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ELEMENTS

OF

ANATOMY

AND THE

ANIMAL OECONOMY.

THE SECOND EDITION,

With conſiderable ALTERATIONS and ADDITIONS.

LONDON:

Printed for J. WALKER, Nº 20, Pater-noſter-Row.

MDCC LXXXI.

TO

Mr. ELSE,

SURGEON AND READER OF ANATOMY TO

St. THOMAS's HOSPITAL IN LONDON;

AND

MEMBER OF THE ROYAL ACADEMY OF

SURGERY AT PARIS.

DEAR SIR,

I HAVE taken the Liberty to prefix your Name to the following Performance, and I wiſh it had been in my Power to have rendered it leſs unworthy your Acceptance. If it ſhould be found to merit the good Opinion of the

World, I ſhall impute my Succeſs to the Inſtruction I imbibed from your ingenious Lectures. I beg the Favour of you to receive it as a Teſtimony of my Reſpect, and as a trifling Acknowledgement of the many Civilities and Offices of Friendſhip with which you have been pleaſed to honour me. Believe me to be, with the ſincereſt Reſpect and Eſteem,

Dear Sir,

your obliged

humble Servant,

SAMUEL FOART SIMMONS.

Wingham in Kent,
Feb. 22, 1775.

PREFACE.

PREFACE.

IN the Preface to the firſt edition of this work, publiſhed in 1775, the editor acknowledged himſelf indebted for his plan and ſome part of his materials, to the *Elemens d'Anatomie Raiſonnée*, written by M. Perſon, an ingenious French phyſician, and originally publiſhed at Paris in 1748. The manner in which that performance was written, ſeemed to be well calculated for ſtudents; and at firſt it was the editor's intention to have given a literal tranſlation of it, with the addition of notes. But on examining it more attentively, a multitude of corrections and additions were found neceſſary to make it adequate to the purpoſe for which it was intended. It contained old and erroneous theories which have long been deſervedly exploded; many of the deſcriptions were inaccurate and imperfect; ſome parts of the body, as, for inſtance, the breaſts, and organs of generation, were wholly omitted; the nature of the lymphatic ſyſtem, and of abſorption, together with the many other diſcoveries and improvements that have been made in anatomy and phyſiology ſince the publication of M. Perſon's book, were of courſe not to be met with in it. Hence the reader will eaſily conceive, that the taſk of new modelling the work, ſo as to render it ſuitable to the preſent ſtate of anatomical knowledge, could fall but little ſhort of that of compoſing a new one; and that this was really the caſe, will be ſufficiently evident to any one who will be at the pains to compare the preſent performance with the French work

work juſt now mentioned. He will find the form retained, but the ſubſtance almoſt every where changed.

In this new edition, the editor has endeavoured to render the work more uſeful, by correcting the errors that had eſcaped him in the former impreſſion, and by making a great number of alterations and additions.

Air-Street, Piccadilly,
March 17, 1781.

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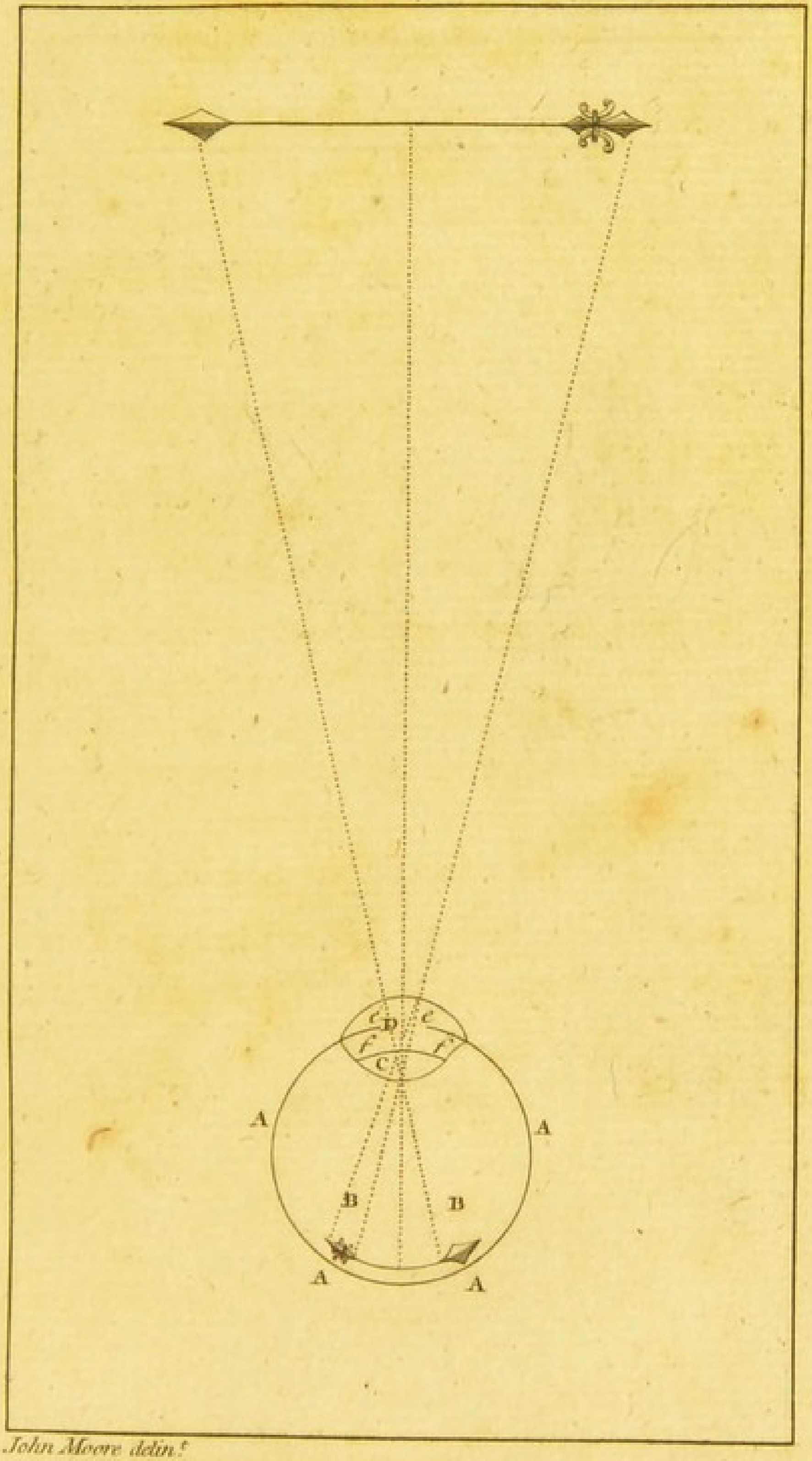

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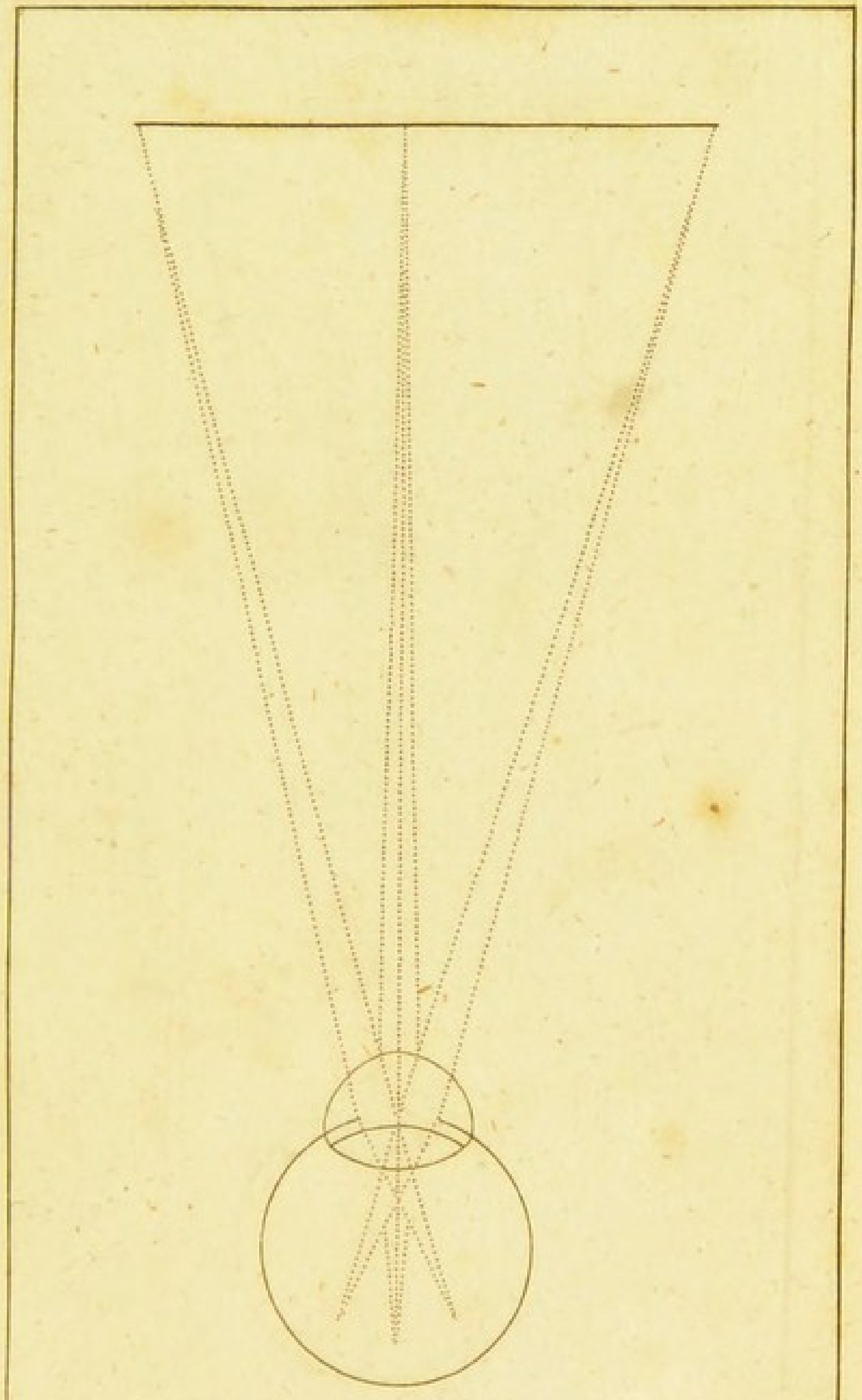

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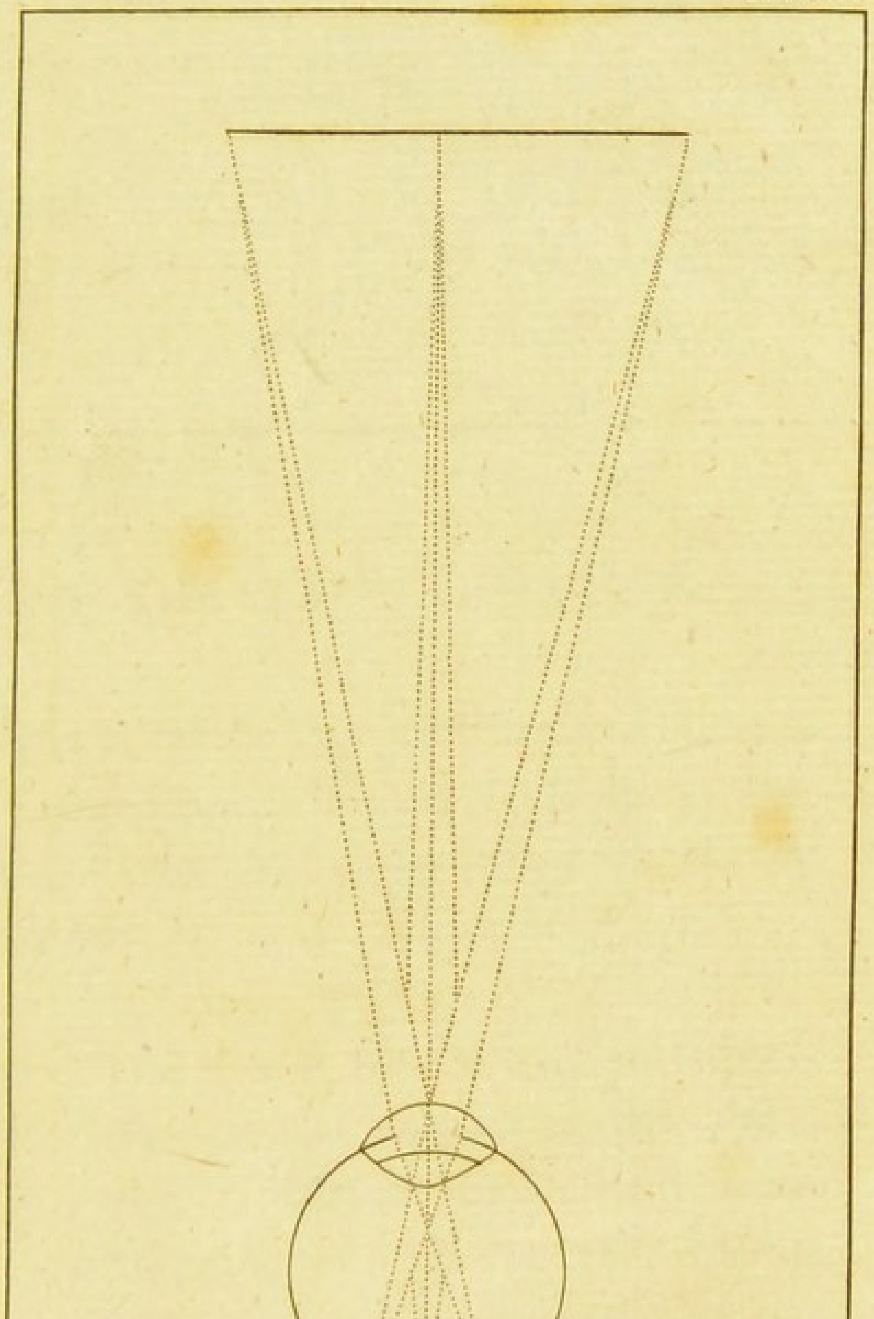
Plate III.



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ELEMENTS

OF

ANATOMY, &c.

INTRODUCTION.

THE etymology of the word Anatomy 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, but the latter affords a more extenſive field for enquiry, as it includes all animals and even plants, ſo far as a knowledge of their ſtructure may tend to improve our ideas of the human body.

The word 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

which ſo many different functions are executed.

THE human body is compoſed of ſolid and fluid parts.—We ſhall deſcribe each of theſe, and at the ſame time ſpeak of their reciprocal action upon each other. This is not common with the generality of anatomical writers, who uſually dwell but little on the animal œconomy which will form the principal part of this work.

ANATOMY, ſo far as it relates to the ſolids, is divided into ſeveral branches, diſtinguiſhed by different names, and alluding to the different parts they uſually deſcribe.—Thus the term

OSTEOLOGY, is allotted to a deſcription of the bones.

MYOLOGY, to that of the muſcles.

ANGEIOLOGY, to that of the veſſels.

NEUROLOGY, to that which treats of the nerves.

ADENOLOGY, to that which gives the hiſtory of the glands.

AND SPLANCHNOLOGY, to that which diſcourſes on the viſcera. All theſe terms are of Greek etymology.—It will be ſufficient, perhaps, for the reader to know their ſignification.

CHAP.

CHAP. I.

OSTEOLOGY.

SECTION I.

Of the Bones in general.

WE will begin with the bones, which may be confidered as the great fupport of the body, tending to give it fhape and firmnefs.—But before we enter into the detail of each particular bone, it will be neceffary to defcribe their compofition and connections, and to explain the nature of the different parts, which have an immediate relation to them; as the cartilages, ligaments, periofteum, marrow and fynovial glands.

Of the Compofition of the Bones.

THE bones are of a firm and hard (*a*) fubftance, of a white color, and perfectly infenfible. They are the moft compact and folid parts of the body, and ferve for the attachment or fupport of all the other parts.

(*a*) An ingenious Swedifh chemift, (Mr. Scheele) has lately difcovered that the bones contain the phofphoric acid united with calcareous earth; and that to this combination they owe their firmnefs.

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, (*a*) or

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

bony

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 ufually confider in a bone, its body and its extremities.—The ancients gave the name of diaphyfis to the body or middle part, and divided the extremities into apophyfis and epiphyfis.—An apophyfis, or procefs, as it is more commonly called, is an eminence continued from the body of the bone, whereas an epiphyfis is at firft a fort of an appendage to the bone, by means of an intermediate cartilage. Many epiphyfes, which appear as diftinct bones in the fœtus, become at length fo completely united to the body of the bone, as not to be diftinguifhable from it in the adult ftate. It is not unufual, however, at the age of eighteen and even twenty years, to find the extremities of bones ftill in the ftate of epiphyfis.

THE names given to the proceffes of bones, are expreffive of their fhape, fize, or ufe; thus if a procefs is large, and of a fpherical form, it is called caput, or head;—if the head is flatted, it is termed condyle.—Some proceffes, from their refemblance to a ftiletto, a breaft, or the beak of a crow, are called ftyloid, maftoid, or coracoid: others are ftiled ridges or fpines.—The two proceffes of the os femoris

derive

derive their name of *trochanters* from their ufe.

A BONE has its cavities as well as proceffes. Thefe cavities either extend quite through its fubftance, or appear only as depreffions. The former are called foramina or holes, and thefe foramina are fometimes termed canals or conduits, according to their form and extent— Of the depreffions, fome are ufeful in articulation.—Thefe are called *cotyloid* when they are deep, as is the cafe with the os innominatum, where it receives the head of the os femoris; or *glenoid* when they are fuperficial, as in the fcapula, where it receives the os humeri. Of the depreffions that are not defigned for articulation, thofe which have fmall apertures are called finufes; others that are large, and not equally furrounded by high brims, are ftiled foffæ—Such as are long and narrow, furrows; or if broad and fuperficial without brims, finuofities. Some are called digital impreffions, from their refemblance to the traces of a finger on foft bodies.

Of

Of the 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, immoveable, 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.

bia. The enarthrofis and arthrodia allow of motion to all fides; the ginglimus only of flexion and extenfion.

The *Synarthrofis*, or immoveable articulation, includes 1. The future, when the two bones are indented into each other, as is the cafe with the parietal bones. 2. Gomphofis, when one bone is fixed into another, in the manner the teeth are placed in their fockets.

