Surface of the ſame bone.

A, Its ſuperior edge, which, joined with the other, forms the ſagittal ſuture. B, The anterior edge, which aſſiſts in the formation of the coronal ſuture. C, The inferior edge for the ſquamous ſuture. D, The poſterior edge for the lambdoid ſuture. E, A depreſſion made by the lateral ſinus. F F, The prints of the arteries of the dura mater.

FIG. 4. The External Surface of the Left Os TEMPORUM.

A, The ſquamous part. B, The maſtoid proceſs. C, The zygomatic proceſs. D, The ſtyloid proceſs. E, The petroſal proceſs. F, The meatus auditorius externus. G, The glenoid cavity for the articulation of the lower jaw. H, The foramen ſtylo-maſtoideum for the portio dura of the ſeventh pair of nerves. I, Paſſages for blood-veſſels into the bone. K, The foramen maſtoideum through which a vein goes to the lateral ſinus.

FIG. 5. The Internal Surface of the Left Os TEMPORUM.

A, The ſquamous part; the upper edge of which aſſiſts in forming the ſquamous ſuture. B, The maſtoid proceſs. C, The ſtyloid proceſs. D, The pars petroſa. E, The entry of the ſeventh pair, or auditory nerve. F, The foſſa, which lodges a part of the lateral ſinus. G, The foramen maſtoideum.

FIG. 6. The External Surface of the OSSEOUS CIRCLE, which terminates the meatus anditorious externus.

A, The anterior part. B, A ſmall part of the groove in which the membrana tympani is fixed.

N. B. This, with the ſubſequent bones of the ear, are here delineated as large as the life.

FIG. 7. The Internal Surface of the OSSEOUS CIRCLE.

A, The anterior part. B, The groove in which the membrana tympani is fixed.

FIG. 8. The Situation and Connection of the Small Bones of the EAR.

A, The malleus. B, The incus. C, The os orbiculare. D, The ſtapes.

FIG. 9. The MALLEUS, with its Head, Handle, and Small Proceſſes.

FIG. 10. The INCUS, with its Body, Superior and Inferior Branches.

FIG. 11. The Os ORBICULARE.

FIG. 12. The STAPES, with its Head, Baſe, and two Crura.

FIG. 13. An Internal View of the LABYRINTH of the EAR.

A, The hollow part of the cochlea, which forms a ſhare

ſhare of the meatus auditorius internus. B, The veſtibulum. C C C, The ſemicircular canals.

FIG. 14. An External View of the LABYRINTH.

A, the ſemicircular canals. B, The feneſtra ovalis which leads into the veſtibulum. C, The feneſtra rotunda which opens into the cochlea. D, The different turns of the cochlea.

FIG. 15. The Internal Surface of the Os SPHENOIDES.

A A, The temporal proceſſes. B B, The pterygoid proceſſes. C C, The ſpinous proceſſes. D D, The anterior clinoid proceſſes. E. The poſterior clinoid proceſs. F, The anterior proceſs which joins the ethmoid bone. G, The ſella turcica for lodging the glandula pituitaria. H, The foramen opticum. K, The foramen lacerum. L, The foramen rotundum. M, The foramen ovale. N, The foramen ſpinale.

FIG. 16. The External Surface of the Os SPHENOIDES.

A A, The temporal proceſſes. B B, The pterygoid proceſſes. C C, The ſpinous proceſſes. D, The proceſſus azygos. E, The ſmall triangular proceſſes which grow from the body of the bone. F F, The orifices of the ſphenoidal ſinuſes. G, The foramen lacerum. H, The foramen rotundum. I, The foramen ovale. K, The foramen pterygoideum.

FIG. 17. The External View of the Os ETHMOIDES.

A, The naſal lamella. B B, The grooves between the naſal lamella and oſſa ſpongioſa ſuperiora. C C, The oſſa ſpongioſa ſuperiora. D D, The ſphenoidal cornua. See Fig. 16. E.

FIG. 18. The Internal View of the Os ETHMOIDES.

A, The criſta galli. B, The cribriform plate, with the different paſſages of the olfactory nerves. C C, Some of the ethmoidal cells. D, The right os planum. E E, The ſphenoidal cornua.

FIG. 19. The right SPHENOIDAL CORNU.

FIG. 20. The left SPHENOIDAL CORNU.

FIG. 21. The External Surface of the Os OCCIPITIS.

A, The upper part of the bone. B, The ſuperior arched ridge. C, The inferior arched ridge. Under the arches are prints made by the muſcles of the neck. D D, The two condyloid proceſſes which articulate the head with the ſpine. E, The cuneiform proceſs. F, The foramen magnum through which the ſpinal marrow paſſes. G G, The poſterior condyloid foramina which tranſmit veins into the lateral ſinuſes. H H, The foramina lingualia for the paſſage of the nine pair of nerves.

FIG. 22. The internal Surface of the Os OCCIPITIS.

A A, The two ſides which aſſiſt to form the lambdoid ſuture. B, The point of the cuneiform proceſs, where it joins the ſphenoid bone. C C, The prints made by the poſterior lobes of the brain. D D, Prints made by the lobes of the cerebellum. E, The cruciform ridge for the attachment of the proceſſes of the dura mater. F, The courſe of the ſuperior longitudinal ſinuſes. G G, The courſe of the two lateral ſinuſes. H, The foramen magnum. I I, The poſterior condyloid foramina.

PLATE XXI.

FIG. 1. A Side-view of the SKELETON.

A A, The oſſa parietalia. B, The ſagittal ſuture. C, The os occipitis. D D, The lambdoid ſuture. E, The ſquamous part of the temporal bone. F, The maſtoid proceſs. G, The meatus auditorius externus. H, The os frontis. I, The os malæ. K, The os maxillare ſuperius. L, The maxilla inferior. M, The teeth of both jaws. N, The ſeventh, or laſt cervical vertebra. O, The ſpinous proceſſes. P, Their tranſverſe and oblique proceſſes. Q, The twelfth or laſt dorſal vertebra. R, The fifth, or laſt lumbar vertebra. S, The ſpinous proceſſes. T, Openings between the vertebræ for the paſſage of the ſpinal nerves. U, The under end of the os ſacrum. V, The os coccygis. W, The os ilium. X, The anterior ſpinous proceſſes. Y, The poſterior ſpinous proceſſes. Z, The iſchiatic niche. a, The right os ilium. b, The oſſa pubis. c, The tuberoſity of the left os iſchium. d, The ſcapula. e, Its ſpine. f, The os humeri. g, The radius. h, The ulna. i, The carpus. k, The metacarpal bone of the thumb. l, The metacarpal bones of the fingers. m, The two bones of the thumb. n, The three bones of each of the fingers. o, The os femoris. p, Its head. q, The trochanter major. r, The external condyle. s, The rotula. t, The tibia, u, The fibula. v, The malleolus externus. w, The aſtragalus. x, The os calcis. y, The os naviculare, z, The three oſſa cuneiformia. 1, The os cuboides. 2, The five metatarſal bones. 3, The two bones of the great toe. 4, The three bones of each of the ſmall toes.

FIG. 2. A View of the Internal Surface of the Baſe of the SKULL.

A A A, The two tables of the ſkull with the diploë. B B, The orbitar plates of the frontal bone. C, The criſta galli, with cribriform plate of the ethmoidal bone on each ſide of it, through which the firſt pair of nerves paſs. D, The cuneiform proceſs of the occipital bone. E, The cruciform ridge. F, The foramen magnum for the paſſage of the ſpinal marrow. G, The zygoma, made by the joining of the zygomatic proceſſes of the os temporum and os malæ. H, The pars ſquamoſa of the os temporum. I, The pars mammillaris. K, The pars petroſa. L, The temporal proceſs of the ſphenoid bone. M M, The anterior clinoid proceſſes. N, The poſterior clinoid proceſs. O, The ſella turcica. P, The foramen opticum, for the paſſage of the optic nerve and ocular artery of the left ſide. Q, The foramen lacerum, for the third, fourth, ſixth, and firſt of the fifth pair of nerves and ocular vein. R, The foramen rotundum, for the ſecond of the fifth pair. S, The foramen ovale, for the third of the fifth pair. T, The foramen ſpinale, for the principal artery of the dura mater. U, The entry of the auditory nerve. V, The paſſage for the lateral ſinus. W, The paſſage of the eighth pair of nerves. X, The paſſage of the ninth pair.

FIG. 3. A View of the External Surface of the Baſe of the SKULL.

A, The two dentes inciſores of the right ſide. B, The dens caninus. C, The two ſmall molares. D, The three large molares. E, The foramen inciſivum, which gives paſſage to ſmall blood-veſſels and nerves. F, The palate-

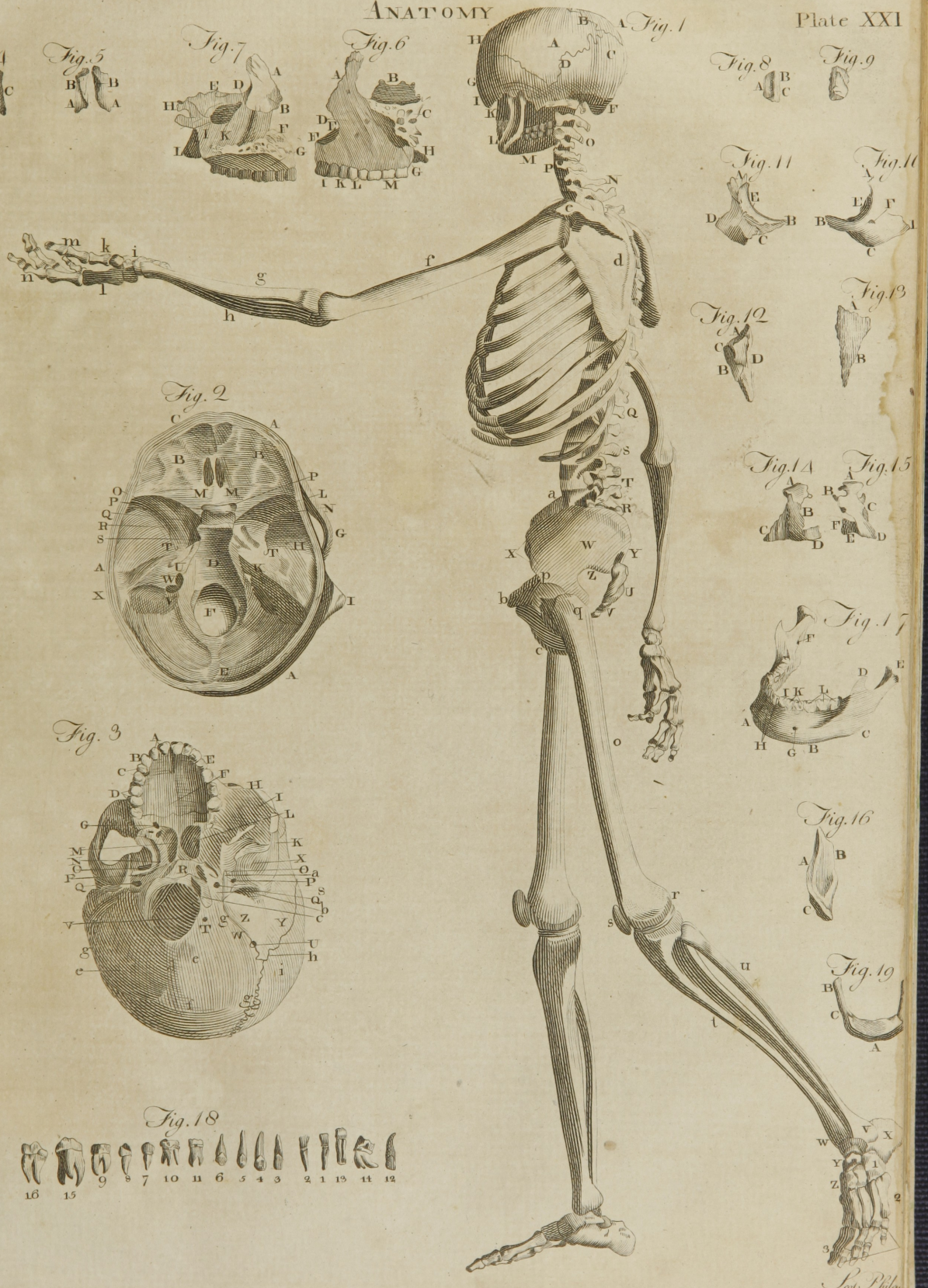


Fig. 1
Fig. 2
Fig. 3
Fig. 4
Fig. 5
Fig. 6
Fig. 7
Fig. 8
Fig. 9
Fig. 10
Fig. 11
Fig. 12
Fig. 13
Fig. 14
Fig. 15
Fig. 16
Fig. 17
Fig. 18
Fig. 19

Osteology. palate-plates of the ossa maxillaria and palati, joined by the longitudinal and transverse palate sutures. G, The foramen palatinum posterius, for the palatine vessels and nerves. H, The os maxillare superius of the right side. I, The os malæ. K, The zygomatic process of the temporal bone. L. The posterior extremity of the ossa spongiosa. M, The posterior extremity of the vomer, which forms the back-part of the septum nasi. N, The pterygoid process of the right side of the sphenoid bone. O O, The foramina ovalia. P P, The foramina spinalia. Q Q, The passages of the internal carotid arteries. R, A hole between the point of each pars petrosa and cuneiform process of the occipital bone, which is filled up with a ligamentous substance in the recent subject. S, The passage of the left lateral sinus. T, The posterior condyloid foramen of the left side. U, The foramen mastoideum. V, The foramen magnum. W, The inferior orbitar fissure. X, The glenoid cavity, for the articulation of the lower jaw. Y, The squamous part of the temporal bone. Z, The mastoid process, at the inner side of which is a fossa for the posterior belly of the digastric muscle. a, The styloid process. b, The meatus auditorius externus. c, The left condyle of the occipital bone. d, The perpendicular occipital spine. e e, The inferior horizontal ridge of the occipital bone. f f, The superior horizontal ridge, which is opposite to the crucial ridge where the longitudinal sinus divides to form the lateral sinuses. g g g, The lambdoid suture. h, The left squamous suture. i, The parietal bone.

FIG. 4. The anterior surface of the OSSA NASI.

A, The upper part, which joins the os frontis. B, The under end, which joins the cartilage of the nose. C, The inner edge, where they join each other.

FIG. 5. The posterior surface of the OSSA NASI.

A A, Their cavity, which forms part of the arch of the nose. B B, Their ridge or spine, which projects a little to be fixed to the fore-part of the septum narium.

FIG. 6. The external surface of the Os MAXILLARE SUPERIUS of the left side.

A, The nasal process. B, The orbitar plate. C, The unequal surface which joins the os malæ. D, The external orbitar hole. E, The opening into the nostril. F, The palate-plate. G, The maxillary tuberosity. H, part of the os palati. I, The two dentes incisores. K, The dens caninus. L, The two small dentes molares. M, The three large dentes molares.

FIG. 7. The internal surface of the Os MAXILLARE SUPERIUS and Os PALATI.

A, The nasal process. B B, Eminences for the connection of the os spongiosum inferius. D, The under end of the lachrymal groove. E, The antrum maxillare. F, The nasal spine, between which and B is the cavity of the nostril. G, The palate-plate. H, The orbitar part of the os palati. I, The nasal plate. K, The suture which unites the maxillary and palate bones. L, The pterygoid process of the palate bones.

FIG. 8. The external surface of the right Os UNGUIS.

A, The orbitar part. B, The lachrymal part. C, The ridge between them.

FIG. 9. The internal surface of the right Os UNGUIS. Osteology.

This side of the bone has a furrow opposite to the external ridge; all behind that is irregular, where it covers part of the ethmoidal cells.

FIG. 10. The external surface of the left Os MALÆ.

A, The superior orbitar process. B, The inferior orbitar process. C, The malar process. D, The zygomatic process. E, The orbitar plate. F, A passage for small vessels into or out of the orbit.

FIG. 11. The internal surface of the left Os MALÆ.

A, The superior orbitar process. B, The inferior orbitar process. C, The malar process. D, The zygomatic process. E, The internal orbitar plate or process.

FIG. 12. The external surface of the right Os SPONGIOSUM INFERIUS.

A, The anterior part. B, The hook-like process for covering part of the antrum maxillare. C, A small process which covers part of the under end of the lachrymal groove. D, The inferior edge turned a little outwards.

FIG. 13. The internal surface of the Os SPONGIOSUM INFERIUS.

A, The anterior extremity. B, The upper edge which joins the superior maxillary and palate bones.

FIG. 14. The posterior and external surface of the right Os PALATI.

A, The orbitar process. B, The nasal lamella. C, The pterygoid process. D, The palate process.

FIG. 15. The anterior and external surface of the right Os PALATI.

A, The orbitar process. B, An opening through which the lateral nasal vessels and nerves pass. C, The nasal lamella. D, The pterygoid process. E, The posterior edge of the palate process for the connection of the velum palati. F, The inner edge by which the two ossa palati are connected.

FIG. 16. The right side of the VOMER.

A, The upper edge which joins the nasal lamella of the ethmoid bone and the middle cartilage of the nose. B, The inferior edge, which is connected to the superior maxillary and palate bones. C, The superior and posterior part which receives the processus azygos of the sphenoid bone.

FIG. 17. The MAXILLA INFERIOR.

A, The chin. B, The base and left side. C, The angle. D, The coronoid process. E, The condyloid process. F, The beginning of the inferior maxillary canal of the right side, for the entry of the nerve and blood-vessels. G, The termination of the left canal. H, The two dentes incisores. I, The dens caninus. K, The two small molares. L, The three large molares.

FIG. 18. The different classes of the TEETH.

1, 2, A fore and back view of the two anterior dentes incisores of the lower jaw. 3, 4, Similar teeth of the upper jaw. 5, 6, A fore and back view of the dentes canini. 7, 8, The anterior dentes molares. 9, 10 11, The posterior dentes molares. 12, 13, 14,

Osteology. 15, 16, Unusual appearances in the shape and size of the teeth.

Fig. 19. The external surface of the Os Hyoides. A, The body. B B, The cornua. C C, The appendices.

Plate XXII.

Fig. 1. A Posterior View of the Sternum and Clavicles, with the ligament connecting the clavicles to each other.

a, The posterior surface of the sternum. b b, The broken ends of the clavicles. c c c c, The tubercles near the extremity of each clavicle. d, The ligament connecting the clavicles.

Fig. 2. A Fore-view of the Left Scapula, and of a half of the Clavicle, with their Ligaments.

a, The spine of the scapula. b, The acromion. c, The inferior angle. d, Inferior costa. e, Cervix. f, Glenoid cavity, covered with cartilage for the arm-bone. g g, The capsular ligament of the joint. h, Coracoid process. i, The broken end of the clavicle. k, Its extremity joined to the acromion. l, A ligament coming out single from the acromion to the coracoid process. m, A ligament coming out single from the acromion, and dividing into two, which are fixed to the coracoid process.

Fig. 3. The Joint of the Elbow of the Left Arm, with the Ligaments.

a, The os humeri. b, Its internal condyle. c c, The two prominent parts of its trochlea appearing through the capsular ligament. d, The ulna. e, The radius, f, The part of the ligamen tincluding the head of the radius.

Fig. 4. The Bones of the Right-Hand, with the Palm in view.

a, The radius. b, The ulna. c, The scaphoid bone of the carpus. d, The os lunare. e, The os cuneiforme. f, The os pisiforme. g, Trapezium. h, Trapezoides. i, Capitatum. k, Unciforme. l. The four metacarpal bones of the fingers. m, The first phalanx. n, The second phalanx. o, The third phalanx. p, The metacarpal bone of the thumb. q, The first joint. r, The second joint.

Fig. 5. The Posterior View of the Bones of the Left Hand.

The explication of Fig. 4. serves for this figure; the same letters pointing out the same bones, though in a different view.

Fig. 6. The Upper Extremity of the Tibia, with the Semilunar Cartilages of the Joint of the Knee, and some Ligaments.

a, The strong ligament which connects the rotula to the tubercle of the tibia. b b, The parts of the extremity of the tibia, covered with cartilage, which appear within the semilunar cartilages. c c, The semilunar cartilages. d, The two parts of what is called the cross ligament.

Fig. 7. The Posterior View of the Joint of the Right Knee.

a, The os femoris cut. b, Its internal condyle. c, Its external condyle. d, The back-part of the tibia. e, The superior extremity of the fibula. f, The edge of the internal semilunar cartilage. g, An oblique ligament. h, A larger perpendicular ligament. i, A ligament connecting the femur and fibula. Osteology.

Fig. 8. The Anterior View of the Joint of the Right Knee.

b, The internal condyle. c, Its external condyle. d, The part of the os femoris, on which the patella moves. e, A perpendicular ligament. f f, The two parts of the crucial ligaments. g g, The edges of the two moveable semilunar cartilages. h, The tibia. i, The strong ligament of the patella. k, The back part of it where the fat has been dissected away. l, The external depression. m, The internal one. n, The cut tibia.

Fig. 9. A View of the inferior part of the Bones of the Right Foot.

a, The great knob of the os calcis. b, A prominence on its outside. c, The hollow for the tendons, nerves, and blood-vessels. d, The anterior extremity of the os calcis. e, Part of the astragalus. f, Its head covered with cartilage. g, The internal prominence of the os naviculare. h, The os cuboides. i, The os cuneiforme internum; k,—Medium; l,—Externum. m, The metatarsal bones of the four lesser toes. n, The first—o, The second—p, The third phalanx of the four lesser toes. q, The metatarsal bones of the great toe. r, Its first—s, Its second joint.

Fig. 10. The Inferior Surface of the two large Sesamoid Bones, at the first Joint of the Great Toe.

Fig. 11. The Superior View of the Bones of the Right Foot.

a, b, as in Fig. 9. c, The superior head of the astragalus. d, &c. as in Fig. 9.

Fig. 12. The View of the Sole of the Foot, with its Ligaments.

a, The great knob of the os calcis. b, The hollow for the tendons, nerves, and blood-vessels. c, The sheaths of the flexores pollicis and digitorum longi opened. d, The strong cartilaginous ligament supporting the head of the astragalus. e, h, Two ligaments which unite into one, and are fixed to the metatarsal bone of the great toe. f, A ligament from the knob of the os calcis to the metatarsal bone of the little toe. g, A strong triangular ligament, which supports the bones of the tarsus. i, The ligaments of the joints of the five metatarsal bones.

Fig. 13. a, The head of the thigh bone of a child. b, The ligamentum rotundum connecting it to the acetabulum, c, The capsular ligament of the joint with its arteries injected. d, The numerous vessels of the mucilaginous gland injected.

Fig. 14. The Back-view of the Cartilages of the Larynx, with the Os Hyoides.

a, The posterior part of the base of the os hyoides. b b, Its cornua. c, The appendix of the right side. d, A ligament sent out from the appendix of the left side, to the styloid process of the temporal bone. e, The union of the base with the left cornu. f f, The posterior sides of (g) the thyroid cartilage. h h, Its superior

Fig. 1

Fig. 2

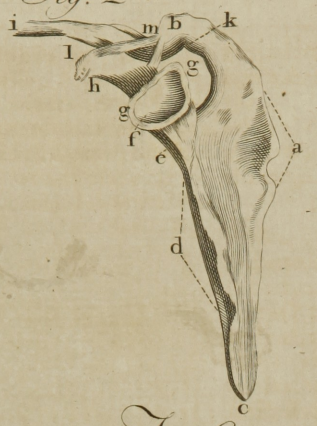


Fig. 3

Fig. 4

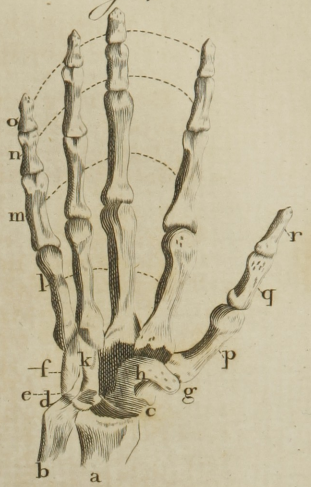


Fig. 5

Fig. 6

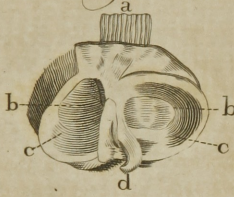


Fig. 7

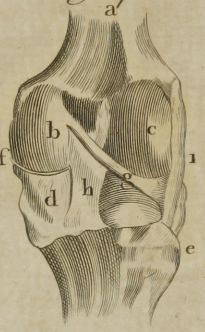


Fig. 8

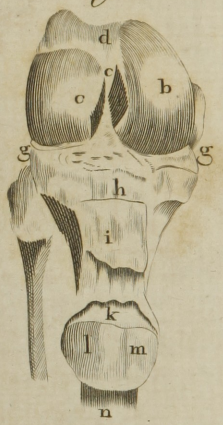


Fig. 10

Fig. 9

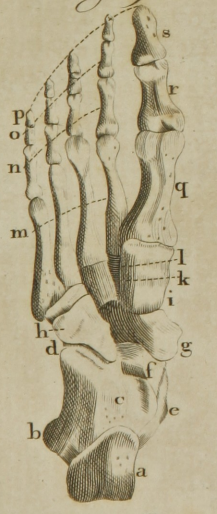


Fig. 11

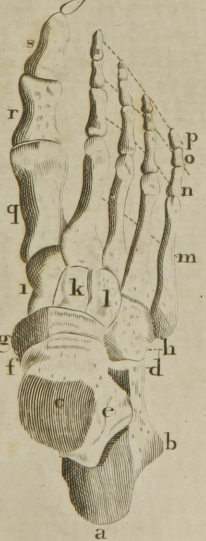


Fig. 12

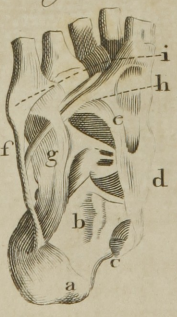


Fig. 13

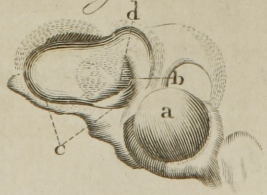


Fig. 14

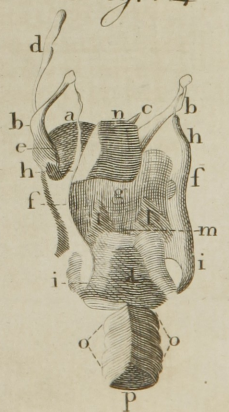


Fig. 15

Scot Philad.a

Osteology. superior cornua. i i, Its inferior cornua. k, The cricoid cartilage. l l, The arytenoid cartilages. m, The entry into the lungs, named *glottis*. n, The epiglottis. o o, The superior cartilages of the trachea. p, Its ligamentous back part.

FIG. 15. The Superior Concave surface of the SESAMOID BONES at the first joint of the Great Toe, with their Ligaments. Osteology.

a, Three sesamoid bones. b, The ligamentous substance in which they are formed.

PART II. OF THE SOFT PARTS IN GENERAL;

OF THE COMMON INTEGUMENTS, WITH THEIR APPENDAGES;

AND OF THE MUSCLES,

73 ANATOMICAL writers usually proceed to a description of the muscles after having finished the osteology; but we shall deviate a little from the common method, with a view to describe every thing clearly and distinctly, and to avoid a tautology which would otherwise be unavoidable. All the parts of the body are so intimately connected with each other, that it seems impossible to convey a just idea of any one of them, without being in some measure obliged to say something of others; and on this account we wish to mention in this place the names and situation of the principal viscera of the body, that when mention is hereafter made of any one of them in the course of the work, the reader may at least know where they are placed.

After this little digression, the common integuments, and after them the muscles will be described; we then propose to enter into an examination of the several viscera and their different functions. In describing the brain, occasion will be taken to speak of the nerves and animal spirits. The circulation of the blood will follow the anatomy of the heart, and the secretions and other matters will be introduced in their proper places.

The body is divided into three great cavities. Of these the uppermost is formed by the bones of the cranium, and incloses the brain and cerebellum.

The second is composed of the vertebræ of the back, the sternum, and true ribs, with the additional assistance of muscles, membranes, and common integuments, and is called the *thorax*—It contains the heart and lungs.

The third, and inferior cavity, is the abdomen. It is separated from the thorax by means of the diaphragm, and is formed by the lumbar vertebræ, the os sacrum, the ossa innominata, and the false ribs, to which we may add the peritonæum, and a variety of muscles. This cavity incloses the stomach, intestines, omentum or cawl, liver, pancreas, spleen, kidneys, urinary bladder, and parts of generation.

Under the division of common integuments are usually included the epidermis, or scarf-skin, the reticulum mucosum of Malpighi, the cutis or true skin, and the membrana adiposa.—The hair and nails, as well as the sebaceous glands may be considered as appendages to the skin.

SECT. I. *Of the* SKIN.

§ 1. *Of the* SCARF-*skin.*

74 Cuticula. THE epidermis, cuticula, or scarf-skin, is a fine, transparent, and insensible pellicle, destitute of nerves and blood-vessels, which invests the body, and everywhere covers the true skin. This scarf-skin, which seems to be very simple, appears, when examined with a microscope, to be composed of several laminæ or scales which are increased by pressure, as we may observe in the hands and feet, where it is frequently much thickened, and becomes perfectly callous. It seems to adhere to the cutis by a number of very minute filaments, but may easily be separated from it by heat, or by maceration in water. Some anatomical writers have supposed that it is formed by a moisture exhaled from the whole surface of the body, which gradually hardens when it comes into contact with the air. They were perhaps induced to adopt this opinion, by observing the speedy regeneration of this part of the body when it has been by any means destroyed, it appearing to be renewed on all parts of the surface at the same time; whereas other parts which have been injured, are found to direct their growth from their circumference only towards their centre. But a demonstrative proof that the epidermis is not a fluid hardened by means of the external air, is that the fœtus in utero is found to have this covering. Lieuwenhoeck supposed its formation to be owing to the expansion of the extremities of the excretory vessels which are found everywhere upon the surface of the true skin. Ruysch attributed its origin to the nervous papillæ of the skin; and Heister thinks it probable, that it may be owing both to the papillæ and the excretory vessels. The celebrated Morgagni, on the other hand, contends*, that it is nothing more than the surface of the cutis, hardened and rendered insensible by the liquor amnii in utero, and by the pressure of the air. This is a subject, however, on which we can advance nothing with certainty.

*Adversar. Anat. II. Animadver. 2.

The cuticle is pierced with an infinite number of pores or little holes, which afford a passage to the hairs, sweat, and insensible perspiration, and likewise to warm water, mercury, and whatever else is capable of being taken in by the absorbents of the skin. The lines which we observe on the epidermis belong to the true skin. The cuticle adjusts itself to them, but does not form them.

§ 2. *Of the Rete Mucosum.*

75 Rete mucosum. BETWEEN the epidermis and cutis we meet with an appearance to which Malpighi, who first described it, gave the name of *rete mucosum*, supposing it to be of a membranous structure, and pierced with an infinite number of pores; but the fact is, that it seems to be nothing more than a mucous substance which may be dissolved by macerating it in water, while the cuticle and cutis preserve their texture.

Of the Integuments, &c.

The colour of the body is found to depend on the colour of this rete mucoſum; for in negroes it is obſerved to be perfectly black, whilſt the true ſkin is of the ordinary colour.

The bliſters which raiſe the ſkin when burnt or ſcalded, have been ſuppoſed by ſome to be owing to a rarefaction of this mucus; but they are more probably occaſioned by an increaſed action of the veſſels of the part, together with an afflux and effuſion of the thinner parts of the blood.

§ 3. *Of the* CUTIS, *or True Skin.*

76 Cutis.

THE cutis is compoſed of fibres cloſely compacted together, as we may obſerve in leather, which is the prepared ſkin of animals. Theſe fibres form a thick network, which everywhere admits the filaments of nerves, and an infinite number of blood-veſſels and lymphatics.

The cutis, when the epidermis is taken off, is found to have, throughout its whole ſurface, innumerable papillæ, which appear like very minute granulations, and ſeem to be calculated to receive the impreſſions of the touch, being the moſt eaſily obſerved where the ſenſe of feeling is the moſt delicate, as in the palms of the hands and on the fingers.

Theſe papillæ are ſuppoſed by many anatomical writers to be continuations of the pulpy ſubſtance of nerves, whoſe coats have terminated in the cellular texture of the ſkin. The great ſenſibility of theſe papillæ evidently proves them to be exceedingly nervous; but ſurely the nervous fibrillæ of the ſkin are of themſelves ſcarcely equal to the formation of theſe papillæ, and it ſeems to be more probable that they are formed like the reſt of the cutis.

Theſe papillæ being deſcribed, the uſes of the epidermis and the reticulum mucoſum will be more eaſily underſtood; the latter ſerving to keep them conſtantly moiſt, while the former protects them from the external air, and modifies their too great ſenſibility.

§ 4. *Of the* GLANDS *of the Skin.*

77 The ſebaceous glands.

In different parts of the body we meet, within the ſubſtance of the ſkin, with certain glands or follicles, which diſcharge a fat and oily humour that ſerves to lubricate and ſoften the ſkin. When the fluid they ſecrete has acquired a certain degree of thickneſs, it approaches to the colour and conſiſtence of ſuet; and from this appearance they have derived their name of *ſebaceous glands*. They are found in the greateſt number in the noſe, ear, nipple, axilla, groin, ſcrotum, vagina, and prepuce.

Beſides theſe ſebaceous glands, we read, in anatomical books, of others that are deſcribed as ſmall ſpherical bodies placed in all parts of the ſkin, in much greater abundance than thoſe juſt now mentioned, and named *miliary*, from their ſuppoſed reſemblance to millet-ſeed. Steno, who firſt deſcribed theſe glands, and Malpighi, Ruyſch, Verheyen, Winſlow, and others, who have adopted his opinions on this ſubject, ſpeak of them as having excretory ducts, that open on the ſurface of the cuticle, and diſtil the ſweat and matter of inſenſible perſpiration; and yet, notwithſtanding the poſitive manner in which theſe pretended glands have been ſpoken of, we are now ſufficiently convinced that their exiſtence is altogether imaginary.

Of the Integuments, &c.

§ 5. *Of the* INSENSIBLE *Perſpiration and* SWEAT.

78 Inſenſible perſpiration.

THE matter of inſenſible perſpiration, or in other words, the ſubtile vapour that is continually exhaling from the ſurface of the body, is not ſecreted by any particular glands, but ſeems to be derived wholly from the extremities of the minute arteries that are everywhere diſperſed through the ſkin. Theſe exhaling veſſels are eaſily demonſtrated in the dead ſubject, by throwing water into the arteries; for then ſmall drops exude from all parts of the ſkin, and raiſe up the cuticle, the pores of which are cloſed by death; and in the living ſubject, a looking-glaſs placed againſt the ſkin, is ſoon obſcured by the vapour. Bidloo fancied he had diſcovered ducts leading from the cutis to the cuticle, and tranſmitting this fluid; but in this he was miſtaken.

When the perſpiration is by any means increaſed, and ſeveral drops that were inſenſible when ſeparate, are united together and condenſed by the external air, they form upon the ſkin ſmall, but viſible, drops called *ſweat* (N). This particularly happens after much exerciſe, or whatever occaſions an increaſed determination of fluids to the ſurface of the body; a greater quantity of perſpirable matter being in ſuch caſes carried through the paſſages that are deſtined to convey it off.

79 Whether theſe are one and the ſame or different excretions.

It has been diſputed, indeed, whether the inſenſible perſpiration and ſweat are to be conſidered as one and the ſame excretion, differing only in degree; or whether they are two diſtinct excretions derived from different ſources. In ſupport of the latter opinion, it has been alledged, that the inſenſible perſpiration is agreeable to nature, and eſſential to health, whereas ſweat may be conſidered as a ſpecies of diſeaſe. But this argument proves nothing; and it ſeems probable, that both the inſenſible vapour and the ſweat are exhaled in a ſimilar manner, though they differ in quantity, and probably in their qualities; the former being more limpid, and ſeemingly leſs impregnated with ſalts than the latter: at any rate we may conſider the ſkin as an emunctory through which the redundant water, and ſometimes the other more ſaline parts of the blood, are carried off.

80 Their uſes.

But the inſenſible perſpiration is not confined to the ſkin only—a great part of what we are conſtantly throwing off in this way is from the lungs. The quantity of fluid exhaled from the human body by this inſenſible perſpiration is very conſiderable. Sanctorius(O) an Italian phyſician, who indefatigably paſſed a great many

(N) Lieuwenhoeck aſſerts that one drop of ſweat is formed by the conflux of fifteen drops of perſpirable vapour.

(O) The inſenſible perſpiration is ſometimes diſtinguiſhed by the name of this phyſician, who was born in the territories of Venice, and was afterwards a profeſſor in the univerſity of Padua. After eſtimating the aliment he took in, and the ſenſible ſecretions and diſcharges, he was enabled to aſcertain with great accuracy the weight or quantity of inſenſible perſpiration by means of a ſtatical chair which he contrived for this purpoſe; and

Of the Integuments, &c.

many years in a ſeries of ſtatical experiments, demonſtrated long ago what has been confirmed by later obſervations, that the quantity of vapour exhaled from the ſkin and from the ſurface of the lungs, amounts nearly to 5-8ths of the aliment we take in. So that if in the warm climate of Italy a perſon eats and drinks the quantity of eight pounds in the courſe of a day, five pounds of it will paſs off by inſenſible perſpiration, while three pounds only will be evacuated by ſtool, urine, ſaliva, &c. But in countries where the degree of cold is greater than in Italy, the quantity of perſpired matter is leſs; in ſome of the more northern climates, it being found not to equal the diſcharge by urine. It is likewiſe obſerved to vary according to the ſeaſon of the year, and according to the conſtitution, age, ſex, diſeaſes, diet, exerciſe, paſſions, &c. of different people.

From what has been ſaid on this ſubject, it will be eaſily conceived, that this evacuation cannot be either much increaſed or diminiſhed in quantity without affecting the health.

The perſpirable matter and the ſweat are in ſome meaſure analogous to the urine, as appears from their taſte and ſaline nature (P). And it is worthy of obſervation, that when either of theſe ſecretions is increaſed in quantity, the other is diminiſhed; ſo that they who perſpire the leaſt, uſually paſs the greateſt quantity of urine, and vice verſa.

§ 6. *Of the* NAILS.

81 The nails.

THE nails are of a compact texture, hard and tranſparent like horn. Their origin is ſtill a ſubject of diſpute. Malpighi ſuppoſed them to be formed by a continuation of the papillæ of the ſkin: Ludwig, on the other hand, maintained, that they were compoſed of the extremities of blood-veſſels and nerves; both theſe opinions are now deſervedly rejected.

They ſeem to poſſeſs many properties in common with the cuticle; like it they are neither vaſcular nor ſenſible, and when the cuticle is ſeparated from the true ſkin by maceration or other means, the nails come away with it.

They appear to be compoſed of different layers, of unequal ſize, applied one over the other. Each layer ſeems to be formed of longitudinal fibres.

In each nail we may diſtinguiſh three parts, viz. the root, the body or middle, and the extremity. The root is a ſoft, thin, and white ſubſtance, terminating in the form of a creſcent; the epidermis adheres very ſtrongly to this part; the body of the nail is broader, redder, and thicker, and the extremity is of ſtill greater firmneſs. Of the Integuments, &c.

The nails increaſe from their roots, and not from their upper extremity.

Their principal uſe is to cover and defend the ends of the fingers and toes from external injury.

§ 7. *Of the* HAIR.

82 The hair.

THE hairs, which from their being generally known do not ſeem to require any definition, ariſe from diſtinct capſules or bulbs ſeated in the cellular membrane under the ſkin (Q). Some of theſe bulbs incloſe ſeveral hairs. They may be obſerved at the roots of the hairs which form the beard or whiſkers of a cat.

The hairs, like the nails, grow only from below by a regular propulſion from their root, where they receive their nouriſhment. Their bulbs, when viewed with a microſcope, are found to be of various ſhapes. In the head and ſcrotum they are roundiſh; in the eyebrows they are oval; in the other parts of the body they are nearly of a cylindrical ſhape. Each bulb ſeems to conſiſt of two membranes, between which there is a certain quantity of moiſture. Within the bulb the hair ſeparates into three or four fibrillæ; the bodies of the hairs, which are the parts without the ſkin, vary in ſoftneſs and colour according to the difference of climate, age, or temperament of body (R).

Their general uſe in the body does not ſeem to be abſolutely determined; but hairs in particular parts, as on the eye-brows and eye-lids, are deſtined for particular uſes, which will be mentioned when thoſe parts are deſcribed.

§ 8. *Of the* CELLULAR MEMBRANE *and* FAT.

83 Cellular membrane

THE cellular membrane is found to inveſt the moſt minute fibres we are able to trace; ſo that by modern phyſiologiſts, it is very properly conſidered as the univerſal connecting medium of every part of the body.

It is compoſed of an infinite number of minute cells united together, and communicating with each other. The two diſeaſes peculiar to this membrane are proofs of ſuch a communication; for in the *emphyſema* all its cells are filled with air, and in the anaſarca they are univerſally diſtended with water. Beſides theſe proofs of communication from diſeaſe, a familiar inſtance of it may be obſerved amongſt butchers, who uſually puncture this membrane, and by inflating it with air add to the good appearance of their meat.

The

---

and from his experiments, which were conducted with great induſtry and patience, he was led to determine what kinds of ſolid or liquid aliment increaſed or diminiſhed it. From theſe experiments he formed a ſyſtem, which he publiſhed at Venice in 1614, in the form of aphoriſms, under the title of "Ars de Medicina Statica."

(P) Minute chryſtals have been obſerved to ſhoot upon the cloaths of men who work in glaſs-houſes. *Haller Elem. Phyſ.*

(Q) Malpighi, and after him the celebrated Ruyſch, ſuppoſed the hairs to be continuations of nerves, being of opinion that they originated from the papillæ of the ſkin, which they conſidered as nervous; and as a corroborating proof of what they advanced, they argued the pain we feel in plucking them out; but later anatomiſts ſeem to have rejected this doctrine, and conſider the hairs as particular bodies, not ariſing from the papillæ (for in the parts where the papillæ abound moſt there are no hairs), but from bulbs or capſules, which are peculiar to them.

(R) The hairs differ likewiſe from each other, and may not be improperly divided into two claſſes; one of which may include the hair of the head, chin, pubes, and axillæ; and the other, the ſofter hairs, which are to be obſerved almoſt every where on the ſurface of the body.

f the
tegu-
ents, &c.

84
at.

The cells of this membrane ſerve as reſervoirs to the oily part of the blood or *Fat*, which ſeems to be depoſited in them, either by tranſudation through the coats of the arteries, that ramify through theſe cells, or by particular veſſels, continued from the end of arteries. Theſe cells are not of a glandular ſtructure, as Malpighi and others after him have ſuppoſed. The fat is abſorbed and carried back into the ſyſtem by the lymphatics. The great waſte of it in many diſeaſes, particularly in the conſumption, is a ſufficient proof that ſuch an abſorption takes place.

The fulneſs and ſize of the body are in a great meaſure proportioned to the quantity of fat contained in the cells of this membrane.

In the living body it ſeems to be a fluid oil, which concretes after death. In graminivorous animals, it is found to be of a firmer conſiſtence than in man.

The fat is not confined to the ſkin alone, being met with every where in the interſtices of muſcles, in the omentum, about the kidneys, at the baſis of the heart, in the orbits, &c.

The chief uſes of the fat ſeems to be to afford moiſture to all the parts with which it is connected; to facilitate the action of the muſcles; and to add to the beauty of the body, by making it every where ſmooth and equal.

Sect. II. *Of the* Muscles.

85.

The muſcles are the organs of motion. The parts that are uſually included under this name conſiſt of diſtinct portions of fleſh, ſuſceptible of contraction and relaxation; the motions of which, in a natural and healthy ſtate, are ſubject to the will, and for this reaſon they are called *voluntary* muſcles. But beſides theſe, there are other parts of the body that owe their power of contraction to their muſcular fibres; thus the heart is of a muſcular texture, forming what is called a *hollow* muſcle; and the urinary bladder, ſtomach, inteſtines, &c. are enabled to act upon their contents, merely becauſe they are provided with muſcular fibres. Theſe are called *involuntary* muſcles, becauſe their motions are not dependent on the will. The muſcles of reſpiration, being in ſome meaſure influenced by the will, are ſaid to have a *mixed* motion.

The names by which the voluntary muſcles are diſtinguiſhed, are founded on their ſize, figure, ſituation, uſe, or the arrangement of their fibres, or their origin and inſertion. But beſides theſe particular diſtinctions, there are certain general ones that require to be noticed. Thus, if the fibres of a muſcle are placed parallel to each other in a ſtraight direction, they form what is ſtyled a *rectilinear* muſcle; if the fibres croſs and interſect each other, they conſtitute a *compound* muſcle; a *radiated* one, if the fibres are diſpoſed in the manner of rays; or a *penniform* muſcle, if, like the plume of a pen, they are placed obliquely with reſpect to the tendon.

Muſcles that act in oppoſition to each other, are called *antagoniſtæ*; thus every extenſor or muſcle has a flexor for its antagoniſt, and *vice verſa*. Muſcles that concur in the ſame action are ſtyled *congeneres*.

The muſcles being attached to the bones, the latter may be conſidered as levers that are moved in different directions by the contraction of thoſe organs.

The end of a muſcle which adheres to the moſt fixed part is uſually called the *origin*, and that which adheres to the more moveable part, the *inſertion*, of the muſcle. Of the Integuments, &c.

In every muſcle we may diſtinguiſh two kinds of fibres; the one ſoft, of a red colour, ſenſible, and irritable, called *fleſhy* fibres; the other of a firmer texture, of a white gliſtening colour, inſenſible, without irritability or the power of contracting, and named tendinous fibres. They are occaſionally intermixed; but the fleſhy fibres generally prevail in the belly or middle part of a muſcle, and the tendinous ones in the extremities. If theſe tendinous fibres are formed into a round ſlender chord, they form what is called the *tendon* of the muſcle; on the other hand, if they are ſpread into a broad flat ſurface, the extremity of the muſcle is ſtyled *aponeuroſis*.

The tendons of many muſcles, eſpecially when they are long and expoſed to preſſure or friction in the grooves formed for them in the bones, are ſurrounded by a tendinous ſheath or *faſcia*, in which we ſometimes find a ſmall mucous ſac or *burſa mucoſa*, which obviates any inconvenience from friction. Sometimes we find whole muſcles, and even ſeveral muſcles, covered by a faſcia of the ſame kind, that affords origin to many of their fibres, dipping down between them, adhering to the ridges of bones, and thus preventing them from ſwelling too much when in action. The moſt remarkable inſtance of ſuch a covering is the *faſcia lata* of the thigh.

Each muſcle is incloſed by a thin covering of cellular membrane, which has been ſometimes improperly conſidered as peculiar to the muſcles, and deſcribed under the name of *propria membrana muſculoſa*. This cellular covering dips down into the ſubſtance of the muſcle, connecting and ſurrounding the moſt minute fibres we are able to demonſtrate, and affording a ſupport to their veſſels and nerves.

Lieuwhenhoeck fancied he had diſcovered, by means of his microſcope, the ultimate diviſion of a muſcle, and that he could point out the ſimple fibre, which appeared to him to be an hundred times leſs than a hair; but he was afterwards convinced how much he was miſtaken on this ſubject, and candidly acknowledged, that what he had taken for a ſimple fibre was in fact a bundle of fibres.

It is eaſy to obſerve ſeveral of theſe faſciculi or bundles in a piece of beef, in which, from the coarſeneſs of its texture, they are very evident.

The red colour which ſo particularly diſtinguiſhes the muſcular or fleſhy parts of animals, is owing to an infinite number of blood-veſſels that are diſperſed through their ſubſtance. When we macerate the fibres of a muſcle in water, it becomes of a white colour like all other parts of the body diveſted of their blood. The blood-veſſels are accompanied by nerves, and they are both diſtributed in ſuch abundance to theſe parts, that in endeavouring to trace the courſe of the blood-veſſels in a muſcle, it would appear to be formed altogether by their ramifications; and in an attempt to follow the branches of its nerves, they would be found to be equal in proportion.

If a muſcle is pricked or irritated, it immediately contracts. This is called its irritable principle; and this

Of the Muſcles.

this irritability is to be conſidered as the characteriſtic of muſcular fibres, and may ſerve to prove their exiſtence in parts that are too minute to be examined by the eye. This power, which diſpoſes the muſcles to contract when ſtimulated, independent of the will, is ſuppoſed to be inherent in them; and is therefore named *vis inſita*. This property is not to be confounded with elaſticity, which the membranes and other parts of the body poſſeſs in a greater or leſs degree in common with the muſcles; nor with ſenſibility, for the heart, though the moſt irritable, ſeems to be the leaſt ſenſible of any of the muſcular parts of the body.

86 Of the vis inſita.

After a muſcular fibre has contracted, it ſoon returns to a ſtate of relaxation, till it is excited afreſh, and then it contracts and relaxes again. We may likewiſe produce ſuch a contraction, by irritating the nerve leading to a muſcle, although the nerve itſelf is not affected.

This principle is found to be greater in ſmall than in large, and in young than in old, animals.

In the voluntary muſcles theſe effects of contraction and relaxation of the fleſhy fibres are produced in obedience to the will, by what may be called the *vis nervoſa*, a property that is not to be confounded with the *vis inſita*. As the exiſtence of a *vis inſita* different from a *vis nervea*, was the doctrine taught by Doctor Haller in his *Elem. Phyſ.* but is at preſent called in queſtion by ſeveral, particularly Doctor Monro, we think it neceſſary to give a few objections, as ſtated in his Obſervations on the Nervous Syſtem:

87 The vis nervea.

"The chief experiment (ſays the Doctor) which ſeems to have led Dr Haller to this opinion, is the well-known one, that the heart and other muſcles, after being detached from the brain, continue to act ſpontaneouſly, or by ſtimuli may be rouſed into action for a conſiderable length of time; and when it cannot be alledged, ſays Dr Haller, that the nervous fluid is by the mind, or otherwiſe, impelled into the muſcle.

"That in this inſtance, we cannot comprehend by what power the nervous fluid or energy can be put in motion, muſt perhaps be granted: But has Dr Haller given a better explanation of the manner in which his ſuppoſed vis inſita becomes active?

"If it be as difficult to point out the cauſe of the action of the vis inſita as that of the action of the vis nervea, the admiſſion of that new power, inſtead of relieving, would add to our perplexity.

"We ſhould then have admitted, that two cauſes of a different nature were capable of producing exactly the ſame effect; which is not in general agreeable to the laws of nature.

"We ſhould find other conſequences ariſe from ſuch an hypotheſis, which tend to weaken the credibility of it. For inſtance, if in a ſound animal the vis nervea alone produces the contraction of the muſcles, we will aſk what purpoſe the vis inſita ſerves? If both operate, are we to ſuppoſe that the vis nervea, impelled by the mind or living principle, gives the order, which the vis inſita executes, and that the nerves are the internuntii; and ſo admit two wiſe agents employed in every the moſt ſimple action? But inſtead of ſpeculating farther, let us learn the effect of experiments, and endeavour from theſe to draw plain concluſions.

"1. When I poured a ſolution of opium in water under the ſkin of the leg of a frog, the muſcles, to the ſurface of which it was applied, were very ſoon deprived of the power of contraction. In like manner, when I poured this ſolution into the cavity of the heart, by opening the vena cava, the heart was almoſt inſtantly deprived of its power of motion, whether the experiment was performed on it fixed in its place, or cut out of the body.

"2. I opened the thorax of a living frog; and then tied or cut its aorta, ſo as to put a ſtop to the circulation of its blood.

"I then opened the vena cava, and poured the ſolution of opium into the heart; and found, not only that this organ was inſtantly deprived of its powers of action, but that in a few minutes the moſt diſtant muſcles of the limbs were extremely weakened. Yet this weakneſs was not owing to the want of circulation, for the frog could jump about for more than an hour after the heart was cut out.

"In the firſt of theſe two experiments, we obſerved the ſuppoſed vis inſita deſtroyed by the opium; in the latter, the vis nervea; for it is evident that the limbs were affected by the ſympathy of the brain, and of the nervous ſyſtem in general, with the nerves of the heart.

"3. When the nerve of any muſcle is firſt divided by a tranſverſe ſection, and then burnt with a hot iron, or punctured with a needle, the muſcle in which it terminates contracts violently, exactly in the ſame manner as when the irritation is applied to the fibres of the muſcle. But when the hot iron, or needle, is confined to the nerve, Dr Haller himſelf muſt have admitted, that the vis nervea, and not the vis inſita, was excited. But here I would aſk two queſtions.

"Firſt, Whether we do not as well underſtand how the vis nervea is excited when irritation is applied to the muſcle as when it is applied to the trunk of the nerve, the impelling power of the mind ſeeming to be equally wanting in both caſes?

"Secondly, If it appears that irritation applied to the trunk of a nerve excites the vis nervea, why ſhould we doubt that it can equally well excite it when applied to the ſmall and very ſenſible branches and terminations of the nerve in the muſcle?

"As, therefore, it appears that the ſuppoſed vis inſita is deſtroyed or excited by the ſame means as the vis nervea; nay, that when, by the application of opium to the heart of a frog, after the aorta is cut and the circulation interrupted, we have deſtroyed the vis inſita, the vis nervea is ſo much extinguiſhed, that the animal cannot act with the diſtant muſcles of the limb; and that theſe afterward grow very torpid, or loſe much of their ſuppoſed vis inſita; it ſeems clearly to follow, that there is no juſt ground for ſuppoſing that any other principle produces the contraction of a muſcle."

The *vis nervoſa*, or operation of the mind, if we may ſo call it, by which a muſcle is brought into contraction, is not inherent in the muſcle like the *vis inſita*; neither is it perpetual, like this latter property. After long continued or violent exerciſe, for example, the

Of the Integuments, &c.

the voluntary muſcles become painful, and at length incapable of further action; whereas the heart and other involuntary muſcles, the motions of which depend ſolely on the *vis inſita*, continue through life in a conſtant ſtate of action, without any inconvenience or waſte of this inherent principle.

The action of the vis nervoſa on the voluntary muſcles, conſtitutes what is called *muſcular motion*; a ſubject that has given riſe to a variety of hypotheſes, many of them ingenious, but none of them ſatisfactory.

Borelli and ſome others have undertaken to explain the cauſe of contraction, by ſuppoſing that every muſcular fibre forms as it were a chain of very minute bladders, while the nerves which are diſtributed through the muſcle, bring with them a ſupply of animal ſpirits, which at our will fill theſe bladders, and by increaſing their diameter in width, ſhorten them, and of courſe the whole fibre.

Borelli ſuppoſes theſe bladders to be of a rhomboidal ſhape; Bernouilli on the other hand contends that they are oval. Our countryman, Cowper, fancied he had filled them with mercury; the cauſe of this miſtake was probably owing to the mercury's inſinuating itſelf into ſome of the lymphatic veſſels. The late ingenious Mr Elliot undertook to account for the phenomena of muſcular motion on principles very different from thoſe juſt now mentioned. He ſuppoſed that a dephlogiſticated ſtate of the blood is requiſite for muſcular action, and that a communication of phlogiſton to the blood is a neceſſary effect of ſuch action.

Of the Integuments, &c.

We know that the muſcular fibre is ſhortened, and that the muſcle itſelf ſwells when in action; but how theſe phenomena are produced, we are unable to determine. We likewiſe know that the nerves are eſſential to muſcular motion; for upon dividing or making a ligature round the nerve leading to a muſcle, the latter becomes incapable of motion. A ligature made on the artery of a muſcle produces a ſimilar effect; a proof this, that a regular ſupply of blood is alſo equally neceſſary to muſcular motion. The cauſe of palſy is uſually not to be ſought for in the muſcle affected, but in the nerve leading to that muſcle, or in that part of the brain of ſpinal marrow from which the nerve derives its origin.

Of the particular Muſcles.

As the enumeration and deſcription of the particular muſcles muſt be dry and unentertaining to the generality of readers, yet cannot be altogether omitted in a work of this nature, it appeared eligible to throw this part of the ſubject into the form of a table; in which the name, origin, inſertion, and principal uſe of each muſcle, will be found deſcribed in few words, and occaſionally its etymology when it is of Greek derivation or difficult to be underſtood.

A TABLE of the MUSCLES, arranged according to their SITUATION.

[*N. B.* This table does not include all the muſcles of the body; thoſe belonging to the eyes, internal ear, inteſtinum rectum, and the male and female organs of generation, being deſcribed in other parts of the work. The reader will be pleaſed to obſerve likewiſe, that although all the muſcles (a few only excepted) are in pairs, mention is here made only of the muſcles of one ſide.]

MUSCLES ſituated	*Name.*	*Origin.*	*Inſertion.*	*Uſe.*
under the integuments of the cranium - - -	1. Occipito frontalis.	From the tranſverſe ridge of the os occipitis.	Into the ſkin of the eye-brows.	To pull the ſkin of the head backwards, and to raiſe the eye-brows and ſkin of the forehead.
	2. Corrugator ſupercilii.	From above the joining of the os frontis, os naſi, and os maxillare.	Into the inner part of the occipito-frontalis.	To draw the eye-brows towards each other, and to wrinkle the forehead.
——— of the eye-lids - -	1. Orbicularis palpebrarum.	From around the edge of the orbit.	Into the naſal proceſs of the os maxillare.	To ſhut the eye.
	2. Levator palpebræ ſuperioris.	From the bottom of the orbit, near the optic foramen.	Into the cartilage of the upper eye-lid.	To open the eye.
——— of the external ear -	1. Attolens auriculam.	From the tendon of the occipito frontalis near the os temporis.	Into the upper part of the ear.	To raiſe the ear.
	2. Anterior auriculæ.	From near the back part of the zygoma.	Into an eminence behind the helix.	To raiſe this eminence, and to pull it forwards.

3. RE-

Of the Muſcles.

	Name.	*Origin.*	*Inſertion.*	*Uſe.*
	3. Retrahentes (s) auriculæ.	From the outer and back part of the root of the maſtoid proceſs.	Into the convex part of the concha.	To ſtretch the concha, and pull the ear backwards.
Muscles of the cartilages of the ear	1. Tragicus.	From the outer and middle part of the concha, near the tragus.	Into the upper part of the tragus.	To depreſs the concha, and pull the point of the tragus a little outwards.
	2. Anti-tragicus.	From the root of the inner part of the helix.	Into the upper part of the anti-tragus.	To dilate the mouth of the concha.
	3. Tranſverſus-auriculæ.	From the upper part of the concha.	Into the inner part of the helix.	To ſtretch the concha and ſcapha, and likewiſe to pull the parts it is connected with towards each other.
	4. Helicis major.	From the upper, anterior, and acute part of the helix.	Into the cartilage of the helix, a little above the tragus.	To depreſs the upper part of the helix.
	5. Helicis minor.	From the lower and fore part of the helix.	Into the helix, near the fiſſure in its cartilage.	To contract the fiſſure.
——of the noſe,	1. Compreſſor (t) naris.	From the outer part of the root of the ala naſi.	Into the naſal proceſs of the os maxillare, and anterior extremity of the os naſi.	To ſtraighten the noſtrils, and likewiſe to corrugate the ſkin of the noſe.
—— of the mouth and lips,	1. Levator labii ſuperioris, alæque naſi.	From the outer part of the orbitar proceſs of the os maxillare, and from the naſal proceſs of that bone, where it joins the os frontis.	Into the upper lip and ala of the noſe.	To draw the upper lip and ſkin of the noſe upwards and outwards.
	2. Levator anguli oris.	From the os maxillare ſuperius, between the orbitar foramen and the firſt dens molares.	Into the orbicularis oris at the angle of the mouth.	To raiſe the corner of the mouth
	3. Zygomaticus major.	From the os malæ near the zygomatic ſuture.	Into the angle of the mouth.	To raiſe the angle of the mouth, and make the cheek prominent, as in laughing.
	4. Zygomaticus minor.	Immediately above the origin of the zyg. major.	Into the angle of the mouth.	To raiſe the angle of the mouth obliquely outwards.
	5. Buccinator.	From the alveoli of the dentes molares in the upper and lower jaws.	Into the angle of the mouth.	To contract the mouth and draw the angle of it outwards and backwards.
	6. Depreſſor labii ſuperioris, alæque naſi.	From the os maxill. ſuper. immediately above the gums of the dentes inciſores.	Into the root of the ala naſi and upper lip.	To draw the ala naſi and upper lip downwards.

(s) Theſe are three ſmall ſlender muſcles. The inferior one is ſometimes wanting.

(t) The noſe is affected by fibres of the occipito frontalis, and by ſeveral muſcles of the face; but this pair, the compreſſores, is the only one that is proper to it.

Of the Muſcles.

	Name.	*Origin.*	*Inſertion.*	*Uſe.*
	7. Depreſſor anguli oris.	At the ſide of the chin from the lower edge of the maxilla inferior.	Into the angle of the mouth.	To draw the corner of the mouth downwards.
	8. Depreſſor labii inferioris.	From the lower and anterior part of the maxilla inferior.	Into the under lip.	To draw the under lip downwards and ſomewhat outwards
	9. Levator labii inferioris.	From near the gums of the inciſores and caninus of the maxilla inferior.	Into the under lip and ſkin of the chin.	To raiſe the under lip and ſkin of the chin.
	10. Orbicularis Oris (u).			To ſhut the mouth by conſtraining the lips.
Muscles of the lower jaw, - -	1. Temporalis.	From part of the os bregmatis and os frontis; ſquamous part of the os temporis; back part of the os malæ, and the temporal proceſs of the os ſphenoides (v)	Into the coronoid proceſs of the lower jaw.	To move the lower jaw upwards.
	2. Maſſeter (w).	From the malar proceſs of the os maxillare, and the lower edges of the os malæ, and of the zygomatic proceſs of the os temporis.	Into the baſis of the coronoid proceſs, and that part of the jaw which ſupports that and the condyloid proceſs.	To raiſe and likewiſe to move the jaw a little forwards and backwards.
	3. Pterygoideus internus.	From the inner ſurface of the outerwing of the pterygoid proceſs of the os ſphenoides, and from the proceſs of the os palati that helps to form the pterygoid foſſa	Into the lower jaw on its inner ſide and near its angle.	To raiſe the lower jaw and draw it a little to one ſide.
	4. Pterygoideus externus.	From the external ala of the pterygoid proceſs, a ſmall part of the adjacent os maxillare, and a ridge in the temporal proceſs of the os ſphenoides.	Into the fore part of the condyloid proceſs of the lower jaw, and likewiſe of the capſular ligament.	To move the jaw forwards and to the oppoſite ſide (x); and at the ſame time to prevent the ligament of the joint from being pinched.
——— ſituated at the fore part of the neck. - -	1. Latiſſimus colli (y).	From the cellular membrane covering	Into the ſide of the chin and integu-	To draw the cheeks and ſkin of the face

(u) This muſcle is, in a great meaſure, if not wholly, formed by the buccinator, zygomatici, depreſſores, and other muſcles that move the lips. Its fibres ſurround the mouth like a ring.

(v) Some of its fibres likewiſe have their origin from a ſtrong faſcia that covers the muſcle and adheres to the bone round the whole circumference of its origin. When we remove this covering, we find the muſcle of a ſemicircular ſhape with its fibres, converging and forming a ſtrong middle tendon.

(w) So called from its uſe in chewing, its derivation being from μασισομαι, *manduco*, "to eat."

(x) This happens when the muſcle acts ſingly. When both act, the jaw is brought horizontally forwards.

(y) This broad and thin muſcular expanſion, which is ſituated immediately under the common integuments, is by Winſlow named *muſculus cutaneus*. Galen gave it the name of πλατυσμα μυωδες (*Platyſma-myoides*); the etymology of which is from πλατυσμος, *dilatatio*, and μυς, *muſculus*, and ειδος, *forma*.

	Name.	*Origin.*	*Inſertion.*	*Uſe.*
		the pectoral, deltoid, and trapezius muſcles.	ments of the cheek.	downwards; and when the mouth is ſhut, to draw all that part of the ſkin to which it is connected below the lower jaw upwards.
	2. Maſtoideus (z).	From the upper part of the ſternum, and from the upper and fore part of the clavicle.	Into the maſtoid proceſs, and as far back as the lambdoidal ſuture.	To move the head to one ſide, or when both muſcles act, to bend it forwards.
Muscles ſituated between the trunk and the os hyoides.	1. Omo-hyoideus (A).	From the upper coſta of the ſcapula near its niche; from part of a ligament that extends acroſs this niche, and ſometimes by a few fibres, from the coracoid proceſs.	Into the baſis of the os hyoides.	To draw the os hyoides in an oblique direction downwards.
	2. Sterno-hyoideus.	From the cartilage of the firſt rib, the inner and upper part of the ſternum, and a ſmall part of the clavicle.	Into the baſis of the os hyoides.	To draw the os hyoides downwards.
	3. Hyo-thyroideus.	From part of the baſis and horn of the os hyoides.	Into a rough oblique line at the ſide of the thyroid cartilage.	To raiſe the thyroid cartilage, or depreſs the os hyoides
	4. Sterno-thyroideus.	From between the cartilages of the 1ſt and 2d ribs at the upper and inner part of the ſternum.	Immediately under the hyo-thyroideus.	To pull the thyroid cartilage downwards.
	5. Crico-thyroideus.	From the anterior part and ſide of the cricoid cartilage.	Into the lower part and inferior horn of the thyroid cartilage.	To pull the cricoid cartilage upwards and backwards, or the thyroid forwards and downwards.
——ſituated between the os hyoides and lower jaw,	1. Diagraſticus (B).	From a foſſa at the root of the maſtoid proceſs, and likewiſe from the os hyoides.	Into the lower and anterior part of the chin.	To draw the lower jaw downwards.
	2. Stylo-hyoideus (c).	From the baſis of the ſtyloid proceſs.	Into the ſide and fore part of the os hyoides near its baſe.	To draw the os hyoides obliquely upwards.

(z) This, on account of its two origins, is by Albinus deſcribed as two diſtinct muſcles, which he names *ſterno-maſtoideus* and *cleido-maſtoideus*.

(A) This muſcle does not always ariſe from the coracoid proceſs, it ſeems to have been improperly named *coraco-hyoides* by Douglas and Albinus. Winſlow calls it *omo-hyoideus*, on account of its general origin from the ſcapula.

(B) From δις and γαστηρ *(biventer)*, becauſe it has two fleſhy bellies with a middle tendon. This tendon paſſes through the ſtylo-hyoideus.

(c) In ſome ſubjects we meet with another muſcle, which from its having nearly the ſame origin, inſertion, and uſe as this, has been named *ſtylo-hyoideus alter*.

Of the Muſcles.

	Name.	*Origin.*	*Inſertion.*	*Uſe.*
	3. Mylo-hyoideus (D).	From the inſide of the lower jaw, between the laſt dens molaris and the chin.	Into the baſis of the os hyoides.	To move the os hyoides to either ſide, forwards or upwards.
	4. (E) Geno-hyoideus.	From the inſide of the chin.	Into the baſe of the os hyoides.	To move the os hyoides forwards or upwards.
	5. Genio-gloſſus.	From the inſide of the chin.	Into the tongue and baſis of the os hyoides.	To move the tongue in various directions.
	6. Hyo-gloſſus (F).	From the horn, baſis, and appendix of the os hyoides.	Into the tongue laterally.	To draw the tongue downwards and inwards.
	7. Lingualis.	Laterally from the root of the tongue.	Into the extremity of the tongue.	To ſhorten the tongue and draw it backwards.
	8. Stylo-gloſſus.	From the ſtyloid proceſs, and ſometimes alſo from a ligament that extends from thence to the angle of the lower jaw.	Into the ſide of the tongue from the root to near its tip.	To move the tongue backwards and to one ſide.
	9. Stylo-pharyngæus.	From the baſis of the ſtyloid proceſs.	Into the ſide of the pharynx and poſterior part of the thyroid cartilage.	To raiſe the thyroid cartilage and pharynx, and likewiſe to dilate the latter.
	10. Circumflexus-palati.	From near the bony part of the Euſtachian tube, and from the ſpinous proceſs of the os ſphenoides.	Into the ſemilunar edge of the os palati and the velum pendulum palati (G).	To dilate and draw the velum obliquely downwards.
	11. Levator palati.	From the membranous part of the Euſtachian tube, and the extremity of the os petroſum.	Into the velum pendulum palati.	To pull the velum backwards.
Muscles ſituated about the fauces,	1. Palato-pharyngæus.	From the lower and anterior part of the cartilaginous extremity of the Euſtachian tube (H); the tendinous expanſion of the circumflexus palati; and the velum pendulum palati near the baſis and back part of the uvula.	Into the upper and poſterior part of the thyroid cartilage.	To raiſe the pharynx and thyroid cartilage, or to pull the velum and uvula backwards and downwards.

Of the Muſcles.

2. Conſtrictor

(D) So named from its ariſing near the dentes molares (μυλοι), and its being inſerted into the os hyoides.

(E) From γενειον, *mentum*, the "chin."

(F) From κερας, *cornu*, and γλωσσα, *lingua*, "the tongue."

(G) This muſcle in its courſe forms a round tendon, which, after croſſing over a kind of hook formed by the inner plate of the pterygoid proceſs of the ſphenoid bone, expands into a tendinous membrane.

(H) The few fibres that ariſe from the Euſtachian tube are deſcribed as a diſtinct muſcle by Albinus, under the name of *ſalpingo pharyngeus*. They ſerve to dilate the mouth of the tube.

	Name.	*Origin.*	*Insertion.*	*Use.*
	2. Constrictor isthmi faucium.	From near the basis of the tongue laterally.	Into the velum pendulum palati, near the basis and fore part of the uvula.	To raise the tongue and draw the velum towards it (I).
	3. Azygos uvulæ.	From the end of the suture that unites the ossa palati.	Into the extremity of the uvula.	To shorten the uvula, and bring it forwards and upwards.
Muscles at the back part of the pharynx	1. Constrictor pharyngis superior.	From the cuneiform process of the occipital bone; the pterygoid process of the os sphenoides, and from each jaw near the last dens molares (K).	Into the middle of the pharynx.	To move the pharynx upwards and forwards, and to compress its upper part.
	2. Constrictor pharyngis medius (L).	From the horn and appendix of the os hyoides, and from the ligament that unites it with the thyroid cartilage.	Into the middle of the processus cuneiformis of the occipital bone, about its middle and before the great foramen.	To draw the os hyoides and pharynx upwards, and to compress the latter.
	3. Constrictor pharyngis inferior (M).	From the cricoid and thyroid cartilages.	Into the middle of the pharynx.	To compress part of the pharynx.
——about the glottis - - -	1. Crico-arytænoideus lateralis.	From the side of the cricoid cartilage.	Into the basis of the arytænoid cartilage laterally.	To open the glottis.
	2. Crico-arytænoideus posticus.	From the cricoid cartilage posteriorly.	Into the basis of the arytænoid cartilage posteriorly.	To open the glottis.
	3. Arytænoideus obliquis.	From the basis of one of the arytænoid cartilages.	Near the extremity of the other arytænoid cartilage.	To draw the parts it is connected with towards each other.
	4. Arytænoideus transversus.	From one of the arytænoid cartilages laterally.	Into the other arytænoid cartilage laterally.	To shut the glottis.
	5. Thyreo-arytænoideus.	From the posterior and under part of the thyroid cartilage.	Into the arytænoid cartilage.	To draw the arytænoid cartilage forwards.
	6. Arytæno-epiglottideus.	From the upper part of the arytænoid cartilage laterally.	Into the side of the epiglottis.	To move the epiglottis outwards.
	7. Thyreo-epiglottideus.	From the thyroid cartilage.	Into the side of the epiglottis.	To pull the epiglottis obliquely downwards (N.)

Muscles

(I) This muscle, and the palato-pharyngæus, likewise serve to close the passage into the fauces, and to carry the food into the pharynx.

(K) The three orders of fibres here mentioned, with a few others derived from the tongue, have given occasion to Douglas to describe them as four distinct muscles, under the names of *cephalo-pharyngæus*, *mylo-pharyngæus*, *ptery-pharyngæus*, and *glosso-pharyngæus*.

(L) Douglas makes two muscles of this, the *hyo-pharyngæus* and *syndesmo-pharyngæus*.

(M) The crico-pharyngæus and thyro-pharyngæus of Douglas.

(N) When either this or the preceding muscle acts with its fellow, the epiglottis is drawn directly downwards upon the glottis.

	Name.	*Origin.*	*Inſertion.*	*Uſe.*
Muscles at the fore part of the neck, cloſe to the vertebræ	1. Rectus capitis internus major.	From the anterior extremities of the tranſverſe proceſſes of the five lowermoſt cervical vertebræ.	Into the fore part of the cuneiform proceſs of the os occipitis.	To bend the head forwards.
	2. Rectus capitis internus minor.	From the anterior and upper part of the firſt cervical vertebra.	Near the baſis of the condyloid proceſs of the os occipitis.	To aſſiſt the laſt deſcribed muſcle.
	3. Rectus capitis lateralis.	From the anterior and upper part of the tranſverſe proceſs of the firſt cervical vertebra.	Into the os occipitis, oppoſite to the ſtylo-maſtoid foramen.	To move the head to one ſide.
	4. Longus colli.	Within the thorax, laterally from the bodies of the three uppermoſt dorſal vertebræ; from the baſis and fore part of the tranſverſe proceſſes of the firſt and ſecond dorſal vertebræ, and of the laſt cervical vertebra; and laſtly, from the anterior extremities of the tranſverſe proceſſes of the 6th, 5th, 4th, and 3d cervical vertebræ.	Into the ſecond cervical vertebra anteriorly.	To pull the neck to one ſide (o).
——— at the fore part of the abdomen	1. Obliquus externus.	From the lower edges of the eight inferior ribs, near their cartilages.	Into the linea alba (p), oſſa pubis (q), and ſpine of the ilium (r).	To compreſs and ſupport the viſcera, aſſiſt in evacuating the fæces and urine, draw down the ribs, and bend the trunk forwards, or obliquely to one ſide.
	2. Obliquus internus.	From the ſpinous proceſs of the three lowermoſt lumbar	Into the cartilages of all the falſe ribs, linea alba (s), and	To aſſiſt the obliquus externus.

(o) When both muſcles act, the neck is drawn directly forwards.

(p) The linea alba is that tendinous expanſion which reaches from the cartilago enſiformis to the os pubis. It is formed by the interlacement of the tendinous fibres of the oblique and tranſverſe muſcles, and on this account ſome anatomiſts have conſidered theſe as three digaſtric muſcles.

(q) A little above the pubis the tendinous fibres of this muſcle ſeparate from each other, ſo as to form an opening called the *ring* of the obliquus externus, and commonly, though improperly, the ring of the abdominal muſcles, there being no ſuch aperture either in the tranſverſalis or obliquus internus. This ring in the male ſubject affords a paſſage to the ſpermatic veſſels, and in the female to the round ligament of the uterus.

(r) From the anterior and upper ſpinous proceſs of the ilium, this muſcle is ſtretched tendinous to the os pubis, and thus forms what is called by ſome *Fallopius's*, and by others *Poupart's ligament*. The blood-veſſels paſs under it to the thigh.

(s) The tendon formed by the upper part of this muſcle in its way to the linea alba is divided into two layers. The poſterior layer runs under, and the anterior one over, the rectus muſcle.

	Name.	*Origin.*	*Inſertion.*	*Uſe.*
		vertebræ, the back part of the os ſacrum, the ſpine of the ilium, and back part of Fallopius's ligament (t).	fore part of the pubis.	
	3. Tranſverſalis.	From the cartilages of the ſeven inferior ribs; the tranſverſe proceſſes of the laſt dorſal, and four upper lumbar vertebræ; the inner part of Fallopius's ligament and the ſpine of the ilium.	Into the linea alba and cartilago enſiformis.	To compreſs the abdominal viſcera.
	4. Rectus abdominis.	From the upper edge of the pubis and the ſymphyſis pubis.	Into the cartilages of the 5th, 6th, and 7th ribs, and the edge of the cartilago enſiformis (u).	To compreſs the fore part of the abdomen, and to bend the trunk forwards.
	5. Pyramidalis (v).	From the anterior and upper part of the pubis.	Into the linea alba and inner edge of the rectus, commonly about two inches above the pubis.	To aſſiſt the lower portion of the rectus.
Muscles at the fore part of the thorax -	1. Pectoralis Major.	From the cartilaginous ends of the 5th and 6th ribs; the ſternum, and anterior part of the clavicle.	Into the upper and inner part of the os humeri (w).	To draw the arm forwards, or obliquely forwards.
	2. Subclavius.	From the cartilage of the firſt rib.	Into the under ſurface of the clavicle.	To move the clavicle forwards and downwards, and to aſſiſt in raiſing the firſt rib.
	3. Pectoralis minor (x).	From the upper edges of the 3d, 4th, and 5th ribs.	Into the coracoid proceſs of the ſcapula.	To move the ſcapula forwards and downwards, or to elevate the ribs.
	4. Serratus Magnus.	From the eight ſuperior ribs.	Into the baſis of the ſcapula.	To bring the ſcapula forwards.

Muscles

(t) From this part it detaches ſome fibres which extend downwards upon the ſpermatic chord, and form what is deſcribed as the cremaſter muſcle.

(u) The fibres of the rectus are generally divided by three tendinous interſections. The two upper thirds of this muſcle paſſing between the tendinous layers of the obliquus internus, are incloſed as it were in a ſheath; but at its lower part we find it immediately contiguous to the peritonæum, the inferior portion of the tendon of the tranſverſalis paſſing over the rectus, and adhering to the anterior layer of the obliquus internus.

(v) This muſcle is ſometimes wanting.

(w) The fibres of this muſcle paſs towards the axilla in a folding manner, and with thoſe of the latiſſimus dorſi from the arm-pit.

(x) This and ſome other muſcles derive their name of *ſerratus*, from their ariſing by a number of tendinous or fleſhy digitations, reſembling the teeth of a ſaw (*ſerra*).

	Name.	*Origin.*	*Inſertion.*	*Uſe.*
MUSCLES that concur in forming the thorax, - -	1. Diaphragma (Y).			
	2. Levatores conſtarum.	From the tranſverſe proceſſes of the laſt cervical and the eleven upper dorſal vertebræ.	Into the upper ſide of each rib, near its tuberoſity.	To move the ribs upwards and outwards.
	3. Intercoſtales externi.	From the lower edge of each upper rib.	Into the ſuperior edge of each lower rib.	To elevate the ribs
	4. Intercoſtales interni (A).			
	5. Sterno-coſtales (B).	From the cartilago enſiformis, and lower and middle part of the ſternum.	Into the cartilages of the 2d, 3d, 4th, 5th, and 6th ribs.	To depreſs the cartilages of the ribs.
——— at the back part of the neck and trunk, - -	1. Trapezius (C), or cucullaris.	From the middle of the os occipitis, and the ſpinous proceſſes of the two inferior cervical, and of all the dorſal, vertebræ (D).	Into the poſterior half of the clavicle, part of the acromion, and the ſpine of the ſcapula.	To move the ſcapula.
	2. Rhomboideus (E).	From the ſpinous proceſſes of the three lowermoſt cervical, and of all the dorſal vertebræ.	Into the baſis of the ſcapula.	To move the ſcapula upwards and backwards.
	3 Latiſſimus dorſi.	From part of the ſpine of the os ilium, the ſpinous proceſſes of the os ſacrum and lumbar vertebræ, and of ſix or eight of the dorſal	Into the os humeri, at the inner edge of the groove for lodging the long head of the biceps muſcle.	To draw the os humeri downwards and backwards, and to roll it upon its axis.

(Y) For a deſcription of the diaphragm, ſee Part IV. Sect. IV.

(A) The origin, inſertion, and uſe of the internal intercoſtals, are ſimilar to thoſe of the external. The reader, however, will be pleaſed to obſerve, that the intercoſtales externi occupy the ſpaces between the ribs only from the ſpine to their cartilages; from thence to the ſternum, there being only a thin membrane, which is ſpread over the intercoſtales interni; and the latter, on the contrary, extend only from the ſternum to the angles of each rib.

The fibres of the external muſcles run obliquely forwards; thoſe of the internal obliquely backwards. This difference in the direction of their fibres induced Galen to ſuppoſe that they were intended for different uſes; that the external intercoſtals, for inſtance, ſerve to elevate, and the internal ones to depreſs the ribs. Fallopius ſeems to have been the firſt who ventured to diſpute the truth of this doctrine, which has ſince been revived by Boyle, and more lately ſtill by Hamberger, whoſe theoretical arguments on this ſubject have been clearly refuted by the experiments of Haller.

(B) Theſe conſiſt of four, and ſometimes five diſtinct muſcles on each ſide. Veſalius, and after him Douglas and Albinus, conſider them as forming a ſingle muſcle, which, on account of its ſhape, they name *triangularis*. Verheyen, Winſlow, and Haller, more properly deſcribe them as ſo many ſeparate muſcles, which, on account of their origin and inſertion, they name *ſterno-coſtales*.

(C) So named by Riolanus, from τραπεζα, on account of its quadrilateral ſhape. Columbus and others gave it the name of *cucullaris*, from its reſemblance to a monk's hood.

(D) The tendinous fibres of this muſcle, united with thoſe of its fellow in the nape of the neck, form what is called the *ligamentum colli*.

(E) This muſcle conſiſts of two diſtinct portions, which are deſcribed as ſeparate muſcles by Albinus, under the names of *rhomboideus minor* and *rhomboideus major*.

Name.	*Origin.*	*Inſertion.*	*Uſe*
	ſal vertebræ; alſo from the four inferior falſe ribs near their cartilages.		
4. Serratus inferior poſticus.	From the ſpinous proceſſes of the two lowermoſt dorſal, and of three of the lumbar vertebræ.	Into the lower edges of the three or four lowermoſt ribs near their cartilages.	To draw the ribs outwards, downwards, and backwards.
5. Levator ſcapulæ.	From the tranſverſe proceſſes of the four uppermoſt vertebræ colli.	Into the upper angle of the ſcapula.	To move the ſcapula forwards and upwards.
6. Serratus ſuperior poſticus.	From the lower part of the ligamentum colli, the ſpinous proceſs of the lowermoſt cervical vertebra, and of the two ſuperior dorſal vertebræ.	Into the 2d, 3d, and 4th ribs.	To expand the thorax.
7. Splenius (F).	From the ſpinous proceſſes of the four or five uppermoſt vertebræ of the back, and of the lowermoſt cervical vertebra.	Into the tranſverſe proceſſes of the two firſt cervical vertebræ, the upper and back part of the maſtoid proceſs, and a ridge on the os occipitis.	To move the head backwards.
8. Complexus (G).	From the tranſverſe proceſſes of the four or five uppermoſt dorſal, and of the ſix lowermoſt cervical vertebræ.	Into the os occipitis.	To draw the head backwards.
9. Trachelo-maſtoideus (H).	From the tranſverſe proceſſes of the firſt dorſal vertebra, and four or five of the lowermoſt, cervical vertebræ.	Into the maſtoid proceſs.	To draw the head backwards.
10. Rectus capitis poſticus major.	From the ſpinous proceſs of the ſecond cervical vertebra.	Into the os occipitis.	To extend the head and draw it backwards.
11. Rectus capitis poſticus minor.	From the firſt vertebra of the neck.	Into the os occipitis.	To aſſiſt the rectus major.
12. Obliquus ſuperior capitis.	From the tranſverſe proceſs of the firſt cervical vertebra.	Into the os occipitis.	To draw the head backwards.
13. Obliquus inferior capitis.	From the ſpinous proceſs of the ſecond cervical vertebra.	Into the tranſverſe proceſs of the firſt cervical vertebra.	To draw the face towards the ſhoulder, and to move the firſt vertebra upon the ſecond.

(F) According to ſome writers, this muſcle has gotten its name from its reſemblance to the ſpleen; others derive it from *ſplenium ſplint*.

(G) So named on account of its complicated ſtricture.

(H) So named from its origin from the neck (τραχηλοις) and its inſertion into the maſtoid proceſs.

Of the Tuſcles.

Of the Muſcles.

Name.	*Origin.*	*Inſertion.*	*Uſe.*
14. Sacro-lumbalis (1).	From the back part of the os ſacrum, ſpine of the ilium, ſpinous proceſſes and roots of the tranſverſe proceſſes of the vertebræ of the loins.	Into the lower edge of each rib.	To draw the ribs downwards, move the body upon its axis, aſſiſt in erecting the trunk, and turn the neck backwards, or to one ſide.
15. Longiſſimus dorſi (K).	The ſame as that of the ſacro-lumbalis.	Into the tranſverſe proceſſes of the dorſal vertebræ.	To ſtretch the vertebræ of the back, and keep the trunk erect.
16. Spinalis dorſi.	From the ſpinous proceſſes of the uppermoſt lumbar and lowermoſt dorſal vertebræ.	Into the ſpinous proceſſes of the nine ſuperior dorſal vertebræ.	To extend the vertebræ.
17. Semi-ſpinalis dorſi.	From the tranſverſe proceſſes of the 7th, 8th, 9th, and 10th vertebræ of the back.	Into the ſpinous proceſſes of the four uppermoſt dorſal, and lowermoſt of the cervical vertebræ.	Te extend the ſpine obliqnely backwards.
18. Multifidus Spinæ (L).	From the os ſacrum, ilium, oblique and tranſverſe proceſſes of the lumbar vertebræ, tranſverſe proceſſes of the dorſal, and four of the cervical vertebræ.	Into the ſpinous proceſſes of the lumbar, dorſal, and ſix of the cervical vertebræ.	To extend the back and draw it backwards, or to one ſide.
19. Semi-ſpinalis colli.	From the tranſverſe proceſſes of the five or ſix uppermoſt dorſal vertebræ.	Into the ſpinous proceſſes of the 2d, 3d, 4th, 5th, and 6th cervical vertebræ.	To ſtretch the neck obliquely backwards.
20. Scalenus (M).	From the tranſverſe proceſſes of the five inferior cervical vertebræ.	Into the upper and outer part of the firſt andſecond ribs.	To move the neck forwards, or to one ſide.

21. Inter-

(1) Several thin faſciculi of fleſhy fibres ariſe from the lower ribs, and terminate in the inner ſide of this muſcle. Steno names them *maſculi ad ſacro lumbalem acceſſorii*. The ſacro-lumbalis likewiſe ſends off a fleſhy ſlip from its upper part, which by Douglas and Albinus is deſcribed as a diſtinct muſcle, under the name of *cervicalis deſcendens*. Morgagni has very properly conſidered it as a part of the ſacro-lumbalis.

(K) At the upper part of this muſcle a broad thin layer of fleſhy fibres is found croſſing, and intimately adhering to it. This portion, which is deſcribed by Albinus, under the name of *tranſverſalis cervicis*, may very properly be conſidered as an appendage to the longiſſimus dorſi. It ariſes from the tranſverſe proceſſes of the five or ſix ſuperior dorſal vertebræ, and is inſerted into the tranſverſe proceſſes of the ſix inferior cervical vertebræ. By means of this appendage the longiſſimus dorſi may ſerve to move the neck to one ſide, or obliquely backwards.

(L) Anatomiſts in general have unneceſſarily multiplied the muſcles of the ſpine. Albinus has the merit of having introduced greater ſimplicity into this part of myology. Under the name of *multifidus ſpinæ*, he has very properly included thoſe portions of muſcular fleſh intermixed with tendinous fibres, ſituated cloſe to the back part of the ſpine, and which are deſcribed by Douglas under the names of *tranſverſales colli, dorſi, & lumborum*.

(M) The ancients gave it this name from its reſemblance to an irregular triangle (σκαληνος). It conſiſts of three fleſhy portions. The anterior one affords a paſſage to the axillary artery, and between this and the middle portion we find the nerves going to the upper extremities. The middle is in part covered by the poſterior portion, which is the longeſt and thinneſt of the three.

Of the Muſcles.

	Name.	*Origin.*	*Inſertion.*	*Uſe.*
	21. Inter-ſpinalis (N).	From the upper part of each of the ſpinous proceſſes of the ſix inferior cervical vertebræ.	Into the under part of each of the ſpinous proceſſes of the vertebræ above.	To draw the ſpinous proceſſes towards each other.
	22. Inter-tranſverſales (O).	From the upper part of each of the tranſverſe proceſſes of the vertebræ.	Into the under part of each of the tranſverſe proceſſes of the vertebræ above.	To draw the tranſverſe proceſſes towards each other.
Muscles within the cavity of the abdomen, on the anterior and lateral parts of the ſpine,	1. Pſoas parvus (P).	From the ſides and tranſverſe proceſſes of the uppermoſt lumbar vertebra, and ſometimes of the lowermoſt dorſal vertebra.	Into the brim of the pelvis, at the junction of the os pubis with the ilium.	To bend the loins forwards.
	2. Pſoas magnus.	From the bodies and tranſverſe proceſſes of the laſt dorſal, and all the lumbar vertebræ.	Into the os femoris, a little below the trochanter minor.	To bend the thigh forwards.
	3. Iliacus internus.	From the inner lip, hollow part, and edge of the os ilium.	In common with the pſoas magnus.	To aſſiſt the pſoas magnus.
	4. Quadratus lumborum (Q).	From the poſterior part of the ſpine of the ilium.	Into the tranſverſe proceſſes of the four uppermoſt lumbar vertebræ, the inferior edge of the laſt rib, and the ſide of the lowermoſt dorſal vertebra.	To ſupport the ſpine, or to draw it to one ſide.
	5. Coccygæus.	From the poſterior and inner edge of the ſpine of the iſchium.	Into the lower part of the os ſacrum, and almoſt the whole length of the os coccygis latterally.	To draw the os coccygis forwards and inwards (R)
——— on the ſcapula and upper part of the os humeri,	1. Deltoides (S).	From the clavicle, proceſſus acromion, and ſpine of the ſcapula.	Into the anterior and middle part of the os humeri.	To raiſe the arm.
	2. Supra-ſpinatus.	From the baſis, ſpine, and upper coſta of the ſcapula.	Into a large tuberoſity at the head of the os humeri.	To raiſe the arm.

(N) In the generality of anatomical books we find theſe muſcles divided into *inter-ſpinalis cervicis, dorſi,* and *lumborum,* but we do not find any ſuch muſcles either in the loins or back.

(O) Theſe muſcles are to be found only in the neck and loins; which have been deſcribed, as the *inter-tranſverſales dorſi* being rather ſmall tendons than muſcles.

(P) This and the following pair of muſcles derive their name of *pſoas* from ψοα, *lumbus,* on account of their ſituation at the anterior part of the loins.

(Q) So called from its ſhape, which is that of an irregular ſquare.

(R) Some of the fibres of this muſcle are united with thoſe of the levator ani, ſo that it aſſiſts in cloſing the lower part of the pelvis.

(S) So named from its ſuppoſed reſemblance to the Greek Δ reverſed.

	Name.	*Origin.*	*Inſertion.*	*Uſe.*
	3. Infra-ſpinatus.	From the baſe and ſpine of the ſcapula.	Into the upper and middle part of the tuberoſity.	To roll the os humeri outwards.
	4. Teres minor (T)	From the inferior coſta of the ſcapula.	Into the lower part of the tuberoſity.	To aſſiſt the infra ſpinatus.
	5. Teres major.	From the inferior angle, and inferior coſta of the ſcapula.	Into the ridge at the inner ſide of the groove formed for the long head of the biceps.	To aſſiſt in the rotatory motion of the arm.
	6. Subſcapularis.	From the baſis, ſuperior and inferior coſta of the ſcapula.	Into the upper part of a ſmall tuberoſity at the head of the os humeri.	To roll the arm inwards.
	7. Coraco-brachialis (U)	From the coracoid proceſs of the ſcapula.	Into the middle and inner ſide of the os humeri.	To roll the arm forwards and upwards.
Muscles on the os humeri, - -	1. Biceps flexor cubiti.	By two heads, one from the coracoid proceſs, and the other, or long head, from the upper and outer edge of the glenoid cavity of the ſcapula.	Into the tuberoſity at the upper end of the radius.	To bend the fore-arm.
	2. Brachialis internus.	From the os humeri, below, and at each ſide of the tendon of the deltoides.	Into a ſmall tuberoſity at the fore part of the coronoid proceſs of the ulna.	To aſſiſt in bending the fore-arm.
	3. Triceps extenſor cubiti.	By three heads: the firſt, from the inferior coſta of the ſcapula; the ſecond, from the upper and outer part of the os humeri; and the third, from the back part of that bone.	Into the upper and outer part of the olecranon.	To extend the fore-arm.
——— on the fore-arm, - -	1. Supinator longus.	From the outer ridge and anterior ſurface of the os humeri, a little above its outer condyle.	Into the radius near its ſtyloid proceſs.	To aſſiſt in turning the palm of the hand upwards.
	2. Extenſor carpi radialis longus.	Immediately below the origin of the nator longus.	Into the upper part of the metacarpal bone of the fore-finger.	To extend the wriſt.
	3. Extenſor carpi radialis brevis.	From the outer and lower part of the outer condyle of the os humeri, and the upper part of the radius.	Into the upper part of the metacarpal bone of the middle finger.	To aſſiſt the extenſor longus.
	4. Extenſor digitorum communis.	From the outer condyle of the os humeri.	Into the back part of all the bones of the fore finger.	To extend the fingers.

5. Extenſor

(T) This and the following pair are called *teres*, from their being of a long and round ſhape.
(U) This muſcle affords a paſſage to the muſculo-cutaneous nerve.

Name.	*Origin.*	*Inſertion.*	*Uſe.*
5. Extenſor minimi digiti.	From the outer condyle of the os humeri.	Into the bones of the little finger.	To extend the little finger.
6. Extenſor carpi ulnaris.	From the outer condyle of the os humeri.	Into the metacarpal bone of the little finger.	To aſſiſt in extending the wriſt.
7. Anconæus (v).	From the outer condyle of the os humeri.	Into the outer edge of the ulna.	To extend the fore arm.
8. Flexor carpi ulnaris.	From the inner condyle of the os humeri, and anterior edge of the olecranon (w).	Into the os piſiforme.	To aſſiſt in bending the hand.
9. Palmaris longus.	From the inner condyle of the os humeri.	Into the internal annular ligament, and aponeuroſis palmaris (x).	To bend the hand.
10. Flexor carpi radialis.	From the inner condyle of the os humeri.	Into the metacarpal bone of the fore finger.	To bend the hand.
11. Pronator radii teres.	From the outer condyle of the os humeri, and coronoid proceſs of the ulna.	Into the anterior and convex edge of the radius near its middle.	To roll the hand inwards.
12. Flexor ſublimis perforatus (y).	From the inner condyle of the os humeri, inner edge of the coronoid proceſs of the ulna, and upper and anterior part of the radius.	Into the ſecond bone of each finger.	To bend the ſecond joint of the finger.
13. Supinator radii brevis.	From the outer condyle of the os humeri, and poſterior ſurface and outer edge of the ulna.	Into the anterior, inner, and upper part of the radius.	To roll the radius outwards.
14. Abductor pollicis longus.	From the middle and back part of the ulna, interoſſeous ligament, and radius.	By two tendons into the os trapezium, and firſt bone of the thumb.	To ſtretch the firſt bone of the thumb outwards.
15. Extenſor minor pollicis.	From the back part of the ulna, and interoſſeous ligament and radius.	Into the convex part of the ſecond bone of the thumb.	To extend the ſecond bone of the thumb obliquely outwards.
16. Extenſor major pollicis.	From the back of the ulna and interoſſeous ligament.	Into the third and laſt bone of the thumb.	To ſtretch the thumb obliquely backwards.
17. Indicator.	From the middle of the ulna.	Into the metacarpal bone of the forefinger.	To extend the forefinger.

18 Flexor

(v) So called from ἀγκων, *cubitus*.

(w) Between the two origins of this muſcle we find the ulnor-nerve going to the fore arm.

(x) The aponeuroſis palmaris is a tendinous membrane that extends over the palm of the hand. Some anatomiſts have ſuppoſed it to be a production of the tendon of this muſcle, but without ſufficient grounds; for in ſome ſubjects we find the palmaris longus inſerted wholly into the annular ligament, ſo as to be perfectly diſtinct from this aponeuroſis; and it now and then happens, that no palmaris longus is to be found, whereas this expanſion is never deficient.

(y) This muſcle is named *perforatus*, on account of the four tendons in which it terminates, being perforated by thoſe of another muſcle, the perforans.