The term *Amphiarthrofis* is applied to thofe articulations which partake both of the fynarthrofis and diarthrofis, as is the cafe with the bodies of the vertebræ, which are capable of motion in a certain degree, although they are firmly connected together by intermediate cartilages.

What is called *Symphyfis*, is the union of two bones into one, as in the lower jaw, for inftance, which in the fœtus confifts of two diftinct bones, but becomes one in a more advanced age, by the offification of the uniting cartilage.

When

When bones are thus joined by the means of cartilages, the union is ftiled *fynchondrofis*— When by ligaments, *fyneurofis*.

Of the Cartilages.

Cartilages are white, folid, fmooth, and elaftic fubftances, between the hardnefs of bones and ligaments, and feemingly of a fibrous texture. We are not able to trace any veffels into their fubftance by injection, nor are they ever found tinged in animals that have been fed with madder.

They may be diftinguifhed into 1ft, thofe which are connected with the bones; and 2dly, thofe which belong to other parts of the body. The firft ferve either to cover the ends and cavities of bones intended for motion, as in the articulations, where by their fmoothnefs they facilitate motions, which the bones alone could not execute with fo much freedom; or they ferve to unite bones together, as in the fymphyfis pubis, or to lengthen them as in the ribs.

Many of them offifying as we advance in life, their number is lefs in the adult than in the

the fœtus, and of courſe there are fewer bones in the old than in the young ſubject.

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.

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 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.* Where it covers the bones of the ſkull, it has gotten the name of *pericranium.*

The

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, 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.

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 this name only to the fat-like ſubſtance, and call the other the medullary juice.

The marrow is contained in a very fine and tranfparent membrane, which is fupplied with a great number of blood-veffels, chiefly from the periofteum. This membrana medullaris adheres to the inner furface of the bones, and furnifhes an infinite number of minute bags or veficles for inclofing the marrow, which is likewife fupported in the cavities of the bones by the long filaments of their reticular fubftance.

Besides the veffels from the periofteum, the membrana medullaris is furnifhed with others, which in the long bones may be feen paffing in near the extremities of the bone, and fending off numerous branches that ramify through all the veficles of this membrane.

The bones, and the cells containing the marrow, are likewife furnifhed with lymphatics. By their means, the marrow, like the fat, may be taken up in a greater quantity than it is fecreted; and hence it is that fo little is found in the bones of thofe who die of lingering difeafes.

It is ftill a matter of controverfy, whether the marrow is fenfible or not. We are certainly

tainly 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 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

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 goes ſo far, as to deſcribe the canals by which it is conveyed through every part of their ſubſtance. But from ſome recent enquiries on this ſubject, I am convinced that theſe pretended canals in a dry bone, are nothing more than the tracts of blood-veſſels, into which, when thoſe veſſels are deſtroyed, the marrow, which then becomes oily, and burſts from its cells, eaſily inſinuates itſelf, and makes its way through the ſubſtance of the bone to its outer ſurface. There do not ſeem to be any ſuch pores in a freſh bone; and in the living body, the marrow is not a fluid oil, but a congealed fat incloſed, as we have ſeen, within its proper cells.

Of the Synovial Glands.

The ſynovial glands are ſmall bodies, ſeemingly of a glandular ſtructure, and exceedingly vaſcular, ſecreting a fluid of a white 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.

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.

Of

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 means of wire.

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.

SECTION II.

Of the Bones of the Head.

THE head is of a roundiſh figure, and ſomewhat oval (*b*). 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.—

(*b*) 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. But the ingenious Dr. Camper, who has made many curious enquiries on this ſubject, ſuppoſes, with good reaſon, that this difference is chiefly owing to certain natural cauſes with which we are as yet unacquainted.

There are eight bones of the cranium, viz. the coronal bone, or os frontis; the two parietal bones, or offa bregmatis; the os occipitis; the two temporal bones; the fphenoid bone, and the os ethmoides, or cribiforme.

Of thefe, only the os occipitis, and offa bregmatis, are confidered as proper to the cranium; the reft being common both to the cranium and face.

These bones are all harder at their furface than in their middle—and on this account they are divided into two tables, and a middle fpongy fubftance called *diplöe*.

Of the Os Frontis

In this, as in all the other bones, we fhall confider its figure, ftructure, proceffes, depreffions and cavities; and the manner in which it is articulated with the other bones.

The os frontis has fome refemblance in fhape to the fhell of the cockle. Externally it is convex, its concave fide 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 like-wise 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 orbitar proceſſes. They ſerve to form the orbits, which are the cavities in 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. Be-tweeen theſe a ridge is extended in form of

an

an arch, and on this the eye-brows are placed. It is called the orbitar or fuperciliary ridge, and in fome meafure covers and defends the globe of the eye. This arch is interrupted near the nofe by a fmall pit, in which the tendon of the mufculus obliquus major of the eye is fixed. In each orbit, under the external procefs, a confiderable depreffion is obferved, in which the lachrymal gland is lodged.

In the anterior part of the os frontis, there is a confiderable difcontinuation of it, which is filled up by the cribiform part of the os ethmoides.

On examining the inner furface of this bone, we obferve an elevation in form of a ridge, which has been called the fpinous procefs; it paffes from the anterior to the pofterior part of the bone, dividing it into two confiderable foffæ, 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 hemifpheres. Befides thefe two foffæ, there are many depreffions, 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.

Of the Parietal Bones.

THE parietal bones are two in number; they are very thin, and even tranfparent in fome places. The particular figure of each of thefe bones is that of an irregular fquare, bordered with indentations through its whole circumference, except at its lower part. It will be eafily conceived, that thefe bones, which compofe the fuperior and lateral parts of the cranium, and cover the greateft part of the brain, form a kind of vault. On their inner furface, we obferve the marks of the veffels of the dura mater.

THE offa parietalia are joined to each other by the fagittal future; to the os fphenoides and offa temporum by the fquamous future; to the os occipitis by the lambdoidal future (*c*), fo called from its refemblance to the Greek letter lambda, and to the os frontis by the coronal future.

(*c*) The lambdoidal future is fometimes very irregular, being compofed of many fmall futures, which furround fo many little bones called offa triquetra, though perhaps improperly, as they are not always triangular.

IN

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

Of the Occipital Bone.

The occipital bone forms the poſterior and inferior parts of the ſcull; 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. Beſides this, there are uſually four other holes peculiar to this bone, and two which are common to it and the oſſa temporum.—Theſe foramina ſerve for the paſſage of the blood-veſſels and nerves. 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, which is very irregular, affords attachment to ſeveral muſcles.—On examining its inner ſurface, we may obſerve a croſs-like appearance, formed by a prominent ridge, that riſes upwards from near the foramen magnum, and by two tranſverſe ſinuoſities, one on each ſide of the ridge. Theſe ſinuoſities ſerve for the reception of the lateral ſinuſes. Four foſſæ are formed by the croſs, two above, and two below the ſinuoſities.—In the former are placed the poſterior lobes of the brain, and in the latter the lobes of the cerebellum.

At the upper part of the os occipitis, we may perceive a continuation of the furrow for the longitudinal ſinus; and at the baſis of the cranium, the cuneiform proceſs (which is the name given to the great apophyſis at the fore part of this bone) is made 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

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.

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 os petroſum, 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 pro-

procefs; one pofterior, called the maftoid or mamillary procefs, from its refemblance to a nipple; and one inferior, called the ftyloid procefs, becaufe it is fhaped like a ftiletto, or dagger.

THE cavities are, 1. The meatus auditorius externus. 2. A large foffa which ferves for the articulation of the lower jaw; it is before the meatus auditorius, and immediately under the zygomatic procefs. 3. The ftylo-maftoid hole, fo called from its fituation between the ftyloid and maftoid proceffes—it is likewife ftyled the aquæduct of Fallopius, and affords a paffage to the portio dura of the auditory, or feventh pair of nerves. 4. Below, and on the fore part of the laft foramen, we obferve part of the jugular foffa, in which the beginning of the internal jugular vein is lodged. Anterior and fuperior to this foffa, is the orifice of a foramen, through which paffes the carotid artery. This foramen runs firft upwards and then forwards, forming a kind of elbow, and terminates at the end of the os petrofum.—At this part of each temporal bone, we may obferve the opening of the

Euftachian

Euſtachian tube, a canal which paſſes from the ear to the mouth.

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 placed; and the former, a portion of the leaſt foſſa for the baſis of the brain.—On the poſterior ſide of the os petroſum, we obſerve the meatus auditorius internus, into which enters the double nerve of the ſeventh pair.

The os petroſum 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

and to the fphenoid bone, by the future of that name.

Of the Os Sphenoides.

This bone, from its fituation amidft the other bones of the head, has been fometimes 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 fides or wings.

On whatever fide we view it, we difcover only proceffes and cavities.—The proceffes, both external and internal, are fo very numerous, that it will be fufficient perhaps for us to defcribe the principal ones, of which there are three on the outfide.- One of thefe is in the middle, and is fhaped like a creft, making part of the feptum narium; the other two are, the pterygoid, or aliform proceffes, one on each fide of the body of the bone, and at no great diftance from it.—Each of thefe proceffes is divided into two wings, and of thefe 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 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 eight holes in this bone, viz. four on each ſide; ſeveral pair of nerves, and ſome blood-veſſels paſs through them.

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

max-

maxillaria, offa malarum, offa palati, and vomer.

This bone makes part of the bafis of the fkull, affifts in forming the orbits, and affords attachment to feveral mufcles.

Of the Os Ethmoides.

The os ethmoides is fituated at the fore part of the bafis of the cranium, and is of a very irregular figure. From the great number of holes with which it is pierced, it is fometimes called *os cribiforme* or fieve-like bone.

It confifts of a middle part and two fides. The middle part is formed of a thin bony plate, in which are an infinite number of holes, that afford a paffage to filaments of the olfactory nerve. From the middle of this plate, both on the outfide and from within, there rifes up a procefs which may be eafily diftinguifhed. The inner one is called crifta galli, from its fuppofed refemblance to a cock's comb. To this procefs the falx of the dura mater is attached. The exterior procefs, which has the fame common bafis as the crifta 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 ſo exceedingly 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

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 cribiform bone, than the feroſity 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 fevaral bones being abfolutely without motion, it may be afked, perhaps, why fuch a multiplicity of bones, and fo great number of futures? Many advantages may poffibly arife from this plurality of bones and futures, which may not yet have been obferved.—We are able, however, to point out many ufeful ends, which could only be accomplifhed by this peculiarity of ftructure.—In this, as in all the other works of nature, the great wifdom of the Creator is evinced, and cannot fail to excite our admiration and gratitude.

The cranium, by being divided into feveral bones, grows much fafter and with greater facility, than if it was compofed of one piece only. In the fœtus, the bones, as we have before obferved, are perfectly diftinct from each other. The offification begins in the middle of each bone, and proceeds gradually to the circumference.—Hence the offification, and of courfe the increafe of the head, is carried on from an infinite number of points at the fame time, and the bones confequently approach each other in the fame proportion. To illuftrate this doctrine more clearly, if it can want

fur-

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 advantages in ſuſpending the proceſſes of the dura mater, are evidently 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 I have met with caſes, 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.

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.

Of the Offa Malarum.

THESE are the prominent fquare bones which are placed under the eyes, forming part of the orbits, and the upper part of the cheeks. Each of them affords three furfaces; one exterior and a little convex; a fecond fuperior and concave, forming the inferior part and fides of the orbit; and a third pofterior, irregular, and hollowed for the lodgement of the lower part of the temporal mufcle.

THE angles of each bone form four proceffes, two of which may be called orbitar proceffes; of thefe the upper one is joined by future to the os frontis, and that below to the maxillary bone. The third is connected with the os fphenoides by means of the tranfverfe future; and the fourth is joined to the zygomatic procefs of the temporal bone, with which it forms the zygoma.

Of the Offa Maxillaria fuperiora.

THESE bones, which are of a very irregular figure, are fo called, becaufe they form the moft confiderable portion of the upper jaw—

They are two in number, and generally remain diſtinct thro' 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—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 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.

In

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

Where theſe two bones are united to each other they project ſomewhat 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.

Of the Oſſa Naſi.

The oſſa naſi form two irregular ſquares. They are thicker and narrower above than be-

low

low—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.

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.

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

Each of thefe bones is connected with the os frontis, os ethmoides, and os maxillare fuperius.

Of the Offa Palati.

These bones, which are fituated at the back part of the roof of the mouth, between the os fphenoides and the offa maxillaria fuperiora, are of a very irregular fhape, and ferve to form the nafal and maxillary foffa, and a fmall portion of the orbit. Where they are united to each other, they rife up into a fpine on their internal furface—this fpine appears to be a continuation of that of the fuperior maxillary bones, and helps to form the feptum narium.

These bones are joined to the offa maxillaria fuperiora, os ethmoides, os fphenoides, and vomer.

Of the Vomer.

This bone derives its name from its refemblance to a plough-fhare.—It is a long and flat bone, fomewhat thicker at its back than at its fore part. At its upper part we obferve a fur-

row

row extending through its whole length—The poſteriorand 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.

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

mina

mina 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.

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

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.

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,

tilages, 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.

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

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 (*a*) affirmed, that he could trace the arteries into the hardeſt part of the teeth; Lewenhoeck (*b*) ſuſpected the fibres of the enamel to be ſo many veſſels; and Monro (*c*) 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 (*d*).

(*a*) Theſaur. 10. num. 27.

(*b*) Arcan. Natur. continuat. Epiſtol.

(*c*) Anatomy of the human bones.

(*d*) Hunter on the teeth.

The bony part, which compofes the inner fubftance of the body, neck, and root of the tooth, refembles other bones in its ftructure, but it is much harder than the moft compact part of bones in general. As a tooth when once formed receives no tinge from a madder diet, and as the minuteft injections do not penetrate into its fubftance, this part of a tooth has, like the enamel, been fuppofed not to be vafcular. But when we confider that the fangs of a tooth are invefted by a periofteum, and that the fwellings of thefe fangs are analogous to the fwellings of other bones, we may reafonably conclude that there is a fimilarity of ftructure, and that this bony part has a circulation through its fubftance, although from its hardnefs we are unable to demonftrate its veffels.

In each tooth we find an inner cavity, into which enter an artery, vein, and nerve. This cavity begins by a fmall opening, and becoming larger, terminates in the body of the tooth. In advanced life this hole fometimes clofes, and the tooth is of courfe rendered infenfible.

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 elasticity. 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 (*e*). The incisores are the

(*e*) 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.

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 (*f*).

(*f*) Mr. Hunter remarks of theſe teeth, that we may trace in them a ſimilarity 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.

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.

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 neceffary to confider the under jaw as a kind of lever, with its fixed points at its articulations with the temporal bones—it will be right to obferve too that its powers arife from its different mufcles, but in elevation chiefly from the temporalis, and that the aliment conftitutes the object of refiftance. It will appear then, that the molares by being placed neareft the centre of motion are calculated to prefs with a much greater force than the other teeth, independent of their grinding powers, and that it is for this reafon we put between them any hard body we wifh to break.

The canini and incifores are placed farther from this point, and of courfe cannot exert fo much force; but they are made for cutting and tearing the food, and this form feems to make amends for their deficiency in ftrength.

There are examples of children who have come into the world with two, three, and even four teeth—but thefe examples are very rare, and 'tis feldom before the feventh, eighth or ninth month after birth that the incifores, which are the firft formed, begin to pafs thro' the gum. The fymptoms 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 jaw. Sometimes the canini, but more commonly

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one of the molares, begins to paſs through the gum firſt.

These twenty 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 fourteen, 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 twenty teeth which ſucceed the temporary ones, twelve 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 twenty teeth, they ſeem to be as completely filled as they are afterwards with thirty-two. 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 twelfth, the ſecond about the eighteenth,

teenth, and the third, or *dens ſapientiæ*, uſually between the twentieth and thirtieth year.

The teeth like other bones, are liable to be affected by diſeaſe. Their removal is likewiſe the natural conſequence 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.

Of the Os Hyoides (*g*).

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.

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

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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.

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.

SECTION III.

Of the Bones of the Trunk.

THE trunk of the ſkeleton conſiſts of the ſpine, the thorax, and the pelvis.

Of the Spine.

THE ſpine is compoſed of a great number of bones called vertebræ, forming a long bony column, in figure not much unlike the letter *ſ*. 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.

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 ſtiled *falſe vertebræ*. It is upon the bones of the ſpine that the body turns; and it it is to this circumſtance they owe their name, which is derived from the Latin verb *vertere*, to turn.

The true vertebræ are divided into three claſſes of cervical, dorſal, 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 ſtiled *oblique* or *articular* proceſſes. They are much ſmaller than the ſpinous or tranſverſe ones. Two of them

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 ſtiled articular proceſſes, from the manner in which they are articulated with each other; the two ſuperior proceſſes of one vertebra being articulated 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 be-

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low 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

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

Of the 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 is 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.

The second vertebra has gotten the name of *dentata* from its having, at its upper and exterior anterior part, a procefs called the *odontoid* or *tooth-like procefs*, which is articulated with the atlas to which this fecond vertebra may be faid to ferve as an axis. This odontoid procefs is of a cylindrical fhape, fomewhat flattened, however anteriorly and pofteriorly. At its fore part where it is received by the atlas, we may obferve a fmooth, convex, articulating furface. It is by means of this articulation that the head performs its rotatory motion, the atlas in that cafe moving upon this odontoid procefs as upon a pivot. But when this motion is in any confiderable degree, or in other words when the head moves much either to the right or left, all the cervical vertebræ feem to affift, otherwife the fpinal marrow would be in danger of being divided tranfverfely by the firft vertebra.

The fpinous procefs of each of the cervical vertebræ is fhorter, and their articular proceffes more oblique than in the other bones of the fpine.

Of the Vertebræ of the Back.

These twelve vertebræ are of a middle fize between thofe of the neck and loins. At their fides we may obferve two depreffions, one at the upper and the other at the lower part of the body of each vertebra, which uniting with fimilar depreffions in the vertebræ above and below, form articulating furfaces, covered with cartilages, for receiving the heads of the ribs ; and at the fore part of their tranfverfe procefs (excepting the two laft) we find an articulating furface for receiving the tuberofity of the ribs.

Of the Lumbar Vertebræ.

These five vertebræ differ only from thofe of the back in their being larger, and in having their fpinous proceffes at a greater diftance from each other—The moft confiderable motions of the trunk are made on thefe vertebræ, and thefe motions could not be performed with fo much eafe, were the proceffes placed nearer to each other.

Of the Os Sacrum.