	Name.	*Origin.*	*Inſertion.*	*Uſe.*
	18. Flexor profundus perforans.	From the upper and fore part of the ulna, and interoſſeous ligament.	Into the fore part of the laſt bone of each of the fingers.	To bend the laſt joint of the fingers.
	19. Flexor longus pollicis.	From the upper and fore part of the radius.	Into the laſt joint of the thumb.	To bend the laſt joint of the thumb.
	20. Pronator radii quadratus.	From the inner and lower part of the ulna.	Into the radius, oppoſite to its origin.	To roll the radius inwards, and of courſe to aſſiſt in the pronation of the hand.
Muscles on the hand,	1. Lumbricales (z).	From the tendons of the perforans.	Into the tendons of the extenſor digitorum communis.	To bend the firſt, and to extend the two laſt joints of the fingers (a).
	2. Abductor brevis pollicis.	From the fore part of the internal annular ligament, os ſcaphoides, and one of the tendons of the abductor longus pollicis.	Into the outer ſide of the 2d bone of the thumb, near its root.	To move the thumb from the fingers.
	3. Opponens pollicis.	From the inner and anterior part of the internal annular ligament, and from the os ſcaphoides.	Into the firſt bone of the thumb.	To move the thumb inwards, and to turn it upon its axis.
	4. Flexor brevis pollicis.	From the os trapezoides, internal annular ligament, os magnum, and os unciforme.	Into the oſſa ſeſamoidea and ſecond bone of the thumb.	To bend the ſecond joint of the thumb.
	5. Abductor pollicis.	From the metacarpal bone of the middle finger.	Into the baſis of the ſecond bone of the thumb.	To move the thumb towards the fingers.
	6. Abductor indices.	From the inner ſide of the firſt bone of the thumb, and from the os trapezium.	Into the firſt bone of the fore finger poſteriorly.	To move the fore finger towards the thumb.
	7. Palmaris brevis.	From the internal annular ligament, and aponeuroſis palmaris.	Into the os piſiforme, and the ſkin covering the abductor minimi digiti.	To contract the palm of the hand.
	8. Abductor minimi digiti.	From the internal annular ligament and os piſiforme.	Into the ſide of the firſt bone of the little finger.	To draw the little finger from the reſt.
	9. Flexor parvus minimi digiti.	From the os unciforme and internal annular ligament.	Into the firſt bone of the little finger.	To bend the little finger.
	10. Abductor metacarpi minimi digiti.	From the os unciforme and internal annular ligament.	Into the metacarpal bone of the little finger.	To move that bone towards the reſt.
	11. Interoſſei interni.	Situated between the metacarpal bones.	Into the roots of the fingers.	To extend the fingers and move them towards the thumb (b).
	12. Interoſſei			

(z) So named from their being ſhaped ſomewhat like the lumbricus or earth-worm.

(a) Fallopius was the firſt who remarked the two oppoſite uſes of this muſcle. Their extending power is owing to their connection with the extenſor communis.

(b) The third interoſſeus internus (for there are four of the externi and three of the interni) differs from the reſt in drawing the middle finger from the thumb.

Of the Muſcles.

	Name.	*Origin.*	*Inſertion.*	*Uſe.*
	12. Interoſſei externi.	Situated between the metacarpal bones on the back of the hand.	Into the roots of the fingers.	To extend the fingers; but the firſt draws the middle finger inwards, the ſecond draws it outwards, and the third draws the ring finger inwards.
Muscles at the back part of the pelvis, and upper part of the thigh, - -	1. Glutæus (c) maximus.	From the ſpine of the ilium, poſterior ſacro iſchiatic ligaments, os ſacrum, and os occygis.	Into the upper part of the *linea aſpera* of the os femoris.	To extend the thigh and draw it outwards.
	2. Glutæus medius.	From the ſpine and ſuperior ſurface of the ilium.	Into the outer and back part of the great trochanter of the os femoris.	To draw the thigh outwards and a little backwards, and when it is bended, to roll it.
	3. Glutæus minimus.	From the outer ſurface of the ilium and the border of its great niche.	Into the upper and anterior part of the great trochanter.	To aſſiſt the former.
	4. Pyriformis (d).	From the anterior part of the os ſacrum.	Into a cavity at the root of the trochanter major.	To roll the thigh outwards.
	5. Gemini (e).	By two portions, one from the outer ſurface of the ſpine of the iſchium; the other from the tuberoſity of the iſchium and poſterior ſacro-iſchiatic ligament.	Into the ſame cavity as the pyriformis.	To roll the thigh outwards, and likewiſe to confine the tendon of the obturator internus, when the latter is in action.
	6. Obturator internus.	From the ſuperior half of the inner border of the foramen thyroideum.	Into the ſame cavity with the former.	To roll the thigh outwards.
	7. Quadratus (f) femoris.	From the tuberoſity of the iſchium.	Into a ridge between the trochanter major and trochanter minor.	To move the thigh outwards.
——— on the thigh (g), - - -	1. Biceps flexor cruris.	By two heads; one from the tuberoſity of the iſchium,	Into the upper and back part of the fibula (h).	To bend the leg.

(c) From γλουτος, *nates*.

(d) So named from its pear-like ſhape.

(e) The two portions of this muſcle having been deſcribed as two diſtinct muſcles by ſome anatomiſts, have occaſioned it to be named *gemini*. The tendon of the obturator internus runs between theſe two portions.

(f) This muſcle is not of the ſquare ſhape its name would ſeem to indicate.

(g) The muſcles of the leg and thigh are covered by a broad tendinous membrane called *faſcia lata*, that ſurrounds them in the manner of a ſheath. It is ſent off from the tendons of the glutæi and other muſcles, and dipping down between the muſcles it covers, adheres to the linea aſpera, and ſpreading over the joint of the knee, gradually diſappears on the leg. It is thickeſt on the inſide of the thigh.

(h) The tendon of this muſcle forms the *outer ham-ſtring*.

Name.	Origin.	Inſertion.	Uſe.
	the other from the linea aſpera near the inſertion of the glutæus maximus.		
2. Semitendinoſus.	From the tuberoſity of the iſchium.	Into the upper and inner part of the tibia.	To bend and draw the leg inwards.
3. Semi-membranoſus (I).	From the tuberoſity of the iſchium.	Into the upper and back part of the head of the tibia.	To bend the leg.
4. Tenſor vaginæ femoris.	From the ſuperior and anterior ſpinous proceſs of the ilium.	Into the inner ſide of the faſcia lata, which covers the outſide of the thigh.	To ſtretch the faſcia.
5. Sartorius.	From the ſuperior and anterior ſpinous proceſs of the ilium.	Into the upper and inner part of the tibia.	To bend the leg inwards (K).
6. Rectus.	By two tendons; one from the anterior and inferior ſpinous proceſs of the ilium; the other from the poſterior edge of the cotyloid cavity.	Into the upper and fore-part of the patella.	To extend the leg.
7. Gracilis.	From the fore-part of the iſchium and pubis.	Into the upper and inner part of the tibia.	To bend the leg.
8. Vaſtus externus (L).	From the anterior and lower part of the great trochanter, and the outer edge of the linea aſpera.	To the upper and outer part of the patella.	To extend the leg.
9. Vaſtus internus.	From the inner edge of the linea aſpera, beginning between the fore-part of the os femoris and the root of the leſſer trochanter.	Into the upper and inner part of the patella.	To extend the leg.
10. Cruræus (M).	From the outer and anterior part of the leſſer trochanter.	Into the upper part of the patella.	To extend the leg.
11. Pectinalis.	From the anterior edge of the os pubis, or pectinis, as it is ſometimes called.	Into the upper and fore part of the linea aſpera.	To draw the thigh inwards, upwards, and to roll it a little outwards.

12. Abductor

(I) So named on account of its origin, which is by a broad flat tendon three inches long.

(K) Spigelius was the firſt who gave this the name of *ſartorius*, or the taylor's muſcle, from its uſe in croſſing the legs.

(L) The vaſtus externus, vaſtus internus, and cruræus, are ſo intimately connected with each other, that ſome anatomiſts have been induced to conſider them as a *triceps*, or ſingle muſcle with three heads.

(M) Under the cruræus we ſometimes meet with two ſmall muſcles, to which Albinus has given the name of *ſub-cruræi*. They terminate on each ſide of the patella, and prevent the capſular ligament from being pinched. When they are wanting, which is very often the caſe, ſome of the fibres of the cruræus are found adhering to the capſula.

	Name.	Origin.	Inſertion.	Uſe.
	12. Abductor longus femoris (N).	From the upper and fore part of the os pubis.	Near the middle and back part of the linea aſpera.	To draw the thigh inwards, upwards, and to roll it a little outwards.
	13. Abductor brevis femoris.	From the fore part of the ramus of the os pubis.	Into the inner and upper part of the linea aſpera.	
	14. Abductor magnus femoris.	From the lower and fore part of the ramus of the os pubis.	Into the whole length of the linea aſpera.	
	15. Obturator externus.	From part of the obturator ligament, and the inner half of the circumference of the foramen thyroideum.	Into the os femoris near the root of the great trochanter.	To move the thigh outwards in an oblique direction, and likewiſe to bend and draw it inwards.
Muscles on the leg,	1. Gaſtrocnemius (O) externus.	By two heads; one from the inner condyle, the other from the outer condyle of the os femoris.	By a great round tendon, common to this and the following muſcle.	To extend the foot.
	2. Gaſtrocnemius (P) internus.	By two heads; one from the back part of the head of the fibula, the other from the upper and back part of the tibia.	By a large tendon (the *tendo achillis*) common to this and the former muſcle, into the lower and back part of the os calcis.	To extend the foot.
	3. Plantaris (Q)	From the upper and poſterior part of the outer condyle of the os femoris.	Into the inſide of the back part of the os calcis.	To aſſiſt in extending the foot.
	4. Popliteus (R)	From the outer condyle of the thigh.	Into the upper and inner part of the tibia.	To aſſiſt in bending the leg and rolling it inwards.
	5. Flexor longus digitorum pedis (S)	From the upper and inner part of the tibia.	By four tendons, which, after paſſing through the perforations in thoſe of the flexor digitorum brevis, are inſerted into the laſt bone of all the toes except the great toe.	To bend the laſt joint of the toe.
	6. Flexor longus pollicis pedis.	From the back part, and a little below the head of the fibula.	Into the laſt bone of the great toe.	To bend the great toe.

(N) This and the two following muſcles have been uſually, but improperly, conſidered as forming a ſingle muſcle with three heads, and on that account named *triceps femoris*.

(O) Ταρροκνημια, *ſura*, "the calf of the leg."

(P) This muſcle is by ſome anatomiſts named *ſoleus*, on account of its being ſhaped like the ſole-fiſh.

(Q) This muſcle has gotten the name of *plantaris*, from its being ſuppoſed to furniſh the aponeuroſis that covers the ſole of the foot; but it does not in the leaſt contribute to the formation of that tendinous expanſion.

(R) So called on account of its ſituation at the ham (*poples*).

(S) This muſcle, about the middle of the foot, unites with a fleſhy maſs, which, from its having firſt been deſcribed by Sylvius, is uſually called *maſſa carnea* Jacobi Sylvii.

	Name.	*Origin.*	*Inſertion.*	*Uſe.*
	7. Tibialis poſticus.	From the back part and outer edge of the tibia, and likewiſe from the interoſſeous ligament and adjacent part of the fibula.	Into the inner and upper part of the os naviculare and ſide of the os cuneiforme medium.	To move the foot inwards.
	8. Peroneus longus.	From the outer ſide of the head of the tibia, and alſo from the upper, anterior, and outer part of the *perone* or fibula, to which it adheres for a conſiderable way down.	Into the metatarſal bone of the great toe.	To move the foot outwards.
	9. Peroneus brevis.	From the outer and fore-part of the fibula.	Into the metatarſal bone of the little toe.	To aſſiſt the laſt deſcribed muſcle.
	10. Extenſor longus digitorum pedis.	From the upper, outer, and fore part of the tibia, interoſſeous ligament, and inner edge of the fibula.	By four tendons into the firſt joint of the ſmaller toes.	To extend the toes.
	11. Peroneus tertius.	From the fore-part of the lower half of the fibula, and from the interoſſeous ligament.	Into the metatarſal bone of the little toe.	To bend the foot.
	12. Tibialis anticus.	From the upper and fore part of the tibia.	Into the os cuneiforme internum.	To bend the foot.
	13. Extenſor proprius pollicis pedis.	From the upper and fore part of the tibia.	Into the convex ſurface of the bones of the great toe.	To extend the great toe.
MUSCLES on the foot,	1. Extenſor brevis digitorum pedis.	From the upper and anterior part of the os calcis.	By four tendons; one of which joins the tendon of the externus longus pollicis, and the other three the tendons of the extenſor digitorum longus.	To extend the toes.
	2. Flexor brevis digitorum pedis.	From the lower part of the os calcis.	By four tendons, which, after affording a paſſage to thoſe of the flexor longus, are inſerted into the ſecond phalanx of each of the ſmall toes.	To bend the ſecond joint of the toes.
	3. Abductor pollicis pedis.	From the inner and lower part of the os calcis.	Into the firſt joint of the great toe.	To move the great toe from the other toes.
	4. Abductor minimi digiti.	From the outer tubercle of the os calcis, the root of the metatarſal bone of the little toe, and alſo from the aponeuroſis plantaris.	Into the outer ſide of the firſt joint of the little toe.	To draw the little toe outwards.

Name.	*Origin.*	*Inſertion.*	*Uſe.*
5. Lumbricales pedis.	From the tendons of the flexor longus digitorum pedis.	Into the tendinous expanſion at the upper part of the toes.	To draw the toes inwards.
6. Flexor brevis pollicis pedis.	From the inferior and anterior part of the os calcis, and alſo from the inferior part of the os cuneiformeexternum.	By two tendons into the firſt joint of the great toe.	To bend the firſt joint of the great toe.
7. Adductor pollicis pedis.	From near the roots of the metatarſal bones of the 2d, 3d, and 4th toes.	Into the outer os ſeſamoideum, or firſt joint of the great toe.	To draw the great toe nearer to the reſt, and alſo to bend it.
8. Tranſverſales pedis.	From the outer and under part of the anterior end of the metatarſal bone of the little toe.	Into the inner os ſeſamoideum, and anterior end of the metatarſal bone of the great toe.	To contract the foot.
9. Flexor brevis minimi digiti pedis.	From the baſis of the metatarſal bone of the little toe.	Into the firſt joint of the little toe.	To bend the little toe.
10. Interoſſei pedis interni (t).	Situated between the metatarſal bones.		
——— externi (u).			

EXPLANATION OF PLATES XXIII. AND XXIV.

PLATE XXIII.

FIG. 1. The MUSCLES immediately under the common teguments on the anterior part of the body are repreſented on the right ſide; and on the left ſide the MUSCLES are ſeen which come in view when the exterior ones are taken away.

A, The frontal muſcle. B, The tendinous aponeuroſis which joins it to the occipital; hence both named *occipito-frontalis*. C, Attolens aurem. D, The ear. E, Anterior auris. F F, Orbicularis palpebrarum. G, Levator labii ſuperioris alæque naſi. H, Levator anguli oris. I, Zygomaticus minor. K, Zygomaticus major. L, Maſſeter. M, Orbicularis oris. N, Depreſſor labii inferioris. O, Depreſſor anguli oris. P, Buccinator. Q Q, Platyſma myoides. RR, Sterno-cleido-maſtoidæus. S, Part of the trapezius. T, Part of the ſcaleni.

SUPERIOR EXTREMITY.—U, Deltoides. V, Pectoralis major. W, Part of the latiſſimus dorſi. XX, Biceps flexor cubiti. Y Y, Part of the brachialis externus. Z Z, The beginning of the tendinous aponeuroſis (from the biceps), which is ſpread over the muſcles of the fore-arm. a a, Its ſtrong tendon inſerted into the tubercle of the radius. b b, Part of the brachialis internus. c, Pronator radii teres. d, Flexor carpi radialis. e, Part of the flexor carpi ulnaris. f, Palmaris longus. g, Aponeuroſis palmaris. 3. Palmaris brevis. 1, Ligamentum carpi annulare. 2 2, Abductor minimi digiti. h, Supinator radii longus. i, The tendons of the thumb. k, Abductor pollicis. l, Flexor pollicis longus. m m, The tendons of the flexor ſublimis perforatus, profundus perforans, and lumbricales.—The ſheaths are entire in the right hand, —in the left cut open to ſhow the tendons of the flexor profundus perforating the ſublimis.

MUSCLES not referred to—in the left ſuperior extremity.—n, Pectoralis minor, ſeu ſerratus anticus minor. o, The two heads of (x x) the biceps. p, Coracobrachialis. q q, The long head of the triceps extenſor cubiti. r r, Teres major. f f, Subſcapularis. t t, Extenſores radiales. u, Supinator brevis. v, The cut extremity of the pronator teres. w, Flexor ſublimis perforatus. x, Part of the flexor profundus. y, Flexor pollicis longus. z, Part of the flexor pollicis brevis. 4, Abductor minimi digiti. 5, The four lumbricales.

TRUNK.—6, Serrated extremities of the ſerratus anticus major. 7 7, Obliquus externus abdominis. 8 8, The linea alba. 9, The umbilicus. 10, Pyramidalis. 11 11, The ſpermatic cord. On the left ſide it is covered by the cremaſter. 12 12, Rectus abdominis. 13, Obliquus internus. 14 14, &c. Intercoſtal muſcles.

INFERIOR EXTREMITIES.—*a a*, The gracilis. *b b*, Parts of the triceps. *c c*, Pectialis. *d d*, Pſoas magnus. *e e*, Iliacus internus. *f*, Part of the glutæus medius. *g*, Part of the glutæus minimus. *h*, Cut extremity of the rectus cruris. *i i*, Vaſtus externus, *k*, Tendon of the rectus cruris. *l l*, Vaſtus internus.

(t) The interoſſei interni are three in number; their uſe is to draw the ſmaller toes towards the great toe.

(u) The interoſſei externi are four in number; the firſt ſerves to move the fore-toe towards the great toe: the reſt move the toes outwards. All the interoſſei aſſiſt in extending the toes.

Of the Muſcles.

* Sartorius muſcle. ** Fleſhy origin of the tenſor vaginæ fæmoris or membranoſus. Its tendinous aponeuroſis covers (*i*) the vaſtus externus in the right ſide. *m m*, Patella. *n n*, Ligament or tendon from it to the tibia. *o*, Rectus cruris. *p*, Cruræus. *q q*, The tibia. *r r*, Part of the Gemellus or gaſtrocnemius externus.* *ſſſ*, Part of the ſoleus or gaſtrocnemius internus. *t*, Tibialis anticus. *u*, Tibialis poſticus. *v v*, Peronæi muſcles. *w w*, Extenſor longus digitorum pedis. *x x*, Extenſor longus pollicis pedis. *y*, Abductor pollicis pedis.

FIG. 2. The MUSCLES, GLANDS, &c. of the Left Side of the face and neck, after the common Teguments and Platyſma myoides have been taken off.

a, The frontal muſcle. b, Temporalis and temporal artery. c, Orbicularis palpebrarum. d, Levator labii ſuperioris alæqui naſi. e, Levator anguli oris. f, Zygomaticus. g, depreſſor labii inferioris. h, Depreſſor anguli oris. i, Buccinator. k, Maſſeter. l l, Parotid gland. m, Its duct. n, Sterno-cleido-maſtoidæus. o, Part of the trapezius. p, Sterno-hyoidæus. q, Sterno-thyroidæus. r, Omo-hyoidæus. ſ, Levator ſcapulæ. t t, Scaleni. u, Part of the ſplenius.

FIG. 3. The MUSCLES of the Face and Neck in view after the exterior ones are taken away.

a a, Corrugator ſupercilii. b, Temporalis. c, Tendon of the levator palpebræ ſuperioris. d, Tendon of the orbicularis palpebrarum. e, Maſſeter. f, Buccinator. g, Levator anguli oris. h, Depreſſor labii ſuperioris alæque naſi. i, Orbicularis oris. k, Depreſſor anguli oris. l, Muſcles of the os hyoides. m, Sterno-cleido-maſtoidæus.

FIG. 4. Some of the MUSCLES of the Os Hyoides and Submaxillary Gland.

a, Part of the maſſeter muſcle. b, Poſterior head of the digraſtic. c, Its anterior head. d d, Sterno-hyoidæus. e, Omo-hyoidæus. f, Stylo-hyoidæus. g, Submaxillary gland in ſitu.

FIG. 5. The Submaxillary Gland and Duct.

a, Muſculus mylo-hyoidæus. b, Hyo-gloſſus. c, Submaxillary gland extra ſitu. d, Its duct.

PLATE XXIV.

FIG. 1. The MUSCLES immediately under the common teguments on the poſterior part of the body, are repreſented in the right ſide; and on the left ſide the MUSCLES are ſeen which come in view when the exterior ones are taken away.

HEAD.—A A, Occipito-frontalis. B, Attollens aurem. C, Part of the orbicularis palpebrarum. D, Maſſeter. E, Pterygoidæus internus.

TRUNK.—Right ſide. F F F, Trapezius ſeu cucullaris. G G G G, Latiſſimus dorſi. H, Part of the obliquus externus abdominis.

TRUNK.—Left ſide. I, Splenius. K, Part of the complexus. L, Levator ſcapulæ. M, Rhomboides. N N, Serratus poſticus inferior. O, Part of the longiſſimus dorſi. P, Part of the ſacro-lumbalis. Q, Part of the ſemi-ſpinalis dorſi. R, Part of the ſerratus anticus major. S, Part of the obliquus internus abdominis.

Of the Muſcles.

SUPERIOR EXTREMITY.—Right ſide. T, Deltoides U, Triceps extenſor cubiti. V, Supinator longus. W W, Extenſores carpi radialis longior and brevior. X X, Extenſor carpi ulnaris. Y Y, Extenſor digitorum communis. Z, Abductor indicis. 1 2 3, Extenſores pollicis.

SUPERIOR EXTREMITY.—Left ſide. a, Supra ſpinatus. b, Infra-ſpinatus. c, Teres minor. d, Teres major. e, Triceps extenſor cubiti. f f, Extenſores carpi radiales. g, Supinator brevis. h, Indicator. 1 2 3, Extenſores pollicis. i, Abductor minimi digiti. k, Interoſſei.

INFERIOR EXTREMITY.—Right ſide. l, Glutæus maximus. m, Part of the Glutæus medius. n, Tenſor vaginæ femoris. o, Gracilis. p p, Abductor femoris magnus. q, Part of the vaſtus internus. r, Semimembranoſus. s, Semitendinoſus. t, Long head of the biceps flexor cruris. u u, Gaſtrocnemius externus ſeu gemellus. v, Tendo Achillis. w, Soleus ſeu gaſtrocnemius internus. x x, Peronæus longus and brevis. y, Tendons of the flexor longus digitorum pedis;—and under them * flexor brevis digitorum pedis. z, Abductor minimi digiti pedis.

INFERIOR EXTREMITY.—Left ſide. *m, n, o, p, q, r, s, t, v, w w, x x, y, z*, Point the ſame parts as in the right ſide. *a*, Pyriformis. *b b*, Gemini. *c c*, Obturator internus. *d*, Quadratus femoris. *e*, Coccygæus. *f*, The ſhort head of the biceps flexor cruris. *g g*, Plantaris. *h*, Poplitæus. *i*, Flexor longus pollicis pedis.

FIG. 2. The Palm of the Left Hand after the common Teguments are removed, to ſhow the MUSCLES of the Fingers.

a, Tendon of the flexor carpi radialis. b, Tendon of the flexor carpi ulnaris. c, Tendons of the flexor ſublimis perforatus, profundus perforans and lumbricales. d, Abductor pollicis. e e, Flexor pollicis longus. f, Flexor pollicis brevis. g, Palmaris brevis. h, Abductor minimi digiti. i, Ligamentum carpiannulare. k, A probe put under the tendons of the flexor digitorum ſublimis; which are perforated by l, the flexor digitorum profundus. m m m m, Lumbricales. n, Abductor pollicis.

FIG. 3 A Fore-view of the foot and Tendons of the Flexores Digitorum.

a, Cut extremity of the tendo Achillis. b, Upper part of the aſtragalus. c, Os calcis. d, Tendon of the tibialis anticus. e, Tendon of the extenſor pollicis longus. f, Tendon of the peronæus brevis. g, Tendons of the flexor digitorum longus, with the nonus Veſalii. h h, The whole of the flexor digitorum brevis.

FIG. 4. MUSCLES of the Anus.

a a, An out line of the buttocks, and upper part of the thighs. b, The teſtes contained in the ſcrotum. c c, Sphincter ani. d, Anus. e, Levator ani. f f, Erector penis. g g, Accelerator urinæ. h, Corpus cavernoſum urethræ.

FIG. 5. MUSCLES of the Penis.

a a, b, d, e e, f f, h, point the ſame as in fig. 4. c, Sphincter ani. g g, Tranſverſalis penis.

PART

Fig. 1.

Fig. 2.

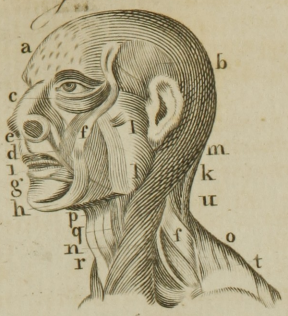
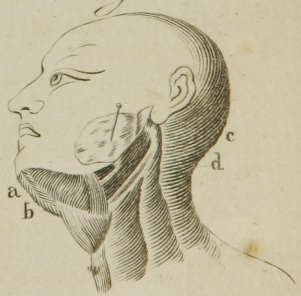
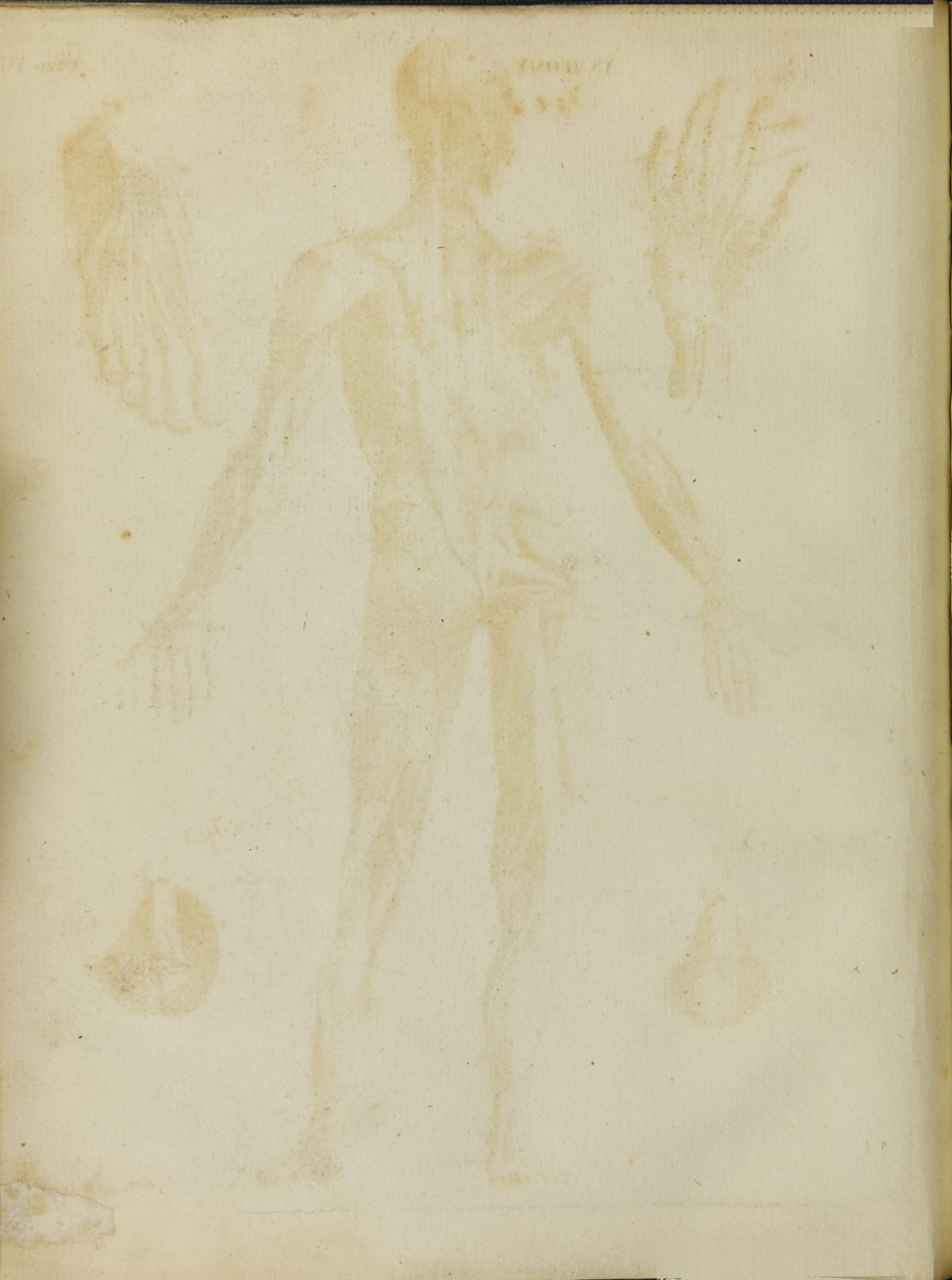


Fig. 3.

Fig. 4.

Fig. 5.





ANATOMY

PART III. OF THE ABDOMEN, OR LOWER BELLY.

88. THE abdomen, or lower belly, extends from the lower extremity of the ſternum, or the hollow, uſually called the pit of the ſtomach, and more properly *ſcrobiculus cordis*, to the lower part of the trunk.

It is diſtinguiſhed into three diviſions called *regions*; of theſe the upper one, which is called the *epigaſtric region*, begins immediately under the ſternum, and extends to within two fingers breadth of the navel, where the middle or *umbilical region* begins, and reaches to the ſame diſtance below the navel. The third, which is called the *hypogaſtric*, includes the reſt of the abdomen, as far as the os pubis.

Each of theſe regions is ſubdivided into three others; two of which compoſe the ſides, and the other the middle part of each region.

The middle part of the upper region is called *epigaſtrium*, and its two ſides *hypochondria*. The middle part of the next region is the umbilical region, properly ſo called, and its two ſides are the flanks, or iliac regions. Laſtly, the middle part of the lower region retains the name of hypogaſtrium, and its ſides are called inguina or groins. The back part of the abdomen bears the name of lumbar region.

Theſe are the diviſions of the lower belly, which are neceſſary to be held in remembrance, as they frequently occur in ſurgical and anatomical writing. We will now proceed to examine the contents of the abdomen; and after having pointed out the names and arrangement of the ſeveral viſcera contained in it, deſcribe each of them ſeparately.

After having removed the ſkin, adipoſe membrane, and abdominal muſcles, we diſcover the peritonæum or membrane that envelopes all the viſcera of the lower belly. This being opened, the firſt part that preſents itſelf is the omentum or cawl, floating on the ſurface of the inteſtines, which are likewiſe ſeen every where looſe and moiſt, and making a great number of circumvolutions through the whole cavity of the abdomen. The ſtomach is placed in the epigaſtrium, and under the ſtomach is the pancreas. The liver fills the right hypochondrium, and the ſpleen is ſituated in the left. The kidneys are ſeen about the middle of the lumbar region, and the urinary bladder and parts of generation are ſeated in the lower diviſion of the belly.

SECT. I. *Of the Peritonæum.*

89 THE peritonæum is a ſtrong ſimple membrane, by which all the viſcera of the abdomen are ſurrounded, and in ſome meaſure ſupported. Many anatomical writers, particularly Winſlow, have deſcribed it as being compoſed of two diſtinct membranous laminæ; but their deſcription ſeems to be erroneous. What perhaps appeared to be a ſecond lamina, being found to be ſimply a cellular coat, which ſends off productions to the blood-veſſels paſſing out of the abdominal cavity. The aorta and vena cava likewiſe derive a covering from the ſame membrane, which ſeems to be a part of the cellular membrane we have already deſcribed.

The peritonæum, by its productions and reduplications, envelopes the greateſt part of the abdominal viſcera. It is ſoft, and capable of conſiderable extenſion; and is kept ſmooth and moiſt by a vapour, which is conſtantly exhaling from its inner ſurface, and is returned again into the circulation by the abſorbents.

This moiſture not only contributes to the ſoftneſs of the peritonæum, but prevents the attrition, and other ill effects which would otherwiſe probably be occaſioned, by the motion of the viſcera upon each other.

When this fluid is ſupplied in too great a quantity, or the abſorbents become incapable of carrying it off, it accumulates, and conſtitutes an aſcites or dropſy of the belly; and when by any means the exhalation is diſcontinued, the peritonæum thickens, becomes diſeaſed, and the viſcera are ſometimes found adhering to each other.

The peritonæum is not a very vaſcular membrane. In a ſound ſtate it ſeems to be endued with little or no feeling, and the nerves that paſs through it appear to belong to the abdominal muſcles.

SECT. II. *Of the Omentum.*

THE omentum, epiploon, or cawl, is a double mem- 90
brane, produced from the peritonæum. It is interlarded with fat, and adheres to the ſtomach, ſpleen, duodenum, and colon; from thence hanging down looſe and floating on the ſurface of the inteſtines. Its ſize is different in different ſubjects. In ſome it deſcends as low as the pelvis, and it is commonly longer at the left ſide than the right.

This part, the ſituation of which we have juſt now deſcribed, was the only one known to the ancients under the name of *epiploon*; but at preſent we diſtinguiſh three omenta, viz. *omentum magnum colico gaſtricum*, *omentum parvum hepatico gaſtricum*, and *omentum colicum*. They all agree in being formed of two very delicate laminæ, ſeparated by a thin layer of cellular membrane.

The omentum magnum colico gaſtricum, of which we have already ſpoken, derives its arteries from the ſplenic and hepatic. Its veins terminate in the vena portæ. Its nerves, which are very few, come from the ſplenic and hepatic plexus.

The omentum parvum hepatico gaſtricum, abounds leſs with fat than the great epiploon. It begins at the upper part of the duodenum, extends along the leſſer curvature of the ſtomach as far as the œſophagus, and terminates about the neck of the gall-bladder, and behind the left ligament of the liver, ſo that it covers the leſſer lobe; near the beginning of which we may obſerve a ſmall opening, firſt deſcribed by Winſlow, through which the whole pouch may eaſily be diſtend-

ed

Of the Abdomen.

ed with air (x). The veſſels of the omentum parvum are derived chiefly from the coronary ſtomachic arteries and veins.

The omentum colicum begins at the fore part of the cœcum and right ſide of the colon. It appears as a hollow conical appendage to theſe inteſtines, and uſually terminates at the back of the omentum magnum. It ſeems to be nothing more than a membranous coat of the cœcum and colon, aſſuming a conical ſhape when diſtended with air.

The uſes of the omentum are not yet ſatisfactorily determined. Perhaps by its ſoftneſs and looſeneſs it may ſerve to prevent thoſe adheſions of the abdominal viſcera, which have been found to take place when the fat of the omentum has been much waſted. Some authors have ſuppoſed, that it aſſiſts in the preparation of bile; but this idea is founded merely on conjecture.

Sect. III. *Of the Stomach.*

91 The ſtomach is a membranous and muſcular bag, in ſhape not unlike a bagpipe, lying acroſs the upper part of the abdomen, and inclining rather more to the left than the right ſide.

It has two orifices, one of which receives the end of the œſophagus, and is called the *cardia*, and ſometimes the left and upper orifice of the ſtomach; though its ſituration is not much higher than the other, which is ſtyled the right and inferior orifice, and more commonly the *pylorus*; both theſe openings are more elevated than the body of the ſtomach.

The aliment paſſes down the œſophagus into the ſtomach through the cardia, and after having undergone the neceſſary digeſtion, paſſes out at the pylorus where the inteſtinal canal commences.

The ſtomach is compoſed of four tunics or coats, which are ſo intimately connected together that it requires no little dexterity in the anatomiſt to demonſtrate them. The exterior one is membranous, being derived from the peritonæum.—The ſecond is a muſcular tunic, compoſed of fleſhy fibres which are in the greateſt number about the two orifices.—The third is called the nervous coat, and within this is the villous or velvet-like coat which compoſes the inſide of the ſtomach.

The two laſt coats being more extenſive than the two firſt, form the folds, which are obſerved every where in the cavity of this viſcus, and more particularly about the pylorus; where they ſeem to impede the too haſty excluſion of the aliment, making a conſiderable plait, called *valvula pylori*.

The inner coat is conſtantly moiſtened by a mucus, which approaches to the nature of the ſaliva, and is called the gaſtric juice; this liquor has been ſuppoſed to be ſecreted by certain minute glands (y) ſeated in the nervous tunic, whoſe excretory ducts open on the ſurface of the villous coat.

The arteries of the ſtomach called the gaſtric arteries are principally derived from the cæliac; ſome of its veins paſs to the ſplenic, and others to the vena portæ; and its nerves are chiefly from the eighth pair or par vagum. Of the Abdomen.

The account given of the tunics of the ſtomach may be applied to the whole alimentary canal; for both the œſophagus and inteſtines are, like this viſcus, compoſed of four coats.

Before we deſcribe the courſe of the aliment and the uſes of the ſtomach, it will be neceſſary to ſpeak of other parts which aſſiſt in the proceſs of digeſtion.

Sect. IV. *Of the Oeſophagus.*

The œſophagus or gullet is a membranous and muſcular canal, extending from the bottom of the mouth to the upper orifice of the ſtomach.—Its upper part where the aliment is received is ſhaped ſomewhat like a funnel, and is called the *pharynx*. 92

From hence it runs down cloſe to the bodies of the vertebræ as far as the diaphragm, in which there is an opening through which it paſſes, and then terminates in the ſtomach about the eleventh or twelfth vertebra of the back.

The œſophagus is plentifully ſupplied with arteries from the external carotid, bronchial, and ſuperior intercoſtal arteries; its veins empty themſelves into the vena azygos, internal jugular, and mammary veins, &c.

Its nerves are derived chiefly from the eighth pair.

We likewiſe meet with a mucus in the œſophagus, which every where lubricates its inner ſurface, and tends to aſſiſt in deglutition.—This mucus ſeems to be ſecreted by very minute glands, like the mucus in other parts of the alimentary canal.

Sect. V. *Of the Inteſtines.*

The inteſtines form a canal, which is uſually ſix times longer than the body to which it belongs. This canal extends from the pylorus, or inferior orifice of the ſtomach, to the anus. 93

It will be eaſily underſtood, that a part of ſuch great length muſt neceſſarily make many circumvolutions, to be confined with ſo many other viſcera within the cavity of the lower belly.

Although the inteſtines are in fact, as we have obſerved, only one long and extenſive canal, yet different parts have been diſtinguiſhed by different names.

The inteſtines are firſt diſtinguiſhed into two parts, one of which begins at the ſtomach, and is called the *thin* or *ſmall inteſtines*, from the ſmall ſize of the canal, when compared with the other part, which is called the *large inteſtines*, and includes the lower portion of the canal down to the anus.

Each of theſe parts has its ſubdiviſions.—The ſmall in-

(x) This membranous bag, though excedingly thin and tranſparent, is found capable of ſupporting mercury, thrown into it by the ſame channel.

(y) Heiſter, ſpeaking of theſe glands, very properly ſays, "in *porcis* facile, in *homine* raro obſervantur;" for although many anatomical writers have deſcribed their appearance and figure, yet they do not ſeem to have been hitherto ſatisfactorily demonſtrated in the human ſtomach; and the gaſtric juice is now more generally believed to be derived from the exhalent arteries of the ſtomach.

Of the Abdomen.

inteſtines being diſtinguiſhed into duodenum, jejunum, and ilium, and the larger portion into cœcum, colon, and rectum.

The ſmall inteſtines fill the middle and fore parts of the belly, while the large inteſtines fill the ſides and both the upper and lower parts of the cavity.

The duodenum, which is the firſt of the ſmall inteſtines, is ſo called, becauſe it is about 12 inches long. It begins at the pylorus and terminates in the jejunum, which is a part of the canal obſerved to be uſually more empty than the other inteſtines.—This appearance gives it its name, and likewiſe ſerves to point out where it begins.

The next diviſion is the ilium, which of itſelf exceeds the united length of the duodenum and jejunum, and has received its name from its numerous circumvolutions. The large circumvolution of the ilium covers the firſt of the large inteſtines called the *cæcum* (x), which ſeems properly to belong to the colon, being a kind of pouch of about four fingers in width, and nearly of the ſame length, having exteriorly a little appendix, called *appendix cæci*.

The cœcum is placed in the cavity of the os ilium on the right ſide, and terminates in the colon, which is the largeſt of all the inteſtines.

This inteſtine aſcends by the right kidney to which it is attached, paſſes under the hollow part of the liver, and the bottom of the ſtomach, to the ſpleen, to which it is likewiſe ſecured, as it is alſo to the left kidney; and from thence paſſes down towards the os ſacrum, where, from its ſtraight courſe, the canal begins to take the name of *rectum*.

There are three ligamentous bands extending thro' the whole length of the colon, which, by being ſhorter than its two inner coats, ſerve to increaſe the plaits on the inner ſurface of this gut.

The *anus* which terminates the inteſtinum rectum, is furniſhed with three muſcles; one of theſe is compoſed of circular fibres, and from its uſe in ſhutting the paſſage of the anus is called *ſphincter ani*.

The other two are the *levatores ani*, ſo called, becauſe they elevate the anus after dejection. When theſe by palſy, or any other diſeaſe, loſe the power of contracting, the anus prolapſes; and when the ſphincter is affected by ſimilar cauſes, the fæces are voided involuntarily.

It has been already obſerved, that the inteſtinal canal is compoſed of four tunics; but it remains to be remarked, that here, as in the ſtomach, the two inner tunics being more extenſive than the other two, form the plaits which are to be ſeen in the inner ſurface of the inteſtines, and are called *valvulæ conniventes*.

Of the Abdomen.

Some authors have conſidered theſe plaits as tending to retard the motion of the fæces, in order to afford more time for the ſeparation of the chyle; but there are others who attribute to them a different uſe: they contend, that theſe valves, by being naturally inclined downwards, cannot impede the deſcent of the fæces, but that they are intended to prevent their return upwards.

They are probably deſtined for both theſe uſes; for although theſe folds incline to their lower ſide, yet the inequalities they occaſion in the canal are ſufficient to retard, in ſome meaſure, the progreſſive motion of the fæces, and to afford a greater ſurface for the abſorption of chyle, and their natural poſition ſeems to oppoſe itſelf to the return of the aliment.

Beſides theſe *valvulæ conniventes*, there is one more conſiderable than the reſt, called the *valve of the colon*; which is found at that part of the canal where the inteſtinum ilium is joined to the colon. This valve permits the alimentary pulp to paſs downwards, but ſerves to prevent its return upwards; and it is by this valve, that glyſters are prevented from paſſing into the ſmall inteſtines (y).

Of the little vermiform appendix of the cœcum, it will be ſufficient to ſay, that its uſes have never yet been aſcertained. In birds we meet with two of theſe appendices.

The inteſtines are lubricated by a conſtant ſupply of mucus, which is probably ſecreted by very minute follicles (z). This mucus promotes the deſcent of the alimentary pulp, and in ſome meaſure defends the inner ſurface of the inteſtines from the irritation to which it would, perhaps, otherwiſe be continually expoſed from the aliment; and which, when in a certain degree, excites a painful diſorder called *colic*, a name given to the diſeaſe, becauſe its moſt uſual ſeat is in the inteſtinum colon.

The inteſtines are likewiſe frequently diſtended with air, and this diſtenſion ſometimes occaſions pain, and conſtitutes the flatulent colic.

The arteries of the inteſtines are continuations of the meſenteric arteries, which are derived in two conſiderable branches from the aorta.—The redundant blood is carried back into the vena portarum.

In the rectum the veins are called *hemorrhoidal*, and are there diſtinguiſhed into internal and external: the firſt are branches of the inferior meſenteric vein, but the latter paſs into other veins. Sometimes theſe veins are diſtended with blood from obſtructions, from weakneſs of their coats, or from other cauſes, and what we call the *hæmorrhoids* takes place. In this diſeaſe they are ſometimes ruptured; and the diſcharge of blood which

---

(x) Anatomiſts have differed with reſpect to this diviſion of the inteſtines.—The method here followed is now generally adopted; but there are authors who allow the name of *cæcum* only to the little appendix, which has likewiſe been called the *vermiform appendix*, from its reſemblance to a worm in ſize and length.

(y) This is not invariably the caſe, for the contents of a glyſter have been found not only to reach the ſmall inteſtines, but to be voided at the mouth. Such inſtances, however, are not common.

(z) Some writers have diſtinguiſhed theſe glands into miliary, lenticular, &c.—Brunner and Peyer were the firſt anatomiſts who deſcribed the glands of the inteſtines, and their deſcriptions were chiefly taken from animals, theſe glandular appearances not ſeeming to have been hitherto ſatisfactorily pointed out in the human ſubject.—It is now pretty generally believed, that the mucus which everywhere lubricates the alimentary canal, is exhaled from the minute ends of arteries; and that theſe extremities firſt open into a hollow veſicle, from whence the depoſited juice of ſeveral branches flows out through one common orifice.

Of the Abdomen.

which consequently follows, has probably occasioned them to be called *hæmorrhoidal veins*.

The nerves of the intestines are derived from the eighth pair.

Sect. VI. *Of the Mesentery.*

94 The name of the *mesentery* implies its situation amidst the intestines. It is in fact a part of the peritonæum, being a reduplication (A) of that membrane from each side of the lumbar vertebræ, to which it is firmly attached, so that it is formed of two laminæ, connected to each other by cellular membrane.

The intestines, in their different circumvolutions, form a great number of arches, and the mesentery accompanies them through all these turns; but by being attached only to the hollow part of each arch, it is found to have only a third of the extent of the intestines.

That part of this membrane which accompanies the small intestines is the *mesentery*, properly so called; but those parts of it which are attached to the colon and rectum are distinguished by the names of *meso-colon* and *meso-rectum*.

There are many conglobate glands dispersed through this double membrane, through which the lacteals and lymphatics pass in their way to the thoracic duct. The blood-vessels of the mesentery were described in speaking of the intestines.

This membrane, by its attachment to the vertebræ, serves to keep the intestines in their natural situation. The idea usually formed of the colic called *miserere*, is perfectly erroneous; it being impossible that the intestines can be twisted, as many suppose they are, in that disease, their attachment to the mesentery effectually preventing such an accident—but a disarrangement sometimes takes place in the intestinal canal itself, which is productive of disagreeable and sometimes fatal consequences.—This is by an introsusception of the intestine, an idea of which may be easily formed, by taking the finger of a glove, and involving one part of it within the other.

If inflammation takes place, the stricture in this case is increased, and the peristaltic motion of the intestines (by which is meant the progressive motion of the fæces downwards) is inverted, and what is called the *iliac passion* takes place. The same effects may be occasioned by a descent of the intestine, or of the omentum either with it or by itself, and thus constituting what is called an *hernia rupture*; a term by which in general is meant the falling down or protrusion of any part of the intestine or omentum, which ought naturally to be contained within the cavity of the belly.

Of the Abdomen.

To convey an idea of the manner in which such a descent takes place, it will be necessary to observe, that the lower edge of the tendon of the musculus obliquus externus, is stretched from the fore-part of the os ilium or haunch-bone of the os pubis, and constitutes what is called *Poupart's* or *Fallopius's ligament*, forming an opening, through which pass the great crural artery and vein. Near the os pubis the same tendinous fibres are separated from each other, and form an opening on each side, called the *abdominal ring*, through which the spermatic vessels pass in men, and the ligamenta uteri in women. In consequence of violent efforts, or perhaps of natural causes, the intestines are found sometimes to pass through these openings; but the peritonæum which incloses them when in their natural cavity, still continues to surround them even in their descent. This membrane does not become torn or lacerated by the violence, as might be easily imagined; but its dilatibility enables it to pass out with the viscus, which it incloses as it were in a bag, and thus forms what is called the *hernial sac*.

If the hernia be under Poupart's ligament, it is called *femoral*; if in the groin, *inguinal* (B); and *scrotal*, if in the scrotum. Different names are likewise given to the hernia as the contents of the sac differ, whether of omentum only or intestine, or both:—but these definitions more properly belong to the province of surgery.

Sect. VII. *Of the Pancreas.*

95 The pancreas is a conglomerate gland placed behind the bottom of the stomach, towards the first vertebra of the loins; shaped like a dog's tongue, with its point stretched out towards the spleen, and its other end extending towards the duodenum. It is about eight fingers breadth in length, two or three in width, and one in thickness.

This viscus, which is of a yellowish colour, somewhat inclined to red, is covered with a membrane which it derives from the peritonæum. Its arteries, which are rather numerous than large, are derived chiefly from the splenic and hepatic, and its veins pass into the veins of the same name.—Its nerves are derived from the intercostal.

The many little glands of which it has been observed the pancreas is composed, all serve to secrete a liquor called the *pancreatic juice*, which in its colour, consistence, and other properties, does not seem to differ from the saliva. Each of these glands sends out a little excretory duct, which, uniting with others, help to form larger ducts; and all these at last terminate in one common excretory duct (first discovered by Virtsungus in

---

(A) He who only reads of the reduplication of membranes, will perhaps not easily understand how the peritonæum and pleura are reflected over the viscera in their several cavities; for one of these serves the same purposes in the thorax that the other does in the abdomen. This disposition, for the discovery of which we are indebted to modern anatomists, constitutes a curious part of anatomical knowledge: but the student, unaided by experience, and assisted only by what the limits of this work would permit us to say on the occasion, would probably imbibe only confused ideas of the matter; and it will perfectly answer the present purpose, if he considers the mesentery as a membrane attached by one of its sides to the lumbar vertebræ, and by the other to the intestines.

(B) The hernia congenita will be considered with the male organs of generation, with which it is intimately connected.

Of the Abdomen.

in 1642), which runs through the middle of the gland, and is now usually called *ductus pancreaticus Virtsungi*. This canal opens into the intestinum duodenum, sometimes by the same orifice with the biliary duct, and sometimes by a distinct opening. The liquor it discharges being of a mild and insipid nature, serves to dilute the alimentary pulp, and to incorporate it more easily with the bile.

Sect. VIII. *Of the Liver.*

96. The liver is a viscus of considerable size, and of a reddish colour; convex superiorly and anteriorly where it is placed under the ribs and diaphragm, and of an unequal surface posteriorly. It is chiefly situated in the right hypochondrium, and under the false ribs; but it likewise extends into the epigastric region, where it borders upon the stomach. It is covered by a production of the peritonæum, which serves to attach it by three of its reduplications to the false ribs. These reduplications are called *ligaments*, though very different in their texture from what are called by the same name in other parts of the body. The umbillical cord, too, which in the fœtus is pervious, gradually becomes a simple ligament after birth; and, by passing to the liver, serves likewise to secure it in its situation.

At the posterior part of this organ where the umbillical vessels enter, it is found divided into two lobes. Of these, the largest is placed in the right hypochondrium; the other, which covers part of the stomach, is called the *little lobe*. All the vessels which go to the liver pass in at the fissure we have mentioned; and the production of the peritonæum, which invests the liver, was described by Glisson, an English anatomist, as accompanying them in their passage, and surrounding them like a glove; hence this production has been commonly known by the name of *capsula of Glisson:* but it appears to be chiefly a continuation of the cellular membrane which covers the vena porta ventralis.

The liver was considered by the ancients as an organ destined to prepare and perfect the blood; but later discoveries have proved, that this opinion was wrong, and that the liver is a glandular substance formed for the secretion of the bile.

The blood is conveyed to the liver by the hepatic artery and the vena porta. This is contrary to the mode of circulation in other parts, where veins only serve to carry off the redundant blood: but in this viscus the hepatic artery, which is derived from the cæliac, is principally destined for its nourishment; and the vena porta, which is formed by the union of the veins from most of the abdominal viscera, furnishes the blood from which the bile is chiefly to be separated; so that these two series of vessels serve very distinct purposes. The vena porta, as it is ramified through the liver, performs the office both of a vein and an artery; for like the former it returns the blood from the extremities of arteries, while as the latter it prepares it for secretion.

The nerves of the liver are branches of the intercostal and par vagum. The bile, after being separated from the mass of blood, in a manner of which mention will be made in another place, is conveyed out of this organ by very minute excretory ducts, called *poribiliarii;* these uniting together like the excretory ducts in the pancreas, gradually form larger ones, which at length terminate in a considerable canal called *ductus hepaticus*.

Of the Abdomen.

Sect. IX. *Of the Gall-bladder.*

97. The gall-bladder is a little membranous bag, shaped like a pear, and attached to the posterior and almost inferior part of the great lobe of the liver.

It has two tunics; of which the exterior one is a production of the peritonæum. The interior, orvillous coat, is supplied with a mucus that defends it from the acrimony of the bile. These two coverings are intimately connected by means of cellular membrane, which from its firm glistening appearance has generally been spoken of as a muscular tunic.

The gall-bladder is supplied with blood-vessels from the hepatic arteries. These branches are called the *cystic arteries*, and the cystic veins carry back the blood.

Its nerves are derived from the same origin as those of the liver.

The neck of the gall-bladder is continued in the form of a canal called *ductus cysticus*, which soon unites with the ductus hepaticus we described as the excretory duct of the liver; and forming one common canal, takes the name of *ductus coledochus communis*, through which both the cystic and hepatic bile are discharged into the duodenum. This canal opens into the intestine in an oblique direction, first passing through the exterior tunic, and then piercing the other coats after running between each of them a very little way. This œconomy serves two useful purposes;—to promote the discharge of bile and to prevent its return.

98 Of the bile.

The bile may be defined to be a natural liquid soap, somewhat unctuous and bitter, and of a yellowish colour, which easily mixes with water, oil, and vinous spirits, and is capable of dissolving resinous substances. From some late experiments made by M Cadet*, it appears to be formed of an animal oil, combined with the alkaline base of sea-salt, a salt of the nature of milk, and a calcareous earth which is slightly ferruginous.

* *Mem. de l'Acad. des Sciences.* 1767.

Its definition seems sufficiently to point out the uses for which it is intended (c). It blends the alimentary mass, by dividing and attenuating it; corrects the too great disposition to acescency, which the aliment acquires in the stomach; and, finally, by its acrimony, tends to excite the peristaltic motion of the intestines.

After what has been said, it will be conceived that there are two sorts of bile; one of which is derived immediately from the liver through the hepatic duct, and the other from the gall-bladder. These two biles, however, do not essentially differ from each other. The hepatic bile indeed is milder, and more liquid than the cystic, which is constantly thicker and yellower;

(c) The ancients, who were not acquainted with the real use of the liver, considered the bile as an excrementitious and useless fluid.

Of the Abdomen.

and by being bitterer, seems to possess greater activity than the other.

Every body knows the source of the hepatic bile, that it is secreted from the mass of blood by the liver; but the origin of the cystic bile has occasioned no little controversy amongst anatomical writers. There are some who contend, that it is separated in the substance of the liver, from whence it passes into the gall-bladder through particular vessels. In deer, and in some other quadrupeds, as well as in several birds and fishes, there is an evident communication, by means of particular vessels, between the liver and the gall-bladder. Bianchi, Winslow, and others, have asserted the existence of such vessels in the human subject, and named them *hepaticycstic ducts*; but it is certain that no such ducts exist.—In obstructions of the cystic duct, the gall-bladder has been found shrivelled and empty: so that we may consider the gall-bladder as a reservoir of hepatic bile; and that it is an established fact, that the whole of the bile contained in the gall-bladder is derived from the liver; that it passes from the hepatic to the cystic duct, and from that to the gall-bladder. The difference in the colour, consistence, and taste of the bile, is merely the consequence of stagnation and absorption. When the stomach is distended with aliment, this reservoir undergoes a certain degree of compression, and the bile passes out into the intestinal canal; and in the efforts to vomit, the gall-bladder seems to be constantly affected, and at such times discharges itself of its contents.

Sometimes the bile concretes in the gall-bladder, so as to form what are called *gall-stones* (D). When these concretions pass into the cystic duct, they sometimes occasion exquisite pain, by distending the canal in their way to the duodenum; and by lodging in the ductus choledochus communis, and obstructing the course of the bile, this fluid will be absorbed, and by being carried back into the circulation occasion a temporary jaundice.

Sect. X. *Of the Spleen.*

99. The spleen is a soft and spongy viscus, of a bluish colour, and about five or six fingers breadth in length, and three in width, situated in the left hypochondrium, between the stomach and the false ribs. That side of it which is placed on the side of the ribs is convex; and the other, which is turned toward the stomach, is concave.

The splenic artery, which is a branch from the cæliac, supplies this viscus with blood, and a vein of the same name carries it back into the vena porta.

Its nerves are derived from a particular plexus called the *splenic*, which is formed by branches of the intercostal nerve, and by the eighth pair, or par vagum.

The ancients, who supposed two sorts of bile, considered the spleen as the receptacle of what they called *atra bilis*. Havers, who wrote professedly on the bones, determined its use to be that of secreting the synovia; and the late Mr Hewson imagined, that it concurred with the thymus and lymphatic glands of the body in forming the red globules of the blood. All these opinions seem to be equally fanciful. The want of an excretory duct has occasioned the real use of this viscus to be still doubtful. Perhaps the blood undergoes some change in it, which may assist in the preparation of the bile. This is the opinion of the generality of modern physiologists; and the great quantity of blood with which it is supplied, together with the course of its veins into the vena portæ, seem to render this notion probable.

Of the Abdomen.

Sect. XI. *Of the Glandulæ Renales, Kidneys, and Ureters.*

100. The glandulæ renales, which were by the ancients supposed to secrete the atra bilis, and by them named *capsulæ atrabilares*, are two flat bodies of an irregular figure, one on each side between the kidney and the aorta.

In the fœtus they are as large as the kidneys: but they do not increase afterwards in proportion to those parts; and in adults and old people they are generally found shrivelled, and much wasted. They have their arteries and veins. Their arteries usually arise from the splenic or the emulgent, and sometimes from the aorta; and their veins go to the neighbouring veins, or to the vena cava. Their nerves are branches of the intercostal.

The use of these parts is not yet perfectly known. In the fœtus the secretion of urine must be in a very small quantity, and a part of the blood may perhaps then pass through these channels, which in the adult is carried to the kidneys to supply the matter of urine.

101. Kidneys. The kidneys are two in number, situated one on the right and the other on the left side in the lumbar region, between the last false rib and the os ilium, by the sides of the vertebræ. Each kidney in its figure resembles a sort of bean, which from its shape is called *kidney-bean*. The concave part of each kidney is turned towards the aorta and vena cava ascendens. They are surrounded by a good deal of fat, and receive a coat from the peritonæum; and when this is removed, a very fine membrane is found investing their substance and the vessels which ramify through them.

Each kidney has a considerable artery and vein, which are called the *emulgent*. The artery is a branch from the aorta, and the vein passes into the vena cava. Their nerves, which every where accompany the blood-vessels, arise from a considerable plexus, which is derived from the intercostal.

In each kidney, which in the adult is of a pretty firm texture, there are three substances to be distinguished (E). The outer part is glandular or cortical, beyond

(D) These concretions sometimes remain in the gall-bladder without causing any uneasiness. Dr Heberden relates, that a gall-stone weighing two drams was found in the gall-bladder of the late Lord Bath, though he had never complained of the jaundice, nor of any disorder which he could attribute to that cause. *Med. Transf.* Vol. ii.

(E) The kidneys in the fœtus are distinctly lobulated; but in the adult they become perfectly firm, smooth, and regular.

Of the Abdomen.

beyond this is the vaſcular or tubular ſubſtance, and the inner part is papillary or membranous.

It is in the cortical part of the kidney that the ſecretion is carried on; the urine being here received from the minute extremities of the capillary arteries, is conveyed out of this cortical ſubſtance by an infinite number of very ſmall cylindrical canals or excretory veſſels, which conſtitute the tubular part. Theſe tubes, as they approach the inner ſubſtance of the kidney, gradually unite together; and thus forming larger canals, at length terminate in ten or twelve little protuberances called *papillæ*, the orifices of which may be ſeen without the aſſiſtance of glaſſes. Theſe papillæ open into a ſmall cavity or reſervoir called the *pelvis of the kidney*, and formed by a diſtinct membranous bag which embraces the papillæ. From this pelvis the urine is conveyed through a membranous canal which paſſes out from the hollow ſide of the kidney, a little below the blood veſſels, and is called *ureter*.

101 Ureters.

The ureters are each about as large as a common writing-pen. They are ſomewhat curved in their courſe from the kidneys, like the letter *ſ*, and at length terminate in the poſterior and almoſt inferior part of the bladder, at ſome diſtance from each other. They paſs into the bladder in the ſame manner as the ductus choledochus communis paſſes into the inteſtinum duodenum, not by a direct paſſage, but by an oblique courſe between the two coats; ſo that the diſcharge of urine into the bladder is promoted, whilſt its return is prevented. Nor does this mode of ſtructure prevent the paſſage of fluids only from the bladder into the ureters, but likewiſe air:—for air thrown into the bladder inflates it, and it continues to be diſtended if a ligature is paſſed round its neck; which ſeems to prove ſufficiently that it cannot paſs into the ureters.

Sect. XII. *Of the Urinary Bladder.*

102 The urinary bladder is a membranous and muſcular bag of an oblong roundiſh ſhape, ſituated in the pelvis, between the os pubis and inteſtinum rectum in men, and between the os pubis and uterus in women. Its upper and wideſt part is uſually called the *bottom*, its narrow part the *neck* of the bladder; the former only is covered by the peritonæum.

The bladder is formed of three coats, connected together by means of cellular membrane. The external or peritonæal, is only a partial one, covering the upper and back part of the bladder. The middle, or muſcular coat, is compoſed of irritable, and of courſe muſcular fibres, which are moſt collected around the neck of the bladder, but not ſo as to form a diſtinct muſcle, or ſphincter, as the generality of anatomiſts have hitherto ſuppoſed.

The inner coat, though much ſmoother, has been ſaid to reſemble the villous tunic of the inteſtines, and like that is provided with a mucus, which defends it againſt the acrimony of the urine.

103 Of the urine.

It will be eaſily conceived from what has been ſaid, that the kidneys are two glandular bodies, thro' which a ſaline and excrementitious fluid called *urine* is conſtantly filtering from the maſs of blood.

While only a ſmall quantity of urine is collected in the bladder, it excites no kind of uneaſineſs; but when a greater quantity is accumulated, ſo that the bladder is diſtended in a certain degree, it excites in us a certain ſenſation, which brings on as it were a voluntary contraction of the bladder to promote its diſcharge.—But this contraction is not effected by the muſcular fibres of the bladder alone: for all the abdominal muſcles contract in obedience to our will, and preſs downwards all the viſcera of the lower belly; and theſe powers being united, at length overcome the reſiſtance of the fibres ſurrounding the neck of the bladder, which dilates and affords a paſſage to the urine through the urethra.

Of the Abdomen.

The frequency of this evacuation depends on the quantity of urine ſecreted; on the degree of acrimony it poſſeſſes; on the ſize of the bladder, and on its degree of ſenſibility.

The urine varies much in its colour and contents. Theſe varieties depend, on age, ſex, climate, diet, and other circumſtances. In infants it is generally a clear watery fluid, without ſmell or taſte. As we advance in life, it acquires more colour and ſmell, and becomes more impregnated with ſalts. In old people it becomes ſtill more acrid and fetid.

In a healthy ſtate it is nearly of a ſtraw colour.—After being kept for ſome time, it depoſites a tartarous matter, which is found to be compoſed chiefly of earth and ſalt, and ſoon incruſts the ſides of the veſſel in which it is contained. While this ſeparation is taking place, appearances like minute fibres or threads of a whitiſh colour, may be ſeen in the middle of the urine, and an oily ſcum obſerved floating on its ſurface. So that the moſt common appearances of the urine are ſufficient to aſcertain that it is a watery ſubſtance, impregnated with earthy, ſaline, and oily particles.

The urine is not always voided of the ſame colour and conſiſtence; for theſe are found to depend on the proportion of its watery part to that of its other conſtituent principles.—Its colour and degree of fluidity ſeem to depend on the quantity of ſaline and inflammable particles contained in it: ſo that an increaſed proportion of thoſe parts will conſtantly give the urine a higher colour, and add to the quantity of ſediment.

The variety in the appearance of the urine, depends on the nature and quantity of ſolid and fluid aliment we take in; and it is likewiſe occaſioned by the different ſtate of the urinary veſſels, by which we mean the channels through which it is ſeparated from the blood, and conveyed through the pelvis into the ureters. The cauſes of calculous concretions in the urinary paſſages, are to be looked for in the natural conſtitution of the body, mode of life, &c.

It having been obſerved, that after drinking any light wine or Spa water, it very ſoon paſſed off by urine, it has been ſuppoſed by ſome, that the urine is not altogether conveyed to the bladder by the ordinary courſe of circulation, but that there muſt certainly exiſt ſome other ſhorter means of communication, perhaps by certain veſſels between the ſtomach and the bladder, or by a retrograde motion in the lymphatics. But it is certain, that if we open the belly of a dog, preſs out the urine from the bladder, paſs a ligature round the emulgent arteries, and then ſew up the abdomen, and give him even the moſt diuretic liquor to drink, the ſtomach and other channels will be diſtend-

Of the Abdomen.

ed with it, but not a drop of urine will be found to have paſſed into the bladder; or the ſame thing happens when a ligature is thrown round the two ureters. This experiment then ſeems to be a ſufficient proof, that all the urine we evacuate, is conveyed to the kidneys through the emulgent arteries, in the manner we have deſcribed.—It is true, that wine and other liquors promote a ſpeedy evacuation of urine: but the diſcharge ſeems to be merely the effect of the ſtimulus they occaſion; by which the bladder and urinary parts are ſolicited to a more copious diſcharge of the urine, which was before in the body, and not immediately of that which was laſt drank; and this increaſed diſcharge, if the ſupply is kept up, will continue: nor will this appear wonderful, if we conſider the great capacity of the veſſels that go to the kidneys; the conſtant ſupply of freſh blood that is eſſential to health; and the rapidity with which it is inceſſantly circulated through the heart to all parts of the body.

Sect. XIII. *Of Digeſtion.*

102. We are now proceeding to ſpeak of *digeſtion*, which ſeems to be introduced in this place with propriety, after a deſcription of the abdominal viſcera, the greater part of which contribute to this function. By *digeſtion* is to be underſtood, the changes the aliment undergoes for the formation of chyle:—theſe changes are effected in the mouth, ſtomach, and ſmall inteſtines.

The mouth, of which every body has a general knowledge, is the cavity between the two jaws, formed anteriorly and laterally by the lips, teeth, and cheeks, and terminating poſteriorly in the throat.

The lips and cheeks are made up of fat and muſcles, covered by the cuticle, which is continued over the whole inner ſurface of the mouth, like a fine and delicate membrane.—Beſide this membrane, the inſide of the mouth is furniſhed with a ſpongy and very vaſcular ſubſtance called the *gums*, by means of which the teeth are ſecured in their ſockets. A ſimilar ſubſtance covers the roof of the mouth, and forms what is called the *velum pendulum palati*, which is fixed to the extremity of the arch formed by the oſſa maxillaria and oſſa palati, and terminates in a ſoft, ſmall, and conical body, named *uvula*; which appears, as it were, ſuſpended from the middle of the arch over the baſis of the tongue.

The velum pendulum palati performs the office of a valve between the cavity of the mouth and the pharynx, being moved by ſeveral muſcles (f).

The tongue is compoſed of ſeveral muſcles (g) which enable it to perform a variety of motions for the articulation of the voice; for the purpoſes of maſtication; and for conveying the aliment into the pharynx. Its upper part is covered with papillæ, which conſtitute the organ of taſte, and are eaſily to be diſtinguiſhed; it is covered by the ſame membrane that lines the inſide of the mouth, and which makes at its inferior part towards its baſis a reduplication called *frænum*.

Of the Abdomen.

Poſteriorly, under the velum palati, and at the baſis of the tongue, is the pharynx: which is the beginning of the œſophagus, ſtretched out every way, ſo as to reſemble the top of a funnel, through which the aliment paſſes into the ſtomach.

The mouth has a communication with the noſtrils at its poſterior and upper part; with the ears, by the Euſtachian tubes; with the lungs, by means of the larynx; and with the ſtomach, by means of the œſophagus.

The pharynx is conſtantly moiſtened by a fluid, ſecreted by two conſiderable glands called the *tonſils*, one on each ſide of the velum palati. Theſe glands, from their ſuppoſed reſemblance to almonds, have likewiſe been called *amygdalus*.

The mouth is moiſtened by a conſiderable quantity of ſaliva. This fluid is derived from the *parotid glands*; a name which by its etymology points out their ſituation to be near the ears. They are two in number, one on each ſide under the os malæ: and they are of the conglomerate kind; being formed of many ſmaller glands, each of which ſends out a very ſmall excretory duct, which unites with the reſt, to form one common channel, that runs over the cheek, and piercing the buccinator muſcle, opens into the mouth on each ſide, by an orifice into which a briſtle may be eaſily introduced.—Beſides theſe, the maxillary glands, which are placed near the inner ſurface of the angle of the lower jaw on each ſide; the ſublingual glands, which are ſituated at the root of the tongue; the glands of the palate, which are ſeated in the velum palati; and thoſe of the cheeks, lips, &c. together with many other leſs conſiderable ones,—pour the ſaliva into the mouth through their ſeveral excretory ducts.

The ſaliva, like all the other humours of the body, is found to be different in different people: but in general, it is a limpid and inſipid fluid, without ſmell in healthy ſubjects; and theſe properties would ſeem to prove that it contains very few ſaline or inflammable particles.

The uſes of the ſaliva ſeem to be to moiſten and lubricate the mouth, and to aſſiſt in reducing the aliment into a ſoft pulp before it is conveyed into the ſtomach.

103 Of hunger and thirſt.

The variety of functions which are conſtantly performed by the living body, muſt neceſſarily occaſion a continual waſte and diſſipation of its ſeveral parts. A great quantity is every day thrown off by the inſenſible perſpiration and other diſcharges; and were not theſe loſſes conſtantly recruited by a freſh ſupply of chyle, the body would ſoon effect its own diſſolution. But nature has very wiſely favoured us with organs fitted to produce ſuch a ſupply; and has at the ſame time endued us with the ſenſations of hunger and thirſt, that our attention may not be diverted from the neceſſary buſineſs of nutrition. The ſenſation of hunger is univerſally

(f) Theſe are the circumflexus palati, levator palati mollis, palato-pharyngæus conſtrictor iſthmi faucium and azygos uvulæ. See page 708.

(g) Theſe are, the genio-gloſſus, hyo-gloſſus, lingualis, and ſtylo-gloſſus. See page 708.

Of the Abdomen.

verſally known; but it would perhaps be difficult to deſcribe it perfectly in words. It may, however, be defined to be a certain uneaſy ſenſation in the ſtomach, which induces us to wiſh for ſolid food; and which likewiſe ſerves to point out the proper quantity, and time for taking it. In deſcribing the ſtomach, mention was made of the gaſtric juice, as every where lubricating its inner coat. This humour mixes itſelf with the aliment in the ſtomach, and helps to prepare it for its paſſage into the inteſtines; but when the ſtomach is perfectly empty, this ſame fluid irritates the coats of the ſtomach itſelf, and produces the ſenſation of hunger.

A certain proportion of liquid aliment is required to aſſiſt in the proceſs of digeſtion, and to afford that moiſture to the body, of which there is ſuch a conſtant diſſipation.—Thirſt induces us to take this neceſſary ſupply of drink; and the ſeat of this ſenſation is in the tongue, fauces, and œſophagus, which from their great ſenſibility are required to be kept moiſt: for though the fauces are naturally moiſtened by the mucus and ſalival juices; yet the blood, when deprived of its watery part or rendered acrimonious by any natural cauſes, never fails particularly to affect theſe parts, and the whole alimentary canal, and to occaſion thirſt.—This is the common effect of fevers and of hard labour, by both which too much of the watery part of the blood is diſſipated.

104 Of maſtication and deglutition.

It has been obſerved, that the aliment undergoes ſome preparation in the mouth before it paſſes into the ſtomach; and this preparation is the effect of maſtication. In treating of the upper and lower jaws, mention was made of the number and arrangement of the teeth. The upper jaw was deſcribed as being immoveable; but the lower jaw was ſpoken of as being capable of elevation and depreſſion, and of a grinding motion. The aliment, when firſt carried into the mouth, is preſſed between the teeth of the two jaws by a very ſtrong and frequent motion of the lower jaw; and the tongue and the cheeks aſſiſting in this proceſs, continue to replace the food between the teeth till it is perfectly divided, and reduced to the conſiſtence of pulp. The inciſores and canini divide it firſt into ſmaller pieces, but it is between the ſurfaces of the dentes molares by the grinding motion of the jaw that the maſtication is completed.

During this proceſs, the ſalival glands being gently compreſſed by the contraction of the muſcles that move the lower jaw, pour out their ſaliva: this helps to divide and break down the food, which at length becomes a kind of pulp, and is then carried over the baſis of the tongue into the fauces. But to effect this paſſage into the œſophagus, it is neceſſary that the other openings which were mentioned as having a communication with the mouth as well as the pharynx, ſhould be cloſed; that none of the aliment, whether ſolid or liquid, may paſs into them, whilſt the pharynx alone is dilated to receive it:—And ſuch a diſpoſition actually takes place in a manner we will endeavour to deſcribe.

The trachea arteria, or windpipe, through which the air is conveyed to the lungs, is placed before the œſophagus—in the act of ſwallowing; therefore, if the *larynx* (for ſo the upper part of the trachea is called) is not cloſed, the aliment will paſs into it in its way to the œſophagus. But this is prevented by a ſmall and very elaſtic cartilage, called *epiglottis*, which is attached only to the fore-part of the larynx; ſo that the food in its paſſage to the œſophagus preſſes down this cartilage, which then covers the glottis or opening of the larynx; and at the ſame time the velum palati being capable of ſome degree of motion, is drawn backwards by its muſcles, and cloſes the openings into the noſe and the Euſtachian tubes.—This, however, is not all. The larynx, which being compoſed of cartilaginous rings, cannot fail in its ordinary ſtate to compreſs the membranous canal of the œſophagus, is in the act of deglutition carried forwards and upwards by muſcles deſtined for that purpoſe; and conſequently drawing the fore-part of the pharynx with it, that opening is fully dilated. When the aliment has reached the pharynx, its deſcent is promoted by its own proper weight, and by the muſcular fibres of the œſophagus, which continue to contract from above downwards, until the aliment has reached the ſtomach. That theſe fibres have no inconſiderable ſhare in deglutition, any perſon may experience, by ſwallowing with his head downwards, when the deſcent of the aliment cannot poſſibly be effected by its weight.

It is neceſſary that the noſtrils and the lungs ſhould communicate with the mouth, for the purpoſes of ſpeech and reſpiration: but if the moſt minute part of our food happens to be introduced into the trachea, it never fails to produce a violent cough, and ſometimes the moſt alarming ſymptoms. This is liable to happen when we laugh or ſpeak in the act of deglutition: the food is then ſaid to have paſſed the wrong way. And indeed this is not improperly expreſſed: for death would ſoon follow, if the quantity of aliment introduced into the trachea ſhould be ſufficient to obſtruct the reſpiration only during a very ſhort time; or if the irritating particles of food ſhould not ſoon be thrown up again by means of the cough, which in theſe caſes very ſeaſonably increaſes in proportion to the degree of irritation.

If the velum palati did not cloſe the paſſage to the noſtrils, deglutition would be performed with difficulty, and perhaps not at all; for the aliment would return through the noſe, as is ſometimes the caſe in drinking. Children, from a deficiency in this velum palati, have been ſeen to die a few hours after birth; and they who from diſeaſe or any other cauſes have not this part perfect, ſwallow with difficulty.

The aliment, after having been ſufficiently divided by the action of the teeth, and attenuated by the ſaliva, is received into the ſtomach, where it is deſtined to undergo a more conſiderable change.

The properties of the aliment not being much altered at its firſt entrance into the ſtomach, and before it is thoroughly blended with the gaſtric juice, is capable of irritating the inner coat of the ſtomach to a certain degree, and occaſions a contraction of its two orifices.—In this membranous bag, ſurrounded by the abdominal viſcera, and with a certain degree of natural heat, the aliment undergoes a conſtant agitation by means of the abdominal muſcles and of the diaphragm, and likewiſe by a certain contraction or expanſion of the muſcular fibres of the ſtomach itſelf. By this motion, every part of the food is expoſed to the action of the gaſtric juice, which gradually divides and attenuates it, and prepares it for its paſſage into the inteſtines.

Some

Of the Abdomen.

Some observations lately published by Mr Hunter in the Philosophical Transactions, tend to throw considerable light on the principles of digestion. There are few dead bodies in which the stomach, at its great end, is not found to be in some degree digested (H). Animals, or parts of animals, possessed of the living principle, when taken into the stomach, are not in the least affected by the action of that viscus; but the moment they lose the living principle, they become subject to its digestive powers. This seems to be the case with the stomach, which is enabled to resist the action of its juices in the living body: but when deprived of the living principle, it is then no longer able to resist the powers of that menstruum, which it had itself formed for the digestion of its contents; the process of digestion appearing to be continued after death. This is confirmed by what happens in the stomachs of fishes: They frequently swallow, without mastication, fish which are larger than the digesting parts of their stomach can contain; and in such cases, that part which is taken into the stomach is more or less dissolved, while that part which remains in the œsophagus is perfectly sound; and here, as well as in the human body, the digesting part of the stomach is often reduced to the same state as the digested part of the food. These appearances tend to prove, that digestion is not effected by a mechanical power, by contractions of the stomach, or by heat; but by a fluid secreted in the coats of the stomach, which is poured into its cavity, and there animalizes the food, or assimilates it to the nature of blood.

From some late experiments by M. Sage,* it appears, that inflammable air has the property of destroying and dissolving the animal texture: And as we swallow with the substances which serve us for food a great quantity of atmospherical air, M. Sage thinks it possible, that dephlogisticated, which is its principle, may be converted in the stomach into inflammable air, or may modify into inflammable air a portion of the oily substance which is the principle of aliments. In this case, would not the inflammable air (he asks), by dissolving our food, facilitate its conversion into chyle?

* *Hist. de Academie yale des iences, &c.* our 1784. em. 15.

Be this as it may, the food, after having remained one, two, or three hours in the stomach, is converted into a greyish pulp, which is usually called *chymus*, a word of Greek etymology, signifying *juice*, and some few milky or chylous particles begin to appear.—But the term of its residence in this bag is proportioned to the nature of the aliment, and to the state of the stomach and its juices. The thinner and more perfectly digested parts of the food pass by a little at a time into the duodenum, through the pylorus, the fibres of which relax to afford it a passage; and the grosser and less digested particles remain in the stomach, till they acquire a sufficient fluidity to pass into the intestines, where the nature of the *chymus* is perfectly changed. The bile and pancreatic juice which flow into the duodenum, and the mucus, which is every where distilled from the surface of the intestines, mix themselves with the alimentary pulp, which they still farther attenuate and dissolve, and into which they seem to infuse new properties.

Of the Abdomen.

Two matters very different from each other in their nature and destination, are the result of this combination.—One of these, which is composed of the liquid parts of the aliment, and of some of its more solid particles, extremely divided and mixed with the juices we have described, constitutes a very mild, sweet, and whitish fluid, resembling milk, and distinguished by the name of *chyle*. This fluid is absorbed by the lacteal veins, which convey it into the circulation, where, by being assimilated into the nature of blood, it affords that supply of nutrition, which the continual waste of the body is found to require.—The other, is the remains of the alimentary mass deprived of all its nutritious particles, and containing only such parts as were rejected by the absorbing mouths of the lacteals. This grosser part, called the *fæces*, passes on through the course of the intestines, to be voided at the anus, as will be explained hereafter; for this process in the œconomy cannot be well understood till the motion of respiration has been explained. But the structure of the intestines is a subject which may be properly described in this place, and deserves to be attended to.

It has been already observed, that the intestinal canal is five or six times as long as the body, and that it forms many circumvolutions in the cavity of the abdomen, which it traverses from the right to the left, and again from the left to the right; in one place descending, and in another extending itself upwards. It was noticed likewise, that the inner coat of the intestines, by being more capacious than their exterior tunics, formed a multitude of plaits placed at a certain distance from each other, and called *valvulæ conniventes*. Now this disposition will be found to afford a farther proof of that divine wisdom, which the anatomist and physiologist cannot fail to discover in all their pursuits. —For if the intestinal canal was much shorter than it naturally is; if instead of the present circumvolutions it passed in a direct course from the stomach; and if its inner surface was smooth and destitute of valves; the aliment would consequently pass with great rapidity to the anus, and sufficient time would be wanting to assimilate the chyle, and for the necessary absorption of it into the lacteals: so that the body would be deprived of the supply of nutrition, which is so essential to life and health; but the length and circumvolutions of the intestines, the inequality of their internal surface,

(H) The Abbé Spallanzani, who has lately written upon digestion, finds, from a variety of experiments, made upon quadrupeds, birds, and fishes, that digestion goes on for some time after death, though far less considerable than in living animals; but heat is necessary in many animals, or at least promotes it in a much greater degree. He found also, that when the stomach was cut out of the body, it had somewhat of the power of digestion, though this was trifling when compared with that which took place when the stomach was left in the body. In not one of the animals was the great curvature of the stomach dissolved, or much eroded after death. There was often a little erosion, especially in different fishes; in which, when he had cleared the stomach of its contents, the internal coat was wanting. In other animals there was only a slight excoriation; and the injury

Of the Abdomen.

face, and the course of the aliment through them, all concur to perfect the separation of the chyle from the fæces, and to afford the necessary nourishment to the body.

Sect. XIV. *Of the Course of the Chyle, and of the Lymphatic System.*

105. An infinite number of very minute vessels, called the *lacteal veins*, arise like net-work from the inner surface of the intestines, (but principally from the *jejunum* and *ilium*), which are distended to imbibe the nutritious fluid or chyle. These vessels, which were discovered by Asellius in 1622 (1), pass obliquely through the coats of the intestine, and running along the mesentery, unite as they advance, and form larger branches, all of which pass through the mesenteric or conglobate glands, which are very numerous in the human subject. As they run between the intestines and these glands, they are styled *venæ lacteæ primis generis*: but after leaving these glands, they are found to be less numerous, and being increased in size, are then called *venæ lacteæ secundi generis*, which go to deposite their contents in the *thoracic duct*, through which the chyle is conveyed into the blood.

This *thoracic duct* begins about the lower part of the first vertebra lumborum, from whence it passes up by the side of the aorta, between that and the vena azygos, close to the vertebræ, being covered by the pleura. Sometimes it is found divided into two branches; but they usually unite again into one canal, which opens into the left subclavian vein, after having run a little way in an oblique course between its coats. The subclavian vein communicates with the vena cava, which passes to the right auricle of the heart.

The lower part of this duct being usually larger than any other part of it, has been named *receptaculum chyli*, or *Pecquet's receptacle*, in honour of the anatomist who first discovered it in 1651. In some quadrupeds, in turtle and in fish, this enlargement * is more considerable in proportion to the size of the duct, than it usually is in the human subject, where it is not commonly found large enough to merit the name of *receptaculum*.

* *Hewson's Exp. Inq.* Part II.

Opportunities of observing the lacteals in the human subject do not often occur; but they may be easily demonstrated in a dog or any other quadruped that is killed two or three hours after feeding upon milk, for then they appear filled with white chyle.

But these *lacteals* which we have described, as passing from the intestines through the mesentery to the thoracic duct, compose only a part of a system of vessels which perform the office of *absorption*, and which constitute, with their common trunk the thoracic duct, and the conglobate glands that are dispersed through the body, what may be styled the *lymphatic system*. So that what is said of the structure of one of these series of vessels may very properly be applied to that of the other.

106 Lymphatic vessels.

The *lymphatic veins* (K) are minute pellucid tubes, which, like the lacteals, direct their course towards the centre of the body, where they pour a colourless fluid into the thoracic duct. The lymphatics from all the lower parts of the body gradually unite as they approach this duct, into which they enter by three or four very large trunks, that seem to form the lower extremity of this canal, or *receptaculum chyli*, which may be considered as the great trunk of the lymphatic system. The lacteals open into it near the same place; and the lymphatics, from a large share of the upper parts of the body, pour their lymph into different parts of this duct as it runs upwards, to terminate in the left subclavian vein. The lymphatics from the right side of the neck, thorax, and right arm, &c. terminate in the right subclavian vein.

As the lymphatics commonly lie close to the large blood-vessels, a ligature passed round the crural artery in a living animal, by including the lymphatics, will occasion a distension of these vessels below the ligature, so as to demonstrate them with ease; and a ligature passed round the thoracic duct, instantly after killing an animal, will, by stopping the course of its contents into

---

jury in all of them was at the inferior part, or great curvature. The coats of the stomach suffer less after death than flesh, or part of the stomach of similar animals put into it: The author assigns as a reason for this, that these bodies are invested on all sides by the gastric fluid, whereas it only acts on the internal surface of the stomach.

(1) We are informed by Galen, that the lacteals had been seen in kids by Erasistratus, who considered them as arteries carrying a milky fluid: but from the remote time in which he lived, they do not seem to have been noticed till they were discovered in a living dog by Asellius, who denominated them *lacteals*, and considered them as serving to convey the chyle from the intestines to the liver; for before the discovery of the thoracic duct, the use of the liver was universally supposed to be that of converting the chyle into blood. But the discovery of the thoracic duct by Pecquet, not long after, corrected this error. Pecquet very candidly confesses, that this discovery accidentally arose from his observing a white fluid, mixed with the blood, flowing out of the vena cava, after he had cut off the heart of a living dog; which he suspected to be chyle, and afterwards traced to its source from the thoracic duct: This duct had been seen near an hundred years before in a horse by Eustachius, who speaks of it as a vein of a particular structure, but without knowing any thing of its termination or use.

(K) The arteries in their course through the body becoming gradually too minute to admit the red globules of the blood, have then been styled *capillary* or *lymphatic arteries*. The vessels which are here described as constituting the lymphatic system, were at first supposed to be continued from those arteries, and to convey back the lymph, either into the red veins or the thoracic duct; the office of absorption having been attributed to the *red veins*. But we know that the *lymphatic veins* are not continuations of the *lymphatic arteries*, but that they constitute the *absorbent system*. There are still, however, some very respectable names among the anatomists of the present age, who contend, that the red veins act likewise as absorbents:—but it seems to have been clearly proved, that the red veins do absorb nowhere but in the cavernous cells of the penis, the erection of which is occasioned by a distension of those cells with arterial blood.

Of the Abdomen.

into the ſubclavian vein, diſtend not only the lacteals, but alſo the lymphatics in the abdomen and lower extremities, with their natural fluids (l).

The coats of theſe veſſels are too thin to be ſeparated from each other; but the mercury they are capable of ſuſtaining, proves them to be very ſtrong; and their great power of contraction, after undergoing conſiderable diſtenſion, together with the irritability with which Baron Haller found them to be endued *, ſeems to render it probable, that, like the blood-veſſels, they have a muſcular coat.

* *Sur le mouvement du ſang* Ex. 95, 298.

The lymphatics are nouriſhed after the ſame manner as all the other parts of the body. For even the moſt minute of theſe veſſels are probably ſupplied with ſtill more minute arteries and veins. This ſeems to be proved by the inflammation of which they are ſuſceptible; and the painful ſwellings which ſometimes take place in lymphatic veſſels, prove that they have nerves as well as blood-veſſels.

Both the lacteals, lymphatics, and thoracic duct, are furniſhed with valves, which are much more common in theſe veſſels than in the red veins. Theſe valves are uſually in pairs, and ſerve to promote the courſe of the chyle and lymph towards the thoracic duct, and to prevent its return. Mention has been made of the glands, through which the lacteals paſs in their courſe through the meſentery; and it is to be obſerved, that the lymphatics paſs through ſimilar glands in their way to the thoracic duct. Theſe glands are all of a conglobate kind, but the changes which the chyle and lymph undergo in their paſſage through them, have not yet been aſcertained.

The *lymphatic veſſels* begin from ſurfaces and cavities in all parts of the bodies as *abſorbents*. This is a fact now univerſally allowed; but how the fluids they abſorb are poured into thoſe cavities, is a ſubject of controverſy. The contents of the abdomen, for inſtance, were deſcribed as being conſtantly moiſtened by a very thin watery fluid. The ſame thing takes place in the pericardium, pleura, and all the other cavities of the body, and this watery fluid is the *lymph*. But whether it is exhaled into thoſe cavities through the minute ends of arteries, or tranſuded through their coats, are the points in diſpute. We cannot here be permitted to relate the many ingenious arguments that have been advanced in favour of each of theſe opinions; nor is it perhaps of conſequence to our preſent purpoſe to enter into the diſpute. It will be ſufficient if the reader can form an idea of what the lymph is, and of the manner in which it is abſorbed.

The *lymph*, from its tranſparency and want of colour, would ſeem to be nothing but water; and hence the firſt diſcoverers of theſe veſſels ſtiled them *ductus aquoſi*: but experiments prove, that the lymph of an healthy animal coagulates by being expoſed to the air, or a certain degree of heat, and likewiſe by being ſuffered to reſt; ſeeming to agree in this property with that part of the blood called the *coagulable lymph*.—This property of the lymph leads to determine its uſe, in moiſtening and lubricating the ſeveral cavities of the body in which it is found; and for which, by its gelatinous principle, it ſeems to be much better calculated than a pure and watery fluid would be, for ſuch it has been ſuppoſed to be by ſome anatomiſts.

Of the Abdomen.

The mouths of the *lymphatics* and *lacteals*, by acting as capillary tubes, ſeem to abſorb the *lymph* and *chyle* ſomewhat in the ſame manner as a capillary tube of glaſs, when put into a baſon of water, is enabled to attract the water into it to a certain height; but it is probable that they likewiſe poſſeſs a living power, which aſſiſts in performing this office. In the human body the *lymph*, or the *chyle*, is probably conveyed upon this principle as far as the firſt pair of valves, which ſeem to be placed not far from the orifice of the abſorbing veſſel, whether *lymphatic* or *lacteal*; and the fluid will then be propelled forwards, by a continuation of the abſorption at the orifice. But this does not ſeem to be the only inducement to its progreſs towards the thoracic duct; theſe veſſels have probably a muſcular coat, which may ſerve to preſs the fluid forwards from one pair of valves to another; and as the large lymphatic veſſels and the thoracic duct are placed cloſe to the large arteries, which have a conſiderable pulſation, it is reaſonable to ſuppoſe, that they derive ſome advantages from this ſituation.

Sect. XV. *Of the Generative Organs; of Conception*, &c.

§ 1. *The Male Organs.*

107.

The male organs of generation have been uſually divided into the parts which ſerve to prepare the ſemen from the blood, and thoſe which are diſtended to convey it into the womb. But it ſeems to be more proper to diſtinguiſh them into the *preparing*, the *containing*, and the *expelling* parts, which are the different offices of the *teſtes*, the *veſiculæ ſeminales*, and the *penis*; and this is the order in which we propoſe to deſcribe them.

The teſtes are two glandular bodies, ſerving to ſecrete the ſemen from the blood. They are originally formed and lodged within the cavity of the abdomen; and it is not till after the child is born, or very near that time, that they begin to paſs into the groin, and from thence into the ſcrotum (m). By this diſpoſition they

(l) In the dead body they may be eaſily domonſtrated by opening the artery ramifying through any viſcus, as in the ſpleen, for inſtance, and then throwing in air; by which the lymphatics will be diſtended. One of them may then be punctured, and mercury introduced into it through a blow-pipe.

(m) It ſometimes happens in diſſecting ruptures, that the inteſtine is found in the ſame ſac, and in contact with the teſtis. This appearance was at firſt attributed to a ſuppoſed laceration of the peritonæum; but later obſervations, by pointing out the ſituation of the teſticles in the fœtus, have led to prove, that the teſtis, as it deſcends into the ſcrotum, carries with it a portion or elongation of the peritonæum, which becomes its tunica vaginalis, or a kind of ſac, in which the teſticle is lodged, as will be explained in the courſe of this ſection. The communication between this ſac and the cavity of the abdomen, is uſually ſoon cut off; but in ſome ſubjects

Of the Abdomen.

they are very wiſely protected from the injuries to which they would be liable to be expoſed, from the different poſitions of the child at the time of parturition.

The teſticles in this ſtate are looſely attached to the pſoæ muſcles, by means of the peritonæum by which they are covered; and they are at this time of life connected in a very particular manner to the parietes of the abdomen, and likewiſe to the ſcrotum, by means of a ſubſtance which Mr Hunter calls the *ligament* or *gubernaculum teſtis*, becauſe it connects the teſtis with the ſcrotum, and directs its courſe in its deſcent. This gubernaculum is of a pyramidal form, with its bulbous head fixed to the lower end of the teſtis and epididymis, and loſes its lower and ſlender extremity in the cellular membrane of the ſcrotum. It is difficult to aſcertain what the ſtructure and compoſition of this gubernaculum is, but it is certainly vaſcular and fibrous; and, from certain circumſtances, it would ſeem to be in part compoſed of the cremaſter muſcle, running upwards to join the lower end of the teſtis.

We are not to ſuppoſe that the teſticle, when deſcended into the ſcrotum, is to be ſeen looſe as a piece of gut or omentum would be in a common hernial ſac. We have already obſerved, that during its reſidence in the cavity of the abdomen it is attached to the peritoneum, which deſcends with it; ſo that when the ſac is completed in the ſcrotum, the teſticle is at firſt attached only to the poſterior part of it, while the fore part of it lies looſe, and for ſome time affords a communication with the abdomen. The ſpermatic chord, which is made up of the ſpermatic artery and vein, and of the vas deferens or excretory duct of the teſtis, is cloſely attached behind to the poſterior part of this elongation of the peritonæum. But the fore part of the peritoneal ſac, which is at firſt looſe and not attached to the teſticle, cloſes after a certain time, and becomes united to the poſterior part, and thus perfectly ſurrounds the teſticle as it were in a purſe.

The teſticles of the fœtus differ only in their ſize and ſituation from thoſe of the adult. In their paſſage from the abdomen they deſcend through the abdominal rings into the ſcrotum, where they are ſupported and defended by various integuments.

What the immediate cauſe of this deſcent is, has not yet been ſatisfactorily determined. It has been aſcribed to the effects of reſpiration, but the teſticles have ſometimes been found in the ſcrotum before the child has breathed; and it does not ſeem to be occaſioned by the action of the cremaſter muſcle, becauſe the ſame effect would be liable to happen to the hedgehog, and ſome other quadrupeds, whoſe teſticles remain in the abdomen during life.

Of the Abdomen.

The ſcrotum, which is the external or common covering of both teſticles, is a kind of ſac formed by the common integuments, and externally divided into two equal parts by a prominent line called *raphe*.

In the inner part of the ſcrotum we meet with a cellular coat called *dartos* (N), which by its duplicature divides the ſcrotum into two equal parts, and forms what is called *ſeptum ſcroti*, which correſponds with the raphe. The collapſion which is ſo often obſerved to take place in the ſcrotum of the healthy ſubject, when excited by cold or by the ſtimulus of venery, ſeems to be very properly attributed to the contractile motion of the ſkin, and not to any muſcular fibres, as is the caſe in dogs and ſome other quadrupeds.

The ſcrotum, then, by means of its ſeptum, is found to make two diſtinct bags, in which the teſticles, inveſted by their proper tunics, are ſecurely lodged and ſeparated from each other. Theſe coats are the cremaſter, the tunica vaginalis, and the tunica albuginea. The firſt of theſe is compoſed of muſcular fibres, and is to be conſidered only as a partial covering of the teſtis; for it ſurrounds only the ſpermatic chord, and terminates upon the upper and external parts of the tunica vaginalis teſtis, ſerving to draw up and ſuſpend the teſticle (o). The tunica vaginalis teſtis has already been deſcribed as being a thin production of the peritonæum, looſely adhering every where to the teſticle, which it includes as it were in a bag. The tunica albuginea is a firm, white, and very compact membrane of a gliſtening appearance, which immediately inveſts the body of the teſtis and the epididymus; ſerving in ſome meaſure to connect them to each other, but without extending itſelf at all to the ſpermatic chord. This tunica albuginea ſerves to confine the growth of the teſtis and epididymus within certain limits, and by giving them a due degree of firmneſs, enables them to perform their proper functions.

Having removed this laſt tunic, we diſcover the ſubſtance of the teſticle itſelf, which appears to be made up of an infinite number of very elaſtic filaments, which may be beſt diſtinguiſhed after macerating the teſticle in water. Each teſticle is made up of the ſpermatic artery and vein, and the excretory veſſels or tubuli ſeminiferi. There are likewiſe a great number of abſorbent veſſels, and ſome branches of nerves to be met with in the teſticles.

The ſpermatic arteries ariſe one on each ſide from the aorta, generally about an inch below the emulgents. The right ſpermatic vein commonly paſſes into the vena cava; but the left ſpermatic vein uſually empties itſelf into the emulgent on that ſide; and it is ſup-

jects it continues open during life; and when an hernia or deſcent of the inteſtine takes place in ſuch a ſubject, it does not puſh down a portion of the peritonæum before it, as it muſt otherwiſe neceſſarily do, but paſſes at once through this opening, and comes in contact with the naked teſticle, conſtituting that particular ſpecies of rupture called *hernia congenita*.

(N) The dartos has uſually been conſidered as a muſcle, and is deſcribed as ſuch both by Douglas and Winſlow. But there being no part of the ſcrotum of the human ſubject which can be ſaid to conſiſt of muſcular fibres, Albinus and Haller have very properly omitted to deſcribe the dartos as a muſcle, and conſider it merely as a cellular coat.

(o) The cremaſter muſcle is compoſed of a few fibres from the obliquus internus abdominis, which uniting with a few from the tranſverſalis, deſcend upon the ſpermatic chord, and are inſenſibly loſt upon the tunica vaginalis of the teſticle. It ſerves to ſuſpend and draw up the teſticle.

poſed to take this courſe into the emulgent, that it may avoid paſſing over the aorta, which it would be obliged to do in its way to the vena cava.