The os facrum which is compofed of five or fix pieces in young fubjects, becomes one bone in more advanced age.

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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 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 compleatly 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.

Of the 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 about three inches long, and 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 gotten 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 greater 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 eafily enabled to keep the body in an erect pofture, for otherwife we fhould be liable to fall forward. Towards its inferior extremity however, it again recedes backward, and thus affifts in forming the pelvis, the name given to the cavity in which the urinary bladder, inteftinum rectum, and other vifcera are placed.

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

It is firm, and yet to this firmnefs there is added a perfect flexibility. If it be required to carry a load upon the head, the neck becomes ftiff with the affiftance of its mufcles, and accommodates itfelf to the load, as if it was compofed only of one bone—In ftooping likewife or in turning to either fide, the fpine turns itfelf in every direction, as if all its bones were feparated from each other.

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.

Of the Bones of the Thorax.

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.

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 two pieces, and ſometimes becomes one bone— It is however generally deſcribed as being compoſed of two parts—one ſuperior, which is broad, thick and ſhort; and one inferior, which is thinner, narrower and longer than the other.

It terminates at its lower part by a cartilage which is called the xyphoid, or ſword-like cartilage, from its ſuppoſed reſemblance to the blade of a ſword, but its ſhape is much more like that of a myrtle leaf.

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.

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

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 lodgement 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 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 a 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.

Of the Bones of the Pelvis.

The pelvis is compofed of the os facrum, os coccygis, and two offa innominata. The two firft of thefe bones were included in our account of the fpine, to which they more properly belong.

In children, each os innominatum is compofed of three diftinct bones; but as we advance in life the intermediate cartilages gradually offify, and the marks of the original feparation difappear, fo that they become one irregular bone; ftill however continuing to retain the names of ilium, ifchium and pubis, by which their divifions were originally diftinguifhed, and to be defcribed as three diftinct bones by the generality of anatomifts. The os ilium forms the upper and moft confiderable part of the bone, the os ifchium its lower and pofterior portion, and the os pubis its fore part.

Of the Os Ilium.

The os ilium or haunch bone, is articulated pofteriorly to the os facrum by a firm

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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 criſta 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, which 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—The ends of this ſpine too from their projecting more than the parts of the bone below them have gotten the name of ſpinal proceſſes—Before the anterior ſpinal procefs the fpine is hollowed for the lodgement of part of the fartorius mufcle, and below the pofterior procefs we obferve a confiderable niche in the bone which in the recent fubject, is formed into a large foramen, by means of a ftrong ligament that is ftretched over its lower part from the os facrum to the fharp-pointed procefs of the ifchium. This hole affords a paffage to the great fciatic nerve, and to the pofterior crural veffels under the pyriform mufcle, part of which is likewife placed in this foramen.

Of the Os Ifchium.

The os ifchium, or hip-bone, which is of a very irregular figure, conftitutes the lower lateral parts of the pelvis, and is commonly divided into its body, tuberofity and ramus. The body forms the lower and moft confiderable portion of the acetabulum, and fends a fharp-pointed procefs backwards, called the fpine of the ifchium. To this procefs the ligament adheres, which was juft now fpoken of, as forming a foramen for the paffage of the fciatic nerve.—The tuberofity, which is the loweft part of the trunk, and fupports us when

we

we ſit, is large and irregular, affording origin to ſeveral mucles. 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 nitch in the bone, it gives paſſage to blood-veſſels and to the poſterior crural nerve. Nature ſeems every where to avoid an unneceſſary weight of bone, and this foramen, no doubt, ſerves to lighten the bones of the pelvis.

Of the 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

In each os pubis we may diftinguifh the body of the bone, its angle, and ramus. The body or outer part is united to the os ilium. The angle comes forwards to form the fymphyfis, and the ramus is a thin procefs which unites with the ramus of the ifchium, to form the foramen thyroideum.

The three bones we have defcribed as compofing each os innominatum, all affift in forming the acetabulum, in which the head of the os femoris is received.

In this cavity we may obferve a little foffa, in which are lodged the mucilaginous glands of the joint. We may likewife notice the pit or depreffion 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 fecure the latter in the focket.

These bones, which are united to each other and to the fpine by many very ftrong ligaments, ferve to fupport the trunk, and to connect it with the lower extremities; and at the fame time to form the pelvis or bafon, in which are lodged the inteftines and urinary

bladder,

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.

SECTION

SECTION IV.

Of the Extremities.

THESE parts of the ſkeleton conſiſt of the upper and lower extremities—We will begin with the upper one, which conſiſts of the ſhoulder, arm and hand—The ſhoulder is compoſed of two bones, the clavicula and ſcapula.

Of the Clavicula.

THIS bone, 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.

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. The largeſt of the three called 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.

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.

Of the Bones of the Arm.

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.

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 terminates in a large, round ſmooth head, which is admitted into the glenoid cavity of the ſcapula.

THE lower extremity has many 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 caſpular 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.

Of the Fore Arm.

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

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 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

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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.

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 (*f*)—This bone follows the ulna in flexion and extenſion, without at all aſſiſting in thoſe motions—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.

(*f*) 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 then be in a ſtate of ſupination.

On

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.

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

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 κοτυλοειδες, (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.

The os cuneiforme, 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 ſtiled *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 a half in breadth;

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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.

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.

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 the metacarpus, are the largeſt, and thoſe of the laſt phalanx the

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 twenty-ſeven 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.

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.

Of the Os Femoris.

The thigh is compoſed only of this bone, which is the largeſt and ſtrongeſt we have. It

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 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, tro-

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 to the ſurface 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 cavity, by means of which it is articulated with the leg by ginglimus.

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.

A ligament likewife arifes from each condyle pofteriorly. One of thefe ligaments paffes from the right to the left, and the other from the left to the right, fo that they interfect each other, and for that reafon are called the crofs ligaments.

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

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

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 fhape it is fomewhat 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 fmooth and fomewhat convex—its pofterior furface, which is more unequal, affords an elevation in the middle

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 connexion 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 likewife tends to increafe the power of the extenfor mufcles of the leg, by removing their direction farther from the center of motion in the manner of a pulley.

Of the Leg.

The leg is compofed of two bones—Of thefe the inner one, which is the largeft, is called tibia—the other is much fmaller, and named fibula.

Of the Tibia.

The tibia, which is fo called from its refemblance to the mufical pipe of the ancients, has three furfaces, and is not very unlike a triangular prifm—Its pofterior furface is the broadeft; anteriorly it has a confiderable ridge called the fhin, between which and the fkin there are no mufcles—At the upper extremity of this bone are two furfaces, a little concave, and feparated from each other by 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 fpoke of as being between the

two

two condyles, ſo that this articulation affords a ſpecimen of the complete 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 tranſverſe 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.

The tibia is hollow thro' 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.

Of the Bones of the Foot.

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.

The astragalus is a large bone with which both the tibia and fibula are articulated. It is the uppermoſt bone of the foot—

—it

—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.

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 (*g*) is attached, which is formed by the tendons of ſeveral muſcles united together—The articulation of

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

this with the other bones, is ſecured by means of ligaments.

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 it is connected with 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.

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

poſteriorly they are united to the os navicu-lare, 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 concife, 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.

Of the Metatarſus.

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.

Of the Bones of the Toes.

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

other four are diftinguifhed into three phalanges. Although the toes are more confined in their motion than the fingers, yet they appear to be perfectly fitted for the purpofes they are defigned for. In walking the toes bring the centre of gravity perpendicular to the advanced foot, and as the foles of the foot are naturally concave, we can at pleafure increafe this concavity, and form a kind of vault, which adjufts itfelf to the different inequalities that occur to us in walking, and which without this mode of arrangement would incommode us exceedingly, efpecially when barefooted.

Of the Offa Sefamoidea.

BESIDES the bones we have already defcribed, there are feveral fmall ones that are met with only in the adult fkeleton, and in perfons who are advanced in life, which from their fuppofed general refemblance to the feeds of the fefamum are called *offa fefamoidea*— They are commonly to be feen at the firft joint of the great toe, and fometimes at the joints of the thumb; they are likewife now and then to be found at the lower extremity of the fibula,

bula, 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.

CHAP. II.

Of the ſoft Parts in General,

AND

Of the common Integuments.

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 of them in the courſe of the work, the reader may at leaſt know where they are placed.

AFTER

After this little digreffion, the common integuments, and after them the mufcles, will be defcribed; we then propofe to enter into an examination of the feveral vifcera and their different functions—In defcribing the brain, occafion will be taken to fpeak of the nerves and animal fpirits. The circulation of the blood will follow the anatomy of the heart, and the fecretions and other matters will be introduced in their proper places.

The body is divided into three great cavities—Of thefe the uppermoft is formed by the bones of the cranium, and inclofes the brain and cerebellum—The fecond is compofed of the vertebræ of the back, the fternum and true ribs with the additional affiftance of mufcles, 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 feparated from the thorax by means of the diaphragm, and is formed by the lumbar vertebræ, the os facrum, the offa innominata, and the falfe ribs, to which we may add the

the peritonæum, and a variety of mufcles—This cavity inclofes the ftomach, inteftines, omentum or cawl, liver, pancreas, fpleen, kidnies, urinary bladder, and parts of generation.

UNDER the divifion of common integuments, are ufually included the epidermis, or fcarf-fkin; the reticulum mucofum of Malpighi; the cutis, or true fkin, and the membrana adipofa—The hair and nails, as well as the febaceous glands, may be confidered as appendages to the fkin.

SECTION I.

Of the Epidermis.

THE epidermis, cuticula or ſcarf ſkin, is a fine, tranſparent and inſenſible pellicle, deſtitute of nerves and blood-veſſels, which inveſts the body, and every where 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 appear-

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 center—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—Leeuwenhoeck ſuppoſed its formation to be owing to the expanſion of the extremities of the excretory veſſels, which are found every where 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.

THE cuticle is pierced with an infinite number of pores, or little holes, which afford a paſſage to the hairs, ſweat and inſenſible perſpiration,

* Adverſar. Anat. II. Animadver. 2.

and

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.

SECTION

SECTION II.

Of the Rete Mucofum.

BETWEEN the epidermis and cutis we meet with an appearance to which Malpighi, who firft defcribed it, gave the name of *rete mucofum*, fuppofing it to be of a membranous ftructure, and pierced with an infinite number of pores; but the fact is, that it feems to be nothing more than a mucous fubftance which may be diffolved by macerating it in water, while the cuticle and cutis preferve their texture.

THE colour of the body is found to depend on the colour of this rete mucofum, for in negroes it is obferved to be perfectly black, whilft the true fkin is of the ordinary colour.

THE blifters which raife the fkin when burnt or fcalded, are probably occafioned by the rarefaction of this mucus.

Of the Cutis, or true Skin.

The cutis is compofed of fibres clofely compacted together, as we may obferve in leather which is the prepared fkin of animals. Thefe fibres form a thick net-work, which every where admits the filaments of nerves, and an infinite number of blood-veffels and lymphatics.

The cutis, when the epidermis is taken off, is found to have throughout its whole furface innumerable papillæ, which appear like very minute granulations, and feem to be calculated to receive the impreffions of the touch, being the moft eafily obferved where the fenfe of feeling is the moft delicate, as in the palms of the hands and on the fingers.

These papillæ are fuppofed by many anatomical writers to be continuations of the pulpy fubftance of nerves, whofe coats have terminated in the cellular texture of the fkin. The great fenfibility of thefe papillæ evidently proves them to be exceedingly nervous; but furely the nervous fibrillæ of the fkin are of them-

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.

Of the Glands of the Skin.

In different parts of the body we meet within the ſubſtance of the ſkin, with certain appearances, which ſeem to be nothing more than very ſmall cylindrical tubes or ſimple follicles, continued from the ends of arteries, and diſcharging a fat and oily humour that ſerves to lubricate and ſoften the ſkin—When this fluid is collected and long retained in theſe follicles, it inſpiſſates, and by enlarging the tubes, gives them the ſpherical appearance that has occaſioned them to be called glands: and 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 *febaceous* glands. They are found in the greateft number in the axilla, groin, fcrotum, vagina, and prepuce.

Besides thefe febaceous glands, we read, in anatomical books, of others that are defcribed as fmall fpherical bodies placed in all parts of the fkin, in much greater abundance than thofe juft now mentioned, and named *miliary*, from their fuppofed refemblance to millet-feed. Steno, who firft defcribed thefe glands, and Malpighi, Ruyfch, Verheyen, Winflow, and others, who have adopted his opinions on this fubject, fpeak of them as having excretory ducts, that open on the furface of the cuticle, and diftil the fweat and matter of infenfible perfpiration; and yet, notwithftanding the pofitive manner in which thefe pretended glands have been fpoken of, we are now fufficiently convinced that their exiftence is altogether imaginary.

Of the Infenfible Perfpiration, and Sweat.

The matter of infenfible perfpiration, or in other words, the fubtile vapour that is continually

tinually exhaling from the furface of the body, is not fecreted by any particular glands, but feems to be derived wholly from the extremities of the minute arteries that are every where difperfed through the fkin. Thefe exhaling veffels are eafily demonftrated in the dead fubject, by throwing water into the arteries; for then fmall drops exfude from all parts of the fkin, and raife up the cuticle, the pores of which are clofed by death; and in the living fubject, a looking-glafs placed againft the fkin, is foon obfcured by the vapour. Bidloo fancied he had difcovered ducts leading from the cutis to the cuticle, and tranfmitting this fluid; but in this he was miftaken.

When the perfpiration is by any means increafed, and feveral drops that were infenfible when feparate, are united together and condenfed by the external air, they form upon the fkin fmall but vifible drops called *fweat* *. This particularly happens after much exercife, or whatever occafions an increafed determina-

* Leeuwenhoeck afferts that one drop of fweat is formed by the conflux of fifteen drops of perfpirable vapour.

tion of fluids to the furface of the body; a greater quantity of perfpirable matter being in fuch cafes carried through the paffages that are deftined to convey it off. It has been difputed indeed, whether the infenfible perfpiration and fweat are to be confidered as one and the fame excretion, differing only in degree, or whether they are two diftinct excretions derived from different fources. In fupport of the latter opinion, it has been alledged, that the infenfible perfpiration is agreeable to nature, and effential to health, whereas fweat may be confidered as a fpecies of difeafe. But this argument proves nothing, and it feems probable, that both the infenfible vapor and the fweat are exhaled in a fimilar manner, though they differ in quantity, and probably in their qualities; the former being more limpid, and feemingly lefs impregnated with falts than the latter: at any rate we may confider the fkin as an emunctory through which the redundant water, and fometimes the other more faline parts of the blood are carried off. But the infenfible perfpiration is not confined to the fkin only—a great part of what we are conftantly 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 (*k*) an Italian physician, who indefatigably passed a great 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 insesinble perspiration, while three pounds only will be evacuated by stool, urine, saliva, &c.—But in

(*k*) 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 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."

countries where the degree of cold is greater than in Italy, the quantity of perfpired matter is lefs; in fome of the more northern climates, it being found not to equal the difcharge by urine—It is likewife obferved to vary according to the feafon of the year, and according to the conftitution, age, fex, difeafes, diet, exercife, paffions, &c. of different people.

From what has been faid on this fubject, it will be eafily conceived, that this evacuation cannot be either much increafed or diminifhed in quantity without affecting the health.

The perfpirable matter and the fweat, are in fome meafure analogous to the urine, as appears from their tafte and faline nature (*l*). And it is worthy of obfervation, that when either of thefe fecretions is increafed in quantity, the other is diminifhed; fo that they who perfpire the leaft, ufually pafs the greateft quantity of urine, and vice verfa.

(*l*) Minute chryftals have been obferved to fhoot upon the cloaths of men who work in glafs-houfes.——*Haller. Elem. Phyf.*

Of

Of the Nails.

The nails are of a compact texture, hard and tranſparent like horn. Their orgin 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.

tremity. 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.

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.

Of 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 (*m*). Some of theſe bulbs incloſe ſeveral hairs

(*m*) 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 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 eye-brows 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 (*o*).

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.

(*o*) The hairs likewiſe differ 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.

THEIR

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.

Of the cellular Membrane and Fat.

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

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 kidnies, at the baſis of the heart, in the orbits, &c.

The

The chief uſes of the fat ſeem 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.

CHAP.

CHAP. III.

Of the MUSCLES.

THE mufcles are the organs of motion. The parts that are ufually included under this name confift of diftinct portions of flefh, fufceptible of contraction and relaxation; the motions of which in a natural and healthy ftate, are fubject to the will, and for this reafon they are called *voluntary* mufcles. But befides thefe, there are other parts of the body that owe their power of contraction to their mufcular fibres; thus the heart is of a mufcular texture, forming what is called a hollow mufcle; and the urinary bladder, ftomach, inteftines, &c. are enabled to act upon their contents, merely becaufe they are provided with mufcular fibres. Thefe are called *involuntary* mufcles, becaufe their motions are not dependent on the will. The mufcles of refpiration, being in fome meafure influenced by the will, are faid 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 ſtiled 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 ſtiled *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.

THAT end of a mufcle which adheres to the moft fixed part is ufually called the *origin*, and that which adheres to the more moveable part the *infertion* of the mufcle.

IN every mufcle we may diftinguifh two kinds of fibres ; the one, foft, of a red colour, fenfible, and irritable, called flefhy fibres ; the other of a firmer texture, of a white gliftening colour, infenfible, without irritability or the power of contracting, and named tendinous fibres. They are occafionally intermixed, but the flefhy fibres generally prevail in the belly or middle part of a mufcle, and the tendinous ones in the extremities. If thefe tendinous fibres are formed into a round flender chord, they form what is called the *tendon* of the mufcle; on the other hand, if they are fpread into a broad flat furface, the extremity of the mufcle is ftiled *aponeurofis*.

THE tendons of many mufcles, efpecially when they are long and expofed to preffure or friction in the grooves formed for them in the bones, are furrounded by a tendinous fheath or *fafcia*, in which we fometimes find a fmall mucous fac or *burfa mucofa*, 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.

Leeuwenhoeck 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,

ledged, 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 in equal proportion.

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

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 mufcles thefe effects of contraction and relaxation of the flefhy fibres are produced in obedience to the will, by what may be called the *vis nervofa*, a property that is not to be confounded with the *vis infita* juft now fpoken of. The *vis nervofa*, or operation of the mind, if we may fo call it, by which a mufcle is brought into contraction, is not inherent in the mufcle like the *vis infita*, neither is it perpetual, like this latter property. After long continued or violent exercife, for example, the voluntary mufcles become painful, and at length incapable of further action; whereas the heart and other involuntary mufcles, the motions of which depend folely on the *vis infita*, continue through life in a conftant ftate of action, without any inconvenience, or wafte of this inherent principle.