The blood is circulated very ſlowly through the ſpermatic artery, which makes an infinite number of circumvolutions in the ſubſtance of the teſticle, where it depoſites the ſemen, which paſſes through the tubuli ſeminiferi. Theſe tubuli ſeminiferi are ſeen running in ſhort waves from the tunica albuginea to the axis of the teſticle; and are divided into diſtinct portions by certain thin membranous productions, which originate from the tunica albuginea. They at length unite, and by an infinite number of convolutions form a ſort of appendix to the teſtis called *epididymis* (P), which is a vaſcular body of an oblong ſhape, ſituate upon the ſuperior part of each teſticle. Theſe tubuli of the epididymis at length form an excretory duct called *vas deferens*, which aſcends towards the abdominal rings, with the other parts that make up the ſpermatic chord, and then a ſeparation takes place; the nerves and blood-veſſels paſſing on to their ſeveral terminations, and the vas deferens going to depoſit its ſemen in the veſiculæ ſeminales, which are two ſoft bodies of a white and convoluted appearance externally, ſituated obliquely between the rectum and the lower part of the bladder, and uniting together at the lower extremity. From theſe reſervoirs (Q), which are plentifully ſupplied with blood-veſſels and nerves, the ſemen is occaſionally diſcharged through two ſhort paſſages, which open into the urethra cloſe to a little eminence called *verumontanum*.

Near this eminence we meet with the proſtate, which is ſituated at the neck of the bladder, and is deſcribed as being of a glandular ſtructure. It is ſhaped ſomewhat like a heart with its ſmall end foremoſt, and inveſts the origin of the urethra. Internally it appears to be of a firm ſubſtance, and compoſed of ſeveral follicles, ſecreting a whitiſh viſcid fluid, that is diſcharged by ten or twelve excretory ducts into the urethra, on each ſide of the openings of the veſiculæ ſeminales at the ſame time, and from the ſame cauſes that the ſemen is expelled. As this latter fluid is found to be exceedingly limpid in the veſiculæ ſeminales of the dead ſubject, it probably owes its whiteneſs and viſcidity to this liquor of the proſtate.

The penis, which is to be conſidered as the vehicle or active organ of procreation, is compoſed of two columns, the corpora cavernoſa, and corpus ſpongioſum. The corpora cavernoſa, which conſtitute the greateſt part of the penis, may be deſcribed as two cylindrical ligamentous tubes, each of which is compoſed of an infinite number of minute cells of a ſpongy texture, which communicate with each other. Theſe two bodies are of a very pliant texture, and capable of conſiderable diſtenſion; and being united laterally to each other, occaſion by this union a ſpace above and another below. The uppermoſt of theſe ſpaces is filled by the blood veſſels, and the lower one, which is larger than the other, by the urethra and its corpus ſpongioſum. Theſe two cavernous bodies are at firſt only ſeparated by a partition of tendinous fibres, which allow them to communicate with each other; but they afterwards devaricate from each other like the branches of the letter Y, and diminiſhing gradually in ſize, are attached,

(P) The teſticles were named *didymi* by the ancients, and the name of this part was given to it on account of its ſituation upon the teſticle.

(Q) That the bags called *veſiculæ ſeminales* are reſervoirs of ſemen, is a circumſtance which has been by anatomiſts univerſally believed. Mr J. Hunter, however, from ſeveral circumſtances, has been induced to think this opinion erroneous.

He has examined theſe veſiculæ in people who have died ſuddenly, and he found their contents to be different in their properties from the ſemen. In thoſe who had loſt one of the teſticles, or the uſe of one of them, by diſeaſe, both the veſiculæ were full, and their contents ſimilar. And in a *luſus naturæ*, where there was no communication between the vaſa deferentia and veſiculæ, nor between the veſiculæ and penis, the ſame thing took place.

From theſe obſervations, he thinks we have a preſumptive proof, That the ſemen can be abſorbed in the body of the teſticle and in the epididymis, and that the veſiculæ ſecrete a mucus which they are capable of abſorbing when it cannot be made uſe of: That the ſemen is not retained in reſervoirs after it is ſecreted, and kept there till it is uſed; but that it is ſecreted at the time, in conſequence of certain affections of the mind ſtimulating the teſticles to this action.

He corroborates his obſervations by the appearance on diſſection in other animals; and here he finds, That the ſhape and contents of the veſiculæ vary much in different animals, while the ſemen in moſt of them he has examined is nearly the ſame: That the vaſa deferentia in many animals do not communicate with the veſiculæ: That the contents of the veſiculæ of caſtrated and perfect animals are ſimilar, and nearly equal in quantity, in no way reſembling the ſemen as emitted from the animal *in coitu*, or what is found in the vas deferens after death. He obſerves likewiſe, that the bulb of the urethra of perfect males is conſiderably larger than in caſtrated animals.

From the whole, he thinks the following inferences may be fairly drawn: That the bags called *veſiculæ ſeminales* are not ſeminal reſervoirs, but glands ſecreting a peculiar mucus; and that the bulb of the urethra is properly ſpeaking the receptacle of the ſemen, in which it is accumulated previous to ejection.

But although he has endeavoured to prove that the veſiculæ do not contain the ſemen, he has not been able to aſcertain their particular uſe. He thinks, however, we may be allowed upon the whole to conclude, that they are, together with other parts, ſubſervient to the purpoſes of generation.

Although the author has treated this ſubject very ably, and made many ingenious obſervations, ſome things may be objected to what he has advanced; of which the following are a few: That thoſe animals who have bags

Of the Abdomen.

tached, one on each side, by means of the ligamentum suspensorium penis to the ramus ischii, and to the inferior portion of the os pubis.

The corpus spongiosum penis, or corpus spongiosum urethræ, as it is styled by some authors, begins as soon as the urethra has passed the prostate, with a thick origin almost like a heart, first under the urethra, and afterwards above it, becoming gradually thinner, and surrounding the whole canal of the urethra, till it terminates in a considerable expansion, and constitutes what is called the *glans penis*, which is exceedingly vascular, and covered with papillæ like the tongue. The cuticle which lines the inner surface of the urethra, is continued over the glans in the same manner as it is spread over the lips.

The penis is invested by the common integuments, but the cutis is reflected back every where from the glans as it is in the eye-lids; so that it covers this part, when the penis is in a relaxed state, as it were with a hood, and from this use is called *prepuce*.

The prepuce is tied down to the under part of the glans by a small ligament called *frænum*, which is in fact only a continuation of the cuticle and cutis. There are many simple sebaceous follicles called *glandulæ odoriferæ*, placed round the basis of the glans; and the fluid they secrete serves to preserve the exquisite sensibility of this part of the penis, and to prevent the ill effects of attrition from the prepuce.

The urethra may be defined to be a membranous canal, passing from the bladder through the whole extent of the penis. Several very small openings, called *lacunæ*, communicate with this canal, through which a mucus is discharged into it; and besides these, there are two glands, first described by Cowper, as secreting a fluid for lubricating the urethra, and called *Cowper's glands* (R); and Littre* speaks of a gland situated near the prostate, as being destined for the same use.

* *Memoires de l'Acad. Royale des Sciences, 1700.*

The urethra being continued from the neck of the bladder, is to be considered as making part of the urinary passage; and it likewise affords a conveyance to the semen, which we have observed is occasionally discharged into it from the vesiculæ seminales. The direction of this canal being first under and then before the pubis, occasions a winding in its course from the bladder to the penis not unlike the turns of the letter *S*.

The penis has three pair of muscles, the erectores, acceleratores, and transversales. They push the blood from the crura to the fore part of the corpora cavernosa. The first originate from the tuberosity of the ischium, and terminate in the corpora cavernosa. The acceleratores arise from the sphincter, and by their insertion serve to compress the bulbous part of the urethra; and the transversales are destined to afford a passage to the semen, by dilating the canal of the urethra.

Of the Abdomen.

The arteries of the penis are chiefly derived from the internal iliacs. Some of them are supposed to terminate by pabulous orifices within the corpora cavernosa and corpus spongiosum; and others terminate in veins, which at last make up the vena magna dorsi penis, and other smaller veins, which are in general distributed in like order with the arteries.

Its nerves are large and numerous. They arise from the great sciatic nerve, and accompany the arteries in their course through the penis.

We have now described the anatomy of this organ; and there only remains to be explained, how it is enabled to attain that degree of firmness and distension which is essential to the great work of generation.

The greatest part of the penis has been spoken of as being of a spongy and cellular texture, plentifully supplied with blood-vessels and nerves, and as having muscles to move it in different directions. Now, the blood is constantly passing into its cells through the small branches of the arteries which open into them, and is from thence as constantly returned by the veins, so long as the corpora cavernosa and corpus spongiosum continue to be in a relaxed and pliant state. But when, from any nervous influence, or other means, which it is not necessary here to define or explain, the erectores penis, ejaculatores seminis, levatores ani, &c. are induced to contract, the veins undergo a certain degree of compression, and the passage of the blood through them is so much impeded, that it collects in them in a greater proportion than they are enabled to carry off, so that the penis gradually enlarges; and being more and more forcibly drawn up against the os pubis, the vena magna itself is at length compressed, and the penis becomes fully distended. But as the causes which first occasioned this distention subside, the penis gradually returns to its state of relaxation.

§ 2. *Female Organs of Generation.* 108

Anatomical writers usually divide the female organs of generation into *external* and *internal*. In the first division they include the *mons veneris*, *labia pudendi*, *perinæum*, *clitoris*, *nymphæ*, and *caruncula myrtiformes*; and in the latter, the *vagina*, with the *uterus* and its appendages.

---

bags called *vesiculæ seminales* perform copulation quickly; whereas others that want them, as in the dog kind, are tedious in copulation: That in the human body, at least, there is a free communication between the vasa deferentia and vesiculæ; and in animals where the author has observed no communication between the vasa deferentia and vesiculæ, there may be a communication by vessels not yet discovered, and which may be compared to the hepato-cystic ducts in fowls and fishes: That the fluid in the end of the vasa deferentia and the vesiculæ seminales are similar, according to the author's own observation: That the vesiculæ in some animals increase and decrease with the testicle at particular seasons: That in birds and certain fishes, there is a dilatation of the ends of the vasa deferentia, which the author himself allows to be a reservoir for the semen.

With respect to the circumstance of the bulb of the urethra answering the purpose of a reservoir, the author has mentioned no facts which tend to establish this opinion. See *Observations on certain Parts of the Animal Oeconomy*.

(R) Both Heister and Morgagni observe, that they have sometimes not been able to find these glands; so that they do not seem to exist in all subjects.

Of the Abdomen.

The *mons veneris*, which is placed on the upper part of the ſymphyſis pubis, is internally compoſed of adipoſe membranes, which makes it ſoft and prominent: it divides into two parts called *labia pudendi*, which deſcending towards the rectum, from which they are divided by the perinæum, form what is called the *fourchette*. The perinæum is that fleſhy ſpace which extends about an inch and an half from the fourchette to the anus, and from thence about two inches to the coccyx.

The labia pudendi being ſeparated, we obſerve a ſulcus called *foſſa magna*; in the upper part of which is placed the clitoris, a ſmall round ſpongy body, in ſome meaſure reſembling the male penis, but impervious, compoſed of two corpora cavernoſa, ariſing from the tuberoſities of the oſſa iſchii; furniſhed with two pair of muſcles, the erectores clitoridis, and the ſphincter or conſtrictor oſtii vaginæ; and terminating in a glans, which is covered with its prepuce. From the lower part, on each ſide of the foſſa, paſs the nymphæ, two membranous and ſpongy folds which ſeem deſtined for uſeful purpoſes in parturition, by tending to enlarge the volume of the vagina as the child's head paſſes through it. Between theſe, about the middle of the foſſa magna, we perceive the orifice of the vagina or os externum, cloſed by folds and wrinkles; and about half an inch above this, and about an inch below the clitoris, appears the meatus urinarius or orifice of the urethra, much ſhorter, though ſomewhat larger, than in men, with a little prominence at its lower edge, which facilitates the introduction of the catheter.

The os externum is ſurrounded internally by ſeveral membranous folds called *caruncul æ myrtiformes*, which are partly the remains of a thin membrane called *hymen*, that covers the vagina in children. In general the hymen is ſufficiently open to admit the paſſage of the menſes, if it exiſts at the time of their appearance; ſometimes, however, it has been found perfectly cloſed.

The vagina, ſituated between the urethra and the rectum, is a membranous cavity, ſurrounded eſpecially at its external extremity with a ſpongy and vaſcular ſubſtance, which is covered by the ſphincter oſtii vaginæ. It terminates in the uterus, about half an inch above the os tincæ, and is wider and ſhorter in women who have had children than in virgins.

All theſe parts are plentifully ſupplied with blood-veſſels and nerves. Around the nymphæ there are ſebaceous follicles, which pour out a fluid to lubricate the inner ſurface of the vagina; and the meatus urinarius, like the urethra in the male ſubject, is conſtantly moiſtened by a mucus, which defends it againſt the acrimony of the urine.

The *uterus* is a hollow viſcus, ſituated in the hypogaſtric region, between the rectum and bladder. It is deſtined to receive the firſt rudiments of the fœtus, and to aſſiſt in the developement of all its parts, till it arrives at a ſtate of perfection, and is fitted to enter into the world, at the time appointed by the wiſe Author of nature.

The uterus, in its unimpregnated ſtate, reſembles a pear in ſhape, ſomewhat flattened, with its fundus or bottom part turned towards the abdomen, and its cervix or neck ſurrounded by the vagina. The entrance into its cavity forms a little protuberance, which has been compared to the mouth of a tench, and is therefore called *os tincæ*.

Of the Abdomen.

The ſubſtance of the uterus, which is of a conſiderable thickneſs, appears to be compoſed of muſcular and ſmall ligamentous fibres, ſmall branches of nerves, ſome lymphatics, and with arteries and veins innumerable. Its nerves are chiefly derived from the intercoſtal, and its arteries and veins from the hypogaſtric and ſpermatic. The membrane which lines its cervix, is a continuation of the inner membrane of the vagina; but the outer ſurface of the body of the uterus is covered with the peritonæum, which is reflected over it, and deſcends from thence to the inteſtinum rectum. This duplicature of the peritonæum, by paſſing off from the ſides of the uterus to the ſides of the pelvis, is there firmly connected, and forms what are called *ligamenta uteri lata*; which not only ſerve to ſupport the uterus, but to convey nerves and blood-veſſels to it.

The *ligamenta uteri rotunda* ariſe from the ſides of the fundus uteri, and paſſing along within the fore-part of the ligamenta lata, deſcend through the abdominal rings, and terminate in the ſubſtance of the mons veneris. The ſubſtance of theſe ligaments is vaſcular, and although both they and the ligamenta lata admit the uterus in the virgin ſtate, to move only about an inch up and down, yet in the courſe of pregnancy they admit of conſiderable diſtenſion, and after parturition return nearly to their original ſtate with ſurpriſing quickneſs.

On each ſide of the inner ſurface of the uterus, in the angle near the fundus, a ſmall orifice is to be diſcovered, which is the beginning of one of the tubæ fallopianæ. Each of theſe tubes, which are two in number, paſſing through the ſubſtance of the uterus, is extended along the broad ligaments, till it reaches the edge of the pelvis, from whence it reflects back; and turning over behind the ligaments, about an inch of its extremity is ſeen hanging looſe in the pelvis, near the ovarium. Theſe extremities, having a jagged appearance, are called *fimbriæ*, or *morſus diaboli*. Each tuba Fallopiana is uſually about three or four inches long. Their cavities are at firſt very ſmall, but become gradually larger, like a trumpet, as they approach the fimbriæ.

Near the fimbriæ of each tuba Fallopiana, about an inch from the uterus, is ſituated an oval body called *ovarium*, of about half the ſize of the male teſticle. Each of theſe ovaria is covered by a production of the peritonæum, and hangs looſe in the pelvis. They are of a flat and angular form, and appear to be compoſed of a white and cellular ſubſtance, in which we are able to diſcover ſeveral minute veſicles filled with a coagulable lymph, of an uncertain number, commonly exceeding 12 in each ovary. In the female of riper years, theſe veſicles become exceedingly turgid, and a kind of yellow coagulum is gradually formed within one of them, which increaſes for a certain time. In conception, one of theſe mature ova is ſuppoſed to be impregnated with the male ſemen, and to be ſqueezed out of its nidus into the Fallopian tu e; after which the ruptured part forms a ſubſtance which in ſome animals is of a yellow colour, and is therefore called *corpus luteum*; and it is obſervable, that the number of theſe ſcars or fiſſures in the ovarium, conſtantly correſponds with the number of fœtuſes excluded by the mother.

Of the Abdomen.

109

§ 3. *Of Conception.*

MAN, being ever curious and inquiſitive, has naturally been led to enquire after the origin of his exiſtence; and the ſubject of generation has employed the philoſophical world in all ages: but in following nature up to her minute receſſes, the philoſopher ſoon finds himſelf bewildered, and his imagination often ſupplies that which he ſo eagerly wiſhes to diſcover, but which is deſtined perhaps never to be revealed to him. Of the many theories which have been formed on this ſubject, that of the ancient philoſophers ſeems to have been the moſt ſimple: they conſidered the male ſemen as alone capable of forming the fœtus, and believed that the female only afforded it a lodging in the womb, and ſupplied it with nouriſhment after it was perfectly formed. This opinion, however, ſoon gave place to another, in which the female was allowed a more conſiderable ſhare in conception.

This ſecond ſyſtem conſidered the fœtus as being formed by the mixture of the ſeminal liquor of both ſexes, by a certain arrangement of its ſeveral particles in the uterus. But in the 16th century, veſicles or eggs were diſcovered in the ovaria or female teſticles; the fœtus had been found ſometimes in the abdomen, and ſometimes in the Fallopian tubes; and the two former opinions were exploded in favour of a new doctrine. The ovaria were compared to a bunch of grapes, being ſuppoſed to conſiſt of veſicles, each of which had a ſtalk; ſo that it might be diſengaged without hurting the reſt, or ſpilling the liquor it contained. Each veſicle was ſaid to include a little animal, almoſt complete in all its parts; and the vapour of the male ſemen being conveyed to the ovarium, was ſuppoſed to produce a fermentation in the veſicle, which approached the neareſt to maturity; and thus inducing it to diſengage itſelf from the ovarium, it paſſed into the tuba Fallopiana, thro' which it was conveyed to the uterus. Here it was ſuppoſed to take root like a vegetable ſeed, and to form, with the veſſels originating from the uterus, what is called the *placenta*; by means of which the circulation is carried on between the mother and the fœtus.

This opinion, with all its abſurdities, continued to be almoſt univerſally adopted till the cloſe of the ſame century, when Lieuwenhoeck, by means of his glaſſes, diſcovered certain opake particles, which he deſcribed as ſo many animalcula, floating in the ſeminal fluid of the male.

This diſcovery introduced a new ſchiſm among the philoſophers of that time, and gave riſe to a ſyſtem which is not yet entirely exploded. According to this theory the male ſemen paſſing into the tubæ Fallopianæ, one of the animalcula penetrates into the ſubſtance of the ovarium, and enters into one of its veſicles or ova. This impregnated ovum is then ſqueezed from its huſk, through the coats of the ovarium, and being ſeized by the fimbriæ, is conducted through the tube to the uterus, where it is nouriſhed till it arrives at a ſtate of perfection. In this ſyſtem there is much ingenuity: but there are certain circumſtances ſuppoſed to take place, which have been hitherto inexplicable. A celebrated modern writer, M. Buffon, endeavours to reſtore, in ſome meaſure, the moſt ancient opinion, by allowing the female ſemen a ſhare in this office; aſſerting, that animalcula or organic particles are to be diſcovered in the ſeminal liquor of both ſexes: he derives the female ſemen from the ovaria, and he contends that no ovum exiſts in thoſe parts. But in this idea he is evidently miſtaken; and the opinion now moſt generally adopted is, that an impregnation of the ovum, by the influence of the male ſemen, is eſſential to conception (s). That the ovum is to be impregnated, there can be no doubt; but as the manner in which ſuch an impregnation is ſuppoſed to take place, and the means by which the ovum afterwards gets into the Fallopian tube, and from thence into the uterus, are ſtill founded chiefly on hypotheſis, we will not attempt to extend farther the inveſtigation of a ſubject concerning which ſo little can be advanced with certainty.

Of the Abdomen.

§ 4. *Of the Fœtus in Utero.*

OPPORTUNITIES of diſſecting the human gravid uterus occurring but ſeldom, the ſtate of the embryo (t) immediately after conception cannot be perfectly known. 110

When the ovum deſcends into the uterus, it is ſuppoſed to be very minute; and it is not till a conſiderable time after conception that the rudiments of the embryo begin to be aſcertained.

About the third or fourth week the eye may diſcover the firſt lineaments of the fœtus; but theſe lineaments are as yet very imperfect, it being only about the ſize of a houſe-fly. Two little veſſels appear in an almoſt tranſparent jelly; the largeſt of which is deſtined to become the head of the fœtus, and the other ſmaller one is reſerved for the trunk. But at this period no extremities are to be ſeen; the umbilical cord appears only as a very minute thread, and the placenta does not as yet abſorb the red particles of the blood. At ſix weeks, not only the head but the features of the face begin to be developed. The noſe appears like a ſmall prominent line, and we are able to diſcover another line under it, which is deſtined for the ſeparation of the lips. Two black points appear in the place of eyes, and two minute holes mark the ears. At the ſides of the trunk, both above and below, we ſee four minute protuberances, which are the rudiments of the arms and legs. At the end of eight weeks the body of the fœtus is upwards of an inch in length, and both the hands and feet are to be diſtinguiſhed. The upper extremities are found to increaſe faſter than the lower ones, and the ſeparation of the fingers is accompliſhed ſooner than that of the toes.

At this period the human form may be deciſively aſcertained;—all the parts of the face may be diſtinguiſhed, the ſhape of the body is clearly marked out, the haunches and the abdomen are elevated, the fingers and

(s) The learned Abbè Spallanzani has thrown much light on this curious ſubject, and has proved by a variety of experiments that the animalcule exiſts entire in the female ovum and that the male ſeed is only neceſſary to vivify and put it in motion.—His experiments and obſervations are worthy the attentive peruſal of every phyſiologiſt.

(t) The rudiments of the child are uſually diſtinguiſhed by this name till the human figure can be diſtinctly aſcertained, and then it has the appellation of *fœtus*.

Of the Abdomen.

and toes are ſeparated from each other, and the inteſtines appear like minute threads.

At the end of the third month, the fœtus meaſures about three inches; at the end of the fourth month, five inches; in the fifth month, ſix or ſeven inches; in the ſixth month, eight or nine inches; in the ſeventh month, eleven or twelve inches; in the eighth month, fourteen or fifteen inches; and at the end of the ninth month, or full time, from eighteen to twenty-two inches. But as we have not an opportunity of examining the ſame fœtus at different periods of pregnancy, and as their ſize and length may be influenced by the conſtitution and mode of life of the mother, calculations of this kind muſt be very uncertain.

The fœtus during all this time aſſumes an oval figure, which correſponds with the ſhape of the uterus. Its chin is found reclining on its breaſt with its knees drawn up towards its chin, and its arms folded over them. But it ſeems likely, that the poſture of ſome of theſe parts is varied in the latter months of pregnancy, ſo as to cauſe thoſe painful twitches which its mother uſually feels from time to time. In natural caſes, its head is probably placed towards the os tincæ from the time of conception to that of its birth; though formerly it was conſidered as being placed towards the fundis uteri till about the eighth or ninth month, when the head, by becoming ſpecifically heavier than the other parts of the body, was ſuppoſed to be turned downwards.

The capacity of the uterus increaſes in proportion to the growth of the fœtus, but without becoming thinner in its ſubſtance, as might naturally be expected. The nouriſhment of the fœtus, during all this time, ſeems to be derived from the placenta, which appears to be originally formed by that part of the ovum which is next the fundus uteri. The remaining part of the ovum is covered by a membrane called *ſpongy chorion* (u); within which is another called *true chorion*, which includes a third termed *amnios* (v): this contains a watery fluid, which is the *liquor amnii* (w), in which the fœtus floats till the time of its birth. On the ſide next the fœtus, the placenta is covered by the amnios and true chorion; on the ſide next the mother it has a production continued from the ſpongy chorion. The amnios and chorion are remarkably thin and tranſparent, having no blood-veſſels entering into their compoſition. The ſpongy chorion is opake and vaſcular.

Of the Abdomen.

In the firſt months of pregnancy, the involucra bear a large proportion to their contents; but this proportion is afterwards reverſed, as the fœtus increaſes in bulk.

The placenta, which is the medium through which the blood is conveyed from the mother to the fœtus, and the manner in which this conveyance takes place, deſerve next to be conſidered.

The placenta is a broad, flat, and ſpongy ſubſtance, like a cake, cloſely adhering to the inner ſurface of the womb, uſually near the fundus, and appearing to be chiefly made up of the ramifications of the umbilical arteries and vein, and partly of the extremities of the uterine veſſels. The arteries of the uterus diſcharge their contents into the ſubſtance of this cake; and the veins of the placenta, receiving the blood either by a direct communication of veſſels, or by abſorption, at length form the umbilical vein, which paſſes on to the ſinus of the vena porta, and from thence to the vena cava, by means of the canalis venoſus, a communication that is cloſed in the adult. But the circulation of the blood through the heart is not conducted in the fœtus as in the adult: in the latter, the blood is carried from the right auricle of the heart through the pulmonary artery, and is returned to the left auricle by the pulmonary vein; but a dilatation of the lungs is eſſential to the paſſage of the blood through the pulmonary veſſels, and this dilatation cannot take place till after the child is born and has reſpired. This deficiency, however, is ſupplied in the fœtus by the immediate communication between the right and left auricle, through an oval opening, in the ſeptum which divides the two auricles, called *foramen ovale*. The blood is likewiſe tranſmitted from the pulmonary artery to the aorta, by means of a duct called *canalis arteriſus*, which, like the canalis venoſus, and foramen ovalæ, gradually cloſes after birth.

The blood is returned again from the fœtus through two arteries called the *umbilical arteries*, which ariſe from the iliacs. Theſe two veſſels taking a winding courſe with the vein, form with that, and the membranes by which they are ſurrounded, what is called the *umbilical chord*. Theſe arteries, after ramifying through the ſubſtance of the placenta, diſcharge their blood into the veins of the uterus; in the ſame manner as the uterine arteries diſcharged their blood into the branches

---

(u) Dr Hunter has deſcribed this as a lamella from the inner ſurface of the uterus. In the latter months of pregnancy it becomes gradually thinner and more connected with the chorion: he has named it *membrana caduca*, or *decidua*, as it is caſt off with the placenta. Signior Scarpa, with more probability, conſiders it as being compoſed of an inſpiſſated coagulable lymph.

(v) In ſome quadrupeds, the urine appears to be conveyed from the bladder through a canal called *urachus*, to the *allantois*, which is a reſervoir, reſembling a long and blind gut, ſituated between the chorion and amnios. The human fœtus ſeems to have no ſuch reſervoir, though ſome writers have ſuppoſed that it does exiſt. From the top of the bladder a few longitudinal fibres are extended to the umbilical chord; and theſe fibres have been conſidered as the urachus, though without having been ever found pervious.

(w) The liquor amnii coagulates like the lymph. It has been ſuppoſed to paſs into the œſophagus, and to afford nouriſhment to the fœtus; but this does not ſeem probable. Children have come into the world without an œſophagus, or any communication between the ſtomach and the mouth; but there has been no well atteſted inſtance of a child's having been born without a placenta; and it does not ſeem likely, that any of the fluid can be abſorbed through the pores of the ſkin, the ſkin in the fœtus being every where covered with a great quantity of mucus.

ANATOMY

Plate XXV

Fig. 1

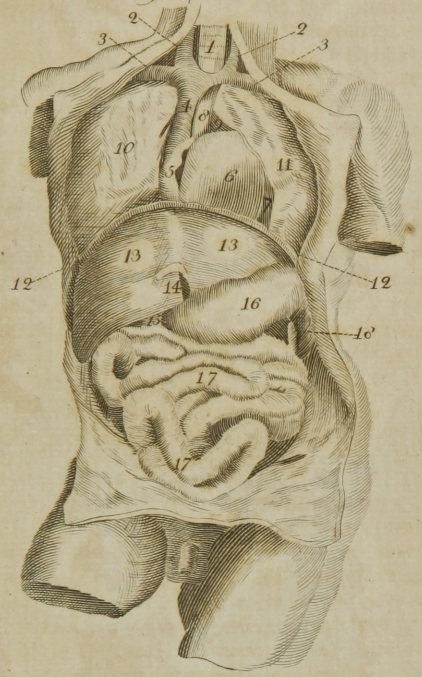


Fig. 2.

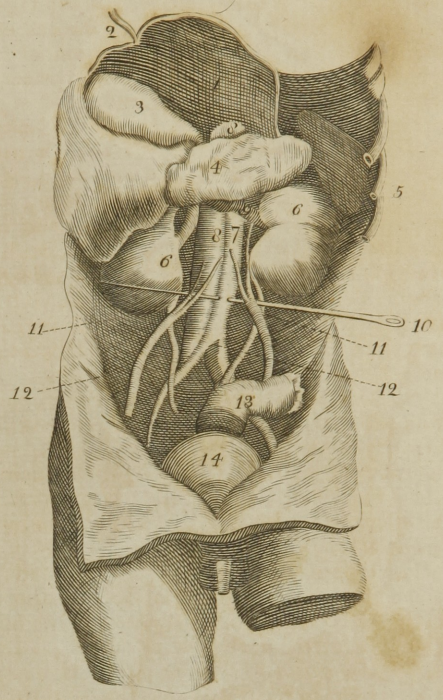


Fig. 3.

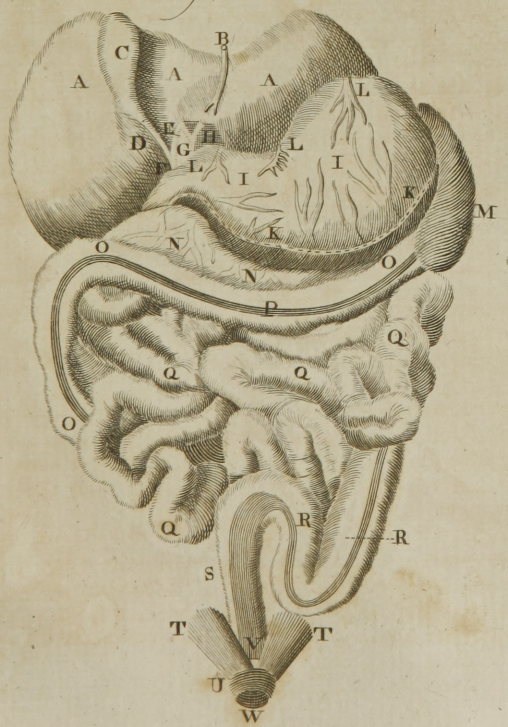


Fig. 4.

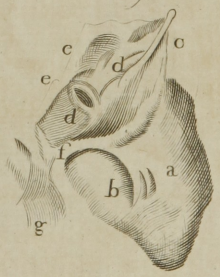
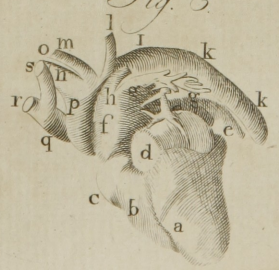


Fig. 5.



Scot. Philad.a

Fig 1

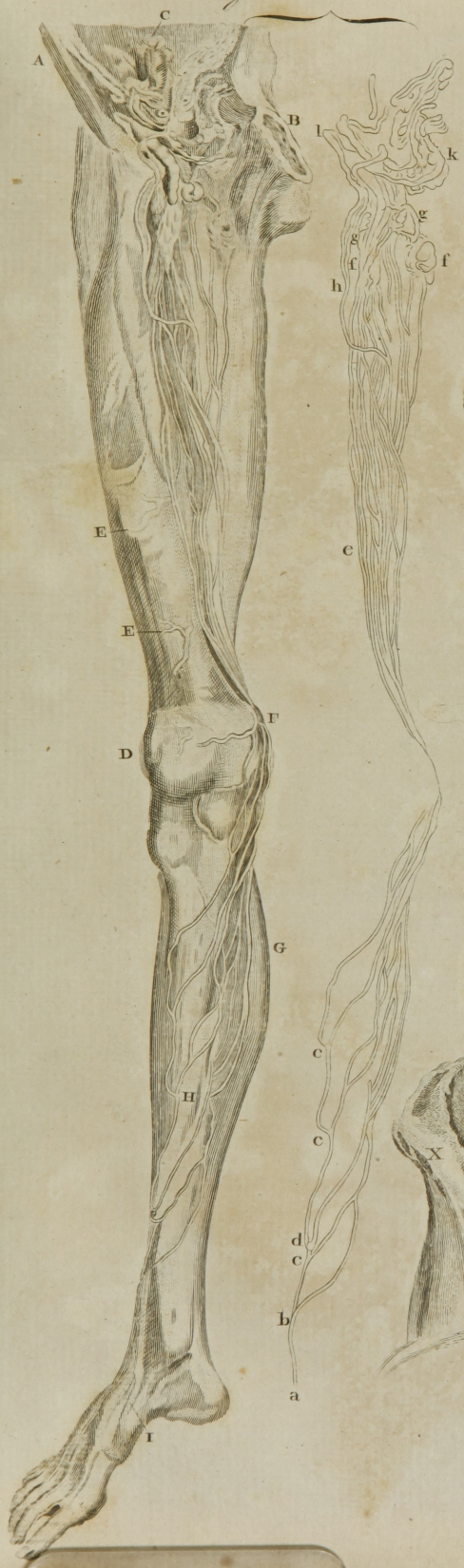


Fig. 3.

Fig 2

Of the Abdomen.

branches of the umbilical vein. So that the blood is conſtantly paſſing in at one ſide of the placenta and out at the other; but in what particular manner it gets through the placenta is a point not yet determined.

Of the Abdomen.

EXPLANATION of PLATES XXV. XXVI. and XXVII.

Plate XXV.

Fig. 1. Shows the Contents of the Thorax and Abdomen in ſitu.

1. Top of the trachea, or wind-pipe. 2 2, The internal jugular veins. 3 3, The ſubclavian veins. 4, The vena cava deſcendens. 5, The right auricle of the heart. 6, The right ventricle. 7, Part of the left ventricle. 8, The aorta deſcendens. 9, The pulmonary artery. 10, The right lung, part of which is cut off to ſhow the great blood veſſels. 11, The left lung entire. 12 12, The anterior edge of the diaphragm. 13 13, The two great lobes of the liver. 14, The ligamentum rotundum. 15, The gall-bladder. 16 The ſtomach. 17 17, The jejunum and ilium. 18, The ſpleen.

Fig. 2. Shows the Organs ſubſervient to the Chylopoietic Viſcera,—with thoſe of Urine and Generation.

1 1, The under ſide of the two great lobes of the liver. a, Lobulus Spigelii. 2, The ligamentum rotundum. 3, The gall-bladder. 4. The pancreas. 5, The ſpleen. 6 6, The kidneys. 7, The aorta deſcendens. 8, Vena cava aſcendens. 9 9, The renal veins covering the arteries. 10, A probe under the ſpermatic veſſels and a bit of the inferior meſenteric artery, and over the ureters. 11 11, The ureters. 12 12, The iliac arteries and veins. 13, The rectum inteſtinum. 14, The bladder of urine.

Fig. 3. Shows the Chylopoietic Viſcera, and Organs ſubſervient to them, taken out of the Body entire.

A A, The under ſide of the two great lobes of the liver. B, Ligamentum rotundum. C, The gall-bladder. D, Ductus cyſticus. E, Ductus hepaticus. F, Ductus communis choledochus. G, Vena portarum. H, Arteria hepatica. I I, The ſtomach. K K, Venæ & arteriæ gaſtro-epiploicæ, dextræ & ſiniſtræ. L L, Venæ & arteriæ coronariæ ventriculi. M, The ſpleen. N N, Meſocolon, with its veſſels. O O O, Inteſtinum colon. P, One of the ligaments of the colon, which is a bundle of longitudinal muſcular fibres. Q Q Q Q, Jejunum and ilium. R R, Sigmoid flexure of the colon with the ligament continued, and over S, The rectum inteſtinum. T T, Levatores ani. U, Sphincter ani. V, The place to which the proſtate gland is connected. W, The anus.

Fig. 4. Shows the Heart of a Fœtus at the full time, with the Right Auricle cut open to ſhow the Foramen Ovale, or paſſage between both Auricles.

a, The right ventricle. b, The left ventricle. c c, The outer ſide of the right auricle ſtretched out. d d, The poſterior ſide, which forms the anterior ſide of the ſeptum. e, The foramen ovale, with the membrane or valve which covers the left ſide. f, Vena cava inferior paſſing through g, A portion of the diaphragm.

Fig. 5. Shows the Heart and Large Veſſels of a Fœtus at the full time.

a, The left ventricle. b, The right ventricle. c, A part of the right auricle. d, Left auricle. e e, The right branch of the pulmonary artery. f, Arteria pulmonalis. g g, The left branch of the pulmonary artery, with a number of its largeſt branches diſſected from the lungs. h, The canalis arterioſus. i, The arch of the aorta. k k, The aorta deſcendens. l, The left ſubclavian artery. m, The left carotid artery. n, The right carotid artery. o, The right ſubclavian artery. p, The origin of the right carotid and right ſubclavian arteries in one common trunk. q, The vena cava ſuperior or deſcendens. r, The right common ſubclavian vein. s, The left common ſubclavian vein.

N. B. All the parts deſcribed in this figure are to be found in the adult, except the canalis arterioſus.

Plate XXVI.

Fig. 1. Exhibits the more ſuperficial Lymphatic Veſſels of the Lower Extremity.

A, The ſpine of the os ilium. B, The os pubis. C, The iliac artery. D, The knee. E, E, F, Branches of the crural artery. G, The muſculus gaſtrocnemius. H, The tibia. I, The tendon of the muſculus tibialis anticus. On the out-lines, a, A lymphatic veſſel belonging to the top of the foot. b, Its firſt diviſion into branches. c, c, c, Other diviſions of the ſame lymphatic veſſel. d, A ſmall lymphatic gland. e, The lymphatic veſſels which lie between the ſkin and the muſcles of the thigh. f, f, Two lymphatic glands at the upper part of the thigh below the groin. g, g, Other glands. h, A lymphatic veſſel which paſſes by the ſide of thoſe glands without communicating with them; and, bending towards the inſide of the groin at (i), opens into the lymphatic gland (k). l, l, Lymphatic glands in the groin, which are common to the lymphatic veſſels of the genitals and thoſe of the lower extremity. m, n, A plexus of lymphatic veſſels paſſing on the inſide of the iliac artery.

Fig. 2. Exhibits a Back View of the Lower Extremity, diſſected ſo as to ſhow the deeper-ſeated Lymphatic Veſſels which accompany the Arteries.

A, The os pubis. B, The tuberoſity of the iſchium. C, That part of the os ilium which was articulated with the os ſacrum. D, The extremity of the iliac artery appearing above the groin. E, The knee. F F, The two cut ſurfaces of the triceps muſcle, which was divided to ſhow the lymphatic veſſels that paſs through its perforation along with the crural artery. G, The edge of the muſculus gracilis. H, The gaſtrocnemius and ſoleus, much ſhrunk by being dried, and by the ſoleus being ſeparated from the

Of the Abdomen.

the tibia to expoſe the veſſels. I, The heel. K, The ſole of the foot. L, The ſuperficial lymphatic veſſels paſſing over the knee, to get to the thigh. On the out-lines; M, The poſterior tibial artery. a, A lymphatic veſſel accompanying the poſterior tibial artery. b, The ſame veſſel croſſing the artery. c, A ſmall lymphatic gland, thro' which this deep-ſeated lymphatic veſſel paſſes. d, The lymphatic veſſel paſſing under a ſmall part of the ſoleus, which is left attached to the bone, the reſt being removed. e, The lymphatic veſſel croſſing the popliteal artery. f, g, h, Lymphatic glands in the ham, through which the lymphatic veſſel paſſes. i, The lymphatic veſſel paſſing with the crural artery, through the perforation of the triceps muſcle. k, The lymphatic veſſel, after it has paſſed the perforation of the triceps, dividing into branches which embrace the artery (1). m, A lymphatic gland belonging to the deep-ſeated lymphatic veſſel. At this place thoſe veſſels paſs to the fore part of the groin, where they communicate with the ſuperficial lymphatic veſſels. n, A part of the ſuperficial lymphatic veſſel appearing on the brim of the pelvis.

FIG. 3. Exhibits the Trunk of the Human Subject, prepared to ſhow the Lymphatic Veſſels and the Ductus Thoracicus.

A, The neck. B B, The two jugular veins. C, The vena cava ſuperior. D D D D, The ſubclavian veins. E, The beginning of the aorta, pulled to the left ſide by means of a ligature, in order to ſhow the thoracic duct behind it. F, The branches ariſing from the curvature of the aorta. G G, The two carotid arteries. H H, The firſt ribs, II, The trachea. K K, The ſpine. L L, the vena azygos. M M, The deſcending aorta. N, The cœliac artery, dividing into three branches. O, The ſuperior meſenteric artery. P, The right crus diaphragmatis. Q Q, The two kidneys. R, The right emulgent artery. S S, The external iliac arteries. g d, The muſculi pſoæ. T, The internal iliac artery. U, The cavity of the pelvis. X X, The ſpine of the os ilium. Y Y, The groins. *a*, A lymphatic gland in the groin, into which lymphatic veſſels from the lower extremity are ſeen to enter. *b b*, The lymphatic veſſels of the lower extremities paſſing under Poupart's ligament. *c c*, A plexus of the lymphatic veſſels lying on each ſide of the pelvis. *d*, The pſoas muſcle with lymphatic veſſels lying upon its inſide. *e*, A plexus of lymphatics, which having paſſed over the brim of the pelvis at (*c*), having entered the cavity of the pelvis, and received the lymphatic veſſels belonging to the viſcera contained in that cavity, next aſcends, and paſſes behind the iliac artery to (*g*). *f*, Some lymphatic veſſels of the left ſide paſſing over the upper part of the os ſacrum, to meet thoſe of the right ſide. *g*, The right pſoas, with a large plexus of lymphatics lying on its inſide. *h h*, The plexus lying on each ſide of the ſpine. *i i i*, Spaces occupied by the lymphatic glands. *k*, The trunk of the lacteals, lying on the under ſide of the ſuperior meſenteric artery. *l*, The ſame dividing into two branches, one of which paſſes on each ſide of the aorta; that of the right ſide being ſeen to enter the thoracic duct at (*m*). *m*, The thoracic duct beginning from the large lymphatics. *n*, The duct paſſing under the lower part of the crus diaphragmatis, and under the right emulgent artery. *o*, The thoracic duct penetrating the thorax. *p*, Some lymphatic veſſels joining that duct in the thorax. *q*, The thoracic duct paſſing under the curvature of the aorta to get to the left ſubclavian vein. The aorta being drawn aſide to ſhow the duct. *r*, A plexus of lymphatic veſſels paſſing upon the trachea from the thyroid gland to the thoracic duct.

Of the Abdomen.

PLATE XXVII.

FIG. 1. Repreſents the Under and Poſterior Side of the Bladder of Urine, &c.

a, The bladder. b b, The inſertion of the ureters. c c, The vaſa deferentia, which convey the ſemen from the teſticles to d d, The veſiculæ ſeminales,—and paſs through e, The proſtate gland, to diſcharge themſelves into f, The beginning of the urethra.

FIG. 2. A tranſverſe Section of the Penis.

g g, Corpora cavernoſa penis. h, Corpus cavernoſum urethræ. i, Urethra. k, Septum penis. l l, The ſeptum between the corpus cavernoſum urethræ and that of the penis.

FIG. 3. A Longitudinal Section of the Penis.

m m, The corpora cavernoſa penis, divided by o, The ſeptum penis. n, The corpus cavernoſum glandis, which is the continuation of that of the urethra.

FIG. 4. Repreſents the Female Organs of Generation.

a, That ſide of the uterus which is next the os ſacrum. 1, Its fundus. 2, Its cervix. b b, The Fallopian or uterine tubes, which open into the cavity of the uterus;—but the other end is open within the pelvis, and ſurrounded by c c, The fimbriæ. d d, The ovaria. e, The os internum uteri, or mouth of the womb. f f, The ligamenta rotunda, which paſſes without the belly, and is fixed to the labia pudendi. g g, The cut edges of the ligamenta lata, which connects the uterus to the pelvis. h, The inſide of the vagina. i, The orifice of the urethra. k, The clitoris ſurrounded by (l,) The præputium. m m, The labia pudendi. n n, The nymphæ.

FIG. 5. Shows the Spermatic Ducts of the Teſticle filled with Mercury.

A, The vas deferens. B, Its beginning, which forms the poſterior part of the epididymis. B, The middle of the epididymis, compoſed of ſerpentine ducts. D, The head or anterior part of the epididymis unravelled. e e e e, The whole ducts which compoſe the head of the epididymis unravelled. f f, The vaſa deferentia. g g, Rete teſtis. h h, Some rectilineal ducts which ſend off the vaſa deferentia. i i, The ſubſtance of the teſticle.

FIG. 6. The right Teſticle entire, and the Epididymis filled with Mercury.

A, The beginning of the vas deferens. B, The vas deferens aſcending towards the abdomen. C, The poſterior part of the epididymis, named *globus minor*. D, The ſpermatic veſſels incloſed in cellular ſubſtance. E, The body of the epididymis. F, Its head, named *globus major*. G, Its beginning from the teſticle. H, The body of the teſticle, incloſed in the tunica albuginea.

PART

ANATOMY

Fig. 1

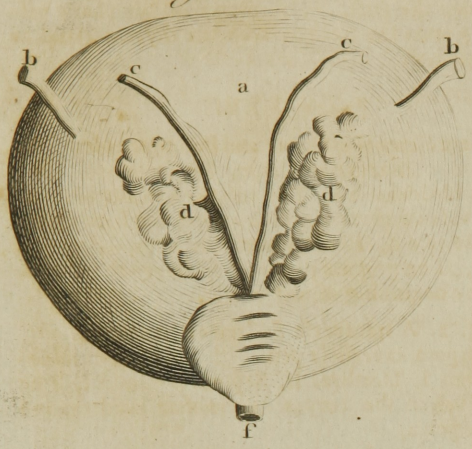


Fig. 4

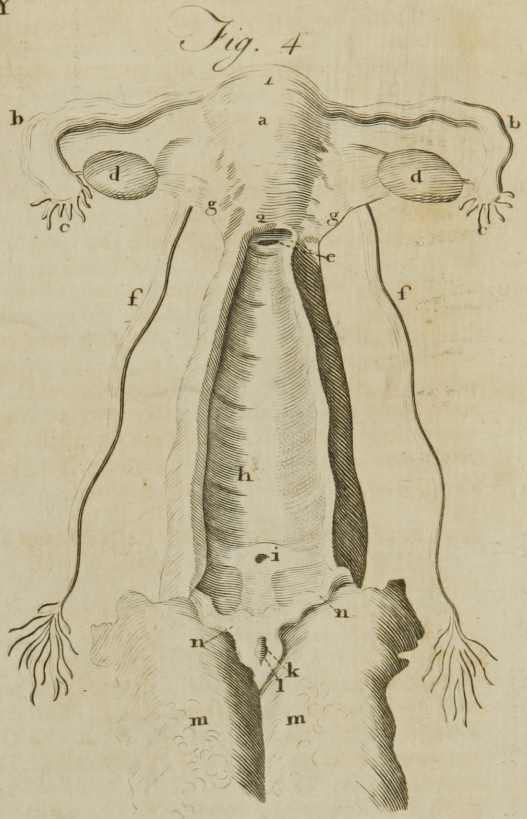


Fig. 2

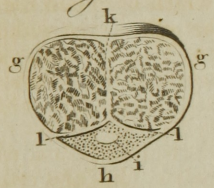


Fig. 5

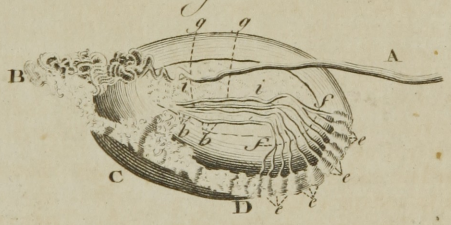


Fig. 6

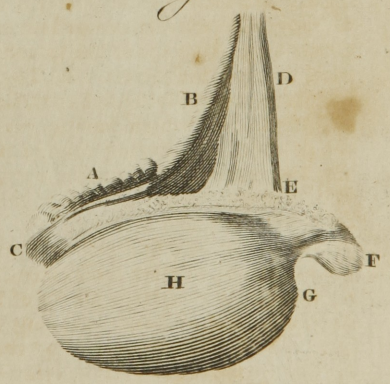
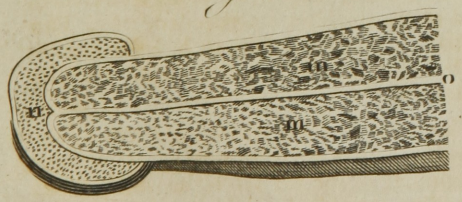


Fig. 3



Scot Philad.a

PART IV. OF THE THORAX.