The action of the vis nervofa on the voluntary mufcles, conftitutes what is called mufcular motion, a fubject that has given rife to a variety of hypothefes, many of them ingenious, but none of them fatisfactory.

Borelli and fome others have undertaken to explain the caufe of contraction, by fuppofing that every mufcular fibre forms as it were a chain of very minute bladders, while the nerves which are diftributed through the mufcle, bring with them a fupply of animal fpirits, which at our will fill thefe bladders, and by increafing their diameter in width, fhorten them, and of courfe the whole fibre.

Borelli fuppofes thefe bladders to be of a rhomboidal fhape; Bernouilli on the other hand contends that they are oval. Our countryman, Cowper, fancied he had filled them with mercury; the caufe of this miftake was probably owing to the mercury's infinuating itfelf into fome of the lymphatic veffels (*a*).

We know that the mufcular fibre is fhortened, and that the mufcle itfelf fwells when in action, but how thefe phænomna are produced, we are unable to determine. We likewife know that the nerves are effential to muf-

(*a*) Mr. Elliott, an ingenious phyfiologift, has lately undertaken to account for the phænomena of mufcular motion on principles very different from thofe juft now mentioned. He fuppofes that a dephlogifticated ftate of the blood is requifite for mufcular action, and that a communication of phlogifton to the blood is a neceffary effect of fuch action.

cular

cular 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 or ſpinal-marrow from which the nerve derives its origin.

Of the particular Muſcles.

It would be inconſiſtent with the plan of an elementary work like this, to enter into a minute deſcription of all the muſcles. I ſhall therefore content myſelf with aſſiſting the memory of the ſtudent by the following table, in which he will find the name, origin, inſertion, and principal uſe of each muſcle deſcribed in few words, and occaſionally its etymology when it is of Greek derivation or difficult to be underſtood. Latin names that apply to the ſhape, direction, ſituation, origin, inſertion, ſize, or uſe of the ſeveral muſcles, ſeem to require no explanation.

A TABLE* of the MUSCLES.

Muscles ſituated under the integuments of the cranium -	*Name.*	*Origin.*	*Inſertion.*	*Uſe.*
	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.

* In this table the muſcles are arranged according to their ſituation, but it 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.

	Name.	*Origin.*	*Insertion.*	*Use.*
Muscles of the external ear -	1. Attollens 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. Retrahentes * 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.
—— 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.

[* Theſe are three ſmall ſlender muſcles. The inferior one is ſometimes wanting.

3. Trans-

	Name.	Origin.	Insertion.	Use.
	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.
MUSCLES of the noſe - - -	1. COMPRESSOR † 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.

† 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.

	Name.	Origin.	Insertion.	Use.
Muscles 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 nafal 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 molaris.	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 zygmaotic ſuture.	Into the angle of the mouth.	To inflate the cheek and raiſe the angle of the mouth.
	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. Bucci-

Name.	*Origin.*	*Insertion.*	*Use.*
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.
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. ORBI-

	Name.	Origin.	Insertion.	Use.
	10. ORBICULARIS *.			To ſhut the mouth by conſtringing 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 †.	Into the coronoid proceſs of the lower jaw.	To move the lower jaw upwards.
	2. MASSETER ‡.	From the malar proceſs of the os maxillare, and the lower edges	Into the baſis of the coronoid proceſs, and that part of the jaw which	To raiſe, and likewiſe to move the jaw a little forwards and backwards.

* 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.

† 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 radiated fibbres, converging and forming a ſtrong middle tendon.

‡ So called from its uſe in chewing, its derivation being from μασσάομαι, *manduco*, to eat.

Name.	*Origin.*	*Infertion.*	*Ufe.*
	of the os malæ, and of the zygomatic procefs of the os temporis.	fupports that and the condyloid procefs.	
3. Pterygoideus internus.	From the inner furface of the outer wing of the pterygoid procefs of the os fphenoides, and from the procefs of the os palati that helps to form the pterygoid foffa.	Into the lower jaw on its inner fide and near its angle.	To raife the lower jaw, and draw it a little to one fide.
4. Pterygoideus externus.	From the external ala of the pterygoid procefs, a fmall part of the adjacent os maxillare, and a ridge in the temporal	Into the fore part of the condyloid procefs of the lower jaw, and likewife of the capfular ligament.	To move the jaw forwards and to the oppofite fide ‡; and at the fame time to prevent the ligament of the joint from being pinched.

‡ This happens when the mufcle acts fingly. When both act, the jaw is brought horizontally forwards.

procefs

	Name.	Origin.	Insertion.	Use.
		procefs of the os fphenoides.		
Muscles fituated at the fore part of the neck - - - -	1. Latissimus colli *.	From the cellular membrane covering the pectoral; deltoid, and trapezius mufcles.	Into the fide of the chin, and integuments of the cheek.	To draw the cheeks and fkin of the face downwards.
	2. Mastoideus †.	From the upper part of the fternum, and from the upper and fore part part of the clavicle.	Into the maftoid procefs, and as far back as the lambdoidal future.	To move the head to one fide, or when both mufcles act, to bend it forwards.

* This broad and thin mufcular expanfion, which is fituated immediately under the common integuments, is by Winflow named *mufculus cutaneus*. Galen gave it the name of πλάτυσμα μῦωδες (*Platyfma-myoides*) the etymology of which is from πλαλυσμὸς *dilatatio*, and μῦς, mufculus, and εἶδος, *forma*.

† This on account of its two origins is by Albinus defcribed as two diftinct mufcles, which he names *fterno-maftoideus* and *cleido-maftoideus*.

	Name.	Origin.	Insertion.	Use.
Muscles ſituated between the trunk and the os hyoides - -	1. Costo-hyoideus ‡.	From the upper coſta of the ſcapula near its nitch; from part of a ligament that extends acroſs this nitch, 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.

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

3. Hyo-

	Name.	Origin.	Insertion.	Use.
	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.
Muscles situated between the os hyoides and and lower jaw	1. Digastricus *.	From a fossa at the root of the mastoid process.	Into the lower and anterior part of the chin.	To draw the lower jaw downwards.

* From δὶς & γαςὴρ (biventer) because it has two fleshy bellies with a middle tendon; this tendon passes through the stylo-hyoideus.

2. Stylo-

Name.	*Origin.*	*Insertion.*	*Use.*
2. Stylo-hyoideus †.	From the basis of the styloid process.	Into the side and forepart of the os hyoides near its base.	To draw the os hyoides obliquely upwards.
3. Mylo-hyoideus ‡.	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. ‖ Genio-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. Cerato-glossus §.	From the horn, basis, and appendix of the os hyoides.	Into the tongue laterally.	To draw the tongue downwards and inwards.

† In some subjects we meet with another muscle, which from its having nearly the same origin, insertion, and used as this, has been named *stylo-hoideus alter*.

‡ So named from its arising near the dentes molares (μύλοι) and its being inserted into the os hyoides.

‖ From γένειον, *mentum*, the chin.

§ From κέρας, *cornu* & γλῶσσα, *lingua*, the tongue.

Name.	*Origin.*	*Infertion.*	*Ufe.*
7. LINGUALIS.	Laterally from the root of the tongue.	Into the extremity of the tongue.	To fhorten the tongue and draw it backwards.
8. STYLO-GLOSSUS.	From the ftyloid procefs, and fometimes alfo from a ligament that extends from thence to the angle of the lower jaw.	Into the fide of the tongue from the root to near its tip.	To move the tongue backwards and to one fide.
9. STYLO-PHARYNGÆUS.	From the bafis of the ftyloid procefs.	Into the fide of the pharynx and pofterior part of the thyroid cartilage.	To raife the thyroid cartilage and pharynx, and likewife to dilate the latter.
10. CIRCUMFLEXUS-PALATI.	From near the bony part of the Euftachian tube, and from the fpinous procefs of the os fphenoides.	Into the femilunar edge of the os palati and the velum pendulum palati *.	To dilate and draw the velum obliquely downwards.

* This mufcle in its courfe, forms a round tendon, which after paffing over a kind of hook formed by the inner plate of the pterygoid procefs of the fphenoid bone, expands into a tendinous membrane.

	Name.	Origin.	Infertion.	Ufe.
	11. LEVATOR PALATI MOLLIS.	From the membranous part of the Euftachian tube, and the extremity of the os petrofum.	Into the velum pendulum palati.	To pull the velum backwards.
MUSCLES fituated about the fauces - -	1. PALATO-PHARYNGÆUS.	From the lower and anterior part of the cartilaginous extremity of the Euftachian tube*; the tendinous expanfion of the circumflexus palati; and the velum pendulum palati near the bafis and back part of the uvula.	Into the upper and pofterior part of the thyroid cartilage.	To raife the pharynx and thyroid cartilage, or to pull the velum and uvula backwards and downwards.

* The few fibres that arife from the Euftachian tube are defcribed as a diftinct mufcle by Albinus, under the name of *falpingo-pharyngæus.* They ferve to dilate the mouth of the tube.

2. CONSTRICTOR

	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 ‡.
	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	Into the middle of the pharynx.	To move the pharynx upwards and forwards, and to compress its upper part.

‡ This muscle and the *palato-pharyngæus* likewise serve to close the passage into the fauces, and to carry the food into the pharynx.

 last

	Name.	Origin.	Insertion.	Use.
		last dens molaris ‡,		
	2. CONSTRICTOR PHARYNGIS MEDIUS *.	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 †.	From the cricoid and thyroid cartilages.	Into the middle of the pharynx.	To compress part of the pharynx.
MUSCLES 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.

‡ 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*.

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

† The *crico-pharyngæus*, and *thyro-pharyngæus* of Douglas.

2. CRICO-

Name.	*Origin.*	*Insertion.*	*Use.*
2. Crico-arytænoidæus posticus.	From the cricoid cartilage posteriorly.	Into the basis of the arytænoid cartilage posteriorly.	To open the glottis.
3. Arytænoideus minor.	From the basis of one of the cartilaginæs arytænoideæ.	Near the extremity of the other arytænoid cartilage.	To draw the parts it is connected with towards each other.
4. Arytænoideus major.	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*.

* 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	Into the second cervical vertebra anteriorly.	To pull the neck to one side †.

† When both muscles act, the neck is drawn directly forwards.

dorsal

	Name.	Origin.	Insertion.	Use.
		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.		
MUSCLES at the fore part of the abdomen - -	1. OBLIQUUS EXTERNUS.	From the lower edges of the eight in-	Into the linea alba *, oſſa pubis †,	To compreſs and ſupport the viſcera, aſ-

* 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.

† 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.

ferior

Name.	*Origin.*	*Insertion.*	*Use.*
	inferior ribs, near their cartilages.	and ſpine of the ilium ‡.	ſiſt 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 vertebræ, the back part of the os ſacrum, the ſpine of the ilium, and back part of Fallopius's ligament *.	Into the cartilages of all the falſe ribs, linea alba †, and fore-part of the pubis.	To aſſiſt the obliquus externus.

‡ 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.

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

† 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.

3. TRANS-

Name.	Origin.	Insertion.	Use.
3. Transversalis.	From the cartilages of the ſeven inferior ribs ; the tranſverſe proceſſes of the laſt dorſal, and 4 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 *.	To compreſs the fore part of the abdomen, and to bend the trunk forwards.

* 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.

5. Pyra-

	Name.	Origin.	Insertion.	Use.
	5. PYRAMIDALIS ‖.	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.	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 §.	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.

‖ This muscle is sometimes wanting.

§ The fibres of this muscle pass towards the axilla in a folding manner, and with those of the latissimus dorsi form the arm-pit.

	Name.	Origin.	Insertion.	Use.
	3. Serratus * anticus.	From the upper edges of the 3d, 4th, and 5th ribs.	Into the coracoid procefs of the fcapula.	To move the fcapula forwards and downwards, or to elevate the ribs.
	4. Serratus magnus.	From the eight fuperior ribs.	Into the bafis of the fcapula.	To bring the fcapula forwards.
Muscles that concur in forming the thorax	1. Diaphragma §.			
	2. Levatores costarum.	From the tranfverfe proceffes of the laft cervical, and the eleven upper dorfal vertebræ.	Into the upper fide of each rib, near its tuberofity.	To move the ribs upwards and outwards.
	3. Intercostales externi.	From the lower edge of each upper rib.	Into the fuperior edge of each lower rib.	To elevate the ribs.

* This and fome other mufcles derive their name of *ferratus*, from their arifing by a number of tendinous or flefhy digitations, refembling the teeth of a faw (*ferra*).

§ For a defcription of the diaphragm, fee Chap. V. Sect. IV.

4. Inter-

Name.	*Origin.*	*Infertion.*	*Ufe.*
4. Intercostales interni ‡.			
5. Sterno-costales *.	From the cartilago enfiformis, lower and middle part of the fternum, and from the cartilage of the 3d rib.	Into the cartilages of the 2d, 3d, 4th, 5th, and 6th ribs.	To deprefs the cartilages of the ribs.

‡ The origin, infertion, and ufe of the internal intercoftals are fimilar to thofe of the external. The reader, however, will be pleafed to obferve, that the intercoftales externi occupy the fpaces between the ribs only from the fpine to their cartilages; from thence to the fternum, there being only a thin membrane, which is fpread over the intercoftales interni; and that the latter on the contrary extend only from the fternum to the angles of each rib.

The fibres of the external mufcles run obliquely forwards; thofe of the internal obliquely backwards. This difference in the direction of their fibres induced Galen to fuppofe that they were intended for different ufes, that the external intercoftals, for inftance, ferve to elevate, and the internal ones to deprefs the ribs. Fallopius feems to have been the firft who ventured to difpute the truth of this doctrine, which has fince been revived by Boyle, and more lately ftill by Hamberger, whofe theoretical arguments on this fubject have been clearly refuted by the experiments of Haller.

* Thefe confift of four, and fometimes five diftinct mufcles on each fide. Vefalius, and after him Douglas and Albinus, confider them as forming a fingle mufcle, which, on account of its fhape, they name *triangularis*. Verheyen, Winflow, and Haller, more properly defcribe them as fo many feparate mufcles, which, on account of their origin and infertion, they name *fterno-coftales*.

	Name.	Origin.	Insertion.	Use.
Muscles at the back part of the neck and trunk - - - -	1. Trapezius §, or cucullaris.	From the middle of the os occipitis, and the spinous processes of the two inferior cervical, and of all the dorsal vertebræ ‡.	Into the posterior half of the clavicle, part of the acromion, and the spine of the scapula.	To move the scapula, neck and head.
	2. Rhomboideus ‖.	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.

§ So named by Riolanus, from τράπεζα, on account of its quadrilateral shape. Columbus and others give it the name of *cucullaris*, from its resemblance to a monk's hood.

‡ The tendinous fibres of this muscle, united with those of its fellow, in the nape of the neck, from what is called the *ligamentum colli*.

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

3. Latis-

Name.	*Origin.*	*Insertion.*	*Use.*
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 vertebræ; alſo from the four inferior falſe ribs near their cartilages.	Into the os humeri, between its two tuberoſities.	To draw the os humeri downwards and backwards, and to roll it upon its axis.
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.

Name.	*Origin.*	*Insertion.*	*Use.*
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 *.	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.

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

Name.	*Origin.*	*Inſertion.*	*Uſe.*
8. COMPLEXUS §.	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 ||.	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.

§ So named on account of its complicated ſtricture.

|| So named from its origin from the neck (τραχηλὸς) and its inſertion into the maſtoid proceſs.

12. OBLIQUUS

Name.	*Origin.*	*Insertion.*	*Use.*
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 1ſt cervical vertebra.	To draw the face towards the ſhoulder, and to move the firſt vertebra upon the ſecond.
14. SACRO-LUMBALIS †.	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.

† Several thin faſcculi of fleſhy fibres ariſe from the lower ribs, and terminate in the inner ſide of this muſcle. Steno names them *muſculi ad ſacro lumbalem acceſſorii.* The ſacro lumbalis likewiſe ſends off a fleſhy flip 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.

15. LONGISSIMUS

Name.	*Origin.*	*Infertion.*	*Ufe.*
15. Longissimus dorsi §.	The fame as that of the facro lumbalis.	Into the tranfverfe proceffes of the dorfal vertebræ.	To ftretch the vertebræ of the back, and keep the trunk erect.
16. Spinalis dorsi.	From the fpinous proceffes of the uppermoft lumbar, and lowermoft dorfal vertebræ.	Into the fpinous proceffes of the nine fuperior dorfal vertebræ.	To extend the vertebræ.
17. Semi-spinalis dorsi.	From the tranfverfe proceffes of the 7th, 8th, 9th and 10th vertebræ of the back.	Into the fpinous proceffes of the four uppermoft dorfal, and lowermoft of the cervical vertebræ.	To extend the fpine obliquely backwards.

§ At the upper part of this mufcle a broad thin ayer of flefhy fibres is found croffing, and intimately adhering to it. This portion, which is defcribed by Albinus, under the name of *tranfverfalis cervicis*, may very properly be confidered as an appendage to the longiffimus dorfi. It arifes from the tranfverfe proceffes of the five or fix fuperior dorfal vertebræ, and is inferted into the tranfverfe proceffes of the fix inferior cervical vertebræ. By means of this appendage the longiffimus dorfi may ferve to move the neck to one fide, or obliquely backwards.

18. Multifidus

Name.	*Origin.*	*Insertion.*	*Use.*
18. MULTIFIDUS SPINÆ ‖.	From the os facrum, ilium, oblique and tranfverfe proceffes of the lumbar vertebræ, tranfverfe proceffes of the dorfal, and four of the cervical vertebræ.	Into the fpinous proceffes of the lumbar, dorfal, and fix of the cervical vertebræ.	To extend the back and draw it backwards, or to one fide.
19. SPINALIS CERVICIS.	From the tranfvefe proceffes of the five or fix uppermoft dorfal vertebræ.	Into the fpinous proceffes of the 2d, 3d, 4th, 5th, and 6th cervical vertebræ.	To ftretch the neck obliquely backwards.

‖ Anatomifts in general have unneceffarily multiplied the mufcles of the fpine. Albinus has the merit of having introduced greater fimplicity into this part of myology. Under the name of *multifidus fpinæ*, he has very properly included thofe portions of mufcular flefh intermixed with tendinous fibres, fituated clofe to the back part of the fpine, and which are defcribed by Douglas, under the names of *tranfverfales colli, dorfi & lumborum.*

Name.	*Origin.*	*Inſertion.*	*Uſe.*
20. Scalenus *.	From the tranſverſe proceſſes of the five inferior cervical vertebræ.	Into the upper and outer part of the firſt and ſecond ribs.	To move the neck forwards, or to one ſide.
21. Inter-spinales †.	From between the ſpinous proceſſes of the ſix inferior cervical vertebræ.	Into the ſpinous proceſſes of the vertebræ above.	To draw the ſpinous proceſſes towards each other.
22. Inter-transversales §.	From between the tranſvervſe proceſſes of the vertebræ.	Into the tranſverſe proceſſes of the vertebræ above.	To draw the tranſverſe proceſſes towards each other.

* The ancients gave it this name from its reſemblance to an irregular triangle (σκαληνὸς.) 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.

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

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

	Name.	Origin.	Insertion.	Use.
Muscles within the cavity of the abdomen, on the anterior and lateral parts of the spine - - - -	1. Psoas parvus ‖.	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.

‖ This and the following pair of muscles derive their name of *psoas*, from ψόα, *lumbus*, on account of their situation at the anterior part of the loins.

3. Iliacus

Name.	*Origin.*	*Infertion.*	*Ufe.*
3. ILIACUS INTERNUS.	From the inner lip, hollow part, and edge of the os ilium.	In common with the pfoas magnus.	To affift the pfoas magnus.
4. QUADRATUS LUMBORUM ‡.	From the pofterior part of the fpine of the ilium.	Into the tranfverfe proceffes of the four uppermoft lumbar vertebræ, the inferior edge of the laft rib, and the fide of the lowermoft dorfal vertebra.	To fupport the fpine, or to draw it to one fide.
5. COCCYGÆUS.	From the pofterior and inner edge of the fpine of the ifchium.	Into the lower part of the os facrum, and almoft the whole length of the os coccygis laterally.	To draw the os coccygis forwards and inwards ‖.

‡ So called from its fhape, which is that of an irregular fquare.
‖ Some of the fibres of this mufcle are united with thofe of the levator ani, fo that it affifts in clofing the lower part of the pelvis.

	Name.	Origin.	Insertion.	Use.
Muscles on the ſcapula, and upper part of the os humeri	1. Deltoides*.	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.
	3. Infra-spinatus.	From the baſis and ſpine of the ſcapula.	Into the upper and middle part of the tuberoſity.	To roll the os humeri outwards.
	4. Teres minor §.	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	To aſſiſt in the rotatory motion of the arm.

* So named from its ſuppoſed reſemblance to the Greek Δ reverſed.

§ This and the following pair are called *teres*, from their being of a long and round ſhape.

head

	Name.	*Origin.*	*Insertion.*	*Use.*
			head of the biceps.	
	6. Subscapularis.	From the basis, superior and inferior costæ 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 ‖.	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 brachii.	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.

‖ This muscle affords a passage to the musculo-cutaneous nerve.

2. Brachialis

	Name.	*Origin.*	*Insertion.*	*Use.*
	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 the fore-arm.
	3. Tricepsbrachii.	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.
Muscles 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

Name.	*Origin.*	*Infertion.*	*Ufe.*
2. EXTENSOR CARPI RADIALIS LONGUS.	Immediately below the origin of the fupinator longus.	Into the upper part of the metacarpal bone of the fore-finger.	To extend the wrift.
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 affift the extenfor longus.
4. EXTENSOR DIGITORUM COMMUNIS.	From the outer condyle of the os humeri.	Into the back part of all the bones of the four fingers.	To extend the fingers.
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 affift in extending the wrift.

Name.	*Origin.*	*Insertion.*	*Use.*
7. ANCONÆUS ‡.	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 *.	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 §.	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.

‡ So called from ἀγκὼν, *cubitus*.

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

§ 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.

Name.	*Origin.*	*Infertion.*	*Ufe.*
11. PRONATOR TERES.	From the outer condyle of the os humeri, and coronoid procefs of the ulna.	Into the anterior and convex edge of the radius, near its middle.	To roll the hand inwards.
12. PERFORATUS ‖.	From the inner condyle of the os humeri, inner edge of the coronoid procefs of the ulna, and upper and anterior part of the radius.	Into the fecond bone of each finger.	To bend the fecond joint of the fingers.
13. SUPINATOR BREVIS.	From the outer condyle of the os humeri, and pofterior furface and outer edge of the ulna.	Into the anterior, inner, and upper part of the radius.	To roll the radius outwards.

‖ This mufcle is named *perforatus*, on account of the four tendons in which it terminates, being perforated by thofe of another mufcle, the perforans.

Name.	*Origin.*	*Insertion.*	*Use.*
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 fore-finger.	To extend the fore-finger.
18. 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

	Name.	Origin.	Insertion.	Use.
	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 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 *.	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 §.
	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.

* So named from their being ſhaped ſomewhat like the *lumbricus* or earth-worm.

§ 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.

3. OPPONENS.

Name.	*Origin.*	*Insertion.*	*Use.*
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. Adductor 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 indicis.	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.
. Palmaris brevis.	From the internal annular liga-	Into the os piſiforme, and the	To contract the palm of the hand.

ment,

Name.	Origin.	Insertion.	Use.
	ment, and aponeurofis palmaris.	fkin covering the abductor minimi digiti.	
8. ABDUCTOR MINIMI DIGITI.	From the internal annular ligament and os pififorme.	Into the fide of the firft bone of the little finger.	To draw the little finger from the reft.
9. FLEXOR PARVUS MINIMI DIGITI.	From the os unciforme and internal annular ligament.	Into the firft bone of the little finger.	To bend the little finger.
10. ADDUCTOR 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 reft.
11. INTEROSSEI INTERNI. —— EXTERNI.	Situated between the metacarpal bones.		To extend the fingers and move them towards the thumb †.

† The third interoffeus internus (for there are four of the externi and three of the interni) differs from the reft in drawing the middle finger from the thumb.

	Name.	Origin.	Insertion.	Use.
Muscles at the back-part of the pelvis, and upper-part of the thigh - - -	1. Glutæus * maximus.	From the ſpine of the ilium, poſterior ſacro-iſchiatic ligaments, os ſacrum, and os coccygis.	Into the upper part of the *linea aſpera* of the os femoris.	To extend the thigh and aſſiſt in its rotatory motion.
	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 aſſiſt the glutæus maximus.
	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 two former.
	4. Pyriformis§.	From the anterior part of the os ſacrum.	Into a cavity at the root of the trochanter major.	To roll the thigh outwards.

* From γλουτός, *nates*.

§ So named from its pear-like ſhape.

Name.	*Origin.*	*Insertion.*	*Use.*
5. GEMINI ‖.	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.	To roll the thigh outwards.
7. QUADRATUS ‡ FEMORIS.	From the tuberosity of the ischium.	Into a ridge between the trochanter major and trochanter minor.	To move the thigh outwards.

‖ 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.

‡ This muscle is not of the square shape its name would seem to indicate.

	Name.	Origin.	Insertion.	Use.
Muscles on the thigh † - - -	1. Biceps cruris.	By two heads; one from the tuberosity of the ischium, the other from the linea aspera near the insertion of the glutæus maximus.	Into the upper and back part of the fibula ‡.	To bend the leg.
	2. Semi-tendinosus.	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 §.	From the tuberosity of the ischium.	Into the upper and back part of the head of the tibia.	To bend the leg.

† 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.

‡ The tendon of this muscle forms the *outer ham-string*.

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

4. Tensor

Name.	*Origin.*	*Insertion.*	*Use.*
4. Tensor Vaginæ femoris.	From the ſuperior and anterior ſpinous proceſs of the ilium.	Into the inner ſide of the faſcia lata.	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 *.
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.

* Spigalius was the firſt who gave this the name of *ſartorius*, or the taylors muſcle, from its uſe in croſſing the legs.

8. Vastus

Name.	*Origin.*	*Insertion.*	*Use.*
8. VASTUS EXTERNUS †.	From the anterior and lower part of the great trochanter, and the outer edge of the linea aſpera.	To the upper and lateral 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 ‡.	From the outer and anterior part of the leſſer trochanter.	Into the upper part of the patella.	To extend the leg.

† 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.

‡ 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.

11. PECTINALIS.

Name.	*Origin.*	*Insertion.*	*Use.*
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 bend the thigh.
12. ADDUCTOR LONGUS FEMORIS †.	From the upper and fore-part of the os pubis.	Near the middle and back part of the linea aspera.	To bend the thigh.
13. ADDUCTOR BREVIS FEMORIS.	From the fore-part of the ramus of the os pubis.	Into the inner and upper part of the linea aspera.	To bend the thigh and move it inwards.
14. ADDUCTOR MAGNUS FEMORIS.	From the lower and fore-part of the ramus of the os pubis.	Into the whole length of the linea aspera.	To move the thigh inwards and assist in bending it.
15. OBTURATOR EXTERNUS.	From part of the obturator ligament, and the inner half of the circumference of	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.

† 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.*

the

	Name.	Origin.	Insertion.	Use.
		the foramen thyroideum.		
Muscles on the leg - - - - -	1. Gastrocremius * 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. Gastrocremus ‡ 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.

* Γαςροκνημία; *sura*, the calf of the leg.
‡ This muscle is by some anatomists named *soleus*, on account of its being shaped like the sole-fish.

Name.	*Origin.*	*Insertion.*	*Use.*
3. Plantaris §.	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 ‡.	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 †.	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.

§ 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.

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

† 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.

6. Flexor

Name.	*Origin.*	*Insertion.*	*Use.*
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.
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.

Name.	*Origin.*	*Insertion.*	*Use.*
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.

	Name.	Origin.	Insertion.	Use.
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.

Name.	*Origin.*	*Infertion.*	*Ufe.*
4. Abductor minimi digiti.	From the outer tubercle of the os calcis, the root of the metatarfal bone of the little toe, and alfo from the aponeurofis plantaris.	Into the outer fide of the firft joint of the little toe.	To draw the little toe outwards.
5. Lumbricales pedis.	From the tendons of the flexor longus digitorum pedis.	Into the tendinous expanfion 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 alfo from the inferior part of the os cuneiforme externum.	By two tendons into the firft joint of the great toe.	To bend the firft joint of the great toe.
7. Adductor pollicis pedis.	From near the roots of the metatarfal bones of the 2d, 3d, and 4th toes.	Into the outer os fefamoideum, or firft joint of the great toe.	To draw the great toe nearer to the reft, and alfo to bend it.

8. Trans-

Name.	*Origin.*	*Inſertion.*	*Uſe.*
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 †.	Situated between the metatarſal bones.		
——— EXTERNI ‡.			

† The interoſſei interni are three in number, their uſe is to draw the ſmaller toes towards the great toe.

‡ 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.

CHAP.

CHAP. IV.

Of the Abdomen, or Lower Belly.

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

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 envelops 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.

SECTION I.

Of the Peritonæum.

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.

vity. The aorta and vena cava likewife derive a covering from the fame membrane, which feems to be a part of the cellular membrane we have already defcribed.

The peritonæum, by its productions and reduplications, envelops the greateft part of the abdominal vifcera. It is foft, and capable of confiderable extenfion; and is kept fmooth and moift by a vapour, which is conftantly exhaling from its inner furface, and is returned again into the circulation by the abforbents.

This moifture not only contributes to the foftnefs of the peritonæum, but prevents the attrition, and other ill effects which would otherwife probably be occafioned, by the motion of the vifcera upon each other.

When this fluid is fupplied in too great a quantity, or the abforbents become incapable of carrying it off, it accumulates, and conftitutes an afcites or dropfy of the belly; and when by any means the exhalation is difcontinued, the peritonæum thickens, becomes difeafed, and the vifcera are fometimes found adhering to each other.

The peritonæum is not a very vafcular membrane. In a found ftate it feems to be endued with little or no feeling, and the nerves that pafs through it appear to belong to the abdominal mufcles.

SECTION II.

Of the Omentum.

THE omentum, epiploon, or cawl, is a double membrane, produced from the peritonæum. It is interlarded with fat, and adheres to the ftomach, fpleen, duodenum, and colon, from thence hanging down loofe and floating on the furface of the inteftines. Its fize is different in different fubjects. In fome it defcends as low as the pelvis, and it is commonly longer at the left-fide than the right.

This part, the fituation of which we have juft now defcribed, was the only one known to the ancients under the name of *epiploon*, but at prefent we diftinguifh three omenta, viz. *omentum magnum colico gaftricum*, *omentum parvum hepatico*

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 distended with air (*x*). The vessels of the omentum parvum

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

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.

SECTION

SECTION III.

Of the Stomach.

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 ſituation is not much higher than the other, which is ſtiled 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 is ſuppoſed to be ſecreted by certain minute glands (*y*) ſeated in the nervous tunic,

(*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.

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.

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.

SECTION 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 of the ſtomach—Its upper part where the aliment is received, is ſhaped ſomewhat like a funnel, and is called the *pharynx*.

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.

SECTION 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.

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

the lower portion of the canal down to the anus.

Each of theſe parts has its ſubdiviſions.—The ſmall inteſtines being diſtinguiſhed into duodenum, jejunum and ileum, 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 twelve 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 *ileum*, which of itſelf exceeds the united length of the duodenum and jejunum, and has received its name from its numerous circumvolutions. The large circum-

circumvolution of the ileum, covers the firſt of the large inteſtines called the *cœcum* (*z*), 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 cœci*.

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*.

(*z*) 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 cœcum only to the little appendix, which has likewiſe been called the vermiform appendix, from its reſemblance to a worm in ſize and length.

There are three ligamentous bands extending through 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*.

Some

Some authors have confidered thefe plaits as tending to retard the motion of the fæces, in order to afford more time for the feparation of the chyle; but there are others who attribute to them a different ufe: they contend, that thefe valves by being naturally inclined downwards, cannot impede the defcent of the fæces, but that they are intended to prevent their return upwards.

They are probably deftined for both thefe ufes; for although thefe folds incline to their lower fide, yet the inequalities they occafion in the canal are fufficient to retard in fome meafure the progreffive motion of the fæces, and to afford a greater furface for the abforption of chyle, and their natural pofition feems to oppofe itfelf to the return of the aliment.

Besides thefe *valvulæ convenientes*, there is one more confiderable than the reft, called the *valve of the colon*; which is found at that part of the canal, where the inteftinum ileum is joined to the colon. This valve permits the alimentary pulp to pafs downwards, but ferves to prevent its return upwards; and it is by this

this valve, that glyſters are prevented from paſſing into the ſmall inteſtines (*a*).

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 (*b*). This mucus promotes the deſcent of the alimentary pulp, and

(*a*) 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.

(*b*) 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 every where 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.

in

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 hæmorrhoidal, 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 conſequently follows, has probably occaſioned them to be called *hæmorrhoidal* veins.

The nerves of the inteſtines are derived from the eighth pair.

SECTION VI.

Of the Meſentery.

THE name of the meſentery implies its ſituation amidſt the inteſtines. It is in fact a part of the peritonæum, being a reduplication (*c*) of that membrane from each ſide

(*c*) 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.

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 introſuſpection 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* or *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.

To

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 dilatability 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*; (*d*) 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.

SECTION VII.

Of the Pancreas.

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

(*d*) The *hernia congenita* will be conſidered with the male organs of generation, with which it is intimately connected.

membrane

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 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.

SECTION VIII.

Of the Liver.

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 umbilical 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 umbilical veſſels enter, it is found divided into two lobes—of thefe the largeft is placed in the right hypocondrium; the other, which covers part of the ftomach, is called the little lobe. All the veffels which go to the liver pafs in at the fiffure we have mentioned, and the production of the peritonæum, which invefts the liver, accompanies them in their paffage, and furrounds them like a glove.—The credit of this difcovery is due to an Englifh anatomift, in honour of whom this membranous production is now univerfally known by the name of *Gliffon*'s *capfula*.

The liver was confidered by the ancients, as an organ deftined to prepare and perfect the blood; but later difcoveries have proved that this opinion was wrong, and that the liver is a glandular fubftance formed for the fecretion of the bile.

The blood is conveyed to the liver by the hepatic artery and the vena portæ. This is contrary to the mode of circulation in other parts, where veins only ferve to carry off the redundant blood; but in this vifcus the hepatic artery, which is derived from the cæliac, is wholly deftined for its nourifhment; and the vena

portæ,

porta, which is formed by the union of the veins from all the principal abdominal viſcera, only furniſhes the blood from which the bile is to be ſeparated: ſo that theſe two ſeries of veſſels ſerve very diſtinct purpoſes. The vena portæ, as it is ramified through the liver, performs the office both of an artery and a vein; for it not only carries blood to the liver, but after having depoſited the bile, brings back not only its own redundant blood, but likewiſe that of the hepatic artery into the vena cava.

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 *pori biliarii*; theſe uniting together like the excretory ducts in the pancreas, gradually form larger ones, which at length terminate in a conſiderable channel called *ductus hepaticus.*

SECTION

SECTION IX.

Of the Gall-bladder.

THE gall-badder 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, or villous 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 choledochus 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.

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 na-

* Mem. de l'Acad. des Sciences, 1767.

ture of milk, and a calcareous earth which is ſlightly ferruginous.

Its definition ſeems ſufficiently to point out the uſes for which it is intended (*e*).—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, 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

(*e*) The ancients, who were not acquainted with the real uſe of the liver, conſidered the bile as an excrementitious and uſeleſs fluid.

blood

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 *hepaticyſtic 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; the difference in the colour, conſiſtence, and taſte of the bile, being 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* (g); and 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.

SECTION X.

Of the Spleen.

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, ſituat-

(g) Theſe concretions ſometimes remain in the gall-bladder without cauſing any uneaſineſs. Dr. Heberden relates, that a gall-ſtone weighing two drachms 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. Tranſ.* Vol. II.

ed 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 towards 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 venæ 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 it 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.

SECTION XI.

Of the Glandulæ Renales, Kidneys, and Ureters.

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.

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

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 (*k*). The outer part is *glandular* or *cortical*—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

(*k*) The kidneys in the fœtus are diſtinctly lobulated, but in the adult they become perfectly firm, ſmooth, and regular.

forming larger canals, at length terminate in ten or twelve little protuberances called *papillæ*, the orifices of which may be feen without the affiftance of glaffes. Thefe papillæ open into a fmall cavity or refervoir called the *pelvis* of the kidney, and formed by a diftinct membranous bag which embraces the papillæ. From this pelvis the urine is conveyed through a membranous canal which paffes out from the hollow fide of the kidney, a little below the blood-veffels, and is called *ureter*.