111 Of the cheſt. THE THORAX, or CHEST, is that cavity of the trunk which extends from the clavicles, or the lower part of the neck, to the diaphragm, and includes the vital organs, which are the heart and lungs; and likewiſe the trachea and œſophagus.—This cavity is formed by the ribs and vertebræ of the back, covered by a great number of muſcles, and by the common integuments, and anteriorly by two glandular bodies called the *breaſts*. The ſpaces between the ribs are filled up by muſcular fibres, which from their ſituation are called *intercoſtal muſcles*.

SECT. I. *Of the Breaſts.*

112. THE *breaſts* may be defined to be two large conglomerate glands, mixed with a good deal of adipoſe membrane. The glandular part is compoſed of an infinite number of minute arteries, veins, and nerves.

The arteries are derived from two different trunks; one of which is called the *internal*, and the other the *external, mammary artery*. The firſt of theſe ariſes from the ſubclavian, and the latter from the axillary.

The veins every where accompany the arteries, and are diſtinguiſhed by the ſame name. The nerves are chiefly from the vertebral pairs. Like all other conglomerate glands, the breaſts are made up of a great many ſmall diſtinct glands, in which the milk is ſecreted from the ultimate branches of arteries. The excretory ducts of theſe ſeveral glands gradually uniting as they approach the nipple, form the tubuli lactiferi, which are uſually more than a dozen in number, and open at its apex, but have little or no communication, as has been ſuppoſed, at the root of the nipple. Theſe ducts, in their courſe from the glands, are ſurrounded by a ligamentary elaſtic ſubſtance, which terminates with them in the nipple. Both this ſubſtance, and the ducts which it contains, are capable of conſiderable extenſion and contraction; but in their natural ſtate are moderately corrugated, ſo as to prevent an involuntary flow of milk, unleſs the diſtending force be very great from the accumulation of too great a quantity.

The whole ſubſtance of the nipple is very ſpongy and elaſtic: its external ſurface is uneven, and full of ſmall tubercles. The nipple is ſurrounded with a diſk or circle of a different colour, called the *areola;* and on the inſide of the ſkin, under the areola, are many ſebaceous glands, which pour out a mucus to defend the areola and nipple: for the ſkin upon theſe parts is very thin; and the nervous papillæ lying very bare, are much expoſed to irritation.

The breaſts are formed for the ſecretion of milk, which is deſtined for the nouriſhment of the child for ſome time after its birth. This ſecretion begins to take place ſoon after delivery, and continues to flow for many months in very large quantities, if the woman ſuckles her child.

The operation of ſuction depends on the principles of the air-pump, and the flow of milk through the lactiferous tubes is facilitated by their being ſtretched out.

The milk, examined chemically, appears to be compoſed of oil, mucilage, and water, and of a conſiderable quantity of ſugar. The generality of phyſiologiſts have ſuppoſed that, like the chyle, it frequently retains the properties of the aliment and medicines taken into the ſtomach; but from ſome late experiments *, this ſuppoſition appears to be ill-founded.

* *Journ. de Med.* 1781.

SECT. II. *Of the Pleura.*

113. THE cavity of the thorax is every where lined by a membrane of a firm texture called *pleura*. It is compoſed of two diſtinct portions or bags, which, by being applied to each other laterally, form a ſeptum called *mediaſtinum;* which divides the cavity into two parts, and is attached poſteriorly to the vertebræ of the back, and anteriorly to the ſternum. But the two laminæ of which this ſeptum is formed, do not every where adhere to each other; for at the lower part of the thorax they are ſeparated, to afford a lodgment to the heart; and at the upper part of the cavity, they receive between them the thymus.

The pleura is plentifully ſupplied with arteries and veins from the internal mammary and the intercoſtals. Its nerves, which are very inconſiderable, are derived chiefly from the dorſal and intercoſtal nerves.

The ſurface of the pleura, like that of the peritonæum and other membranes lining cavities, is conſtantly bedewed with a ſerous moiſture (w) which prevents adheſion of the viſcera.

The mediaſtinum, by dividing the breaſt into two cavities, obviates many inconveniences, to which we ſhould otherwiſe be liable. It prevents the two lobes of the lungs from compreſſing each other when we lie on one ſide; and conſequently contributes to the freedom of reſpiration, which is diſturbed by the leaſt preſſure on the lungs. If the point of a ſword penetrates between the ribs into the cavity of the thorax, the lungs on that ſide ceaſe to perform their office; becauſe the air being admitted through the wound, prevents the dilatation of that lobe; while the other lobe, which is ſeparated from it by the mediaſtinum, remains unhurt, and continues to perform its function as uſual.

SECT. II. *Of the Thymus.*

114. THE *thymus* is a glandular ſubſtance, the uſe of which is not perfectly aſcertained, its excretory duct not having yet been diſcovered. It is of an oblong

(w) When this fluid is exhaled in too great a quantity, or is not properly carried off, it accumulates and conſtitutes the hydrops pectoris.

Of the Thorax.

figure, and is larger in the fœtus and in young children than in adults, being ſometimes nearly effaced in very old ſubjects. It is placed in the upper part of the thorax, between the two laminæ of the mediaſtinum; but at firſt is not altogether contained within the cavity of the cheſt, being found to border upon the upper extremity of the ſternum.

Sect. IV. *Of the Diaphragm.*

115. The cavity of the thorax is ſeparated from that of the abdomen, by a fleſhy and membranous ſubſtance called the *diaphragm* or *midriff*. The greateſt part of it is compoſed of muſcular fibres; and on this account ſyſtematic writers uſually place it very properly among the muſcles. Its middle part is tendinous, and it is covered by the pleura above, and by the peritonæum below. It ſeems to have been improperly named *ſeptum tranſverſum*, as it does not make a plane tranſverſe diviſion of the two cavities, but forms a kind of vault, the fore-part of which is attached to the ſternum. Laterally it is fixed to the laſt of the true ribs, and to all the falſe ribs; and its lower and poſterior part is attached to the vertebræ lumborum, where it may be ſaid to be divided into two portions or crura (x).

The principal arteries of the diaphragm are derived from the aorta, and its veins paſs into the vena cava. Its nerves are chiefly derived from the cervical pairs. It affords a paſſage to the vena cava through its tendinous part, and to the œſophagus through its fleſhy portion. The aorta paſſes down behind it between its crura.

The diaphragm not only ſerves to divide the thorax from the abdomen, but by its muſcular ſtructure is rendered one of the chief agents in reſpiration. When its fibres contract, its convex ſide, which is turned towards the thorax, becomes gradually flat, and by increaſing the cavity of the breaſt, affords room for a complete dilatation of the lungs, by means of the air which is then drawn into them by the act of inſpiration. The fibres of the diaphragm then relax; and as it reſumes its former ſtate, the cavity of the thorax becomes gradually diminiſhed, and the air is driven out again from the lungs by a motion contrary to the former one, called *exſpiration*.

It is in ſome meaſure, by means of the diaphragm, that we void the fæces at the anus, and empty the urinary bladder. Beſides theſe offices, the acts of coughing, ſneezing, ſpeaking, laughing, gaping, and ſighing, could not take place without its aſſiſtance; and the gentle preſſure which all the abdominal viſcera receive from its conſtant and regular motion, cannot fail to aſſiſt in the performance of the ſeveral functions which were aſcribed to thoſe viſcera.

Of the Thorax.

116.

Sect. V. *Of the Trachea.*

The trachea or windpipe, is a cartilaginous and membranous canal, through which the air paſſes into the lungs. Its upper part, which is called the *larynx*, is compoſed of five cartilages. The uppermoſt of theſe cartilages is placed over the glottis or mouth of the larynx, and is called *epiglottis*, which has been before ſpoken of, as cloſing the paſſage to the lungs in the act of ſwallowing. At the ſides of the glottis are placed the two arytenoide cartilages, which are of a very complex figure, not eaſy to be deſcribed. The anterior and larger part of the larynx is made up of two cartilages; one of which is called *thyroides* or *ſcutiformis*, from its being ſhaped like a buckler; and the other *cricoides* or *annularis*, from its reſembling a ring. Both theſe cartilages may be felt immediately under the ſkin, at the fore-part of the throat, and the thyroides, by its convexity, forms an eminence called *pomum adami*, which is uſually more conſiderable in the male than in the female ſubject.

All theſe cartilages are united to each other by means of very elaſtic, ligamentous fibres; and are enabled, by the aſſiſtance of their ſeveral muſcles, to dilate or contract the paſſage of the larynx, and to perform that variety of motion which ſeems to point out the larynx as the principal organ of the voice; for when the air paſſes out through a wound in the trachea, it produces no ſound.

Theſe cartilages are moiſtened by a mucus, which ſeems to be ſecreted by minute glands ſituated near them. The upper part of the trachea is covered anteriorly and laterally by a conſiderable body, which is ſuppoſed to be of a glandular ſtructure, and from its ſituation near the thyroid cartilage is called the *thyroid gland*; though its excretory duct has not yet been diſcovered, or its uſe aſcertained.

The glottis is interiorly covered by a very fine membrane, which is moiſtened by a conſtant ſupply of a watery fluid. From the larynx the canal begins to take the name of *trachea* or *aſpera arteria*, and extends from thence as far down as the third or fourth vertebra of the back, where it divides into two branches, which are the right and left bronchial tube. Each of theſe bronchi (y) ramifies through the ſubſtance of that lobe of the lungs to which it is diſtributed, by an infinite number of branches, which are formed of cartilages ſeparated from each other like thoſe of the trachea, by an intervening membranous and ligamentary ſubſtance. Each of theſe cartilages is of an angular figure; and as they become gradually leſs and leſs in their diameter, the lower ones are in ſome meaſure received into thoſe above them, when the lungs, after being inflated, gradually collapſe by the air being puſhed

(x) Anatomical writers have uſually deſcribed the diaphragm as being made up of two muſcles united by a middle tendon; and theſe two portions or crura form what they ſpeak of as the *inferior muſcle*, ariſing from the ſides and fore-part of the vertebræ.

(y) The right bronchial tube is uſually found to be ſomewhat ſhorter and thicker than the left; and M. Portal, who has publiſhed a memoir on the action of the lungs on the aorta in reſpiration, obſerves, that the left bronchial tube is cloſely connected by the aorta; and from ſome experiments he is induced to conclude, that in the firſt reſpirations, the air only enters into the right lobe of the lungs. *Memoires de l' Academie Royale des Sciences*, 1769.

Of the Thorax.

ed out from them in exſpiration. As the branches of the bronchi become more minute, their cartilages become more and more angular and membranous, till at length they are found to be perfectly membranous, and at laſt become inviſible.

The trachea is furniſhed with fleſhy or muſcular fibres; ſome of which paſs through its whole extent longitudinally, while the others are carried round it in a circular direction; ſo that by the contraction or relaxation of theſe fibres, it is enabled to ſhorten or lengthen itſelf, and likewiſe to dilate or contract the diameter of its paſſage.

The trachea and its branches, in all their ramifications, are furniſhed with a great number of ſmall glands which are lodged in their cellular ſubſtance, and diſcharge a mucous fluid on the inner ſurface of theſe tubes.

The cartilages of the trachea, by keeping it conſtantly open, afford a free paſſage to the air, which we are obliged to be inceſſantly reſpiring; and its membranous part, by being capable of contraction and dilatation, enables us to receive and expel the air in a greater or leſs quantity, and with more or leſs velocity, as may be required in ſinging or in declamation. This membranous ſtructure of the trachea poſteriorly, ſeems likewiſe to aſſiſt in the deſcent of the food, by preventing that impediment to its paſſage down the œſophagus, which might be expected if the cartilages were complete rings.

The trachea receives its arteries from the carotid and ſubclavian arteries, and its veins paſs into the jugulars. Its nerves ariſe from the recurrent branch of the eighth pair, and from the cervical plexus.

Sect. VI. *Of the Lungs.*

The lungs fill the greater part of the cavity of the breaſt. They are of a ſoft and ſpongy texture, and are divided into two lobes, which are ſeparated from each other by the mediaſtinum, and are externally covered by a production of the pleura. Each of theſe is divided into two or three leſſer lobes; and we commonly find three in the right ſide of the cavity, and two in the left.

To diſcover the ſtructure of the lungs, it is required to follow the ramifications of the bronchi, which were deſcribed in the laſt ſection. Theſe becoming gradually more and more minute, at length terminate in the cellular ſpaces or veſicles, which make up the greateſt part of the ſubſtance of the lungs, and readily communicate with each other.

The lungs ſeem to poſſeſs but little ſenſibility. Their nerves, which are ſmall, and few in number, are derived from the intercoſtal and eighth pair. This laſt pair having reached the thorax, ſends off a branch on each ſide of the trachea, called the *recurrent*, which reaſcends at the back of the trachea, to which it furniſhes branches in its aſcent, as well as to the œſophagus, but it is chiefly diſtributed to the larynx and its muſcles. By dividing the recurrent and ſuperior laryngeal nerves at their origin, an animal is deprived of its voice.

There are two ſeries of arteries which carry blood to the lungs: theſe are the arteriæ bronchiales, and the pulmonary artery.

The arteriæ bronchiales begin uſually by two branches; one of which commonly ariſes from the right intercoſtal, and the other from the trunk of the aorta: but ſometimes there are three of theſe arteries, and in ſome ſubjects only one. The uſe of theſe arteries is to ſerve for the nouriſhment of the lungs, and their ramifications are ſeen creeping every where on the branches of the bronchi. The blood is brought back from them by the bronchial vein into the vena azygos.

Of the Thorax.

The pulmonary artery and vein are not intended for the nouriſhment of the lungs: but the blood in its paſſage through them is deſtined to undergo ſome changes, or to acquire certain eſſential properties (from the action of the air), which it has loſt in its circulation through the other parts of the body. The pulmonary artery receives the blood from the right ventricle of the heart, and dividing into two branches, accompanies the bronchi every where, by its ramifications through the lungs; and the blood is afterwards conveyed back by the pulmonary vein, which gradually forming a conſiderable trunk, goes to empty itſelf into the left ventricle of the heart; ſo that the quantity of blood which enters into the lungs, is perhaps greater than that which is ſent in the ſame proportion of time through all the other parts of the body.

Sect. VII. *Of Reſpiration.*

Respiration conſtitutes one of thoſe functions which are properly termed *vital*, as being eſſential to life; for to live and to breathe are in fact ſynonymous terms. It conſiſts in an alternate contraction and dilatation of the thorax, by firſt inſpiring air into the lungs, and then expelling it from them in exſpiration.

It will perhaps be eaſy to diſtinguiſh and point out the ſeveral phenomena of reſpiration; but to explain their phyſical cauſe will be attended with difficulty: for it will naturally be enquired, how the lungs, when emptied of the air, and contracted by exſpiration, become again inflated, they themſelves being perfectly paſſive? How the ribs are elevated in oppoſition to their own natural ſituation? and why the diaphragm is contracted downwards towards the abdomen? Were we to aſſert that the air, by forcing its way into the cavity of the lungs, dilated them, and conſequently elevated the ribs, and preſſed down the diaphragm, we ſhould ſpeak erroneouſly. What induces the firſt inſpiration, it is not eaſy to aſcertain; but after an animal has once reſpired, it would ſeem likely that the blood, after exſpiration, finding its paſſage through the lungs obſtructed, becomes a ſtimulus, which induces the intercoſtal muſcles and the diaphragm to contract, and enlarge the cavity of the thorax, in conſequence perhaps of a certain nervous influence, which we will not here attempt to explain. The air then ruſhes into the lungs; every branch of the bronchial tubes, and all the cellular ſpaces into which they open, become fully dilated; and the pulmonary veſſels being equally diſtended, the blood flows through them with eaſe. But as the ſtimulus which firſt occaſioned this dilatation ceaſes to operate, the muſcles gradually contract, the diaphragm riſes upwards again, and diminiſhes the cavity of the cheſt; the ribs return to their former ſtate; and as the air paſſes out in exſpiration, the lungs gradually collapſe, and a reſiſtance to the paſſage of the blood again takes place. But the heart continuing to receive and expel the

Of the Thorax.

blood, the pulmonary artery begins again to be diſtended, the ſtimulus is renewed, and the ſame proceſs is repeated, and continues to be repeated, in a regular ſucceſſion, during life: for though the muſcles of reſpiration, having a mixed motion, are (unlike the heart) in ſome meaſure dependent on the will, yet no human being, after having once reſpired, can live many moments without it. In an attempt to hold one's breath, the blood ſoon begins to diſtend the veins, which are unable to empty their contents into the heart; and we are able only, during a very little time, to reſiſt the ſtimulus to inſpiration. In drowning, the circulation ſeems to be ſtopped upon this principle; and in hanging, the preſſure made on the jugular veins, may cooperate with the ſtoppage of reſpiration in bringing on death.

Till within theſe few years phyſiologiſts were entirely ignorant of the uſe of reſpiration. It was at length diſcovered in part by the illuſtrious Dr Prieſtley. He found that the air exſpired by animals was phlogiſticated; and that the air was fitter for reſpiration, or for ſupporting animal life, in proportion as it was freer from the phlogiſtic principle. It had long been obſerved, that the blood in paſſing through the lungs acquired a more florid colour. He therefore ſuſpected, that it was owing to its having imparted phlogiſton to the air: and he ſatisfied himſelf of the truth of this idea, by experiments, which ſhowed, that the craſſementum of extravaſated blood, phlogiſticated air in proportion as it loſt its dark colour. He farther found, that blood thus reddened had a ſtrong attraction for phlogiſton; inſomuch that it was capable of taking it from phlogiſticated air, thereby becoming of a darker colour. From hence it appeared that the blood, in its circulation through the arterial ſyſtem, imbibes a conſiderable quantity of phlogiſton, which is diſcharged from it to the air in the lungs.

This diſcovery has ſince been proſecuted by two very ingenious phyſiologiſts, Dr Crawford and Mr Elliot. It had been ſhown by profeſſors Black and Irvine, that different bodies have different capacities for containing fire. For example, that oil and water, when equally hot to the ſenſe and the thermometer, contain different proportions of that principle; and that unequal quantities of it are required, in order to raiſe thoſe ſubſtances to like temperatures. The enquiries of Dr Crawford and Mr Elliot tend to prove, that the capacities of bodies for containing fire are diminiſhed by the addition of phlogiſton, and increaſed by its ſeparation: the capacity of calx of antimony, for example, being greater than that of the antimony itſelf. Common air contains a great quantity of fire; combuſtible bodies very little. In combuſtion, a double elective attraction takes place; the phlogiſton of the body being transferred to the air, the fire contained in the air to the combuſtible body. But as the capacity of the latter is not increaſed ſo much as that of the former is diminiſhed, only part of the extricated fire will be abſorbed by the body. The remainder therefore will raiſe the temperature of the compound; and hence we may account for the heat attending combuſtion. As the uſe of reſpiration is to dephlogiſticate the blood, it ſeems probable, that a like double elective attraction takes place in this proceſs; the phlogiſton of the blood being transferred to the air, and the fire contained in the air to the blood; but with this difference, that the capacities being equal, the whole of the extricated fire is abſorbed by the latter. The blood in this ſtate circulating through the body, imbibes phlogiſton, and of courſe gives out its fire; part only of which is abſorbed by the parts furniſhing the phlogiſton, the remainder, as in combuſtion, becoming ſenſible; and is therefore the cauſe of the heat of the body, or what is called animal heat.

Of the Thorax.

In confirmation of this doctrine it may be obſerved, that the venous blood contains leſs fire than the arterial; combuſtible bodies leſs than incombuſtible ones; and that air contains leſs of this principle, according as it is rendered, by combination with phlogiſton, leſs fit for reſpiration (z).

In aſcending very high mountains, reſpiration is found to become ſhort and frequent, and ſometimes to be attended with a ſpitting of blood. Theſe ſymptoms ſeem to be occaſioned by the air being too rare and thin to dilate the lungs ſufficiently; and the blood gradually accumulating in the pulmonary veſſels, ſometimes burſts through their coats, and is brought up by coughing. This has likewiſe been accounted for in a different way, by ſuppoſing that the air contained in the blood, not receiving an equal preſſure from that of the atmoſphere, expands, and at length ruptures the very minute branches of the pulmonary veſſels; upon the ſame principle that fruits and animals put under the receiver of an air-pump, are ſeen to ſwell as the outer air becomes exhauſted. But Dr Darwin of Litchfield has lately publiſhed ſome experiments, which ſeem to prove, that no air or elaſtic vapour does exiſt in the blood-veſſels, as has been generally ſuppoſed; and he is induced to impute the ſpitting of blood, which has ſometimes taken place in aſcending high mountains, to accident, or to violent exertions; as it never happens to animals that are put into the exhauſted receiver of an air-pump, where the diminution of preſſure is many times greater than on the ſummit of the higheſt mountains.

Sect. VIII. *Of the Voice.*

Respiration has already been deſcribed as affording us many advantages; and next to that of life, its moſt important uſe ſeems to be that of forming the voice and ſpeech. The ancients, and almoſt all the moderns, have conſidered the organ of ſpeech as a kind of muſical inſtrument, which may be compared to a flute, to an hautboy, to an organ, &c. and they argue after the following manner.

The trachea, which begins at the root of the tongue, and goes to terminate in the lungs, may be compared to the pipe of an organ, the lungs dilating like bellows during the time of inſpiration; and as the air is driven out from them in exſpiration, it finds its paſſage ſtraitened by the cartilages of the larynx, againſt which it ſtrikes.

(z) See Crawford's Experiments and Obſervations on Animal Heat, and Elliot's Philoſophical Obſervations.

Of the Thorax.

ſtrikes. As theſe cartilages are more or leſs elaſtic, they occaſion in their turn more or leſs vibration in the air, and thus produce the ſound of the voice; the variation in the ſound and tone of which depends on the ſtate of the glottis, which, when ſtraitened, produces an acute tone, and a grave one when dilated.

The late M. Ferein communicated to the French Academy of Sciences a very ingenious theory on the formation of the voice. He conſidered the organ of the voice as a *ſtring*, as well as a *wind*, inſtrument; ſo that what art has hitherto been unable to conſtruct, and what both the fathers Merſenne and Kircher ſo much wiſhed to ſee, M. Ferein imagined he had at length diſcovered in the human body. He obſerves, that there are at the edges of the glottis certain tendinous chords, placed horizontally acroſs it, which are capable of conſiderable vibration, ſo as to produce ſound, in the ſame manner as it is produced by the ſtrings of a violin or a harpſichord: and he ſuppoſes that the air, as it paſſes out from the lungs, acts as a bow on theſe ſtrings, while the efforts of the breaſt and lungs regulate its motion, and produce the variety of tones. So that according to this ſyſtem the variation in the voice is not occaſioned by the dilatation or contraction of the glottis, but by the diſtenſion or relaxation of theſe ſtrings, the ſound being more or leſs acute in proportion as they are more or leſs ſtretched out. Another writer on this ſubject ſuppoſes, that the organ of voice is a double inſtrument, which produces in uniſon two ſounds of a different nature; one by means of the air, and the other by means of the chords of the glottis. Neither of theſe ſyſtems, however, are univerſally adopted. They are both liable to inſuperable difficulties; ſo that the manner in which the voice is formed has never yet been ſatisfactorily aſcertained: we may obſerve, however, that the ſound produced by the glottis is not articulated. To effect this, it is required to paſs through the mouth, where it is differently modified by the action of the tongue, which is either puſhed againſt the teeth, or upwards towards the palate; detaining it in its paſſage, or permitting it to flow freely, by contracting or dilating the mouth.

Sect. IX. *Of Dejection.*

120 By dejection we mean the act of voiding the fæces at the anus; and an account of the manner in which this is conducted was reſerved for this part of the work, becauſe it ſeemed to require a knowledge of reſpiration to be perfectly underſtood.

The inteſtines were deſcribed as having a periſtaltic motion, by which the fæces were gradually advancing towards the anus. Now, whenever the fæces are accumulated in the inteſtinum rectum in a ſufficient quantity to become troubleſome, either by their weight or acrimony, they excite a certain uneaſineſs which induces us to go to ſtool.—To effect this, we begin by making a conſiderable inſpiration; in conſequence of which the diaphragm is carried downwards towards the lower belly; the abdominal muſcles are at the ſame time contracted in obedience to the will; and the inteſtines being compreſſed on all ſides, the reſiſtance of the *ſphincter* is overcome, and the fæces paſs out at the anus; which is afterwards drawn up by its longitudinal fibres, which are called *levatores ani*, and then by means of its *ſphincter* is again contracted: but it ſometimes happens, as in dyſenteries for inſtance, that the fæces are very liquid, and have conſiderable acrimony; and then the irritation they occaſion is more frequent, ſo as to promote their diſcharge without any preſſure from the diaphragm or abdominal muſcles; and ſometimes involuntarily, as is the caſe when the ſphincter becomes paralytic.

Of the Thorax.

Sect. X. *Of the Pericardium, and of the Heart and its Auricles.*

The two membranous bags of the pleura, which were deſcribed as forming the mediaſtinum, recede one from the other, ſo as to afford a lodgment to a firm membranous ſac, in which the heart is ſecurely lodged; this ſac, which is the *pericardium*, appears to be compoſed of two tunics, united to each other by cellular membrane.—The outer coat, which is thick, and in ſome places of tendinous complexion, is a production of the mediaſtinum; the inner coat, which is extremely thin, is reflected over the auricles and ventricles of the heart, in the ſame manner as the tunica conjunctiva, after lining the eye lids, is reflected over the eye. 121 Pericardium.

This bag adheres to the tendinous part of the diaphragm, and contains a coagulable lymph, the *liquor pericardii*, which ſerves to lubricate the heart and facilitate its motions; and ſeems to be ſecreted and abſorbed in the ſame manner as it is in the other cavities of the body.

The arteries of the pericardium are derived from the phrenic, and its veins paſs into veins of the ſame name; its nerves are likewiſe branches of the phrenic.

The ſize of the pericardium is adapted to that of the heart, being uſually large enough to contain it looſely. As its cavity does not extend to the ſternum, the lungs cover it in inſpiration; and as it every where inveſts the heart, it effectually ſecures it from being injured by lymph, pus, or any other fluid, extravaſated into the cavities of the thorax.

122 Heart, ar its auricle

The heart is a hollow muſcle of a conical ſhape, ſituated tranſverſely between the two laminæ of the mediaſtinum, at the lower part of the thorax; having its baſis turned towards the right ſide, and its point or apex towards the left.—Its lower ſurface is ſomewhat flattened towards the diaphragm. Its baſis, from which the great veſſels originate, is covered with fat, and it has two hollow and fleſhy appendages, called *auricles*.—Round theſe ſeveral openings, the heart ſeems to be of a firm ligamentous texture, from which all its fibres ſeem to originate; and as they advance from thence towards the apex, the ſubſtance of the heart ſeems to become thinner.

The heart includes two cavities of *ventricles*, which are ſeparated from each other by a fleſhy ſeptum; one of theſe is called the *right*, and the other the *left*, *ventricle*; though perhaps, with reſpect to their ſituation, it would be more proper to diſtinguiſh them into the *anterior* and *poſterior ventricles*.

The heart is exteriorly covered by a very fine membrane; and its ſtructure is perfectly muſcular or fleſhy, being compoſed of fibres which are deſcribed as paſſing in different directions; ſome as being extended longitudinally from the baſis to the apex; others, as taking an oblique or ſpiral courſe; and a third ſort as being

Of the Thorax.

being placed in a tranverſe direction (A).—Within the two ventricles we obſerve ſeveral furrows; and there are likewiſe tendinous ſtrings, which ariſe from fleſhy *columnæ* in the two cavities, and are attached to the valves of the auricles: That the uſe of theſe and the other valves of the heart may be underſtood, it muſt be obſerved, that four large veſſels paſs out from the baſis of the heart, viz. two arteries and two veins; and that each of theſe veſſels is furniſhed with a thin membranous production, which is attached all round to the borders of their ſeveral orifices, from whence hanging looſely down they appear to be divided into two or three diſtinct portions. But as their uſes in the arteries and veins are different, ſo are they differently diſpoſed. Thoſe of the arteries are intended to give way to the paſſage of the blood into them from the ventricles, but to oppoſe its return: and, on the contrary, the valves of the veins are conſtructed ſo as to allow the blood only to paſs into the heart. In conſequence of theſe different uſes, we find the valves of the pulmonary artery and of the aorta attached to the orifices of thoſe veſſels, ſo as to have their concave ſurfaces turned towards the artery; and their convex ſurfaces, which mutually meet together, being placed towards the ventricle, only permit the blood to paſs one way, which is into the arteries. There are uſually three of theſe valves belonging to the pulmonary artery, and as many to the aorta; and from their figure they are called *valvulæ ſemilunares*. The communication between the two great veins and the ventricles is by means of the two appendages or auricles into which the blood is diſcharged; ſo that the other valves which may be ſaid to belong to the veins, are placed in each ventricle, where the auricle opens into it. The valves in the right ventricle are uſually three in number, and are named *valvulæ tricuſpides*; but in the left ventricle we commonly obſerve only two, and theſe are the *valvulæ mitrales*. The membranes which form theſe valves in each cavity are attached ſo as to project ſomewhat forward; and both the *tricuſpides* and the *mitrales* are connected with the tendinous ſtrings, which were deſcribed as ariſing from the fleſhy *columnæ*. By the contraction of either ventricle, the blood is driven into the artery which communicates with that ventricle; and theſe tendinous ſtrings being gradually relaxed as the ſides of the cavity are brought nearer to each other, the valves naturally cloſe the opening into the auricle, and the blood neceſſarily directs its courſe into the then only open paſſage, which is into the artery; but after this contraction, the heart becomes relaxed, the tendinous ſtrings are again ſtretched out, and, drawing the valves of the auricle downwards, the blood is poured by the veins into the ventricle, from whence, by another contraction, it is again thrown into the artery, as will be deſcribed hereafter. The right ventricle is not quite ſo long, though ſomewhat larger, than the left; but the latter has more ſubſtance than the other: and this ſeems to be, becauſe it is intended to tranſmit the blood to the moſt diſtant parts of the body, whereas the right ventricle diſtributes it only to the lungs.

Of the Thorax.

The heart receives its nerves from the par vagum and the intercoſtals. The arteries which ſerve for its nouriſhment are two in number, and ariſe from the aorta. They ſurround in ſome meaſure the baſis of the heart, and from this courſe are called the *coronary arteries*. From theſe arteries the blood is returned by veins of the ſame name into the auricles, and even into the ventricles.

The muſcular bags called the *auricles* are ſituated at the baſis of the heart, at the ſides of each other; and, correſponding with the two ventricles, are like thoſe two cavities diſtinguiſhed into *right* and *left*. Theſe ſacs, which are interiorly unequal, have externally a jagged appendix; which, from its having been compared to the extremity of an ear, has given them their name of *auricles*.

Sect. XI. *Angiology, or a Deſcription of the Blood-veſſels.*

The heart has been deſcribed as contracting itſelf, 123
and throwing the blood from its two ventricles into the pulmonary artery and the aorta, and then as relaxing itſelf and receiving a freſh ſupply from two large veins, which are the pulmonary vein and the vena cava. We will now point out the principal diſtributions of theſe veſſels.

The *pulmonary artery* ariſes from the right ventricle by a large trunk, which ſoon divides into two conſiderable branches, which paſs to the right and left lobes of the lungs: each of theſe branches is afterwards divided and ſubdivided into an infinite number of branches and ramifications, which extend through the whole ſubſtance of the lungs; and from theſe branches the blood is returned by the veins, which, contrary to the courſe of the arteries, begin by very minute canals, and gradually become larger, forming at length four large trunks called *pulmonary veins*, which terminate in the *left auricle* by one common opening, from whence the blood paſſes into the *left ventricle*. From this ſame ventricle ariſes the *aorta* or *great artery*, which at its beginning is nearly an inch in diameter: it ſoon ſends off two branches, the *coronaries*, which go to be diſtributed to the heart and its auricles. After this, at or about the third or fourth vertebra of the back, it makes a conſiderable curvature; from this curvature (B) ariſe three arteries; one of which ſoon divides into two branches. The firſt two are the left ſubclavian and the left carotid, and the third is a common trunk to the right ſubclavian and right carotid; though ſometimes both the carotids ariſe diſtinctly from the aorta.

The two *carotids* aſcend within the ſubclavians, along the ſides of the trachea; and when they have reached the larynx, divide into two principal branches, the *internal* and *external carotid*. The firſt of theſe runs a little

(A) Authors differ about the courſe and diſtinctions of theſe fibres; and it ſeems right to obſerve, that the ſtructure of the heart being more compact than that of other muſcles, its fibres are not eaſily ſeparated.

(B) Anatomiſts uſually call the upper part of this curvature *aorta aſcendens*; and the other part of the artery to its diviſion at the iliacs, *aorta deſcendens*: but they differ about the place where this diſtinction is to be introduced; and it ſeems ſufficiently to anſwer every purpoſe, to ſpeak only of the aorta and its curvature.

Of the Thorax.

little way backwards in a bending direction; and having reached the under part of the ear, passes through the canal into the os petrosum, and entering into the cavity of the cranium, is distributed to the brain and the membranes which invelope it, and likewise to the eye. The *external carotid* divides into several branches, which are distributed to the larynx, pharynx, and other parts of the neck; and to the jaws, lips, tongue, eyes, temples, and all the external parts of the head.

Each *subclavian* is likewise divided into a great number of branches. It sends off the *vertebral artery*, which passes through the openings we see at the bottom of the transverse processes of the vertebræ of the neck, and in its course sends off many ramifications to the neighbouring parts. Some of its branches are distributed to the spinal marrow, and after a considerable inflection it enters into the cranium, and is distributed to the brain. The *subclavian* likewise sends off branches to the muscles of the neck and scapula; and the mediastinum, thymus, pericardium, diaphragm, the breasts, and the muscles of the thorax, and even of the abdomen, derive branches from the subclavian, which are distinguished by different names, alluding to the parts to which they are distributed; as the *mammary*, the *phrenic*, the *intercostal*, &c. But notwithstanding the great number of branches which have been described as arising from the subclavian, it is still a considerable artery when it reaches the *axilla*, where it drops its former name, which alludes to its passage under the clavicle, and is called the *axillary* artery; from which a variety of branches are distributed to the muscles of the breast, scapula, and arm.—But its main trunk taking the name of *brachialis*, runs along on the inside of the arm near the os humeri, till it reaches the joint of the fore-arm, and then it divides into two branches. This division however is different in different subjects; for in some it takes place higher up and in others lower down. When it happens to divide above the joint, it may be considered as a happy disposition in case of an accident by bleeding; for supposing the artery to be unfortunately punctured by the lancet, and that the hæmorrhage could only be stopped by making a ligature on the vessel, one branch would remain unhurt, through which the blood would pass uninterrupted to the fore-arm and hand. One of the two branches of the brachialis plunges down under the flexor muscles, and runs along the edge of the ulna; while the other is carried along the outer surface of the radius, and is easily felt at the wrist, where it is only covered by the common integuments. Both these branches commonly unite in the palm of the hand, and form an arterial arch from whence branches are detached to the fingers.

The *aorta*, after having given off at its curvature the carotids and subclavians which convey blood to all the upper parts of the body, descends upon the bodies of the vertebræ a little to the left, as far as the os sacrum, where it drops the name of *aorta*, and divides into two considerable branches. In this course, from its curvature to its bifurcation, it sends off several arteries in the following order: 1. One or two little arteries, first demonstrated by Ruysch as going to the bronchi, and called *arteriæ bronchinales Ruyschii*. 2. The arteriæ œsophageæ. These are commonly three or four in number. They arise from the fore-part of the aorta, and are distributed chiefly to the œsophagus. 3. The inferior intercostal arteries, which are distributed between the ribs in the same manner as the arteries of the three or four superior ribs are, which are derived from the subclavian. These arteries send off branches to the medulla spinalis. 4. The diaphragmatic or inferior phrenic arteries, which go to the diaphragm, stomach, omentum, duodenum, pancreas, spleen, liver, and gall-bladder. 5. The cœliac, which sends off the coronary-stomachic, the splenic, and the hepatic artery. 6. The superior mesenteric artery, which is distributed to the mesentery and small intestines. 7. The emulgents, which go to the kidneys. 8. The arteries, which are distributed to the glandulæ renales. 9. The spermatic. 10. The inferior mesenteric artery, which ramifies through the lower portion of the mesentery and the large intestines.—A branch of this artery which goes to the rectum is called the *internal hæmorrhoidal*. 11. The lumbar arteries, and a very small branch called the *sacra*, which are distributed to the muscles of the loins and abdomen, and to the os sacrum and medulla spinalis.

Of the Thorax.

The trunk of the aorta, when it has reached the last vertebra lumborum, or the os sacrum, drops the name of *aorta*, and separates into two forked branches called the *iliacs*. Each of these soon divides into two branches; one of which is called the *internal iliac*, or *hypogastic artery*, and is distributed upon the contents of the pelvis and upon the muscles on its outer side. One branch, called *pudenda communis*, sends small ramifications to the end of the rectum under the name of *hæmorrhoidales externæ*, and is afterwards distributed upon the penis. The other branch, the external iliac, after having given off the circumflex artery of the os ilium and the epigastric, which is distributed to the recti-muscles, passes out of the abdomen under Poupart's ligament, and takes the name of *crural artery*. It descends on the inner part of the thigh close to the os femoris, sending off branches to the muscles, and then sinking deeper in the hind part of the thigh, reaches the ham, where it takes the name of *popliteal*: after this it separates into two considerable branches; one of which is called the *anterior tibial artery*; the other divides into two branches, and these arteries all go to be distributed to the leg and foot.

The blood, which is thus distributed by the aorta to all parts of the body, is brought back by the veins, which are supposed to be continued from the ultimate branches of arteries; and uniting together as they approach the heart, at length form the large trunks, the vena cava ascendens, and vena cava descendens.

All the veins which bring back the blood from the upper extremities, and from the head and breast, pass into the vena cava descendens; and those which return it from the lower parts of the body terminate in the vena cava ascendens; and these two cavas uniting together as they approach the heart, open by one common orifice into the left auricle.

It does not here seem to be necessary to follow the different divisions of the veins as we did those of the arteries; and it will be sufficient to remark, that in general every artery is accompanied by its vein, and that both are distinguished by the same name. But, like

Of the Thorax.

like many other general rules, this too has its exceptions (c). The veins for inſtance, which accompany the external and internal carotid, are not called the *carotid veins*, but the *external* and *internal jugular*.—In the thorax, there is a vein diſtinguiſhed by a proper name, and this is the *azygos*, or *vena ſine pari*. This vein, which is a pretty conſiderable one, runs along by the right ſide of the vertebræ of the back, and is chiefly deſtined to receive the blood from the intercoſtals on that ſide, and from the lower half of thoſe on the left ſide, and to convey it into the vena cava deſcendens. In the abdomen we meet with a vein, which is ſtill a more remarkable one, and this is the *vena portæ*, which performs the office both of an artery and a vein. It is formed by a re-union of all the veins which come from the ſtomach, inteſtines, omentum, pancreas, and ſpleen, ſo as to compoſe one great trunk, which goes to ramify through the liver; and after having depoſited the bile, its ramifications unite and bring back into the vena cava, not only the blood which the vena portæ had carried into the liver, but likewiſe the blood from the hepatic artery. Every artery has a vein which correſponds with it; but the trunks and branches of the veins are more numerous than thoſe of the arteries.—The reaſons for this diſpoſition are perhaps more difficult to be explained; the blood in its courſe through the veins is much farther removed from the ſource and cauſe of its motion, which are in the heart, than it was when in the arteries; ſo that its courſe is conſequently leſs rapid, and enough of it could not poſſibly be brought back to the heart in the moment of its dilatation, to equal the quantity which is driven into the arteries from the two ventricles, at the time they contract; and the equilibrium which is ſo eſſential to the continuance of life and health would conſequently be deſtroyed, if the capacity of the veins did not exceed that of the arteries, in the ſame proportion that the rapidity of the blood's motion through the arteries exceeds that of its return through the veins.

A large artery ramifying through the body, and continued to the minute branches of veins, which gradually unite together to form a large trunk, may be compared to two trees united to each other at their tops; or rather as having their ramifications ſo diſpoſed that the two trunks terminate in one common point; and if we farther ſuppoſe, that both theſe trunks and their branches are hollow, and that a fluid is inceſſantly circulated through them, by entering into one of the trunks and returning through the other, we ſhall be enabled to conceive how the blood is circulated through the veſſels of the human body.

Every trunk of an artery, before it divides, is nearly cylindrical, or of equal diameter through its whole length, and ſo are all its branches when examined ſeparately. But every trunk ſeems to contain leſs blood than the many branches do into which that trunk ſeparates; and each of theſe branches probably contains leſs blood than the ramifications do into which it is ſubdivided: and it is the ſame with the veins; the volume of their ſeveral ramifications, when conſidered together, being found to exceed that of the great trunk which they form by their union.

Of the Thorax.

The return of the blood through the veins to the heart, is promoted by the action of the muſcles, and the pulſation of the arteries. And this return is likewiſe greatly aſſiſted by the *valves* which are to be met with in the veins, and which conſtitute one of the great diſtinctions between them and the arteries. Theſe valves, which are ſuppoſed to be formed by the inner coat of the veins, permit the blood to flow from the extremities towards the heart, but oppoſe its return. They are moſt frequent in the ſmaller veins. As the column of blood increaſes, they ſeem to become leſs neceſſary; and therefore in the vena cava aſcendens, we meet with only one valve, which is near its origin.

The arteries are compoſed of ſeveral tunics. Some writers enumerate five of theſe tunics; but perhaps we may more properly reckon only three, viz. the *nervous*, *muſcular*, and *cuticular* coats. The veins are by ſome anatomiſts deſcribed as having the ſame number of coats as the arteries; but as they do not ſeem to be irritable, we cannot with propriety ſuppoſe them to have a muſcular tunic. We are aware of Dr Verſchuir's * experiments to prove that the jugular and ſome other veins poſſeſs a certain degree of irritability; but it is certain, that his experiments, repeated by others, have produced a different reſult; and even he himſelf allows, that ſometimes he was unable to diſtinguiſh any ſuch property in the veins. Both theſe ſeries of veſſels are nouriſhed by ſtill more minute arteries and veins, which are ſeen creeping over their coats, and ramifying through their whole ſubſtance, and are called *vaſa vaſorum*; they have likewiſe many minute branches of nerves.

* *De Arteriarum et Venarum vi irritabili*, 4to.

The arteries are much ſtronger than the veins, and they ſeem to require this force to be enabled to reſiſt the impetus with which the blood circulates through them, and to impel it on towards the veins.

When the heart contracts, it impels the blood into the arteries, and ſenſibly diſtends them; and theſe veſſels again contract, as the heart becomes relaxed to receive more blood from the auricles; ſo that the cauſe of the contraction and dilatation of the arteries ſeems to be eaſy to be underſtood, being owing in part to their own contractile power, and in part to the action of the heart; but in the *veins*, the effects of this impulſe not being ſo ſenſibly felt, and the veſſels themſelves having little or no contractile power, the blood ſeems to flow in a conſtant and equal ſtream: and this, together with its paſſing gradually from a ſmall channel into a larger one, ſeems to be the reaſon why the *veins* have no pulſatory motion, except the large ones near the heart; and in theſe it ſeems to be occaſioned by the motion of the diaphragm, and by the regurgitation of the blood in the *cavas*.

SECT.

(c) In the extremities, ſome of the deep-ſeated veins, and all the ſuperficial ones, take a courſe different from that of the arteries.

Of the Thorax.

Sect. XII. *Of the Action of the Heart, Auricles, and Arteries.*

124. The heart, at the time it contracts, drives the blood from its ventricles into the arteries; and the arteries being thus filled and diſtended, are naturally inclined to contract the moment the heart begins to dilate, and ceaſes to ſupply them with blood. Theſe alternate motions of contraction and dilatation of the heart and arteries, are diſtinguiſhed by the names of *ſyſtole* and *diaſtole*. When the heart is in a ſtate of contraction or ſyſtole, the arteries are at that inſtant diſtended with blood, and in their diaſtole; and it is in this ſtate we feel their pulſatory motion, which we call the *pulſe*. When the heart dilates, and the arteries contract, the blood is impelled onwards into the veins, through which it is returned back to the heart. While the heart, however, is in its ſyſtole, the blood cannot paſs from the veins into the ventricles, but is detained in the auricles, which are two reſervoirs formed for this uſe, till the diaſtole, or dilatation of the heart, takes place; and then the diſtended auricles contract, and drive the blood into the ventricles: ſo that the auricles have an alternate ſyſtole and diaſtole as well as the heart.

Although both the ventricles of the heart contract at the ſame time, yet the blood paſſes from one to the other. In the ſame moment, for inſtance, that the left ventricle drives the blood into the aorta, the right ventricle impels it into the pulmonary artery, which is diſtributed through all the ſubſtance of the lungs. The blood is afterwards brought back into the left ventricle by the pulmonary vein, at the ſame time that the blood is returned by the cavas, into the right ventricle, from all the other parts of the body.

This ſeems to be the mode of action of the heart and its veſſels: but the cauſe of this action has, like all other intricate and intereſting ſubjects, been differently explained. It ſeems to depend on the ſtimulus made on the different parts of the heart by the blood itſelf, which by its quantity and heat, or other properties (D), is perhaps capable of firſt exciting that motion, which is afterwards continued through life, independent of the will, by a regular return of blood to the auricles, in a quantity proportioned to that which is thrown into the arteries.

The heart poſſeſſes the *vis inſita*, or principle of irritability, in a much greater degree than any other muſcle of the body. The pulſe is quicker in young than in old ſubjects, becauſe the former are *cæt. par.* more irritable than the latter. Upon the ſame principle we may explain, why the pulſe is conſtantly quicker in weak than in robuſt perſons.

Sect. XIII. *Of the Circulation.*

125. After what has been obſerved of the ſtructure and action of the heart and its auricles, and likewiſe of the arteries and veins, there ſeem to be but very few arguments required to demonſtrate the *circulation of the blood*, which has long ſince been eſtabliſhed as a medical truth. This circulation may be defined to be a perpetual motion of the blood, in conſequence of the action of the heart and arteries, which impel it through all the parts of the body, from whence it is brought back by the veins of the heart.

Of the Thorax.

A very ſatisfactory proof of this circulation, and a proof eaſy to be underſtood, may be deduced from the different effects of preſſure on an artery and a vein. If a ligature, for inſtance, is paſſed round an artery, the veſſel ſwells conſiderably between the ligature and the heart; whereas if we tie up a vein, it only becomes filled between the extremity and the ligature, and this is what we every day obſerve in bleeding. The ligature we paſs round the arm on theſe occaſions, compreſſes the ſuperficial veins; and the return of the blood through them being impeded, they become diſtended. When the ligature is too looſe, the veins are not ſufficiently compreſſed, and the blood continues its progreſs towards the heart; and, on the contrary, when it is made too tight, the arteries themſelves become compreſſed; and the flow of the blood through them being impeded, the veins cannot be diſtended.

Another phænomenon, which effectually proves the circulation, is the loſs of blood that every living animal ſuſtains by opening only a ſingle artery of a moderate ſize; for it continues to flow from the wounded veſſel till the equilibrium is deſtroyed which is eſſential to life. This truth was not unknown to the ancients; and it ſeems ſtrange that it did not lead them to a knowledge of the circulation, as it ſufficiently proves, that all the other veſſels muſt communicate with that which is opened. Galen, who lived more than 1500 years ago, drew this concluſion from it; and if we farther obſerve, that he deſcribes (after Eraſiſtratus, who flouriſhed about 450 years before him) the ſeveral valves of the heart, and determines their diſpoſition and uſes, it will appear wonderful, that a period of near 2000 years ſhould afterwards elapſe before the true courſe of the blood was aſcertained. This diſcovery, for which we are indebted to the immortal Harvey, has thrown new lights on phyſiology and the doctrine of diſeaſes, and conſtitutes one of the moſt important periods of anatomical hiſtory.

Sect. XIV. *Of the Nature of the Blood.*

126. Blood, recently drawn from a vein into a baſon, would ſeem to be an homogeneous fluid of a red colour (E); but when ſuffered to reſt, it ſoon coagulates, and divides into two parts, which are diſtinguiſhed by the names of *craſſamentum* and *ſerum*. The craſſamentum is the red coagulum, and the ſerum is the water in which it floats. Each of theſe may be again ſeparated into two others; for the craſſamentum, by being

(D) Dr Harvey long ago ſuggeſted, that the blood is poſſeſſed of a living principle; and Mr J. Hunter has lately endeavoured to revive this doctrine; in ſupport of which he has adduced many ingenious arguments. The ſubject is a curious one, and deſerves to be proſecuted as an inquiry which cannot but be intereſting to phyſiologiſts.

(E) The blood, as it flows through the arteries, is obſerved to be more florid than it is in the veins; and this redneſs is acquired in its paſſage through the lungs. *Vid.* ſect. vii.