The *ureters* are each about as large as a common writing-pen. They are fomewhat curved in their courfe from the kidneys, like the letter *f*, and at length terminate in the pofterior, and almoft inferior part of the bladder, at fome diftance from each other. They pafs into the bladder in the fame manner as the *ductus choledochus communis* paffes into the *inteftinum duodenum*, not by a direct paffage, but by an oblique courfe between the two coats; fo that the difcharge of urine into the bladder is promoted, whilft its return is prevented.— Nor does this mode of ftructure prevent the paffage of fluids only from the bladder into the ureters, but likewife air:—for air thrown

into

into the bladder inflates it, and it continues to be diftended if a ligature is paffed round its neck; which feems to prove fufficiently, that it cannot pafs into the ureters.

SECTION XII.

Of the Urinary Bladder.

THE *urinary bladder* is a membranous and mufcular bag of an oblong roundifh fhape, fituated in the pelvis, between the os pubis and inteftinum rectum in men, and between the os pubis and vagina in women. Its upper and wideft part is ufually called the *bottom*, its narrower part the *neck* of the bladder; the former only is covered by the peritonæum.

The bladder is formed of two coats, connected together by means of cellular membrane. The external, or *mufcular* coat, is compofed of irritable, and of courfe mufcular fibres, which are moft collected around the neck of the bladder, but not fo as to form a diftinct mufcle, or *fphincter*, as the generality of anatomifts have hitherto fuppofed.

THE inner or *villous* coat refembles the villous tunic of the inteftines, and like that is provided with a mucus, which defends it againft the acrimony of the urine.

Of the Urine.

IT will be eafily conceived from what has been faid, that the kidneys are two glandular bodies, through which a faline and excrementitious fluid called *urine*, is conftantly filtring from the mafs of blood.

WHILE only a fmall quantity of urine is collected in the bladder, it excites no kind of uneafinefs; but when a greater quantity is accumulated, fo that the bladder is diftended in a certain degree, it excites in us a certain fenfation, which brings on as it were a voluntary contraction of the bladder to promote its difcharge:—but this contraction is not effected by the mufcular fibres of the bladder alone, for all the abdominal mufcles contract in obedience to our will, and prefs downwards all the vifcera of the lower belly; and thefe

thefe powers being united, at length overcome the refiftance of the fibres furrounding the neck of the bladder, which dilates and affords a paffage to the urine through the urethra.

THE frequency of this evacuation depends on the quantity of urine fecreted; on the degree of acrimony it poffeffes; on the fize of the bladder, and on its degree of fenfibility.

THE urine varies much in its colour and contents. Thefe varieties depend on age, fex, climate, diet, and other circumftances. In infants it is generally a clear watery fluid, without fmell or tafte. As we advance in life, it acquires more colour and fmell, and becomes more impregnated with falts. In old people it becomes ftill more acrid and fœtid.

IN a healthy ftate it is nearly of a ftraw colour.—After being kept for fome time, it depofits a tartarous matter, which is found to be compofed chiefly of earth and falt, and foon incrufts the fides of the veffel in which it is contained. While this feparation 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

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 diſtended with it, but not a drop of urine will be found to have paſſed into the bladder. 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

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.

SECTION XIII.

Of Digeſtion.

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

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 mufcles, covered by the cuticle, which is continued over the whole inner furface of the mouth, like a fine and delicate membrane—befide this membrane, the infide of the mouth is furnifhed with a fpongy and very vafcular fubftance called the gums, by means of which the teeth are fecured in their fockets—a fimilar fubftance 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 offa maxillaria and offa palati, and terminates in a foft, fmall, and conical body, named *uvula*; which appears, as it were fufpended from the middle of the arch over the bafis of the tongue.

The velum pendulum palati performs the office of a valve between the cavity of the mouth

mouth and the pharynx, being moved by ſe-veral muſcles (*a*).

The *tongue* is compoſed of ſeveral muſcles (*b*) 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*.

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

(*a*) Theſe are the *circumflexus palati, levator palati mollis, palato-pharyngæus, conſtrictor iſthmi faucium,* and *azygos uvulæ*. See page 147, &c ſeq.

(*b*) Theſe are, the *genio-gloſſus, cerato-gloſſus, lingualis,* and *ſtylo-gloſſus*. See page 146, &c ſeq.

the

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 *amygdales*.

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 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 *ſub-*

lingual

lingual glands, which are ſituated at the root of the tongue, and the *glands of the palate*, which are ſeated in the velum palati, 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.

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 per-

ſpiration

ſpiration 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 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.

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, which 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—ſuch a diſpoſition actually takes place in a manner we will endeavour to deſcribe.

The *trachea arterea* 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 mufcles deftined for that purpofe; and confequently drawing the fore-part of the pharynx with it, that opening is fully dilated. When the aliment has reached the pharynx, its defcent is promoted by its own proper weight, and by the mufcular fibres of the œfophagus, which continue to contract from above downwards, until the aliment has reached the ftomach. That thefe fibres have no inconfiderable fhare in deglutition, any perfon may experience, by fwallowing with his head downwards, when the defcent of the aliment cannot poffibly be effected by its weight.

It is neceffary that the noftrils and the lungs fhould communicate with the mouth, for the purpofes of fpeech and refpiration: but if the moft minute part of our food happens to be introduced into the trachea, it never fails to produce a violent cough, and fometimes the moft alarming fymptoms—this is liable to happen when we laugh or fpeak in the act of deglutition—the food is then faid to have paffed the wrong way; and indeed this is not improperly expreffed, for death would foon 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

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 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. 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, is then no longer able to refift the power of that menftruum, which it had itfelf formed for the digeftion of its contents: the procefs of digeftion appearing to be continued after death. This is confirmed by what happens in the ftomachs of fifhes: they frequently fwallow without maftication, fifh which are larger than the digefting parts of their ftomach can contain, and in fuch cafes, that part which is taken into the ftomach, is more or lefs diffolved, while that part which remains in the œfophagus is perfectly found; and here, as well as in the human body, the digefting part of the ftomach is often reduced to the fame ftate as the digefted part of the food.—Thefe appearances lead to prove, that digeftion is not effected by a mechanical power, by contractions of the ftomach, or by heat; but by a fluid fecreted in the coats of the ftomach, which is poured into its cavity, and there animalizes the food, or affimilates it to the nature of blood.

The food, after having remained during one, two, or three hours in the ftomach, is converted into a greyifh pulp, which is ufually

called

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, thro' 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.

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 defcribed, conftitutes a very mild, fweet, and whitifh fluid, refembling milk, and diftinguifhed by the name of *chyle*. This fluid is abforbed by the lacteal veins, which convey it into the circulation, where, by being affimilated into the nature of blood, it affords that fupply of nutrition, which the continual wafte of the body is found to require.—The other, is the remains of the alimentary mafs deprived of all its nutritious particles, and containing only fuch parts as were rejected by the abforbing mouths of the lacteals. This groffer part, called the *fæces*, paffes on through the courfe of the inteftines, to be voided at the anus, as will be explained hereafter; for this procefs in the œconomy cannot be well underftood, till the motion of refpiration has been explained. But the ftructure of the inteftines is a fubject which may be properly defcribed in this place, and deferves to be attended to.

It has been already obferved, that the inteftinal canal is five or fix times as long as the body, and that it forms many circumvolutions in the cavity of the abdomen, which it traverfes from the right to the left, and again from

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, 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.

SECTION

SECTION XIV.

Of the Courſe of the Chyle, and of the Lymphatic Syſtem.

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 *ileum*,) which are deſtined to imbibe the nutritious fluid or chyle. Theſe veſſels which were diſcovered by Aſellius in 1622 (*o*), paſs obliquely, through

(*o*) We are informed by Galen, that the lacteals had been ſeen by Eraſiſtratus in kids, 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 his 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 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 ſtiled *venæ lacteæ primi 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 depoſit 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, af-

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.

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ter 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 (*p*) 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*.

Opportunities of obſerving the lacteals in the human ſubject do not often occur; but they may eaſily be 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

(*p*) Hewſon's Exp. Inq. Part. II.

part

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 ſtiled 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.

THE *lymphatic veins* (*q*) are minute pellucid tubes, which, like the lacteals, direct their courſe towards the centre of the body, where

(*q*) The arteries in their courſe through the body becoming gradually too minute to admit the red globules of the blood, have then been ſtiled *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 no where but in the cavernous cells of the penis, the erection of which is occaſioned by a diſtenſion of thoſe cells with arterial blood.

they

they pour a colourlefs 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 feem to form the lower extremity of this canal, or *receptaculum chyli*, which may be confidered as the great trunk of the lymphatic fyftem. The lacteals open into it near the fame place, and the lymphatics from all the upper parts of the body, pour their lymph into different parts of this duct as it runs upwards, to terminate in the left fubclavian vein.

As the lymphatics commonly lie clofe to the large blood-veffels, a ligature paffed round the crural artery in a living animal, by including the lymphatics, will occafion a diftenfion of thefe veffels below the ligature, fo as to demonftrate them with eafe; and a ligature paffed round the thoracic duct, inftantly after killing an animal, will, by ftopping the courfe of its contents into the fubclavian vein, diftend not only the lacteals, but alfo the lymphatics in the abdomen and lower extremities, with their natural fluids (*r*).

(*r*) In the dead body they may be eafily demonftrated by opening the artery ramifying through any vifcus, as

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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 (*s*), ſeems to render it probable, that like the blood-veſſels, they have a muſcular coat.

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

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.

(*s*) Sur le mouvement du Sang. Exp. 295, 298.

much

much more common in thefe veffels than in the red veins. Thefe valves are ufually in pairs, and ferve to promote the courfe 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 pafs in their courfe through the mefentery; and it is to be obferved, that the lymphatics pafs through fimilar glands in their way to the thoracic duct.—Thefe glands are all of the conglobate kind, but the changes, which the chyle and lymph undergo in their paffage through them, have not yet been afcertained.

The *lymphatic veffels* begin from furfaces and cavities in all parts of the body as *abfor-bents*.—This is a fact now univerfally allowed; but how the fluids they abforb are poured into thofe cavities, is a fubject of controverfy. —The contents of the abdomen, for inftance, were defcribed as being conftantly moiftened by a very thin watery fluid.—The fame 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 thofe cavities through the minute ends of arteries, or tranfuded through their

coats,

coats, are the points in difpute. We cannot here be permitted to relate the many ingenious arguments that have been advanced in favour of each of thefe opinions; nor is it perhaps of confequence to our prefent purpofe, to enter into the difpute.—It will be fufficient if the reader can form an idea of what the lymph is, and of the manner in which it is abforbed.

The *lymph*, from its tranfparency and want of colour, would feem to be nothing but water; and hence the firft difcoverers of thefe veffels ftiled them *ductus aquofi*—but experiments prove, that the lymph of an healthy animal coagulates by being expofed to the air, or a certain degree of heat, and likewife by being fuffered to reft; feeming to agree in this property, with that part of the blood called the *coagulable lymph*.—This property of the lymph leads to determine its ufe, in moiftening and lubricating the feveral cavities of the body, in which it is found; and for which, by its gelatinous principle, it feems to be much better calculated than a pure and watery fluid would be, for fuch it has been fuppofed to be by fome anatomifts.

The mouths of the *lymphatics* and *lacteals*, by acting as capillary tubes, ſeem to abſorb the *lymph* and *chyle* 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.—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 muſular 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.

SECTION

SECTION XV.

Of the Male Organs of Generation.

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 destined 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 (*u*).—By this disposition

(*u*) 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 tion they are very wifely protected from the injuries to which they would be liable to be expofed, from the different pofitions of the child at the time of parturition.

The tefticles in this ftate are loofely attached to the *pfoæ mufcles*, 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 likewife to the fcrotum, by means of a fubftance, which Mr. Hunter calls the *ligament* or *gubernaculum teftis*, becaufe it

to a fuppofed laceration of the peritonæum; but later obfervations, by pointing out the fituation of the tefticles in the fœtus, have led to prove, that the teftis as it defcends into the fcrotum, carries with it a portion or elongation of the peritonæum, which becomes its *tunica vaginalis* or a kind of fac, in which the tefticle is lodged, as will be explained in the courfe of this fection. The communication between this fac and the cavity of the abdomen, is ufually foon cut off; but in fome fubjects it continues open during life; and when an *hernia* or defcent of the ieteftine takes place in fuch a fubject, it does not pufh down a portion of the peritonæum before it, as it muft otherwife neceffarily do, but paffes at once through this opening, and comes in contact with the naked tefticle, conftituting that particular fpecies of rupture, called *hernia congenita*.

connects

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 peritonæum, 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 peritonæal 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 in the hedgehog, and ſome other quadrupeds, whoſe teſticles remain in the abdomen during life.

The

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* (*y*), 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

((*y*) 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, 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 (*a*). 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 epididymis; 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 con-

(*a*) 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.

fine

ſine the growth of the teſtis and epididymis 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 exrcetory 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 ſuppoſed 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 depoſits 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* (*a*), 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 ex-

(*a*) 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.

ternally,

ternally, ſituated obliquely between the rectum and the lower part of the bladder, and uniting together at the lower extremity: From theſe reſervoirs, 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 confidered as the vehicle or active organ of procreation, is compofed of two columns, the *corpora cavernofa* and *corpus fpongiofum*.—The *corpora cavernofa*, which conftitute the greateft part of the penis, may be defcribed as two cylindrical, ligamentous tubes, each of which is compofed of an infinite number of minute cells of a fpongy texture, which communicate with each other. —Thefe two bodies are of a very pliant texture, and capable of confiderable diftenfion; and being united laterally to each other, occafion by this union, a fpace above and another below.—The uppermoft of thefe fpaces is filled by the blood-veffels, and the lower one, which is larger than the other by the urethra. Thefe two cavernous bodies are at firft only feparated by a partition of tendinous fibres, which allow them to communicate with each other; but they afterwards divaricate from each other like the branches of the letter Y, and diminifhing gradually in fize, are attached, one on each fide, by means of the *ligamentum fufpenforium penis* to the *ramus ifchii*, and to the inferior portion of the os pubis.

THE *corpus ſpongioſum penis*, or *corpus ſpongioſum urethræ*, as it is ſtiled 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

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* (*c*); and Littre (*d*) speaks of a gland situated near the prostate, as being destined for the same use.

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

(*c*) 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.

(*d*) Memoires de l'Acadamie Royale des Sciences, 1700.

have

have obſerved, is occaſionally diſcharged into it from the veſiculæ ſeminales. The direction of this canal being firſt under and then before the pubis, occaſion 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*. 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.

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 arife from the great fciatic nerve, and accompany the arteries in their courfe through the penis.

We have now defcribed the anatomy of this organ, and there only remains to be explained, how it is enabled to attain that degree of firmnefs and diftenfion, which is effential to the great work of generation.

The greateft part of the penis has been fpoken of, as being of a fpongy and cellular texture, plentifully fupplied with blood-veffels and nerves, and as having mufcles to move it in different directions: now, the blood is conftantly paffing into its cells through the fmall branches of the arteries which open into them, and is from thence as conftantly abforbed by the pabulous orifices of fome of its veins, fo long as the corpora cavernofa and corpus fpongiofum continue to be in a relaxed and pliant ftate. But when from any nervous influence or other means, which it is not neceffary here to define or explain, the erectores or other mufcles of the penis, are induced to contract; the veins undergo a certain degree of compreffion,

and

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 diſtenſion ſubſide, the penis gradually returns to its ſtate of relaxation.

Of the Female Organs of Generation.

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 *carunculæ myrtiformes*; and in the latter, the *vagina*, with the *uterus* and its appendages.

THE *mons veneris*, which is placed on the upper part of the ſymphiſis pubis, is internally compoſed of adipoſe membrane, 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 cocyx.

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 os ischii; furnished with two pair of muscles, the *erectores clitoridis*, and the *constrictores cunni*; 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

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 on the inſide by ſeveral membranous folds called *carunculæ myrtiformes*, which are commonly ſuppoſed to be 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 compoſed of two membranes, one of which is muſcular, and the other a continuation of that which covers the foſſa magna, ſurrounded with a ſpongy cellular ſubſtance. 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*.

The

THE ſubſtance of the uterus, which is of a conſiderable thickneſs, appears to be compoſed of many glands interwoven with 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 hemorrhoidal. 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 *ligamenti 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 ſurprizing 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 tubia fallopiana is uſually about three inches long. Their cavities are at firſt very ſmall, but becomes gradually larger, like a trumpet, as they approach the fimbriæ.

NEAR

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 glandular ſubſtance, in which we are able to diſcover ſeveral minute veſicles filled with a coagulable lymph, of an uncertain number, but not often exceeding twelve 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 till its coat diſappears, and it then changes into an hemiſpherical body, called *corpus luteum*, which reſembles a bunch of currants, and is hollow, containing within its cavity the very minute membranes or eggs, each of which may become the ſeat of a fœtus.—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 tube; and it is obſervable, that the number of ſcars or fiſſures in the ovarium, conſtantly correſponds with the number of fœtuſes excluded by the mother.

Of Conception.

MAN, being ever curious and inquiſitive, has naturally been led to inquire 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, through which it was conveyed into 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

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 Leeuwenhoeck, 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,

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.—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 Fœtus in Utero.

Opportunities of diſſecting the human gravid uterus occurring but ſeldom, the ſtate of of the *embryo* (*f*) immediately after conception cannot be perfectly known.

When the ovum descends into the uterus, it is supposed to be very minute; and it is not till several days after conception, that the rudiments of the embryo begin to be ascertained. —About the seventh day the eye may discover the first lineaments of the fœtus; but these lineaments are as yet very imperfect. Two little vesicles 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 chord appears only as a very minute thread, and the placenta does not as yet absorb the red particles of the blood. At the end of fifteen days, 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

(*f*) 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*.

the

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 three weeks the body of the fœtus is ſomewhat augmented, 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.

Towards the end of the firſt month, the fœtus is about an inch long, and 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 toes are ſeparated from each other, and the inteſtines appear like minute threads. After ſix weeks the fœtus is grown much longer, and the human figure appears to be more perfect, but the head is ſtill larger in proportion than the other parts of the body.

At the end of the fecond month, the fœtus meafures two inches and a quarter, at the end of the third month three inches and a half, and about the fourth or fifth month, ufually about five inches; and from that time to the end of the ninth month it gradually increafes to about the length of twelve inches, fometimes more, and fometimes not quite fo much.