Of the Thorax.

repeatedly washed in warm water, gives out all its red globules, and what remains appears to be composed of the coagulable lymph (F), which is a gelatinous substance, capable of being hardened by fire till it becomes perfectly horny: and if we expose the serum to a certain degree of heat, part of it will be found to coagulate like the white of an egg, and there will remain a clear and limpid water, resembling urine both in its appearance and smell.

The serum and crassamentum differ in their proportion in different constitutions; in a strong person, the crassamentum is in a greater proportion to the serum than in a weak one;* and the same difference is found to take place in diseases (G).

* *Hewson's Experim. Enq.* Part I.

Sect. XV. *Of Nutrition.*

127. The variety of functions which we have described as being incessantly performed by the living body, and the continual circulation of the blood through it, must necessarily occasion a constant dissipation of the several parts which enter into its composition. In speaking of the insensible perspiration, we observed how much was incessantly passing off from the lungs and the surface of the skin. The discharge by urine is likewise every day considerable; and great part of the bile, saliva, &c. are excluded by stool. But the solid, as well as the fluid parts of the body, require a constant renewal of nutritious particles. They are exposed to the attrition of the fluids which are circulated through them; and the contraction and relaxation they repeat so many thousand times in every day, would necessarily occasion a dissolution of the machine, if the renewal was not proportioned to the waste.

It is easy to conceive how the chyle formed from the aliment is assimilated into the nature of blood, and repairs the loss of the fluid parts of our body; but how the solids are renewed, has never yet been satisfactorily explained. The nutritious parts of the blood are probably deposited by the arteries by exsudation through their pores into the tela cellulosa; and as the solid parts of the body are in the embryo only a kind of jelly, which gradually acquires the degree of consistence they are found to have when the body arrives at a more advanced age; and these same parts which consist of bones, cartilages, ligaments, muscles, &c. are sometimes reduced again by disease to a gelatinous state; we may, with some degree of probability, consider the coagulable lymph as the source of nutrition.

Of the Thorax.

If the supply of nourishment exceeds the degree of waste, the body increases; and this happens in infancy and in youth: for at those periods, but more particularly the former one, the fluids bear a large proportion to the solids; and the fibres being soft and yielding, are proportionably more capable of extension and increase. But when the supply of nutrition only equals the waste, we neither increase or decrease; and we find this to be the case when the body has attained its full growth or *acmè*: for the solids having then acquired a certain degree of firmness and rigidity, do not permit a farther increase of the body. But as we approach to old age, rigidity begins to be in excess, and the fluids (H) bear a much less proportion to the solids than before. The dissipation of the body is greater than the supply of nourishment; many of the smaller vessels become gradually impervious (I); and the fibres losing their moisture and their elasticity, appear flaccid and wrinkled. The lilies and the roses disappear, because the fluids by which they were produced can no longer reach the extremities of the capillary vessels of the skin. As these changes take place, the nervous power being proportionably weakened, the irritability and sensibility of the body, which were formerly so remarkable, are greatly diminished; and in advanced life, the hearing, the eye-sight, and all the other senses, become gradually impaired.

Sect. XVI. *Of the Glands and Secretions.*

128. The glands are commonly understood to be small, roundish, or oval bodies formed by the convolution of a great number of vessels, and destined to separate particular humours from the mass of blood.

They are usually divided into two classes; but it seems more proper to distinguish three kinds of glands, viz. the mucous, conglobate, and conglomerate.

The *mucous glands*, or follicles, as they are most commonly called, are small cylindrical tubes continued from

---

(F) It may not be improper to observe, that till of late the *coagulable lymph* has been confounded with the *serum* of the blood, which contains a substance that is likewise coagulable, though only when exposed to heat, or combined with certain chemical substances; whereas the other coagulates spontaneously when exposed to the air or to rest.

(G) When the blood separates into *serum* and *crassamentum*, if the latter be covered with a crust of a whitish or buff colour, it has been usually considered as a certain proof of the blood's being in a state of too great viscidity. This appearance commonly taking place in inflammatory diseases, has long served to confirm the theory which ascribes the cause of inflammation to lentor and obstructions. But from the late Mr Hewson's experiments it appears, that when the action of the arteries is increased, the blood, instead of being more viscid, is, on the contrary, more fluid than in the ordinary state, previous to inflammation: and that in consequence of this, the coagulable lymph suffers the red globules, which are the heaviest part of the blood, to fall down to the bottom before it coagulates: so that the crassamentum is divided into two parts; one of which is found to consist of the coagulable lymph alone (in this case termed the *buff*); and the other, partly of this and partly of the red globules.

(H) As the fluids become less in proportion to the solids, their acrimony is found to increase; and this may perhaps compensate for the want of fluidity in the blood, by diminishing its cohesion.

(I) In infancy, the arteries are numerous and large in respect to the veins, and the lymphatic glands are larger than at any other time of life; whereas, in old age, the capacity of the venous system exceeds that of the arteries, and the lymphatic system almost disappears.

Of the Thorax.

from the ends of arteries. In ſome parts of the body, as in the tonſils, for example, ſeveral of theſe follicles may be ſeen folded together in one common covering, and opening into one common ſinus. Theſe follicles are the veſſels that ſecrete and pour out mucus in the mouth, œſophagus, ſtomach, inteſtines, and other parts of the body.

The *conglobate glands* are peculiar to the lymphatic ſyſtem. Every lymphatic vein paſſes through a gland of this kind in its way to the thoracic duct. They are met with in different parts of the body, particularly in the axilla, groin, and meſentery, and are either ſolitary or in diſtinct cluſters.

The *conglomerate glands* are of much greater bulk than the conglobate, and ſeem to be an aſſemblage of many ſmaller glands. Of this kind are the liver, kidneys, &c. Some of them, as the pancreas, parotids, &c. have a granulated appearance. All theſe conglomerate glands are plentifully ſupplied with blood-veſſels; but their nerves are in general very minute, and few in number. Each little granulated portion furniſhes a ſmall tube, which unites with other ſimilar ducts, to form the common excretory duct of the gland.

The principal glands, and the humours they ſecrete, have been already deſcribed in different parts of this work; and there only remains for us to examine the general ſtructure of the glands, and to explain the mechaniſm of ſecretion. On the firſt of theſe ſubjects two different ſyſtems have been formed; each of which has had, and ſtill continues to have, its adherents. One of theſe ſyſtems was advanced by Malpighi, who ſuppoſed that an artery entering into a gland ramifies very minutely through its whole ſubſtance; and that its branches ultimately terminate in a veſicular cavity or follicle, from whence the ſecreted fluid paſſes out through the excretory duct. This doctrine at firſt met with few opponents; but the celebrated Ruyſch, who firſt attempted minute injections with wax, afterwards diſputed the exiſtence of theſe follicles, and aſſerted, that every gland appears to be a continued ſeries of veſſels, which after being repeatedly convoluted in their courſe through its ſubſtance, at length terminate in the excretory duct. Anatomiſts are ſtill divided between theſe two ſyſtems: that of Malpighi, however, ſeems to be the beſt founded.

The mode of ſecretion has been explained in a variety of ways, and they are all perfectly hypothetical. In ſuch an inquiry it is natural to aſk, how one gland conſtantly ſeparates a particular humour, while another gland ſecretes one of a very different nature from the blood? The bile, for inſtance, is ſeparated by the liver, and the urine by the kidneys. Are theſe ſecretions to be imputed to any particular diſpoſitions in the fluids, or is their cauſe to be looked for in the ſolids?

It has been ſuppoſed, that every gland contains within itſelf a fermenting principle, by which it is enabled to change the nature of the blood it receives, and to endue it with a particular property. So that, according to this ſyſtem, the blood, as it circulates through the kidneys, becomes mixed with the fermenting principle of thoſe glands, and a part of it is converted into urine; and again, in the liver, in the ſalival and other glands, the bile, the ſaliva, and other juices, are generated from a ſimilar cauſe. But it ſeems to be impoſſible for any liquor to be confined in a place expoſed to the circulation, without being carried away by the torrent of blood, every part of which would be equally affected; and this ſyſtem of fermentation has long been rejected as vague and chimerical. But as the cauſe of ſecretion continued to be looked for in the fluids, the former ſyſtem was ſucceeded by another, in which recourſe was had to the analogy of the humours. It was obſerved, that if paper is moiſtened with water, and oil and water are afterwards poured upon it, that the water only will be permitted to paſs through it; but that, on the other hand, if the paper has been previouſly ſoaked in oil inſtead of water, the oil only, and not the water, will be filtered through it. Theſe obſervations led to a ſuppoſition, that every ſecretory organ is originally furniſhed with a humour analogous to that which it is afterwards deſtined to ſeparate from the blood; and that in conſequence of this diſpoſition, the ſecretory veſſels of the liver, for inſtance, will only admit the bilous particles of the blood, while all the other humours will be excluded. This ſyſtem is an ingenious one, but the difficulties with which it abounds are unanſwerable; for oil and water are immiſcible; whereas the blood, as it is circulated through the body, appears to be an homogeneous fluid. Every oil will paſs through a paper moiſtened only with one kind of oil; and wine, or ſpirits mixed with water, will eaſily be filtered through a paper previouſly ſoaked in water. Upon the ſame principle, all our humours, though differing in their other properties, yet agreeing in that of being perfectly miſcible with each other, will all eaſily paſs through the ſame filtre.—But theſe are not all the objections to this ſyſtem. The humours which are ſuppoſed to be placed in the ſecretory veſſels for the determination of ſimilar particles of the blood, muſt be originally ſeparated without any analogous fluid; and that which happens once, may as eaſily happen always. Again, it ſometimes happens from a vicious diſpoſition, that humours are filtered through glands which are naturally not intended to afford them a paſſage; and when this once has happened, it ought, according to this ſyſtem, to be expected always to do ſo: whereas this is not the caſe; and we are, after all, naturally led to ſeek for the cauſe of ſecretions in the ſolids. It does not ſeem right to aſcribe it to any particular figure of the ſecretory veſſels; becauſe the ſoft texture of thoſe parts does not permit them to preſerve any conſtant ſhape, and our fluids ſeem to be capable of accommodating themſelves to every kind of figure. Some have imputed it to the difference of diameter in the orifices of the different ſecretory veſſels. To this doctrine objections have likewiſe been raiſed; and it has been argued, that the veſſels of the liver, for inſtance, would, upon this principle, afford a paſſage not only to the bile, but to all the other humours of leſs conſiſtence with it. In reply to this objection, it has been ſuppoſed, that ſecondary veſſels exiſt, which originate from the firſt, and permit all the humours thinner than the bile to paſs through them.

Each of theſe hypotheſes is probably very remote from the truth.

EXPLANATION of PLATE XXVIII.

This plate repreſents the Heart in ſitu, all the large Arteries and Veins, with ſome of the Muſcles, &c.

Muscles, &c.—Superior Extremity.—a, Maſſeter. b, Complexus. C, Digaſtricus. d, Os hyoides. e, Thyroid gland. f, Levator ſcapulæ. g, Cucullaris. h h, The clavicles cut. i, The deltoid muſcle. k, Biceps flexor cubiti cut. l, Caraco-brachialis. m, Triceps extenſor cubiti. n, The heads of the pronator teres, flexor carpi radiales, and flexor digitorum ſublimis, cut. o, The flexor carpi ulnaris, cut at its extremity. p, Flexor digitorum profundus. q, Supinator radii longus, cut at its extremity. r, Ligamentum carpi tranſverſale. s, Extenſores carpi radiales. t, Latiſſimus dorſi. u, Anterior edge of the ſerratus anticus major. v v, The inferior part of the diaphragm. w w, Its anterior edge cut. x x, The kidneys. y, Tranſverſus abdominis. z, Os ilium.

Inferior Extremity.—*a*, Pſoas magnus. *b*, Iliacus internus. *c*, The fleſhy origin of the tenſor vagina femoris. *d d*, The oſſa pubis cut from each other. *e*, Muſculus pectineus cut from its origin. *f*, Short head of the triceps abductor femoris cut. *g*, The great head of the triceps. *h*, The long head cut. *i*, Vaſtus internus. *k*, Vaſtus externus. *l*, Crureus. *m*, Gemellus. *n*, Soleus. *o*, Tibia. *p*, Peronæus longus. *q*, Peronæus brevis. *r*, Fibula.

Heart and Blood-vessels.—A, The heart, with the coronary arteries and veins. B, The right auricle of the heart. C, The aorta aſcendens. D, The left ſubclavian artery. E, The left carotid artery. F, The common trunk which ſends off the right ſubclavian and right carotid arteries. G, The carotis externa. H, Arteria facialis, which ſends off the coronary arteries of the lips. I, Arteria temporalis profunda. K, Aorta deſcendens. L L, The iliac arteries,—which ſend off M M, The femoral or crural arteries. *N. B.* The other arteries in this figure have the ſame diſtribution as the veins of the ſame name:—And generally, in the anatomical plates, the deſcription to be found on the one ſide, points out the ſame parts in the other. 1, The frontal vein. 2, The facial vein. 3, Vena temporalis profunda. 4, Vena occipitalis. 5, Vena jugularis externa. 6, Vena jugularis interna, covering the arteria carotis communis. 7, The vaſcular arch on the palm of the hand, which is formed by, 8, The radial artery and vein, and, 9, The ulnar artery and vein. 10 10, Cephalic vein. 11, Baſilic vein, that on the right ſide cut. 12, Median vein. 13, The humeral vein, which, with the median, covers the humeral artery. 14 14, The external thoracic or mammary arteries and veins. 15, The axillary vein, covering the artery. 16 16, The ſubclavian veins, which, with (6 6) the jugulars, form, 17, The vena cava ſuperior. 18, The cutaneous arch of veins on the fore part of the foot. 19, The vena tibialis antica, covering the artery. 20, The vena profunda femoris, covering the artery. 21, The upper part of the vena ſaphena major. 22, The femoral vein. 23 23, The iliac veins. 24 24, Vena cava inferior. 25 25, The renal veins covering the arteries. 26 26, The diaphragmatic veins.

Part V. Of the BRAIN and NERVES.

Sect. I. *Of the Brain and its Integuments.*

129. THE bones of the cranium were deſcribed in the oſteological part of this work, as incloſing the brain, and defending it from external injury: but they are not its only protection; for when we make an horizontal ſection through theſe bones, we find this maſs everywhere ſurrounded by two membranes (k), the dura and pia mater.—The firſt of theſe lines the interior ſurface of the cranium, to which it everywhere adheres ſtrongly (l), but more particularly at the ſutures, and at the many foramina through which veſſels paſs between it and the pericranium. The *dura mater* (m) is perfectly ſmooth and inelaſtic, and its inner ſurface is conſtantly bedewed with a fine pellucid fluid, which everywhere ſeparates it from the pia mater. The dura mater ſends off ſeveral conſiderable proceſſes, which divide the brain into ſeparate portions, and prevent them from compreſſing each other. Of theſe proceſſes there is one ſuperior and longitudinal, called the *falx*, or *falciform proceſs*, from its reſemblance to a ſcythe. It ariſes from the ſpine of the os frontis, near the chriſta galli, and extending along in the direction of the ſagittal ſuture, to beyond the lambdoidal ſuture, divides the brain into two hemiſ-

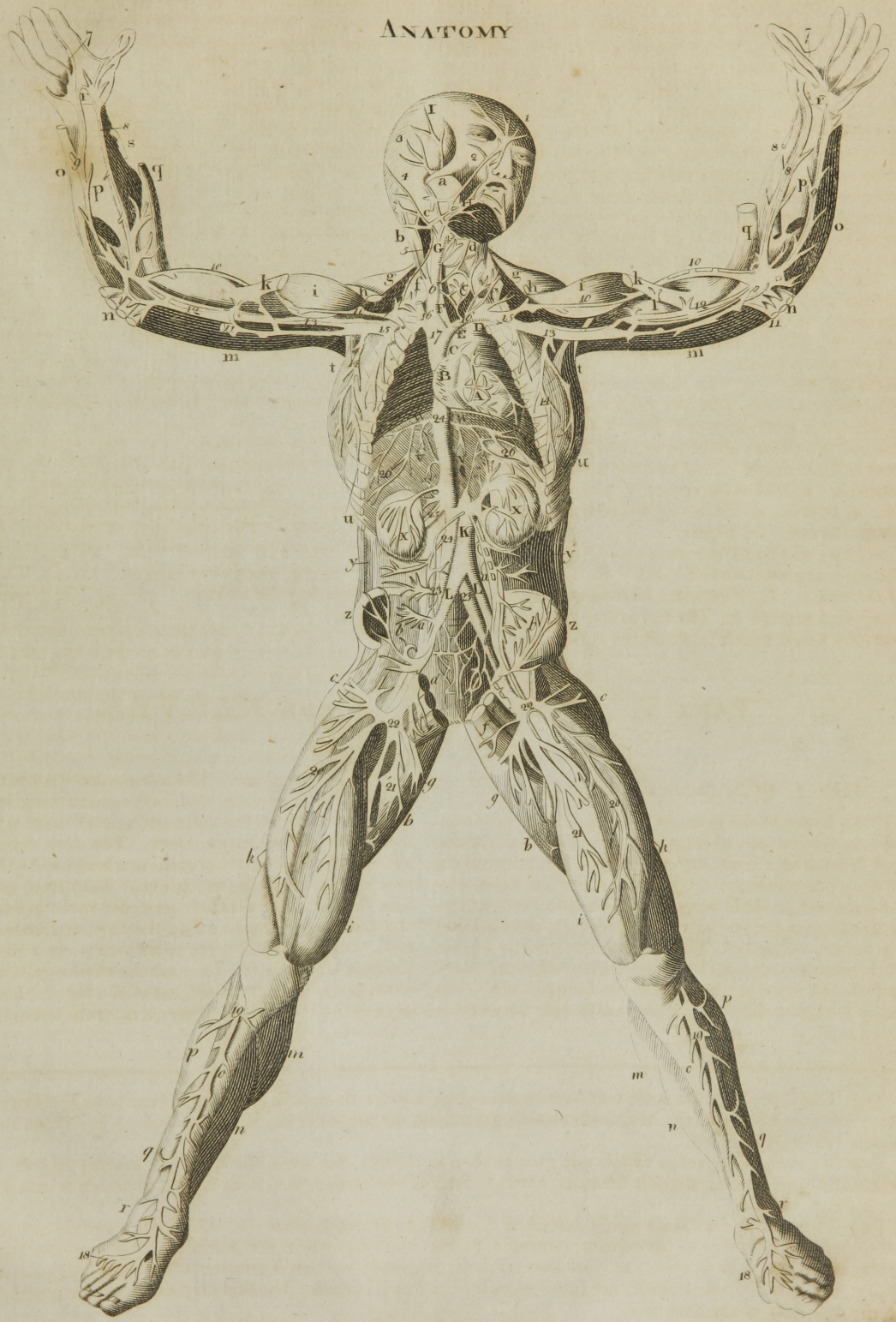
130 Integuments of the brain.

(k) The Greeks called theſe membranes *meninges*; but the Arabians, ſuppoſing them to be the ſource of all the other membranes of the body, afterwards gave them the names of *dura* and *pia mater*; by which they are now uſually diſtinguiſhed.

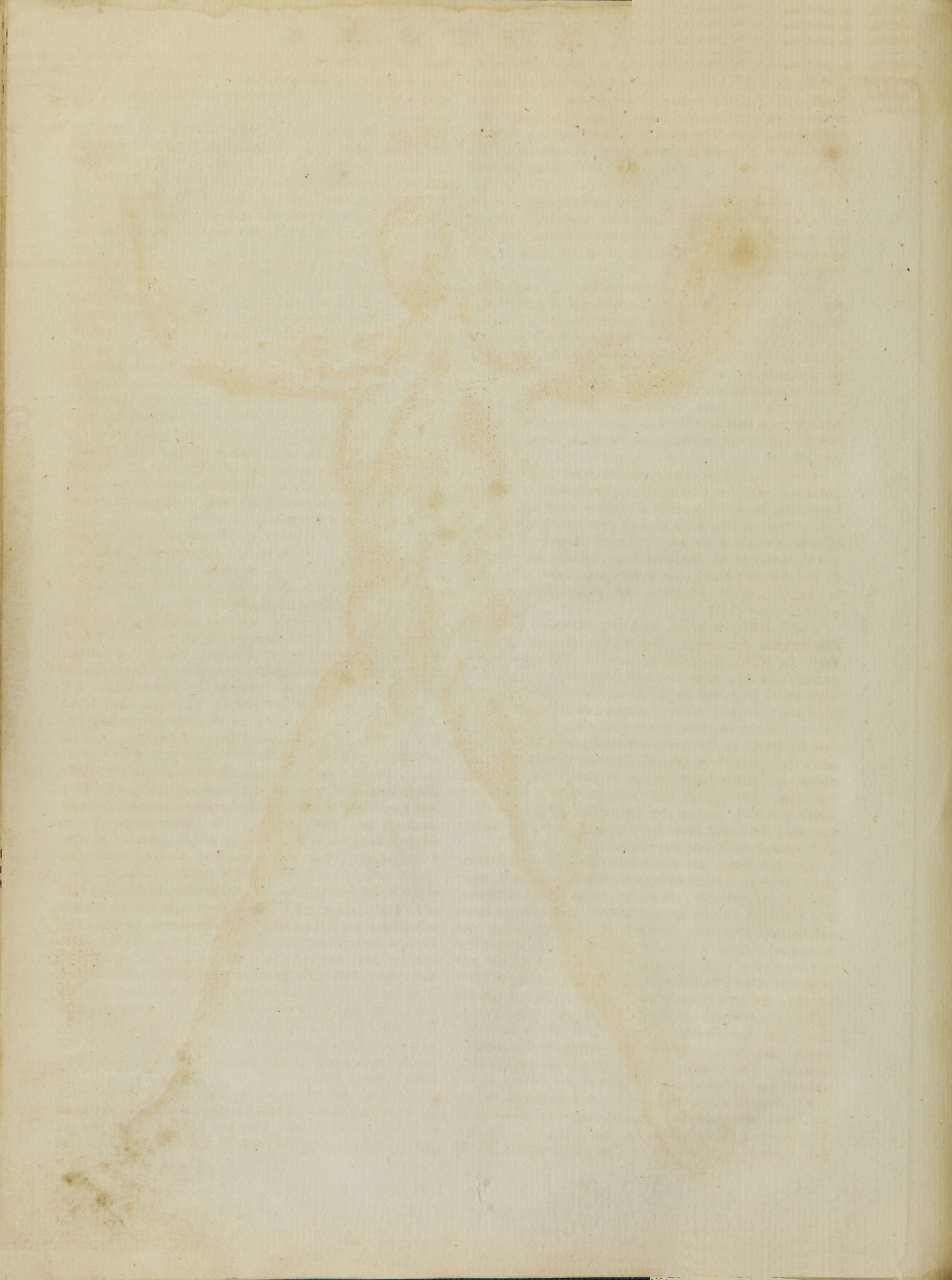
(l) In young ſubjects this adheſion is greater than in adults; but even then, in the healthy ſubject, it is no where eaſily ſeparable, without breaking through ſome of the minute veſſels by means of which it is attached to the bone.

(m) This membrane is commonly deſcribed as conſiſting of two laminæ; of which the external one is ſuppoſed to perform the office of perioſteum internum to the cranium, while the internal one forms the folds and proceſſes of the dura mater. In the natural ſtate, however, no ſuch ſeparation is apparent; like other membranes, we may indeed divide it, not into two only, but many laminæ; but this diviſion is artificial, and depends on the dexterity of the anatomiſt.

ANATOMY



Scot Philad.a



Of the Brain and Nerves.

hemiſpheres. A little below the lambdoidal ſuture, it divides into two broad wings or expanſions called the *tranſverſe* or *lateral proceſſes*, which prevents the lobes of the cerebrum from preſſing on the cerebellum. Beſides theſe there is a fourth, which is ſituated under the tranſverſe proceſſes, and being continued to the ſpine of the occiput, divides the cerebellum into two lobes.

The blood, after being diſtributed through the cavity of the cranium by means of the arteries, is returned, as in the other parts of the body, by veins which all paſs on to certain channels, ſituated behind theſe ſeveral proceſſes.

Theſe canals or ſinuſes communicate with each other, and empty themſelves into the internal jugular veins, which convey the blood into the vena cava. They are in fact triangular veins, running through the ſubſtance of the dura mater, and, like the proceſſes, are diſtinguiſhed into *longitudinal* and *lateral*; and where theſe three meet, and where the fourth proceſs paſſes off, we obſerve a fourth ſinus, which is called *torcular*; Herophilus, who firſt deſcribed it, having ſuppoſed that the blood at the union of theſe two veins, is, as it were, in a preſs.

Beſides theſe four canals, which were known to the ancients, modern anatomiſts enumerate many others, by giving the appellation of *ſinuſes* to other veins of the dura mater, which for the moſt part empty themſelves into ſome of thoſe we have juſt now deſcribed. There are the inferior longitudinal ſinus, the ſuperior and inferior petrous ſinuſes, the cavernous ſinuſes, the circular ſinus, and the anterior and poſterior occipital ſinuſes.

Theſe ſinuſes or veins, by being conveyed through a thick denſe membrane, firmly ſuſpended, as the dura mater is, within the cranium, are leſs liable to rupture; at the ſame time they are well ſupported, and by running every where along the inner ſurface of the bones, they are prevented from preſſing on the ſubſtance of the brain. To prevent too great a dilatation of them, we find filaments (called *chordæ Williſii*, from their having been firſt noticed by Willis) ſtretched acroſs their cavities; and the oblique manner in which the veins from the brain run through the ſubſtance of the brain into theſe channels, ſerves the purpoſe of a valve, which prevents the blood from turning back into the ſmaller and weaker veſſels of the brain.

The *pia mater* is a much ſofter and finer membrane than the dura mater; being exceedingly delicate, tranſparent, and vaſcular. It inveſts every part of the brain, and ſends off an infinite number of elongations, which inſinuate themſelves between the convolutions, and even into the ſubſtance of the brain. This membrane is compoſed of two laminæ; of which the exterior one is named *tunica arachnoidea*, from its thinneſs, which is equal to that of a ſpider's web. Theſe two laminæ are intimately adherent to each other at the upper part of the brain, but are eaſily ſeparable at the baſis of the brain, and through the whole length of the medulla ſpinalis. The external layer, or tunica arachnoidea, appears to be ſpread uniformly over the ſurface of the brain, but without entering into its furrows as the inner layer does; the latter being found to inſinuate itſelf between the convolutions, and even into the interior cavities of the brain. The blood-veſſels of the brain are diſtributed through it in their way to that organ, and are therefore divided into very minute ramifications, before they penetrate the ſubſtance of the brain.

Of the Brain and Nerves.

131 The brain

There are ſeveral parts included under the general denomination of *brain*. One of theſe, which is of the ſofteſt conſiſtence, and fills the greateſt part of the cavity of the cranium, is the *cerebrum*, or *brain* properly ſo called. Another portion, which is ſeated in the inferior and poſterior part of the head, is the *cerebellum*; and a third, which derives its origin from both theſe, is the *medulla oblongata*.

132 Cerebrum

The *cerebrum* is a medullary maſs of a moderate conſiſtence, filling up exactly all the upper part of the cavity of the cranium, and divided into two hemiſpheres by the falx of the dura mater. Each of theſe hemiſpheres is uſually diſtinguiſhed into *an interior*, *a middle*, and *a poſterior lobe*. The firſt of theſe is lodged on the orbital proceſſes of the os frontis; the middle lobes lie on the middle foſſæ of the baſis of the cranium, and the poſterior lobes are placed on the tranſverſe ſeptum of the os occipitis, immediately over the cerebellum, from which they are ſeparated by the lateral proceſſes of the dura mater. Theſe two portions afford no diſtinguiſhing mark of ſeparation; and on this account Haller, and many other modern anatomiſts, omit the diſtinction of middle lobe, and ſpeak only of the anterior and poſterior lobes of the brain.

The cerebrum appears to be compoſed of two diſtinct ſubſtances. Of theſe, the exterior one, which is of a greyiſh or aſh-colour, is called the *cortex*, and is ſomewhat ſofter than the other, which is very white, and is called *medulla* or *ſubſtantia alba*.

After having removed the falx, and ſeparated the two hemiſpheres from each other, we perceive a white convex body, the corpus calloſum, which is a portion of the medullary ſubſtance, uniting the two hemiſpheres to each other, and not inveſted by the cortex. By making an horizontal inciſion in the brain, on a level with this corpus calloſum, we diſcover two oblong cavities, named the *anterior* or *lateral ventricles*, one in each hemiſphere. Theſe two ventricles, which communicate with each other by a hole immediately under the plexus choroides, are ſeparated laterally by a very fine medullary partition, called *ſeptum lucidum*, from its thinneſs and tranſparency. The lower edge of this ſeptum is fixed to the fornix, which is a kind of medullary arch (as its name implies) ſituated under the corpus calloſum, and nearly of a triangular ſhape. Anteriorly the fornix ſends off two medullary chords, called its *anterior crura*; which ſeem to be united to each other by a portion of medullary ſubſtance, named *commiſſura anterior cerebri*. Theſe crura diverging from one another, are loſt at the outer ſide of the lower and fore-part of the third ventricle. Poſteriorly the fornix is formed into two other crura, which unite with two medullary protuberances called *pedes hippocampi*, and ſometimes *cornua ammonis*, that extend along the back-part of the lateral ventricles. The concave edge of the pedes hippocampi is covered by a medullary lamina, called *corpus fimbriatum*.

Neither the edges of the fornix, nor its poſterior crura, can be well diſtinguiſhed, till we have removed the plexus choroides. This is a production of the pia mater, which is ſpread over the lateral ventricles. Its

looſe

Of the Brain and Nerves.

looſe edges are collected, ſo as to appear like a vaſcular band on each ſide.

When we have removed this plexus, we diſcover ſeveral other protuberances included in the lateral ventricles. Theſe are the corpora ſtriata, the thalami nervorum opticorum, the tubercula quadrumgemina, and the pineal gland.

The *corpora ſtriata* are two curved oblong eminences, that extend along the anterior part of the lateral ventricles. They derive their name from their ſtriated appearance, which is owing to an intermixture of the cortical and medullary ſubſtances of the brain. The *thalami nervorum opticorum*, are ſo called, becauſe the optic nerves ariſe chiefly from them, and they are likewiſe compoſed both of the cortex and medulla. They are ſeparated from the corpora ſtriata only by a kind of medullary chord, the geminum centrum ſemi-circulare. The thalami are nearly of an oval ſhape, and are ſituated at the bottom of the upper cavity of the lateral ventricles. They are cloſely united, and at their convex part ſeem to become one body.

Anteriorly, in the ſpace between the thalami, we obſerve an orifice by which the lateral ventricles communicate, and another leads down from this, under the different appellations of *foramen commune anterius*, *vulva iter ad infundibulum*, but more properly *iter ad tertium ventriculum*; and the ſeparation of the thalami from each other poſteriorly, forms another opening or interſtice called *anus*. This has been ſuppoſed to communicate with the third ventricle; but it does not, the bottom of it being ſhut up by the pia mater. The back part of the anus is formed by a kind of medullary band, which connects the thalami to each other, and is called *commiſſura poſterior cerebri*.

Behind the thalami and commiſſura poſterior, we obſerve a ſmall, ſoft, greyiſh, and oval body, about the ſize of a pea. This is the glandula pinealis; it is deſcribed by Galen under the name of *conarion*, and has been rendered famous by Deſcartes, who ſuppoſed it to be the ſeat of the ſoul. Galen ſeems formerly to have entertained the ſame opinion. Some modern writers have, with as little reaſon, imagined that the ſoul is placed in the corpus calloſum.

The pineal gland reſts upon four remarkable eminences, diſpoſed in pairs, and ſeated immediately below it. Theſe tubercles, which by the ancients were called *teſtes* and *nates*, have, ſince the time of Winſlow, been more commonly named *tubercula quadrugemina*.

Under the thalami we obſerve another cavity, the third ventricle, which terminates anteriorly in a ſmall medullary canal, the infundibulum, that leads to the glandula pituitaria. It has been doubted, whether the infundibulum is really hollow; but ſome late experiments on this part of the brain * by Profeſſor Murray of Upſal, clearly prove it to be a medullary canal, ſurrounded by both laminæ of the pia mater. After freezing the brain, this channel was found filled with ice; and de Haen tells † us, he found it dilated, and filled with a calcareous matter (N).

The ſoft ſpongy body in which the infundibulum terminates, was by the ancients ſuppoſed to be of a glandular ſtructure, and deſtined to filter the ſeroſity of the brain. Spigelius pretended to have diſcovered its excretory duct, but it ſeems certain that no ſuch duct exiſts. It is of an oblong ſhape, compoſed, as it were, of two lobes. In ruminant animals it is much larger than in man.

Of the Brain and Nerves.

From the poſterior part of the third ventricle, we ſee a ſmall groove or channel, deſcending obliquely backwards. This channel, which is called the *aqueduct of Sylvius*, though it was known to the ancients, opens into another cavity of the brain, placed between the cerebellum and medulla oblongata, and called the *fourth ventricle*.

133 Cerebellum.

The *cerebellum*, which is divided into two lobes, is commonly ſuppoſed to be of a firmer texture than the cerebrum; but the truth is, that in the greater number of ſubjects, there appears to be no ſenſible difference in the conſiſtence of theſe two parts. It has more of the cortical than of the medullary ſubſtance in its compoſition.

The furrow that divides the two lobes of the cerebellum leads anteriorly to a proceſs, compoſed of medullary and cortical ſubſtances, covered by the pia mater; and which, from its being divided into numerous furrows, reſembling the rings of the earth-worm, is named *proceſſus vermiformis*. This proceſs forms a kind of ring in its courſe between the lobes.

The ſurface of the cerebellum does not afford thoſe circumvolutions which appear in the cerebrum; but inſtead of theſe, we obſerve a great number of minute furrows, running parallel to each other, and nearly in a tranſverſe direction. The pia mater inſinuates itſelf into theſe furrows.

When we cut into the ſubſtance of the cerebellum, from above downwards, we find the medullary part running in a kind of ramifying courſe, and exhibiting an appearance that has gotten the name of *arbor vitæ*. Theſe ramifications unite to form a medullary trunk; the middle, anterior, and moſt conſiderable part of which forms two proceſſes, the crura cerebelli, which unite with the crura cerebri, to form the medulla oblongata. The laſt furniſhes two other proceſſes, which loſe themſelves under the nates, and thus unite the lobes of the cerebellum to the poſterior part of the cerebrum. Under the nates we obſerve a tranſverſe medullary line, or linea alba, running from one of theſe proceſſes to the other; and between them we find a very thin medullary lamina, covered with the pia mater, which the generality of anatomiſts have (though ſeemingly without reaſon) conſidered as a valve formed for cloſing the communication between the fourth ventricle and the aquæductus Sylvii. Vieuſſens named it *valvula major cerebri*.

134 Medulla oblongata.

The *medulla oblongata* is ſituated in the middle, lower, and poſterior part of the cranium, and may be conſidered as a production or continuation of the whole medullary ſubſtance of the cerebrum and cerebellum, being formed by the union of two conſiderable medullary proceſſes of the cerebrum, called *crura cerebri*,

* *Diſp. de fundibulo cerebri.*

† *Ratio ſed.* m. vi. 271.

(N) The under part of it, however, appears to be impervious; at leaſt no injection that can be depended on has been made to paſs from it into the glandula pituitaria without laceration of parts.

Of the Brain and Nerves.

bri, with two other ſmaller ones from the cerebellum, which were juſt now ſpoken of under the name of *crura cerebelli*.

The crura cerebri ariſe from the middle and lower part of each hemiſphere. They are ſeparated from each other at their origin, but are united below, where they terminate in a middle protuberance, the *pons Varolii*, ſo called, becauſe Varolius compared it to a bridge. This name, however, can convey no idea of its real appearance. It is, in fact, nothing more than a medullary protuberance, nearly of a ſemi-ſpherical ſhape, which unites the crura cerebri to thoſe of the cerebellum.

Between the crura cerebri, and near the anterior edge of the pons Varolii, are two tubercles, compoſed externally of medullary, and internally of cineritious, ſubſtance, to which Euſtachius firſt gave the name of *eminentiæ mamillares*.

Along the middle of the poſterior ſurface of the medulla oblongata, where it forms the anterior part of the fourth ventricle, we obſerve a kind of furrow which runs downwards and terminates in a point. About an inch above the lower extremity of this fiſſure, ſeveral medullary filaments are to be ſeen running towards it on each ſide in an oblique direction, ſo as to give it the appearance of a writing-pen; hence it is called *calamus ſcriptorius*.

From the poſterior part of the pons Varolii, the medulla oblongata deſcends obliquely backwards; at its fore-part, immediately behind the pons Varolii, we obſerve two pair of eminences, which were deſcribed by Euſtachius, but received no particular appellation till the time of Vieuſſens, who gave them the names of *corpora olivaria* and *corpora pyramidalia*. The former are the outermoſt, being placed one on each ſide. They are nearly of an oval ſhape, and are compoſed of medulla, with ſtreaks of cortical ſubſtance. Between theſe are the corpora pyramidalia, each of which terminates in a point. In the human ſubject theſe four eminences are ſometimes not eaſily diſtinguiſhed

135 Medulla ſpinalis.

The *medulla ſpinalis*, or *ſpinal marrow*, which is the name given to the medullary chord that is extended down the vertebral canal, from the great foramen of the occipital bone to the bottom of the laſt lumbar vertebra, is a continuation of the medulla oblongata. Like the other parts of the brain, it is inveſted by the dura and pia mater. The firſt of theſe, in its paſſage out of the cranium, adheres to the foramen of the os occipitis. Its connection with the ligamentary ſubſtance that lines the cavity of the ſpine, is only by means of cellular membrane; but between the ſeveral vertebræ, where the nerves paſs out of the ſpine, it ſends off prolongations, which adhere ſtrongly to the vertebral ligaments. Here, as in the cranium, the dura mater has its ſinuſes or large veins. Theſe are two in number, and are ſeen running on each ſide of the medullary column, from the foramen magnum of the os occipitis to the lower part of the os ſacrum. They communicate together by ramifying branches at each vertebra, and terminate in the vertebral, intercoſtal, and ſacral veins.

Of the Brain and Nerves.

The pia mater is connected with the dura mater by means of a thin tranſparent ſubſtance, which from its indentations between the ſpinal nerves has obtained the name of *ligamentum denticulatum*. It is ſomewhat firmer than the tunica arachnoidea, but in other reſpects reſembles that membrane. Its uſe is to ſupport the ſpinal marrow, that it may not affect the medulla oblongata by its weight.

The ſpinal marrow itſelf is externally of a white colour; but upon cutting into it we find its middle-part compoſed of a darker coloured maſs, reſembling the cortex of the brain. When the marrow has reached the firſt lumbar vertebra, it becomes extremely narrow, and at length terminates in an oblong protuberance; from the extremity of which the pia mater ſends off a prolongation or ligament, reſembling a nerve, that perforates the dura mater, and is fixed to the os coccygis.

The medulla ſpinalis gives riſe to 30 or 31 pair of nerves, but they are not all of the ſame ſize, nor do they all run in the ſame direction. The upper ones are thinner than the reſt, and are placed almoſt tranſverſely: as we deſcend we find them running more and more obliquely downwards, till at length their courſe is almoſt perpendicular, ſo that the lowermoſt nerves exhibit an appearance that is called *cauda equina*, from its reſemblance to a horſe's tail.

The arteries that ramify through the different parts of the brain, are derived from the internal carotid and from the vertebral arteries. The medulla ſpinalis is ſupplied by the anterior and poſterior ſpinal arteries, and likewiſe receives branches, from the cervical, the inferior and ſuperior intercoſtal, the lumbar, and the ſacral arteries.

Sect. II. *Of the Nerves.*

136. The nerves are medullary chords, differing from each other in ſize, colour, and conſiſtence, and deriving their origin from the medulla oblongata and medulla ſpinalis. There are 39, and ſometimes 40, pair of theſe nerves; nine (o) of which originate from the medulla oblongata, and 30 or 31 from the medulla ſpinalis. They appear to be perfectly inelaſtic, and likewiſe to poſſeſs no irritability. If we irritate muſcular fibres, they immediately contract; but nothing of this ſort happens if we irritate a nerve. They carry with them a covering from the pia mater; but derive no tunic from the dura mater, as hath been generally, though erroneouſly, ſuppoſed, ever ſince the time of Galen (p), the

(o) It has been uſual to deſcribe the ten pair of nerves as ariſing from the medulla oblongata; but as the tenth pair ariſe in the ſame manner as the other ſpinal nerves, Santorini, Heiſter, Haller, and others, ſeem very properly to have claſſed them among the nerves of the ſpine.

(p) Baron Haller and Profeſſor Zinn ſeem to have been the firſt who demonſtrated, that the dura mater is reflected upon and adheres to the perioſteum at the edges of the foramina that afford a paſſage to the nerves out of the cranium, and vertebral canal, or is ſoon loſt in the cellular ſubſtance.

Of the Brain and Nerves.

the outer covering of the nerves being in fact nothing more than the cellular membrane. This covering is very thick where the nerve is exposed to the action of muscles; but where it runs through a bony canal, or is secure from pressure, the cellular tunic is extremely thin, or altogether wanting. We have instances of this in the portio mollis of the auditory nerve, and in the nerves of the heart.

By elevating, carefully and gently, the brain from the basis of the cranium, we find the first nine pair arising in the following order: 1. The nervi olfactorii, distributed through the pituitary membrane, which constitutes the organ of smell. 2. The optici, which go to the eyes, where they receive the impressions of visible objects. 3. The oculorum motores, so called because they are distributed to the muscles of the eye. 4. The pathetici, distributed to the superior oblique muscles of the eyes, the motion of which is expressive of certain passions of the soul. 5. The nerves of this pair soon divide into three principal branches, and each of these has a different name. Its upper division is the ophthalamicus, which is distributed to various parts of the eyes, eye-lids, forehead, nose, and integuments of the face. The second is called the *maxillaris superior*, and the third *maxillaris inferior;* both which names allude to their distribution. 6. The abductores; each of these nerves is distributed to the abductor muscle of the eye, so called, because it helps to draw the globe of the eye from the nose. 7. The auditorii (Q), which are distributed through the organs of hearing. 8. The par vagum, which derives its name from the great number of parts to which it gives branches both in the thorax and abdomen. 9. The linguales, or hypo-glossi, which are distributed to the tongue, and appear to contribute both to the organ of taste and to the motions of the tongue (R).

It has already been observed, that the spinal marrow sends off 30 or 31 pair of nerves; these are chiefly distributed to the exterior parts of the trunk and to the extremities. They are commonly distinguished into the *cervical*, *dorsal*, *lumbar*, and *sacral nerves*. The cervical, which pass out from between the several vertebræ of the neck, are eight (S) in number; the dorsal, twelve; the lumbar, five; and the sacral, five or six; the number of the latter depending on the number of holes in the os sacrum. Each spinal nerve at its origin is composed of two fasciculi of medullary fibres. One of these fasciculi arises from the anterior, and the other from the posterior, surface of the medulla. These fasciculi are separated by the ligamentum denticulatum; after which we find them contiguous to one another. They then perforate the dura mater, and unite to form a considerable knot or ganglion. Each of these ganglions sends off two branches; one anterior, and the other posterior. The anterior branches communicate with each other at their coming out of the spine, and likewise send off one, and sometimes more branches, to assist in the formation of the intercostal nerve.

The knots or ganglions of the nerves just now spoken of, are not only to be met with at their exit from the spine, but likewise in various parts of the body. They occur in the nerves of the medulla oblongata, as well as in those of the spine. They are not the effects of disease, but are to be met with in the same parts of the same nerves, both in the fœtus and adult. They are commonly of an oblong shape, and of a greyish colour, somewhat inclined to red, which is perhaps owing to their being extremely vascular. Internally we are able to distinguish something like an intermixture of the nervous filaments.

Some writers have considered them as so many little brains; Lancisi fancied he had discovered muscular fibres in them, but they are certainly not of an irritable nature. A late writer, Dr Johnstone *, imagines they are intended to deprive us of the power of the will over certain parts, as the heart, for instance: but if this hypothesis were well founded, we should meet with them only in the nerves leading to involuntary muscles; whereas it is certain, that the voluntary muscles receive their nerves through ganglions. Doctor Monro, from observing the accurate intermixture of the minute nerves which compose them, considers them as new sources of nervous energy †.

The nerves, like the blood-vessels, in their course through the body, communicate with each other; and each of these communications constitutes what is called a *plexus*, from whence branches are again detached to different parts of the body. Some of these are constant

* *Essay on the Use of the Ganglions of the Nerves.*

† *Observations on the Nervous System.*

(Q) This pair, soon after its entrance into the meatus auditorius internus, separates into two branches. One of these is of a very soft and pulpy consistence, it is called the *portio mollis* of the seventh pair, and is spread over the inner part of the ear. The other passes out through the aqueduct of Fallopius in a firm chord, which is distinguished as the portio dura, and is distributed to the external ear and other parts of the neck and face.

(R) Heister has summed up the uses of these nine pair of nerves in the two following Latin verses:

"*Olfaciens, cernens, oculosque movens, patiensque,*
"*Gustans, abducens, audiensque, vagansque, loquensque.*"

(S) Besides these, there is another pair called *accessorii*, which arises from the medulla spinalis at its beginning; and ascending through the great foramen of the os occipitis into the cranium, passes out again close to the eighth pair, with which, however, it does not unite; and it is afterwards distributed chiefly to the muscles of the neck, back, and scapula. In this course it sends off filaments to different parts, and likewise communicates with several other nerves. Physiologists are at a loss how to account for the singular origin and course of these nervi accessorii. The ancients considered them as branches of the eighth pair, distributed to muscles of the scapula: Willis likewise considered them as appendages to that pair, and on that account named them *accessorii*. They are sometimes called the *spinal* pair; but as this latter name is applicable to all the nerves of the spine indiscriminately, it seems better to adopt that given by Willis.

ANATOMY

Plate XXIX

Fig. 1

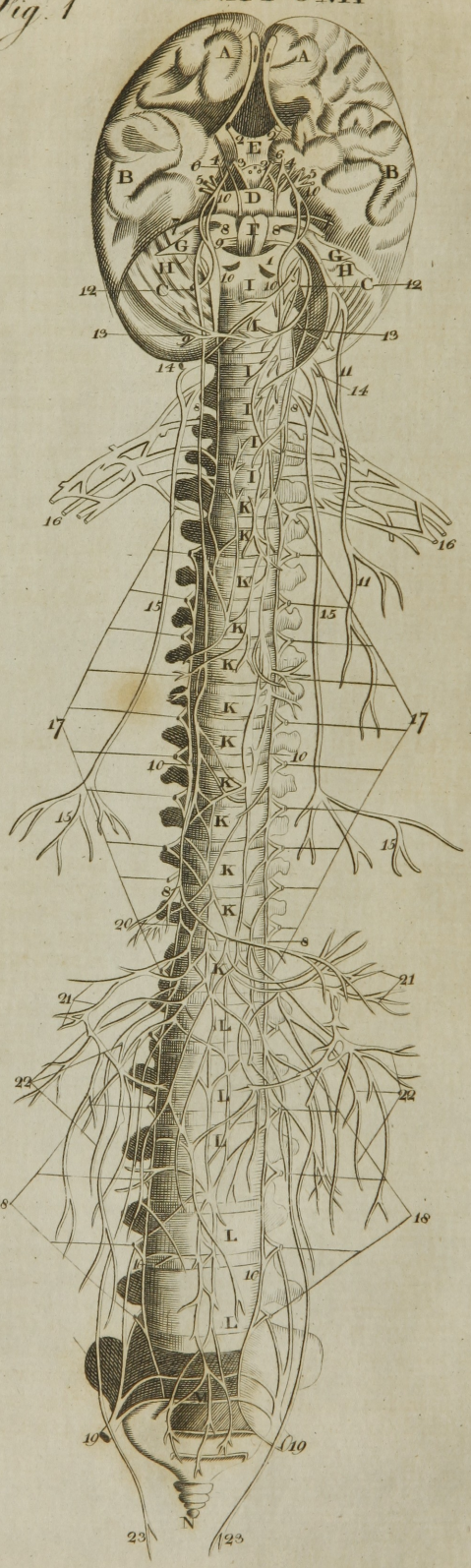


Fig. 2

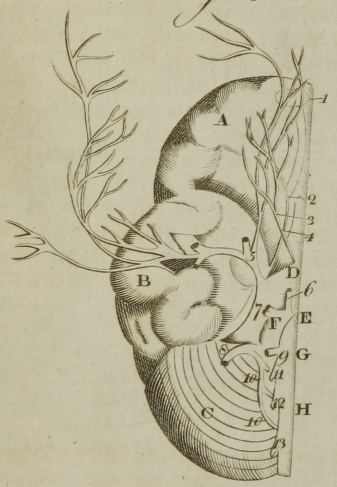


Fig. 3

Fig. 4

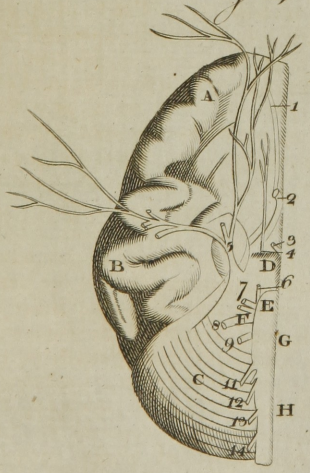
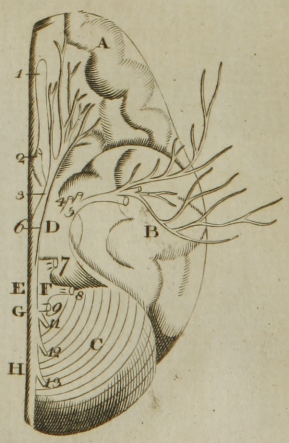


Fig. 5



Scott Sc. Philad.a

Of the Brain and Nerves.

ſtant and conſiderable enough to be diſtinguiſhed by particular names, as the *ſemilunar plexus*; the *pulmonary plexus*; the *hepatic*, the *cardiac*, &c.

It would be foreign to the purpoſe of this work, to follow the nerves through all their diſtributions; but it may be remembered, that in deſcribing the different viſcera, mention was made of the nerves diſtributed to them. There is one pair, however, called the *intercoſtal*, or *great ſympathetic nerve*, which ſeems to require particular notice, becauſe it has an almoſt univerſal connection and correſpondence with all the other nerves of the body. Authors are not perfectly agreed about the origin of the intercoſtal; but it may perhaps not improperly be deſcribed, as beginning from filaments of the fifth and ſixth pair; it then paſſes out of the cranium, through the bony canal of the carotid, from whence it deſcends laterally cloſe to the bodies of the vertebræ, and receives branches from almoſt all the vertebral nerves; forming almoſt as many ganglions in its courſe through the thorax and abdomen. It ſends off an infinite number of branches to the viſcera in thoſe cavities, and forms ſeveral plexuſes with the branches of the eighth pair or par vagum.

That the nerves are deſtined to convey the principles of motion and ſenſibility to the brain from all parts of the ſyſtem, there can be no doubt; but how theſe effects are produced, no one has ever yet been able to determine. The inquiry has been a conſtant ſource of hypotheſis in all ages, and has produced ſome ingenious ideas, and many erroneous poſitions, but without having hitherto afforded much ſatisfactory information.

Of the Brain and Nerves.

Some phyſiologiſts have conſidered a trunk of nerves as a ſolid chord, capable of being divided into an infinite number of filaments, by means of which the impreſſions of feeling are conveyed to the ſenſorium commune. Others have ſuppoſed it to be a canal, which afterwards ſeparates into more minute channels; or, perhaps, as being an aſſemblage of many very ſmall and diſtinct tubes, connected to each other, and thus forming a cylindrical chord. They who contend for their being ſolid bodies, are of opinion, that feeling is occaſioned by vibration; ſo that, for inſtance, according to this ſyſtem, by pricking the finger, a vibration would be occaſioned in the nerve, diſtributed through its ſubſtance; and the effects of this vibration, when extended to the ſenſorium, would be an excital of pain. But the inelaſticity, the ſoftneſs, the connection, and the ſituation of the nerves, are ſo many proofs that vibration has no ſhare in the cauſe of feeling.

Others have ſuppoſed, that in the brain and ſpinal marrow, a very ſubtile fluid is ſecreted, and from thence conveyed through the imperceptible tubes, which they conſider as exiſting in the nerves. They have farther ſuppoſed, that this very ſubtile fluid, to which they have given the name of *animal ſpirits*, is ſecreted in the cortical ſubſtance of the brain and ſpinal marrow, from whence it paſſes through the medullary ſubſtance. This, like the other ſyſtem, is founded altogether on hypotheſis; but it ſeems to be an hypotheſis derived from much more probable principles, and there are many ingenious arguments to be brought in its ſupport.

EXPLANATION OF PLATE XXIX.

FIG. 1. Repreſents the Inferior part of the Brain; —the Anterior part of the whole Spine, including the Medulla Spinalis;—with the origin and large portions of all the NERVES.

A A, The anterior lobes of the cerebrum. B B, The lateral lobes of the cerebrum. C C, The two lobes of the cerebellum. D, Tuber annulare. E, The paſſage from the third ventricle to the infundibulum. F, The medulla oblongata, which ſends off the medulla ſpinalis through the ſpine. G G, That part of the os occipitis which is placed above (H H) the tranverſe proceſſes of the firſt cervical vertebra. I I, &c. The ſeven cervical vertebræ, with their intermediate cartilages. K K, &c. The twelve dorſal vertebræ, with their intermediate cartilages. L L, &c. The five lumbar vertebræ, with their intermediate cartilages. M, The os ſacrum. N, The os coccygis.

NERVES.—1 1, The firſt pair of nerves, named *olfactory*, which go to the noſe. 2 2, The ſecond pair, named *optic*, which goes to form the tunica retina of the eye. 3 3, The third pair, named *motor oculi*; it ſupplies moſt of the muſcles of the eye-ball. 4 4, The fourth pair, named *pathetic*,—which is wholly ſpent upon the muſculus trochlearis of the eye. 5 5, The fifth pair divides into three branches.—The firſt, named *ophthalmic*, goes to the orbit, ſupplies the lachrymal gland, and ſends branches out to the forehead and noſe.—The ſecond, named *ſuperior maxillary*, ſupplies the teeth of the upper jaw, and ſome of the muſcles of the lips.—The third named *inferior maxillary*, is ſpent upon the muſcles and teeth of the lower jaw, tongue, and muſcles of the lips. 6 6, The ſixth pair, which, after ſending off the beginning of the intercoſtal or great ſympathetic, is ſpent upon the abductor oculi. 7 7, The ſeventh pair, named *auditory*, divides into two branches.—The largeſt, named *portio mollis*, is ſpent upon the internal ear.—The ſmalleſt, *portio dura*, joins to the fifth pair within the internal ear by a reflected branch from the ſecond of the fifth; and within the tympanum, by a branch from the third of the fifth, named *chorda tympani*.—Vid. fig. 3. near B. 8 8, &c. The eighth pair, named *par vagum*,—which accompanies the intercoſtal, and is ſpent upon the tongue, larynx, pharynx, lungs, and abdominal viſcera. 9 9, The ninth pair, which are ſpent upon the tongue. 10 10, &c. The intercoſtal, or great ſympathetic, which is ſeen from the ſixth pair to the bottom of the pelvis on each ſide of the ſpine, and joining with all the nerves of the ſpine;—in its progreſs ſupplying the heart, and, with the par vagum, the contents of the abdomen and pelvis. 11 11, The acceſſorius, which is ſpent upon the ſternocleido-maſtoidæus and trapezius muſcles. 12 12, The firſt cervical nerves;—13 13, The ſecond cervical nerves;—both ſpent upon the muſcles that lie on the neck, and teguments of the neck and head. 14 14, The third cervical nerves, which, after ſending off (15 15, &c.) the phrenic nerves to the diaphragm,

Of the Brain and Nerves.

ſupply the muſcles and teguments that lie on the ſide of the neck and top of the ſhoulder. 16 16, The brachial plexus, formed by the fourth, fifth, ſixth, ſeventh cervicals, and firſt dorſal nerves.—which ſupply the muſcles and teguments of the ſuperior extremity. 17 17, The twelve dorſal, or proper intercoſtal nerves, which are ſpent upon the intercoſtal muſcles and ſome of the large muſcles which lie upon the thorax. 18 18, The five lumbar pairs of nerves, which ſupply the lumbar and abdominal muſcles, and ſome of the teguments and muſcles of the inferior extremity. 19 19, The ſacro-ſciatic, or poſterior crural nerve, formed by the two inferior lumbar, and three ſuperior of the os ſacrum. This large nerve ſupplies the greateſt part of the muſcles and teguments of the inferior extremity. 20, The ſtomachic plexus, formed by the eighth pair. 21 21, Branches of the ſolar or cæliac plexus, formed by the eighth pair and intercoſtals, which ſupply the ſtomach and chylopoietic viſcera. 22 22, Branches of the ſuperior and inferior meſenteric plexuſes, formed by the eighth pair and intercoſtals, which ſupply the chylopoietic viſcera, with part of the organs of urine and generation. 23 23, Nerves which accompany the ſpermatic cord. 24 24, The hypogaſtric plexus, which ſupplies the organs of urine and generation within the pelvis.

Of the Brain and Nerves.

FIG. 2, 3, 4, 5. Shows different Views of the Inferior part of the Brain, cut perpendicularly through the Middle,—with the Origin and large Portions of all the Nerves which paſs out through the Bones of the Cranium,—and the three firſt Cervicals.

A, The anterior lobe. B, The lateral lobe of the cerebrum. C, One of the lobes of the cerebellum. D, Tuber annulare. E, Corpus pyramidale, in the middle of the medulla oblongata. F, The corpus olivare, in the ſide of the medulla oblongata. G, The medulla oblongata. H, The medulla ſpinalis.

NERVES.—1 2 3 4 5 6 7 8 and 9, Pairs of nerves. 10 10, Nervus acceſſorius, which comes from—11, 12, and 13, The three firſt cervical nerves.

PART VI. OF THE SENSES, AND THEIR ORGANS.

137 IN treating of the ſenſes, we mean to confine ourſelves to the external ones of *touch*, *taſte*, *ſmelling*, *hearing*, and *viſion*. The word *ſenſe*, when applied to theſe five, ſeems to imply not only the ſenſation excited in the mind by certain impreſſions made on the body, but likewiſe the organ deſtined to receive and tranſmit theſe impreſſions to the ſenſorium. Each of theſe organs being of a peculiar ſtructure, is ſuſceptible only of particular impreſſions, which will be pointed out as we proceed to deſcribe each of them ſeparately.

SECT. I. *Of Touch.*

138 THE ſenſe of touch may be defined to be the faculty of diſtinguiſhing certain properties of bodies by the feel. In a general acceptation, this definition might perhaps not improperly be extended to every part of the body poſſeſſed of ſenſibility (T), but it is commonly confined to the nervous papillæ of the cutis, or true ſkin, which, with its appendages, and their ſeveral uſes, have been already deſcribed.

The exterior properties of bodies, ſuch as their ſolidity, moiſture, inequality, ſmoothneſs, dryneſs, or fluidity, and likewiſe their degree of heat, ſeem all to be capable of making different impreſſions on the papillæ, and conſequently of exciting different ideas in the ſenſorium commune. But the organ of touch, like all the other ſenſes, is not equally delicate in every part of the body, or in every ſubject; being in ſome much more exquiſite than it is in others.

SECT. II. *Of the Taſte.*

THE ſenſe of taſte is ſeated chiefly in the tongue; the ſituation and figure of which are ſufficiently known. 139

On the upper ſurface of this organ we may obſerve a great number of papillæ, which, on account of their difference in ſize and ſhape, are commonly divided into three claſſes. The largeſt are ſituated towards the baſis of the tongue. Their number commonly varies from ſeven to nine, and they ſeem to be mucous follicles. Thoſe of the ſecond claſs are ſomewhat ſmaller, and of a cylindrical ſhape. They are moſt numerous about the middle of the tongue. Thoſe of the third claſs are very minute, and of a conical ſhape. They are

(T) In the courſe of this article, mention has often been made of the ſenſibility or inſenſibility of different parts of the body: it will therefore, perhaps, not be amiſs to obſerve in this place, that many parts which were formerly ſuppoſed to poſſeſs the moſt exquiſite ſenſe, are now known to have but little or no feeling, at leaſt in a ſound ſtate; for in an inflamed ſtate, even the bones, the moſt inſenſible parts of any, become ſuſceptible of the moſt painful ſenſations. This curious diſcovery is due to the late Baron Haller. His experiments prove, that the bones, cartilages, ligaments, tendons, epidermis, and membranes (as the pleura, pericardium, dura and pia mater, perioſteum, &c.), may in a healthy ſtate be conſidered as inſenſible. As ſenſibility depends on the brain and nerves, of courſe different parts will poſſeſs a greater or leſs degree of feeling, in proportion as they are ſupplied with a greater or ſmaller number of nerves. Upon this principle it is, that the ſkin, muſcles, ſtomach, inteſtines, urinary bladder, ureters, uterus, vagina, penis, tongue, and retina, are extremely ſenſible, while the lungs and glands have only an obſcure degree of feeling.

Of the Senſes.

are very numerous on the apex and edges of the tongue, and have been ſuppoſed to be formed by the extremities of its nerves.

We obſerve a line, the *linea linguæ mediana*, running along the middle of the tongue, and dividing it as it were into two portions. Towards the baſis of the tongue, we meet with a little cavity, named by Morgagni *foramen cœcum*, which ſeems to be nothing more than a common termination of ſome of the excretory ducts of mucous glands ſituated within the ſubſtance of the tongue.

We have already obſerved, that this organ is every where covered by the cuticle, which, by forming a reduplication, called the *frænum*, at its under part, ſerves to prevent the too great motion of the tongue, and to fix it in its ſituation. But, beſides this attachment, the tongue is connected by means of its muſcles and membranous ligaments, to the lower jaw, the os hyoides, and the ſtyloid proceſſes.

The principal arteries of the tongue are the linguales, which ariſe from the external carotid. Its veins empty themſelves into the external jugulars. Its nerves ariſe from the fifth, eighth, and ninth, pair.

The variety of taſtes ſeems to be occaſioned by the different impreſſions made on the papillæ by the food. The different ſtate of the papillæ with reſpect to their moiſture, their figure, or their covering, ſeems to produce a conſiderable difference in the taſte, not only in different people, but in the ſame ſubject, in ſickneſs and in health. The great uſe of the taſte ſeems to be to enable us to diſtinguiſh wholeſome and ſalutary food from that which is unhealthy; and we obſerve that many quadrupeds, by having their papillæ (u) very large and long, have the faculty of diſtinguiſhing flavours with infinite accuracy.

Sect. III. *Of Smelling.*

140. The ſenſe of ſmelling, like the ſenſe of taſte, ſeems intended to direct us to a proper choice of aliment, and is chiefly ſeated in the noſe, which is diſtinguiſhed into its external and internal parts. The ſituation and figure of the former of theſe do not ſeem to require a definition. It is compoſed of bones and cartilages, covered by muſcular fibres and by the common integuments. The bones make up the upper portion, and the cartilages the lower one. The ſeptum narium, like the noſe, is likewiſe in part bony, and in part cartilaginous. Theſe bones and their connections were deſcribed in the oſteology.

The internal part of the noſe, beſides the oſſa ſpongioſa, has ſix cavities or ſinuſes, the maxillary, the frontal, and the ſphenoid, which were all deſcribed with the bones of the head. They all open into the noſtrils; and the noſe likewiſe communicates with the mouth, larynx, and pharynx, poſteriorly behind the velum palati.

All theſe ſeveral parts, which are included in the internal diviſion of the noſe, viz. the inner ſurface of the noſtrils, the lamellæ of the oſſa ſpongioſa, and the ſinuſes, are lined by a thick and very vaſcular membrane, which, though not unknown to the ancients, was firſt well deſcribed by Schneider*, and is therefore now commonly named *membrana pituitaria Schneideri*. This membrane is truly the organ of ſmelling; but its real ſtructure does not yet ſeem to be perfectly underſtood. It appears to be a continuation of the cuticle, which lines the inner ſurface of the mouth. In ſome parts of the noſe it is ſmooth and firm, and in others it is looſe and ſpongy. It is conſtantly moiſtened by a mucous ſecretion; the finer parts of which are carried off by the air we breathe, and the remainder, by being retained in the ſinuſes, acquires conſiderable conſiſtence. The manner in which this mucus is ſecreted has not yet been ſatisfactorily aſcertained; but it ſeems to be by means of mucous follicles.

Of the Senſes.

* *De Carrbo*, lib. iii.

Its arteries are branches of the internal maxillary and internal carotid. Its veins empty themſelves into the internal jugulars. The firſt pair of nerves, the olfactory, are ſpread over every part of it, and it likewiſe receives branches from the fifth pair.

After what has been ſaid of the pituitary membrane, it will not be difficult to conceive how the air we draw in at the noſtrils, being impregnated with the effluvia of bodies, excites in us that kind of ſenſation we call *ſmelling*. As theſe effluvia, from their being exceedingly light and volatile, cannot be capable in a ſmall quantity of making any great impreſſion on the extremities of the olfactory nerves, it was neceſſary to give conſiderable extent to the pituitary membrane, that by this means a greater number of odoriferous particles might be admitted at the ſame time. When we wiſh to take in much of the effluvia of any thing, we naturally cloſe the mouth, that all the air we inſpire may paſs through the noſtrils; and at the ſame time, by means of the muſcles of the noſe, the noſtrils are dilated, and a greater quantity of air is drawn into them.

In many quadrupeds, the ſenſe of ſmelling is much more extenſive and delicate than it is in the human ſubject; and in the human ſubject it ſeems to be more perfect the leſs it is vitiated by a variety of ſmells. It is not always in the ſame ſtate of perfection, being naturally affected by every change of the pituitary membrane, and of the lymph with which that membrane is moiſtened.

Sect. IV. *Of Hearing.*

141. Before we undertake to explain the manner in which we are enabled to receive the impreſſions of ſound, it will be neceſſary to deſcribe the *ear*, which is the *organ of hearing*. It is commonly diſtinguiſhed into external and internal. The former of theſe diviſions includes all that we are able to diſcover without diſſection, and the meatus auditorius, as far as the tympanum; and the latter, all the other parts of the ear.

The *external ear* is a cartilaginous funnel, covered by the common integuments, and attached, by means of its ligaments and muſcles, to the temporal bone. Although capable only of a very obſcure motion, it is

(u) Malpighi's deſcription of the papillæ, which has been copied by many anatomical writers, ſeems to have been taken chiefly from the tongues of ſheep.

Of the Senſes.

found to have ſeveral muſcles. Different parts of it are diſtinguiſhed by ſeveral names; all its cartilaginous part is called *ala* or *wing*, to diſtinguiſh it from the ſoft and pendent part below, called the *lobe*. Its outer circle or border is called *helix*, and the ſemicircle within this, *antihelix*. The moveable cartilage placed immediately before the meatus auditorius, which it may be made to cloſe exactly, is named *tragus*; and an eminence oppoſite to this at the extremity of the antihelix, is called *antitragus*. The concha is a conſiderable cavity formed by the extremities of the helix and antihelix. The meatus auditorius, which at its opening is cartilaginous, is lined with a very thin membrane, which is a continuation of the cuticle from the ſurface of the ear.

In this canal we find a yellow wax, which is ſecreted by a number of minute glands or follicles, each of which has an excretory duct. This ſecretion, which is at firſt of an oily conſiſtence, defends the membrane of the tympanum from the injuries of the air; and by its bitterneſs, prevents minute inſects from entering into the ear. But when from neglect or diſeaſe it accumulates in too great a quantity, it ſometimes occaſions deafneſs. The inner extremity of the meatus is cloſed by a very thin tranſparent membrane, the membrana tympani, which is ſet in a bony circle like the head of a drum. In the laſt century Rivinus, profeſſor at Leipſic, fancied he had diſcovered a hole in this membrane, ſurrounded by a ſphincter, and affording a paſſage to the air, between the external and internal ear. Cowper, Heiſter, and ſome other anatomiſts, have admitted this ſuppoſed foramen, which certainly does not exiſt. Whenever there is any opening in the membrana tympani, it may be conſidered as accidental. Under the membrana tympani runs a branch of the fifth pair of nerves, called *chorda tympani*; and beyond this membrane is the cavity of the tympanum, which is about ſeven or eight lines wide, and half ſo many in depth; it is ſemiſpherical, and every where lined by a very fine membrane. There are four openings to be obſerved in this cavity. It communicates with the mouth by means of the Euſtachian tube. This canal, which is in part bony and in part cartilaginous, begins by a very narrow opening at the anterior and almoſt ſuperior part of the tympanum, increaſing in ſize as it advances towards the palate of the mouth, where it terminates by an oval opening. This tube is every where lined by the ſame membrane that covers the inſide of the mouth. The real uſe of this canal does not ſeem to have been hitherto ſatisfactorily aſcertained; but ſound would ſeem to be conveyed through it to the membrana tympani, deaf perſons being often obſerved to liſten attentively with their mouths open. Oppoſite to this is a minute paſſage, which leads to the ſinuoſities of the maſtoid proceſs; and the two other openings, which are in the internal proceſs of the os petroſum, are the feneſtra ovalis, and feneſtra rotunda, both of which are covered by a very fine membrane.

There are three diſtinct bones in the cavity of the tympanum; and theſe are the malleus, incus, and ſtapes. Beſides theſe there is a fourth, which is the *os orbiculare*, conſidered by ſome anatomiſts as a proceſs of the ſtapes, which is neceſſarily broken off by the violence we are obliged to uſe in getting at theſe bones; but when accurately conſidered, it ſeems to be a diſtinct bone.

Of the Senſes.

The *malleus* is ſuppoſed to reſemble a hammer, being larger at one extremity, which is its head, than it is at the other, which is its handle. The latter is attached to the membrana tympani, and the head of the bone is articulated with the incus.

The *incus*, as it is called from its ſhape, though it ſeems to have leſs reſemblance to an anvil than to one of the dentes molares with its roots widely ſeparated from each other, is diſtinguiſhed into its body and its legs. One of its legs is placed at the entry of the canal which leads to the maſtoid proceſs; and the other, which is ſomewhat longer, is articulated with the ſtapes, or rather with the os orbiculare, which is placed between them.

The third bone is very properly named *ſtapes*, being perfectly ſhaped like a ſtirrup. Its baſis is fixed into the feneſtra ovalis, and its upper part is articulated with the os orbiculare. What is called the *feneſtra rotunda*, though perhaps improperly, as it is more oval than round, is obſerved a little above the other, in an eminence formed by the os petroſum, and is cloſed by a continuation of the membrane that lines the inner ſurface of the tympanum. The ſtapes and malleus are each of them furniſhed with a little muſcle, the ſtapedeus and tenſor tympani. The firſt of theſe, which is the ſmalleſt in the body, ariſes from a little cavern in the poſterior and upper part of the cavity of the tympanum; and its tendon, after paſſing through a hole in the ſame cavern, is inſerted at the back part of the head of the ſtapes. This muſcle, by drawing the ſtapes obliquely upwards, aſſiſts in ſtretching the membrana tympani.

The tenſor tympani (x), or internus mallei, as it is called by ſome writers, ariſes from the cartilaginous extremity of the Euſtachian tube, and is inſerted into the back part of the handle of the malleus, which it ſerves to pull inwards, and of courſe helps to ſtretch the membrana tympani.

The labyrinth is the only part of the ear which remains to be deſcribed. It is ſituated in the os petroſum, and is ſeparated from the tympanum by a partition which is every where bony, except at the two feneſtræ. It is compoſed of three parts; and theſe are the veſtibulum, the ſemicircular canals, and the cochlea.

The *veſtibulum* is an irregular cavity, much ſmaller than the tympanum, ſituated nearly in the centre of the os petroſum, between the tympanum, the cochlea, and the ſemicircular canals. It is open on the ſide of the tympanum by means of the feneſtra ovalis, and communicates with the upper portion of the cochlea by an oblong foramen, which is under the feneſtra ovalis, from which it is ſeparated only by a very thin partition.

Each of the three *ſemicircular canals* forms about half

(x) Some anatomiſts deſcribe three muſcles of the malleus; but only this one ſeems to deſerve the name of muſcle; what are called the *externus* and *obliquus mollei*, ſeeming to be ligaments rather than muſcles.

Of the Senſes.

half a circle of nearly a line in diameter, and running each in a different direction, they are diſtinguiſhed into *vertical*, *oblique*, and *horizontal*. Theſe three canals open by both their extremities into the veſtibulum; but the vertical and the oblique being united together at one of their extremities, there are only five orifices to be ſeen in the veſtibulum.

The *cochlea* is a canal which takes a ſpiral courſe, not unlike the ſhell of a ſnail. From its baſis to its apex it makes two turns and a half; and is divided into two canals by a very thin lamina or ſeptum, which is in part bony and in part membranous, in ſuch a manner that theſe two canals only communicate with each other at the point. One of them opens into the veſtibulum, and the other is covered by the membrane that cloſes the feneſtra rotunda. The bony lamella which ſeparates the two canals is exceedingly thin, and fills about two thirds of the diameter of the canal. The reſt of the ſeptum is compoſed of a moſt delicate membrane, which lines the whole inner ſurface of the cochlea, and ſeems to form this diviſion in the ſame manner as the two membranous bags of the pleura, by being applied to each other, form the mediaſtinum.

Every part of the labyrinth is furniſhed with a very delicate perioſteum, and filled with a watery fluid, ſecreted as in other cavities. This fluid tranſmits to the nerves the vibrations it receives from the membrane cloſing the feneſtra rotunda, and from the baſis of the ſtapes, where it reſts on the feneſtrum ovale. When this fluid is collected in too great a quantity, or is compreſſed by the ſtapes, it is ſuppoſed to eſcape through two minute canals or aqueducts, lately deſcribed by Dr Cotunni *, an ingenious phyſician at Naples. One of theſe aqueducts opens into the bottom of the veſtibulum, and the other into the cochlea, near the feneſtra rotunda. They both paſs through the os petroſum, and communicate with the cavity of the cranium where the fluid that paſſes through them is abſorbed; and they are lined by a membrane which is ſuppoſed to be a production of the dura mater.

* *De aquæductibus Auris Humanæ Internæ*, 8vo, 1760.

The arteries of the external ear come from the temporal and other branches of the external carotid, and its veins paſs into the jugular. The internal ear receives branches of arteries from the baſilary and carotids, and its veins empty themſelves into the ſinuſes of the dura mater, and into the internal jugular.

The portio mollis of the ſeventh pair is diſtributed through the cochlea, the veſtibulum, and the ſemicircular canals; and the portio dura ſends off a branch to the tympanum, and other branches to the external ear and parts near it.

The *ſenſe of hearing*, in producing which all the parts we have deſcribed aſſiſt, is occaſioned by a certain modulation of the air collected by the funnel-like ſhape of the external ear, and conveyed through the meatus auditorius to the membrana tympani. That ſound is propagated by means of the air, is very eaſily proved by ringing a bell under the receiver of an air-pump; the ſound it affords being found to diminiſh gradually as the air becomes exhauſted, till at length it ceaſes to be heard at all. Sound moves through the air with infinite velocity; but the degree of its motion ſeems to depend on the ſtate of the air, as it conſtantly moves faſter in a denſe and dry, than it does in a moiſt and rarefied air. See *Acouſtics*, n° 20.

Of the Senſes.

That the air vibrating on the membrana tympani communicates its vibration to the different parts of the labyrinth, and by means of the fluid contained in this cavity affects the auditory nerve ſo as to produce ſound, ſeems to be very probable; but the ſituation, the minuteneſs, and the variety of the parts which compoſe the ear, do not permit much to be advanced with certainty concerning their mode of action.

Some of theſe parts ſeem to conſtitute the immediate organ of hearing, and theſe are all the parts of the veſtibulum: but there are others which ſeem intended for the perfection of this ſenſe, without being abſolutely eſſential to it. It has happened, for inſtance, that the membrana tympani, and the little bones of the ear, have been deſtroyed by diſeaſe, without depriving the patient of the ſenſe of hearing (Y).

Sound is more or leſs loud in proportion to the ſtrength of the vibration; and the variety of ſounds ſeems to depend on the difference of this vibration; for the more quick and frequent it is, the more acute will be the ſound, and *vice verſa*.

Before we conclude this article, it will be right to explain certain phenomena, which will be found to have a relation to the organ of hearing.

Every body has, in conſequence of particular ſounds, occaſionally felt that diſagreeable ſenſation which is uſually called *ſetting the teeth on edge*: and the cauſe of this ſenſation may be traced to the communication which the portio dura of the auditory nerve has with the branches of the fifth pair that are diſtributed to the teeth, being probably occaſioned by the violent tremor produced in the membrana tympani by theſe very acute ſounds. Upon the ſame principle we may explain the ſtrong idea of ſound which a perſon has who holds a vibrating ſtring between his teeth.

The humming which is ſometimes perceived in the ear, without any exterior cauſe, may be occaſioned either by an increaſed action of the arteries in the ears, or by convulſive contractions of the muſcles of the malleus and ſtapes, affecting the auditory nerve in ſuch a manner as to produce the idea of ſound. An ingenious philoſophical writer * has lately diſcovered, that there are ſounds liable to be excited in the ear by irritation, and without any aſſiſtance from the vibrations of the air.

* *Elliot's Philoſophical Obſervations on the Senſes of Viſion and Hearing*, 8vo.

Sect. V. *Of Viſion* †.

† See Optics 142.

The eyes, which conſtitute the organ of viſion, are ſituated in two bony cavities named *orbits*, where they are ſurrounded by ſeveral parts, which are either intended to protect them from external injury, or to aſſiſt in their motion.

The

(Y) This obſervation has led to a ſuppoſition, that a perforation of this membrane may in ſome caſes of deafneſs be uſeful; and Mr Cheſelden relates, that, ſome years ago, a malefactor was pardoned on condition that he ſhould ſubmit to this operation; but the public clamour raiſed againſt it was ſo great, that it was thought right not to perform it.

Of the Senſes.

The globe of the eye is immediately covered by two eye-lids or palpebræ, which are compoſed of muſcular fibres covered by the common integuments, and lined by a very fine and ſmooth membrane, which is from thence extended over part of the globe of the eye, and is called *tunica conjunctiva*. Each eye-lid is cartilaginous at its edge; and this border which is called *tarſus*, is furniſhed with a row of hairs named *cilia* or *eye-laſhes*.

The cilia ſerve to protect the eye from inſects and minute bodies floating in the air, and likewiſe to moderate the action of the rays of light in their paſſage to the retina. At the roots of theſe hairs there are ſebaceous follicles, firſt noticed by Meibomius, which diſcharge a glutinous liniment. Sometimes the fluid they ſecrete has too much viſcidity, and the eye-lids become glued to each other.

The upper border of the orbit is covered by the eye-brows or ſupercilia, which by means of their two muſcles are capable of being brought towards each other, or of being carried upwards. They have been conſidered as ſerving to protect the eyes, but they are probably intended more for ornament than utility (z).

The orbits, in which the eyes are placed, are furniſhed with a good deal of fat, which affords a ſoft bed on which the eye performs its ſeveral motions. The inner angle of each orbit, or that part of it which is near the noſe, is called *canthus major*, or the *great angle*; and the outer angle, which is on the oppoſite ſide of the eye, is the *canthus minor*, or *little angle*.

The little reddiſh body which we obſerve in the great angle of the eye-lids, and which is called *caruncula lachrymalis*, is ſuppoſed to be of a glandular ſtructure, and, like the follicles of the eye-lids, to ſecrete an oily humour. But its ſtructure and uſe do not ſeem to have been hitherto accurately determined. The ſurface of the eye is conſtantly moiſtened by a very fine limpid fluid called the *tears*, which is chiefly, and perhaps wholly, derived from a large gland of the conglomerate kind, ſituated in a ſmall depreſſion of the os frontis near the outer angle of the eye. Its excretory ducts pierce the tunica conjunctiva juſt above the cartilaginous borders of the upper eye-lids. When the tears were ſuppoſed to be ſecreted by the caruncule, this gland was called *glandula innominata*; but now that its ſtructure and uſes are aſcertained, it very properly has the name of *glandula lachrymalis*. The tears poured out by the ducts of this gland are, in a natural and healthy ſtate, inceſſantly ſpread over the ſurface of the eye, to keep it clear and tranſparent, by means of the eye-lids, and as conſtantly paſs out at the oppoſite corner of the eye or inner angle, through two minute orifices, the puncta lachrymalia (A); being determined into theſe little openings by a reduplication of the tunica conjunctiva, ſhaped like a creſcent, the two points of which anſwer to the puncta. This reduplication is named *membrana*, or *valvula ſemilunaris*. Each of theſe puncta is the beginning of a ſmall excretory tube, through which the tears paſs into a little pouch or reſervoir, the ſacculus lachrymalis, which lies in an excavation formed partly by the naſal proceſs of the os maxillare ſuperius, and partly by the os unguis. The lower part of this ſac forms a duct called the *ductus ad nares*, which is continued through a bony channel, and opens into the noſe, through which the tears are occaſionally diſcharged (B).

Of the Senſes.

The motions of the eye are performed by ſix muſcles; four of which are ſtraight and two oblique. The ſtraight muſcles are diſtinguiſhed by the names of *elevator*, *depreſſor*, *adductor*, and *abductor*, from their ſeveral uſes in elevating and depreſſing the eye, drawing it towards the noſe, or carrying it from the noſe towards the temple. All theſe four muſcles ariſe from the bottom of the orbit, and are inſerted by flat tendons into the globe of the eye. The oblique muſcles are intended for the more compound motions of the eye. The firſt of theſe muſcles, the obliquus ſuperior, does not, like the other four muſcles we have deſcribed, ariſe from the bottom of the orbit, but from the edge of the foramen that tranſmits the optic nerve, which ſeparates the origin of this muſcle from that of the others. From this beginning it paſſes in a ſtraight line towards a very ſmall cartilaginous ring, the ſituation of which is marked in the ſkeleton by a little hollow in the internal orbitar proceſs of the os frontis. The tendon of the muſcle, after paſſing through this ring, is inſerted into the upper part of the globe of the eye, which it ſerves to draw forwards, at the ſame time turning the pupil downwards.

The obliquus inferior ariſes from the edge of the orbit, under the opening of the ductus lachrymalis; and is inſerted ſomewhat poſteriorly into the outer ſide of the globe, ſerving to draw the eye forwards and turn the pupil upwards. When either of theſe two muſcles acts ſeparately, the eye is moved on its axis; but when they act together, it is compreſſed both above and below. The eye itſelf, which is now to be deſcribed, with its tunics, humours, and component parts, is nearly of a ſpherical figure. Of its tunics, the conjunctiva has been already deſcribed as a partial covering, reflected from the inner ſurface of the eye-lids over the anterior portion of the eye. What has been named *albuginea* cannot properly be conſidered as a coat of the eye, being in fact nothing more than the tendons of the ſtraight muſcles ſpread over ſome parts of the ſclerotica.

The immediate tunics of the eye, which are to be demonſtrated when its partial coverings, and all the other parts with which it is ſurrounded, are removed, are the ſclerotica, cornea, choroides, and retina.

The *ſclerotica*, which is the exterior coat, is every where

(z) It is obſervable, that the eye-brows are peculiar to the human ſpecies.

(A) It ſometimes happens, that this very pellucid fluid, which moiſtens the eye, being poured out through the excretory ducts of the lachrymal gland faſter than it can be carried off through the puncta, trickles down the cheek, and is then ſtrictly and properly called *tears*.

(B) When the ductus ad nares becomes obſtructed in conſequence of diſeaſe, the tears are no longer able to paſs into the noſtrils; the ſacculus lachrymalis becomes diſtended; and inflammation, and ſometimes ulceration, taking place, conſtitute the diſeaſe called *fiſtula lachrymalis*.

Of the Senſes.

where white and opaque, and is joined at its anterior edge to another, which has more convexity than any other part of the globe, and being exceedingly tranſparent is called *cornea* (c). Theſe two parts are perfectly different in their ſtructure; ſo that ſome anatomiſts ſuppoſe them to be as diſtinct from each other as the glaſs of a watch is from the caſe into which it is fixed. The ſclerotica is of a compact fibrous ſtructure; the cornea, on the other hand, is compoſed of a great number of laminæ united by cellular membrane. By macerating them in boiling water, they do not ſeparate from each other, as ſome writers have aſſerted; but the cornea ſoon ſoftens, and becomes of a glutinous conſiſtence.

The ancients ſuppoſed the ſclerotica to be a continuation of the dura mater. Morgagni and ſome other modern writers are of the ſame opinion; but this point is diſputed by Winſlow, Haller, Zin, and others. The truth ſeems to be, that the ſclerotica, though not a production of the dura mater, adheres intimately to that membrane.

The *choroides* is ſo called becauſe it is furniſhed with a great number of veſſels. It has likewiſe been named *uvea*, on account of its reſemblance to a grape. Many modern anatomical writers have conſidered it as a production of the pia mater. This was likewiſe the opinion of the ancients; but the ſtrength and thickneſs of the choroides, when compared with the delicate ſtructure of the pia mater, are ſufficient proofs of their being two diſtinct membranes.

The choroides has of late generally been deſcribed as conſiſting of two laminæ; the innermoſt of which has been named after Ruyſch, who firſt deſcribed it. It is certain, however, that Ruyſch's diſtinction is ill founded, at leaſt with reſpect to the human eye, in which we are unable to demonſtrate any ſuch ſtructure, although the tunica choroides of ſheep and ſome other quadrupeds may eaſily be ſeparated into two layers.

The choroides adheres intimately to the ſclerotica round the edge of the cornea; and at the place of this union, we may obſerve a little whitiſh areola, named *ligamentum ciliare*, though it is not of a ligamentous nature.

They who ſuppoſe the choroides to be compoſed of two laminæ, deſcribe the external one as terminating in the ligamentum ciliare, and the internal one as extending farther to form the iris, which is the circle we are able to diſtinguiſh through the cornea: but this part is of a very different ſtructure from the choroides; ſo that ſome late writers have perhaps not improperly conſidered the iris as a diſtinct membrane. It derives its name from the variety of its colours, and is perforated in the middle. This perforation, which is called the *pupil* or *ſight* of the eye, is cloſed in the fœtus by a very thin vaſcular membrane. This membrana pupillaris commonly diſappears about the ſeventh month.

Of the Senſes.

On the under ſide of the iris we obſerve many minute fibres, called *ciliary proceſſes*, which paſs in radii or parallel lines from the circumference to the centre. The contraction and dilatation of the pupil are ſuppoſed to depend on the action of theſe proceſſes. Some have conſidered them as muſcular, but they are not of an irritable nature; others have ſuppoſed them to be filaments of nerves: but their real ſtructure has never yet been clearly aſcertained.

Beſides theſe ciliary proceſſes, anatomiſts uſually ſpeak of the circular fibres of the iris, but no ſuch ſeem to exiſt.

The poſterior ſurface of the iris, the ciliary proceſſes, and part of the tunica choroides, are covered by a black mucus for the purpoſes of accurate and diſtinct viſion; but the manner in which it is ſecreted has not been determined.

Immediately under the tunica choroides we find the third and inner coat, called the *retina*, which ſeems to be merely an expanſion of the pulpy ſubſtance of the optic nerve, extending to the border of the cryſtaline humour.

The greateſt part of the globe of the eye, within theſe ſeveral tunics, is filled by a very tranſparent and gelatinous humour of conſiderable conſiſtence, which, from its ſuppoſed reſemblance to fuſed glaſs, is called the *vitreous humour*. It is inveſted by a very fine and delicate membrane, called *tunica vitrea*, and ſometimes *arachnoides*.—It is ſuppoſed to be compoſed of two laminæ; one of which dips into its ſubſtance, and by dividing the humour into cells adds to its firmneſs. The fore-part of the vitreous humour is a little hollowed, to receive a very white and tranſparent ſubſtance of a firm texture, and of a lenticular and ſomewhat convex ſhape, named the *cryſtaline humour*. It is included in a capſula, which ſeems to be formed by a ſeparation of the two laminæ of the tunica vitrea.

The fore-part of the eye is filled by a very thin and tranſparent fluid, named the *aqueous humour*, which occupies all the ſpace between the cryſtalline and the prominent cornea.—The part of the choroides which is called the *iris*, and which comes forward to form the pupil, appears to be ſuſpended as it were in this humour, and has occaſioned this portion of the eye to be diſtinguiſhed into two parts. One of theſe, which is the little ſpace between the anterior ſurface of the cryſtalline and the iris, is called the *poſterior chamber*; and the other, which is the ſpace between the iris and the cornea, is called the *anterior chamber* of the eye (d). Both theſe ſpaces are completely filled with the aqueous humour. (e).

The eye receives its arteries from the internal carotid

(c) Some writers, who have given the name of *cornea* to all this outer coat, have named what is here and moſt commonly called *ſclerotica*, *cornea opaca*; and its anterior and tranſparent portion, *cornea lucida*.

(d) We are aware that ſome anatomiſts, particularly Lieutaud, are of opinion, that the iris is every where in cloſe contact with the cryſtalline, and that it is of courſe right to ſpeak only of one chamber of the eye; but as this does not appear to be the caſe, the ſituation of the iris and the two chambers of the eye are here deſcribed in the uſual way.

(e) When the cryſtalline becomes opaque, ſo as to prevent the paſſage of the rays of light to the retina, it conſtitutes what is called a *cataract*; and the operation of couching conſiſts in removing the diſeaſed cryſtalline from

tid through the foramina optica; and its veins paſs through the foramina lacera, and empty themſelves into the lateral ſinuſes. Some of the ramifications of theſe veſſels appear on the inner ſurface of the iris, where they are ſeen to make very minute convolutions, which are ſufficiently remarkable to be diſtinguiſhed by the name of *circulus arterioſus*, though perhaps improperly, as they are chiefly branches of veins.

The optic nerve paſſes in at the poſterior part of the eye, in a conſiderable trunk, to be expanded for the purpoſes of viſion, of which it is now univerſally ſuppoſed to be the immediate ſeat. But Meſſrs Mariotte and Mery contended, that the choroides is the ſeat of this ſenſe; and the ancients ſuppoſed the cryſtalline to be ſo. Beſides the optic, the eye receives branches from the third, fourth, fifth, and ſixth pair of nerves.

The humours of the eye, together with the cornea, are calculated to refract and converge the rays of light in ſuch a manner as to form at the bottom of the eye a diſtinct image of the object we look at; and the point where theſe rays meet is called the *focus* of the eye. On the retina, as in the *camera obſcura*, the object is painted in an inverted poſition; and it is only by habit that we are enabled to judge of its true ſituation, and likewiſe of its diſtance and magnitude. To a young gentleman who was born blind, and who was couched by Mr Cheſelden, every object (as he expreſſed himſelf) ſeemed to touch his eyes as what he felt did his ſkin; and he thought no objects ſo agreeable as thoſe which were ſmooth and regular, although for ſome time he could form no judgment of their ſhape, or gueſs what it was in any of them that was pleaſing to him.

In order to paint objects diſtinctly on the retina, the cornea is required to have ſuch a degree of convexity, that the rays of light may be collected at a certain point, ſo as to terminate exactly on the retina.—If the cornea is too prominent, the rays, by converging too ſoon, will be united before they reach the retina, as is the caſe with near-ſighted people or *myopes*; and on the contrary, if it is not ſufficiently convex, the rays will not be perfectly united when they reach the back-part of the eye; and this happens to long-ſighted people or *preſbi*, being found conſtantly to take place as we approach to old age, when the eye gradually flattens (F). Theſe defects are to be ſupplied by means of glaſſes. He who has too prominent an eye, will find his viſion improved by means of a concave glaſs; and upon the ſame principles, a convex glaſs will be found uſeful to a perſon whoſe eye is naturally too flat.

EXPLANATION of PLATE XXX.

Figure 1. Shows the Lachrymal Canals, after the Common Teguments and Bones have been cut away.

a, The lachrymal gland. b, The two puncta lachrymalia, from which the two lachrymal canals proceed to c, The lachrymal ſac. d, The large lachrymal duct. e, Its opening into the noſe. f, The caruncula lachrymalis. g, The eye-ball.

Fig. 2. An interior View of the Coats and Humours of the Eye.

a a a a, The tunica ſclerotica cut in four angles, and turned back. b b b b, The tunica choroides adhering to the inſide of the ſclerotica, and the ciliary veſſels are ſeen paſſing over—c c, The retina which covers the vitreous humour. d d, The ciliary proceſſes, which were continued from the choroid coat. e e, The iris. f, The pupil.

Fig. 3. Shows the Optic Nerves, and Muſcles of the Eye.

a a, The two optic nerves before they meet. b, The two optic nerves conjoined. c, The right optic nerve. d, Muſculus attollens palpebræ ſuperioris. e, Attollens oculi. f, Abductor. g g, Obliquus ſuperior, or trochlearis. h, Adductor. i, The eye-ball.

Fig. 4. Shows the Eye-ball with its Muſcles.

a, The optic nerve. b, Muſculus trochlearis. c, Part of the os frontis, to which the trochlea or pully is fixed, through which,—d, The tendons of the trochlearis paſſes. e, Attollens oculi. f, Adductor oculi. g, Abductor oculi. h, Obliquus inferior. i, Part of the ſuperior maxillary bone to which its fixed. k, The eye-ball.

Fig. 5. Repreſents the Nerves and Muſcles of the Right Eye, after part of the Bones of the orbit have been cut away.

A, The eye-ball. B, The lachrymal gland. C, Muſculus abductor oculi. D, Attollens. E, Levator palpebræ ſuperioris. F, Depreſſor oculi. G, Adductor. H, Obliquus ſuperior, with its pully. I, Its inſertion into the ſclerotic coat. K, Part of the obliquus inferior. L, The anterior part of the os frontis cut. M, The criſta galli of the ethmoid bone. N, The poſterior part of the ſphenoid bone. O, Tranſverſe ſpinous proceſs of the ſphenoid bone. P, The carotid artery, denuded where it paſſes through the bones. Q, The carotid artery within the cranium. R, The ocular artery.

Nerves.—a a, The optic nerve. b, The third pair.—c, Its joining with a branch of the firſt branch of the fifth pair, to form l,—The lenticular ganglion, which ſends off the ciliary nerves, d. e e, The fourth pair. f, The trunk of the fifth pair. g, The firſt branch of the fifth pair, named ophthalmic.—h, The frontal branch of it. i, Its ciliary branches, along with which the naſal twig is ſent to the noſe. k, Its branch to the lachrymal gland. l, The lenticular ganglion. m, The ſecond branch of the fifth pair, named ſuperior maxillary. n, The third branch of the fifth pair, named inferior maxillary. o, The ſixth pair of

---

from its bed in the vitreous humour. In this operation the cornea is perforated, and the aqueous humour eſcapes out of the eye, but it is conſtantly renewed again in a very ſhort time. The manner, however, in which it is ſecreted, has not yet been determined.

(F) Upon this principle, they who in their youth are near-ſighted may expect to ſee better as they advance in life, as their eyes gradually become more flat.

Scot Philad

of nerves,—which ſends off p, The beginning of the great ſympathetic. q, The remainder of the ſixth pair, ſpent on c, The abductor oculi.

Fig. 6. Repreſents the head of a youth, where the upper part of the cranium is ſawed off,—to ſhow the upper part of the brain, covered by the pia mater, the veſſels of which are minutely filled with wax.

AA, The cut edges of the upper part of the cranium. B, The two tables and intermediate diploë. BB, The two hemiſpheres of the cerebrum. CC, The inciſure made by the falx. D, Part of the tentorium cerebello ſuper expanſum. E, part of the falx, which is fixed to the criſta galli.

Fig. 7. Repreſents the parts of the External Ear, with the Parotid Gland and its Duct.

a a, The helix. b, The antihelix. c, The antitragus. d, The tragus. e, The lobe of the ear. f, The cavitas innominata. g, The ſcapha. h, The concha. i i, The parotid gland. k, A lymphatic gland, which is often found before the tragus. l, The duct of the parotid gland. m, Its opening into the mouth.

Fig. 8. A view of the poſterior part of the external ear, meatus auditorius, tympanum, with the ſmall bones, and Euſtachian tube of the right ſide.

a, The back part of the meatus, with the ſmall ceruminous glands. b, The incus. c, Malleus. d, The chorda tympani. e, Membrana tympani. f, The Euſtachian tube. g, Its mouth from the fauces.

Fig. 9. Repreſents the anterior part of the right external ear, the cavity of the tympanum—its ſmall bones, cochlea, and ſemicircular canals.

a, The malleus. b, Incus with its long leg, reſting upon the ſtapes. c, Membrana tympani. d, e, The Euſtachian tube, covered by part of—f f, The muſculus circumflexus palati. 1, 2, 3, The three ſemicircular canals. 4, The veſtible. 5, The cochlea. 6, The portio mollis of the ſeventh pair of nerves.

Fig. 10. Shows the muſcles which compoſe the fleſhy ſubſtance of the Tongue.

a a, The tip of the tongue, with ſome of the papillæ minimæ. b, The root of the tongue. c, Part of the membrane of the tongue, which covered the epiglottis. d d, Part of the muſculus hyo-gloſſus. e, The lingualis. f, Genio-gloſſus. g g, Part of the ſtylo-gloſſus.

Med. Hist.
WZ
270
F997c
1790
c.1

★ ★ ARMY ★ ★
MEDICAL LIBRARY
Cleveland Branch