The fœtus during all this time affumes an oval figure, which correfponds with the fhape of the uterus. Its chin is found reclining on its breaft with its knees drawn up towards its chin, and its arms folded over them. But it feems likely, that the pofture of fome of thefe parts is varied in the latter months of pregnancy, fo as to caufe thofe painful twitches, which its mother ufually feels from time to time.—In natural cafes its head is probably placed towards the os tincæ, from the time of conception to that of its birth; though formerly it was confidered as being placed towards the fundus uteri, till about the eighth or ninth month, when the head, by becoming fpecifically heavier than the other parts of the body, was fuppofed to be turned downwards.

The

The capacity of the uterus increafes in proportion to the growth of the fœtus, but without becoming thinner in its fubftance as might naturally be expected.—The nourifhment of the fœtus, during all this time, feems 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 unconnected part of the ovum, and likewife the furface of the placenta, are covered by a membrane called *chorion* (*g*); and within, this is another pellucid membrane called *amnios* (*h*); and thefe two include a watery fluid,

(*g*) Befides thefe two membranes, Dr. Hunter has difcovered a third, which is the exterior one, being fuppofed to be a lamella from the inner furface 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 caft off with the placenta.

(*h*) In fome quadrupeds the urine appears to be conveyed from the bladder through a canal called *urachus*, to the *allantois*, which is a refervoir, refembling a long and blind gut, fituated between the chorion and amnios. The human fœtus feems to have no fuch refervoir, though fome writers have fuppofed that it does exift. From the top of the bladder, a few longitudinal fibres are extended to the umbilical chord; and thefe fibres have been confidered as the urachus, though without having been ever found pervious.

which

which is the *liquor amnii* (*i*), in which the fœtus floats till the time of its birth.—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 to be clearly deſcribed, as being a ſubject not generally underſtood.—Without ſuch an explanation it might perhaps be readily ſuppoſed, that the arteries of the uterus paſs into the ſubſtance of the placenta; and that the blood, after being conveyed through the umbilical arteries to the

(*i*) 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.

fœtus,

fœtus, is returned back by the umbilical vein to the placenta, and from thence to the uterus. —Such an idea, however, would be a very erroneous one. We will point out the true manner in which this proceſs is conducted.

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 as it were made up of the ramifications of the umbilical arteries and vein. The arteries of the uterus diſcharge their contents into the ſpongy cells of this cake, and the veins of the placenta, abſorbing the blood from theſe cells in the ſame manner as they abſorb it in the corpora cavernoſa penis, at length form the *umbilical vein*, which paſſes on to the ſinus of the vena portæ, 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 an 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 arterioſus*, which, like the canalis venoſus, and foramen ovale, gradually cloſes after birth.

THE blood is returned again from the fœtus through two arteries called the *umbilical arteries*, which ſometimes ariſe from the iliacs, and ſometimes from the aorta deſcendens. 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, open and diſcharge their blood into its cells, from whence it is abſorbed by the veins of the uterus; ſo that a conſtant depoſition and abſorption are carried on, and the fœtus is found

found to have a circulation independent of its mother.

CHAP. V.

Of the Thorax.

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.

SECTION I.

Of the Breaſts.

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

form the *tubuli lactiferi* (*l*), which are uſually about ſeven or eight in number, and open at its apex. 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

(*l*) Nuck was the firſt who obſerved that theſe tubuli communicate with each other before they reach the nipple.

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 (*m*), this ſuppoſition appears to be ill founded.

SECTION II.

Of the Pleura.

THE cavity of the thorax is every where lined by a membrane of a firm texture called *pleura*. It is compoſed of two diſtinct

(*m*) See the *Journ. de Med.* for Jan. 1781.

portions

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 (*n*), which prevents adheſions of the viſcera.

(*n*) When this fluid is exhaled in too great a quantity, or is not properly carried off, it accumulates and conſtitutes the *hydrops pectoris*.

The mediaſtinum, by dividing the breaſt into two cavities, obviates many inconveniencies, 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.

SECTION III.

Of the Thymus.

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 figure, and is larger in the fœtus, and in young children than in adults,

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.

SECTION IV.

Of the Diaphragm.

THE cavity of the thorax is ſeparated from that of the abdomen, by a fleſhy and membranous ſeptum 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 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

its lower and pofterior part is attached to the vertebræ lumborum, where it may be faid to be divided into two portions or *crura* (*o*).

The principal arteries of the diaphragm are derived from the aorta, and its veins pafs into the vena cava.—Its nerves are chiefly derived from the cervical pairs.—It affords a paffage to the vena cava through its tendinous part, and to the œfophagus through its flefhy portion.—The aorta paffes down behind it between its *crura*.

The diaphragm not only ferves to divide the thorax from the abdomen, but by its mufcular ftructure, is rendered one of the chief agents in refpiration.—When its fibres contract, its convex fide which is turned towards the thorax, becomes gradually flat, and by increafing the cavity of the breaft, affords room for a complete dilatation of the lungs, by means of the air which is then drawn into them by

(*o*) Anatomical writers have ufually defcribed the diaphragm, as being made up of two mufcles united by a middle tendon; and thefe two portions or crura, form what they fpeak of as the *inferior mufcle*, arifing from the fides and fore-part of the vertebræ.

the

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.

SECTION 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

posed of five cartilages. The uppermost and smallest 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. The sides of the larynx are composed of 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

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, and the cricoid and thyroid cartilages, are in ſome meaſure covered anteriorly by a conſiderable body, which is ſuppoſed to be of a glandular ſtructure, and from its ſituation is called the *thyroid gland;* though its excretory duct has not yet been diſcovered, or its real 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 fourth or fifth vertebra of the back, where it divides into two branches, which are the right and left bronchial tube.—Each of theſe *bronchi* (*p*), ramifies through the ſubſtance

(*p*) 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 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 out from them in expiration.—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

lungs on the aorta in reſpiration, obſerves, that the left bronchial tube is cloſely contracted 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.

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.

SECTION 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

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 this recurrent nerve at its 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 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.

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.

SECTION 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 phænomena 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 expiration 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 blood, the pulmonary

artery

artery begins again to be diftended, the ftimulus is renewed, and the fame procefs is repeated, and continues to be repeated, in a regular fucceffion during life: for though the mufcles of refpiration, having a mixed motion, are, (unlike the heart) in fome meafure dependent on the will, yet no human being, after having once refpired, can live many moments without it.— In an attempt to hold one's breath, the blood foon begins to diftend the veins, which are unable to empty their contents into the heart; and we are able only, during a very little time, to refift the ftimulus to infpiration. In drowning, the circulation feems to be ftopped upon this principle; and in hanging, the preffure made on the jugular veins, may co-operate with the ftoppage of refpiration in bringing on death.

Till within thefe few years, phyfiologifts were entirely ignorant of the ufe of efpiration. It was at length difcovered, in part, by the illuftrious Dr. Prieftley. He found that the air expired by animals was phlogifticated; and that air was fitter for refpiration, or for fupporting animal life, in proportion as it was freer from the phlogiftic principle. It had long been obferved, 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 ſhewed, that the craſſamentum 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,

ford, 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.

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 *.

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

* See Crawford's *Experiments and Obſervations on Animal Heat*, and Elliot's *Philoſophical Obſervations.*

likewiſe

likewife been accounted for in a different way, by fuppofing that the air contained in the blood, not receiving an equal preffure from that of the atmofphere, expands, and at length ruptures the very minute branches of the pulmonary veffels; upon the fame principle that fruits and animals put under the receiver of an air-pump, are feen to fwell as the outer air becomes exhaufted. But Dr. Darwin of Litchfield, has lately publifhed fome experiments, which feem to prove, that no air or elaftic vapour does exift in the blood-veffels, as has been generally fuppofed; and he is induced to impute the fpitting of blood, which has fometimes taken place in afcending high mountains, to accident, or to violent exertions; as it never happens to animals that are put into the exhaufted receiver of an air-pump, where the diminution of preffure is many times greater, than on the fummit of the higheft mountains.

SECTION

SECTION 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 expiration, it finds its paſſage ſtraitened by the cartilages of the larynx, againſt which it 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

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 diſ-

tenſion

tenſion 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.

SECTION

SECTION IX.

Of Dejection.

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 re-

stance

fiſtance 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.

SECTION 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 lodgement 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 by cellular membrane.—The outer coat, which in thick, and in ſome places of a 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.

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,

heart, it effectually fecures it from being injured by lymph, pus, or any other fluid, extravafated into the cavities of the thorax.

Of the Heart.

THE heart is a hollow mufcle of a conical fhape, fituated tranfverfely between the two laminæ of the mediaftinum, at the lower part of the thorax; having its *bafis* turned towards the right fide, and its point or *apex* towards the left.—Its lower furface is fomewhat flattened towards the diaphragm. Its bafis, from which the great veffels originate, is covered with fat, and it has two hollow and flefhy appendages, called *auricles*.—Round thefe feveral openings, the heart feems to be of a firm, ligamentous texture, from which all its fibres feem to originate; and as they advance from thence towards the apex, the fubftance of the heart feems to become thinner.

THE heart includes two cavities or *ventricles*; which are feparated from each other by a flefhy feptum; one of thefe is called the *right*, and the other the *left ventricle*; though perhaps,

haps, with refpect to their fituation, it would be more proper to diftinguifh them into the *anterior* and *pofterior ventricles*.

The heart is exteriorly covered by a very fine membrane; and its ftructure is perfectly mufcular or flefhy, being compofed of fibres which are defcribed as paffing in different directions; fome as being extended longitudinally from the bafis to the apex—others, as taking an oblique or fpiral courfe; and a third fort as being placed in a tranfverfe direction (*y*).—Within the two ventricles we obferve feveral furrows, and there are likewife tendinous ftrings, which arife from flefhy *columnæ* in the two cavities, and are attached to the valves of the auricles—that the ufe of thefe, and the other valves of the heart, may be underftood, it muft be obferved, that four large veffels pafs out from the bafis of the heart, *viz.* two arteries and two veins; and that each of thefe veffels is furnifhed with a thin membranous production, which is attached all round to the

(*y*) Authors differ about the courfe and diftinctions of thefe fibres;—and it feems right to obferve, that the ftructure of the heart being more compact than that of other mufcles, its fibres are not eafily feparated.

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

each ventricle, where the auricle opens into it. The valves in the right ventricle are ufually three in number, and are named *valvulæ tricufpides*; but in the left ventricle, we commonly obferve only two, and thefe are the *valvulæ mitrales*. The membranes which form thefe valves in each cavity, are attached fo as to project fomewhat forward, and both the *tricufpides* and the *mitrales* are connected with the tendinous ftrings, which were defcribed as arifing from the flefhy *columnæ*. By the contraction of either ventricle, the blood is driven into the artery which communicates with that ventricle, and thefe tendinous ftrings being gradually relaxed, as the fides of the cavity are brought nearer to each other, the valves naturally clofe the opening into the auricle, and the blood neceffarily directs its courfe into the then only open paffage, which is into the artery; but after this contraction, the heart becomes relaxed, the tendinous ftrings are again ftretched 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 defcribed hereafter. The right ventricle is not quite fo 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.

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*.

Angiology, or a Defcription of the Blood-veffels.

The heart has been defcribed as contracting itfelf, and throwing the blood from its two ventricles into the pulmonary artery and the aorta, and then as relaxing itfelf and receiving a frefh fupply from two large veins, which are the pulmonary vein, and the vena cava; we will now point out the principal diftributions of thefe veffels.

The *pulmonary artery* arifes from the *right ventricle* by a large trunk, which foon divides into two confiderable branches, which pafs to the right and left lobes of the lungs—each of thefe branches is afterwards divided and fubdivided, into an infinite number of branches and ramifications, which extend through the whole fubftance of the lungs, and from thefe branches the blood is returned by the veins, which, contrary to the courfe 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 (*z*) 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 cartoid; though ſometimes both the carotids ariſe diſtinctly from the aorta.

THE two *cartoids* 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 way

(*z*) 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.

backwards

backwards in a bending direction, and having reached the under part of the ear, paſſes thro' the canal in the os petroſum, and entering into the cavity of the cranium, is diſtributed to the brain and the membranes which invelope it.—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 diftributed; as the *mammary*, the *phrenic*, the *intercoftal*, &c. But notwithftanding the great number of branches which have been defcribed as arifing from the fubclavian, it is ftill a confiderable artery when it reaches the *axilla*, where it drops its former name, which alludes to its paffage under the clavicle, and is called the *axillary* artery; from which a variety of branches are diftributed to the mufcles of the breaft, fcapula, and arm.—But its main trunk taking the name of *brachialis*, runs along within fide the arm, near the os humeri, till it reaches the joint of the fore-arm, and then it divides into two branches. This divifion however is different in different fubjects; for in fome it takes place higher up, and in others lower down. When it happens to divide above the joint, it may be confidered as a happy difpofition in cafe of an accident by bleeding;—for fuppofing the artery to be unfortunately punctured by the lancet, and that the hæmorrhage could only be ftopt by making a ligature on the veffel, one branch would remain unhurt, through which the blood would pafs uninterrupted to the fore-arm and hand.—One of the two branches of the *brachialis*, plunges

plunges down under the flexor mufcles, and runs along the edge of the ulna; while the other is carried along the outer furface of the radius, and is eafily felt at the wrift, where it is only covered by the common integuments. Both thefe 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 *fubclavians*, which convey blood to all the upper parts of the body, defcends upon the bodies of the vertebræ a little to the left, as far as the os facrum, where it drops the name of *aorta*, and divides into two confiderable branches. In this courfe from its curvature to its bifurcation, it fends off feveral arteries, in the following order: 1. Two little arteries, and fometimes only one, firft demonftrated by Ruyfch as going to the bronchi, and called *arteriæ bronchiales Ruyfchii*. 2. The *arteriæ œfophageæ*; thefe are commonly three or four in number. They arife from the forepart of the aorta, and are diftributed chiefly to the œfophagus. 3. The *inferior intercoftal arteries*, which are diftributed between the ribs in the fame manner as the arteries of the

three

three or four superior ribs are, which are derived from the subclavian. These arteries send off branches to the medulla spinalis. 4. The *cæliac*, which sends off the two *diaphragmatic* or *inferior phrenic arteries*, the *coronary stomachic artery*, and the *hepatic artery*; which are distributed to the diaphragm, stomach, omentum, duodenum, pancreas, spleen, liver, and gall-bladder. 5. The *superior mesenteric artery*, which is distributed to the mesentery and small intestines. 6. The *emulgents*, which go to the kidneys. 7. The arteries which are distributed to the *glandulæ renales*. 8. The *spermatic*. 9. 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*. 10. 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.

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

two forked branches called the *iliacs.* Each of thefe foon divides into two branches, one of which is called the *internal iliac*, or *hypogaftric artery*, and is diftributed to the urinary bladder, inteftinum rectum, and the neighbouring parts. That branch which goes to the *rectum*, is called the *external hæmorrhoid.*—The *external iliac*, after having given off the *umbilical* artery, and the *epigaftric*, which is diftributed to the recti mufcles, paffes out of the abdomen under Poupart's ligament, and takes the name of *crural artery.* It defcends on the inner part of the thigh, clofe to the os femoris, fending off branches to the mufcles, and then finking deeper in the hind part of the thigh, reaches the ham, where it takes the name of *popliteal:* after this it feparates into two confiderable branches, one of which is called the *anterior tibial* artery; the other divides into two branches, and thefe arteries all go to be diftributed to the leg and foot.

The blood, which is thus diftributed by the aorta to all parts of the body, is brought back by the veins, which are fuppofed to be continued from the ultimate branches of arteries, and uniting together as they approach the heart,

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 many other general rules, this too has its exceptions (*b*). 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

(*b*) In the extremities, ſome of the deep ſeated veins, and all the ſuperficial ones, take a courſe different from that of the arteries.

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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 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 not 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 conſequent-

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ly lefs rapid, and enough of it could not pof-fibly 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 fo effential to the continuance of life and health, would confequently be deftroyed, if the capacity of the veins did not exceed that of the arteries, in the fame 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 fo difpofed, that the two trunks terminate in one common point; and if we farther fuppofe, that both thefe trunks and their branches are hollow, and that a fluid is inceffantly circulated through them, by entering into one of the trunks and returning through the other, we fhall be enabled to conceive how the blood is circulated through the veffels of the human body.

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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.

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,

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 (*c*) 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.

(*c*) De Arteriarum & Venarum vi irritabili, 4to.

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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*.

SECTION XI.

Of the Action of the Heart, Auricles, and Arteries.

THE *heart* at the time it contracts, drives the blood from its ventricles into the arteries; and the arteries being thus filled and diftended, are naturally inclined to contract, the moment the heart begins to dilate and ceafes to fupply them with blood.—Thefe alternate motions of contraction and dilatation of the heart and arteries, are diftinguifhed by the names of *fyftole* and *diaftole*.—When the heart is in a ftate of contraction or *fyftole*, the arteries are at that inftant diftended with blood, and in their *diaftole*; and it is in this ftate we feel their pulfatory motion, which we call the *pulfe*. 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 *fyftole*, the blood cannot pafs from the veins into the ventricles, but is detained in the auricles, which are two refervoirs formed for this

this ufe, till the *diaftole*, or dilatation of the heart takes place, and then the diftended auricles contract, and drive the blood into the ventricles, fo that the auricles have an alternate *fyftole* and *diaftole*, as well as the heart.

ALTHOUGH both the ventricles of the heart contract at the fame time, yet the blood paffes from one to the other.—In the fame moment, for inftance, that the left ventricle drives the blood into the aorta, the right ventricle impels it into the pulmonary artery, which is diftributed through all the fubftance of the lungs.—The blood is afterwards brought back into the left ventricle by the pulmonary vein, at the fame time that the blood is returned by the cavas, into the right ventricle, from all the other parts of the body.

THIS feems to be the mode of action of the heart, and its veffels; but the caufe of this action, has, like all other intricate and interefting fubjects, been differently explained. It feems to depend on the ftimulus made on the different parts of the heart by the blood itfelf, which by its quantity and heat, or other properties (*g*), 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.

(*g*) 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.

SECTION

SECTION XII.

Of the Circulation.

AFTER what has been obferved of the ftructure and action of the heart and its auricles, and likewife of the arteries and veins, there feem to be but very few arguments required to demonftrate *the circulation of the blood*, which has long fince been eftablifhed as a medical truth. This circulation may be defined to be a perpetual motion of the blood, in confequence 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 to the heart.

A VERY fatisfactory proof of this circulation, and a proof eafy to be underftood, may be deduced from the different effects of preffure on an artery and a vein. If a ligature, for inftance, is paffed round an artery, the veffel fwells confiderably 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

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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.

SECTION XIII.

Of the Nature of the Blood.

BLOOD, recently drawn from a vein into a baſon, would ſeem to be an homogeneous fluid of a red colour (*i*); but when ſuffered to reſt, it ſoon coagulates, and divides into two parts, which are diſtinguiſhed by the names of *craſſamentum* and *ſerum*. The *craſſa-*

(*i*) 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.

mentum is the red coagulum, and the *ferum* is the water in which it floats. Each of thefe may be again feparated into two others; for the *craffamentum*, by being repeatedly wafhed in warm water, gives out all its red globules, and what remains, appears to be compofed of the *coagulable lymph* (*k*), which is a gelatinous fubftance, capable of being hardened by fire till it becomes perfectly horny: and if we expofe the *ferum* 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, refembling urine both in its appearance and fmell.

THE *ferum* and *craffamentum* differ in their proportion in different conftitutions; in a ftrong perfon, the craffamentum is in a greater proportion to the ferum, than in a weak

(*k*) It may not be improper to obferve, that till of late the *coagulable lymph* has been confounded with the *ferum* of the blood, which contains a fubftance that is likewife coagulable, though only when expofed to heat, or combined with certain chemical fubftances; whereas the other coagulates fpontaneoufly, when expofed to the air or to reft.

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one (*l*); and the fame difference is found to take place in difeafes (*m*).

SECTION XIV.

Of Nutrition.

THE variety of functions which we have defcribed as being inceffantly performed by the living body, and the continual circula-

(*l*) Hewfon's Experim. Enq. Part I.

(*m*) When the blood feparates into *ferum* and *craffamentum*, if the latter be covered with a cruft of a whitifh or buff-colour, it has been ufually confidered as a certain proof of the blood's being in a ftate of too great vifcidity. This appearance commonly taking place in inflammatory difeafes, has long ferved to confirm the theory which afcribes the caufe of inflammation to lentor and obftructions. But from the late Mr. Hewfon's experiments it appears, that when the action of the arteries is increafed, the blood, inftead of being more vifcid, is on the contrary, more fluid than in the ordinary ftate, previous to inflammation: and that in confequence of this, the *coagulable lymph* fuffers the red globules, which are the heavieft part of the blood, to fall down to the bottom before it coagulates; fo that the craffamentum is divided into two parts; one of which is found to confift of the coagulable lymph alone, (in this cafe termed the *buff*), and the other, partly of this, and partly of the red globules.

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tion 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,

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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.

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 nor decrease; and we find this to be the case, when the body has attained its full growth or *acme*: 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 excefs, and the fluids (*n*) bear a much lefs proportion to the folids, than before. The diffipation of the body, is greater than the fupply of nourifhment; many of the fmaller veffels become gradually impervious (*o*); and the fibres lofing their moifture and their elafticity, appear flaccid and wrinkled.—The lilies and the rofes difappear, becaufe the fluids by which they were produced, can no longer reach the extremities of the capillary veffels of the fkin.—As thefe changes take place, the nervous power being proportionably weakened, the irritability and fenfibility of the body, which were formerly fo remarkable, are greatly diminifhed; and in advanced life, the hearing, the eye-fight, and all the other fenfes become gradually impaired.

(*n*) As the fluids become lefs in proportion to the folids, their acrimony is found to increafe; and this may perhaps compenfate for the want of fluidity in the blood, by diminifhing its cohefion.

(*o*) In infancy, the arteries are numerous and large, in refpect 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 fyftem exceeds that of the arteries, and the lymphatic fyftem almoft difappears.

SECTION

SECTION XV.

Of the Glands and Secretions.

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 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.

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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, kidnies, &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 ſe-

cretion.

cretion.—On the firft of thefe fubjects two different fyftems have been formed, each of which has had, and ftill continue to have, its adherents. One of thefe fyftems was advanced by Malpighi, who fuppofed that an artery, entering into a gland, ramifies very minutely through its whole fubftance; and that its branches ultimately terminate in a veficular cavity or follicle, from whence the fecreted fluid paffes out through the excretory duct.—This doctrine at firft met with few opponents, but the celebrated Ruyfch, who firft attempted minute injections with wax, afterwards difputed the exiftence of thefe follicles, and afferted, that every gland appears to be a continued feries of veffels, which after being repeatedly convoluted in their courfe through its fubftance, at length terminate in the excretory duct. Anatomifts are ftill divided between thefe two fyftems; that of Malpighi, however, feems to be the beft founded.

The mode of fecretion has been explained in a variety of ways, and they are all perfectly hypothetical.—In fuch an enquiry, it is natural to afk, how one gland conftantly feparates a particular humour, while another gland ſecrets 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 diſpoſition 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

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 bilious 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 from 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 ſecretion 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

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.

CHAP. VI.

Of the Brain and its Integuments.

THE bones of the *cranium* were defcribed in the ofteological part of this work, as inclofing the brain, and defending it from external injury: but they are not its only protection, for when we make an horizontal fection through thefe bones, we find this mafs every where furrounded by two membranes (*q*), the *dura* and *pia mater*.—The firft of thefe lines the interior furface of the cranium, to which it adheres ftrongly (*r*) at the futures, and at the many foramina, through which veffels pafs be-

(*q*) The Greeks called thefe membranes, *meninges*; but the Arabians, fuppofing them to be the fource of all the other membranes of the body, afterwards gave them the names of *dura* and *pia mater*, by which they are now ufually diftinguifhed.

(*r*) In young fubjects, this adhefion is greater than in adult; but even then, in the healthy fubject, it is no where eafily feparable, without breaking through fome of the minute veffels, by means of which it is attached to the bone.

tween

tween it and the pericranium. The *dura mater* (*s*) is perfectly fmooth and inelaftic, and its inner furface is conftantly bedewed with a fine pellucid fluid, which every where feparates it from the pia mater.—The dura mater fends off feveral confiderable proceffes, which divide the brain into feparate portions, and prevent them from compreffing each other. Of thefe proceffes there is one fuperior and longitudinal, called the *falx*, or *falciform procefs*, from its refemblance to a fcythe. It arifes from the fpine of the os frontis, near the crifta galli, and extending along in the direction of the fagittal future, to beyond the lambdoidal future, divides the brain into two hemifpheres. A little below the lambdoidal future, it divides into two broad wings or expanfions called the *tranfverfe* or *lateral proceffes*, which pre-

(*s*) This membrane is commonly defcribed, as confifting of two laminæ, of which the external one is fuppofed to perform the office of periofteum internum to the cranium, while the internal one forms the folds and proceffes of the dura mater. In the natural ftate, however, no fuch feparation is apparent; like other membranes, we may indeed divide it, not into two only, but many laminæ; but this divifion is artificial, and depends on the dexterity of the anatomift.

vents 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

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 thro' 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

into very minute ramifications, before they penetrate the ſubſtance of 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.*

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 anterior*, *a middle*, and *a poſterior lobe.* The firſt of theſe is lodged on the orbital proceſſes of the os frontis; the middle lobes lie in 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,

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

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 edges are collected, ſo as to appear like a vaſcular band on each ſide.

When we have removed this plexus, we difcover feveral other protuberances included in the lateral ventricles. Thefe are the *corpora ftriata*, the *thalami nervorum opticorum*, the *tubercula quadrugemina*, and the *pineal gland.*

The *corpora ftriata* are two curved oblong eminences, that extend along the anterior part of the lateral ventricles. They derive their name from their ftriated appearance, which is owing to an intermixture of the cortical and medullary fubftances of the brain. The *thalami nervorum opticorum*, are fo called, becaufe the optic nerves arife chiefly from them, and they are likewife compofed both of the cortex and medulla. They are feparated from the corpora ftriata only by a kind of medullary chord, the *geminum centrum femi-circulare*. The thalami are nearly of an oval fhape, and are fituated at the bottom of the upper cavity of the lateral ventricles. They are clofely united, and at their convex part feem to become one body.

Anteriorly, in the fpace between the thalami, we obferve an orifice called *vulva*; and their feparation from each other pofteriorly, forms

forms another called *anus*. Both theſe openings communicate with the third ventricle. 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

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 (*a*) 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 Haën tells (*b*) us, he found it dilated, and filled with a calcareous matter.

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.

From the poſterior part of the third ventricle, we ſee a ſmall groove or channel, deſcending obliquely backwards. This channel,

(*a*) Diſp. de Infundibulo Cerebri. (*b*) Ratio Med. Tom. VI. p. 271.

which

which is called the *aquæduct 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*.

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

ſerve 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 reſt 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

the fourth ventricle and the aqueductus Sylvii. Vieuſſens named it *valvula major cerebri.*

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*, 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, compofed externally of medullary, and internally of cineritious fubftance, to which Euftachius firft gave the name of *eminentiæ mammillares*.

ALONG the middle of the pofterior furface of the medulla oblongata, where it forms the anterior part of the fourth ventricle, we obferve a kind of furrow which runs downwards and terminates in a point. About an inch above the lower extremity of this fiffure, feveral medullary filaments are to be feen running towards it on each fide, in an oblique direction, fo as to give it the appearance of a writing-pen; hence it is called *calamus fcriptorius*.

FROM the pofterior part of the *pons Varolii*, the medulla oblongata defcends obliquely backwards; at its fore-part, immediately behind the *pons Varolii*, we obferve two pair of eminences, which were defcribed by Euftachius, but received no particular appellation till the time of Vieuffens, who gave them the names of *corpora olivaria*, and *corpora pyramidalia*. The former are the outermoft, being placed

one

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.

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

from the foramen magnum of the os occipitis, to the lower part of the os facrum. They communicate together by ramifying branches at each vertebra, and terminate in the vertebral, intercoftal, and facral veins.

The pia mater is connected with the dura mater by means of a thin tranfparent fubftance, which from its indentations between the fpinal nerves, has obtained the name of *ligamentum denticulatum*. It is fomewhat firmer than the tunica arachnoidea, but in other refpects refembles that membrane. Its ufe is to fupport the fpinal marrow, that it may not affect the medulla oblongata by its weight.

The fpinal marrow itfelf is externally of a white colour, but upon cutting into it we find its middle-part compofed of a darker coloured mafs, refembling the cortex of the brain. When the marrow has reached the firft lumbar vertebra, it becomes extremely narrow, and at length terminates in an oblong protuberance, from the extremity of which the pia mater fends off a prolongation or ligament, refembling a nerve, that perforates the dura mater, and is fixed to the os coccygis.

The medulla ſpinalis gives riſe to thirty or thirty-one 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.

Of the Nerves.

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 thirty-nine, and ſometimes forty pair of theſe nerves; nine (*a*) of which originate from the medulla oblongata, and thirty or thirty-one 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 (*b*), the outer covering of the nerves being in fact nothing more than cellular membrane. This covering is very thick where the nerve

(*a*) It has been uſual to deſcribe ten pair of nerves, as ariſing from the medulla oblongâta; 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.

(*b*) 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.

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 *opthalamicus*, which is distributed to various parts of the eyes, eye-lids, fore-head, 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* (*c*), 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 *hypoglоſſi*, which are diſtributed to the tongue, and appear to contribute both to the organ of taſte, and to the motions of the tongue (*d*).

It has already been obſerved, that the ſpinal marrow ſends off thirty or thirty-one pair

(*c*) 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, 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 aquæduct 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.

(*d*) 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, loquenſ-
"que."

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 (*e*) 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

(*e*) 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.

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 (*f*), 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 nerves leading to involuntary muſcles; whereas it is certain, that the voluntary muſcles receive their nerves through ganglions. Other theories have been formed concerning them, none of which, however, have as yet led to aſcertain their uſe.

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 and conſiderable enough to be diſtinguiſhed by par-

(*f*) An Eſſay on the Uſe of the Ganglions of the Nerves.

ticular

ticular names, as the *femilunar plexus*; the *pulmonary plexus*, the *hepatic*, the *cardiac*, &c.

It would be foreign to the purpofe of this work, to follow the nerves through all their diftributions; but it may be remembered, that in defcribing the different vifcera, mention was made of the nerves diftributed to them. There is one pair, however, called the *intercoftal* or *great fympathetic nerve*, which feems to require particular notice, becaufe it has an almoft univerfal connection and correfpondence with all the other nerves of the body.—Authors are not perfectly agreed about the origin of the *intercoftal*; but it may perhaps not improperly be defcribed, as beginning from filaments of the fifth and fixth pair; it then paffes out of the cranium, through the bony canal of the carotid, from whence it defcends laterally clofe to the bodies of the vertebræ, and receives branches from almoft all the vertebral nerves; forming almoft as many *ganglions* in its courfe through the thorax and abdomen. It fends off an infinite number of branches to the vifcera in thofe cavities, and forms feveral *plexus* 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 enquiry 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.

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 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 ef-

fects

fects 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.

CHAP. VII.

Of the Senses.

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.

SECTION I.

Of the Sense of Touch.

THE *sense* of *touch* may be defined to be the faculty of distinguishing certain properties of bodies by the feel. In a general acceptation,

acceptation, this definition might perhaps not improperly be extended to every part of the body poſſeſſed of ſenſibility (*g*), 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,

(*g*) In the courſe of this volume, 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.

neſs, 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.

SECTION II.

Of the Taſte.

THE *ſenſe of taſte* is ſeated chiefly in the tongue, of the ſituation and ſtructure of which, ſome account has already been given in a former part (*b*) of the work.

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

(*b*) See page 215.

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 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 cæcum*, which ſeems to be nothing more than 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

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 (*i*) very large and long, have the faculty of diſtinguiſhing flavours with infinite accuracy.

(*i*) 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.

SECTION III.

Of Smelling.

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, la-

rynx,

rynx, 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, tho' not unknown to the ancients, was firſt well deſcribed by Schneider (*k*), 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.

(*k*) De Catarrho, 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.

SECTION IV.

Of Hearing.

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 mufcles, to the temporal bone. Although capable only of a very obfcure motion, it is found to have feveral mufcles.—Different parts of it are diftinguifhed by different names; all its cartilaginous part is called *ala* or *wing*, to diftinguifh it from the foft and pendent part below, called the *lobe*. Its outer circle or border is called *helix*, and the femicirle within this, *antihelix*. The moveable cartilage placed immediately before the meatus auditorius, which it may be made to clofe exactly, is named *tragus*; and an eminence oppofite to this at the extremity of the *antihelix*, is called *antitragus*. The *concha* is a confiderable 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 furface of the ear.

In this canal we find a yellow wax, which is fecreted by a number of minute glands or follicles, each of which has an excretory duct. This fecretion, which is at firft of an oily confiftence, defends the membrane of the tympanum from the injuries of the air; and by its bitternefs,

bitternefs, prevents minute infects from entering into the ear. But, when from neglect or difeafe, it accumulates in too great a quantity, it fometimes occafions deafnefs. The inner extremity of the meatus is clofed by a very thin tranfparent membrane, the *membrana tympani*, which is fet in a bony circle like the head of a drum.—In the laft century, Rivinus, profeffor at Leipfic, fancied he had difcovered a hole in this membrane, furrounded by a fphincter, and affording a paffage to the air, between the external and internal ear. Cowper, Heifter, and fome other anatomifts, have admitted this fuppofed foramen, which certainly does not exift. Whenever there is any opening in the membrana tympani, it may be confidered 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 feven or eight lines wide, and half fo many in depth—it is femi-fpherical, and every where lined by a very fine membrane. There are four openings to be obferved in this cavity. It communicates with the mouth, by means of the *Euftachian tube*. This canal, which is in part bony, and in part cartilaginous,

nous, 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

but when accurately conſidered, it ſeems to be a diſtinct bone.

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

haps improperly, as it is more oval than round, is obferved a little above the other, in an eminence formed by the os petrofum, and is clofed by a continuation of the membrane that lines the inner furface of the tympanum. The ftapes and malleus are each of them furnifhed with a little mufcle, the *ftapedeus* and *tenfor tympani*. The firft of thefe, which is the fmalleft in the body, arifes from a little cavern in the pofterior and upper part of the cavity of the tympanum; and its tendon, after paffing through a hole in the fame cavern, is inferted at the back part of the head of the ftapes. This mufcle, by drawing the ftapes obliquely upwards, affifts in ftretching the membrana tympani.

The *tenfor tympani* (*l*) or *internus mallei*, as it is called by fome writers, arifes from the cartilaginous extremity of the Euftachian tube, and is inferted into the back part of the handle of the malleus, which it ferves to pull inwards, and

(*l*) Some anatomifts defcribe three mufcles of the malleus, but only this one feems to deferve the name of mufcle, what are called the *externus*, and *obliquus mollei*, feeming to be ligaments, rather than mufcles.

of

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 *ſemi-circular canals*, and the *cochlea.*

The *veſtibulum* is an irregular cavity, much ſmaller than the tympanum, ſituated nearly in the center of the os petroſum, between the tympanum, the cochlea, and the ſemi-circular 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 *ſemi-circular canals*, forms about 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 veftibulum; but the *vertical* and the *oblique*, being united together at one of their extremities, there are only five orifices to be feen in the veftibulum.

The *cochlea* is a canal which takes a fpiral courfe, not unlike the fhell of a fnail. From its bafis to its apex it makes two turns and a half, and is divided into two canals by a very thin lamina or feptum, which is in part bony, and in part membranous, in fuch a manner, that thefe two canals only communicate with each other at the point. One of them opens into the veftibulum, and the other is covered by the membrane that clofes the *feneftra rotunda*. The bony lamella which feparates the two canals, is exceedingly thin, and fills about two thirds of the diameter of the canal. The reft of the feptum is compofed of a moft delicate membrane, which lines the whole inner furface of the cochlea, and feems to form this divifion in the fame manner as the two membranous bags of the pleura, by being applied to each other, form the mediaftinum.

Every part of the labyrinth is furnifhed with a very delicate periofteum, and filled with a

watery

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 eſcapes through two minute canals or *aquæducts*, lately deſcribed by Dr. Cotunni (*m*), an ingenious phyſician at Naples. One of theſe aquæducts 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.

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

(*m*) De Aqueductibus Auris Humanæ Internæ, 8vo. Neapol, 1760.

themſelves

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 *ſemi-circular 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.

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 (*n*).

(*n*) 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.

Sound is more or lefs loud, in proportion to the ftrength of the vibration ; and the variety of founds feems to depend on the difference of this vibration; for the more quick and frequent it is, the more acute will be the found, and *vice verfa*.

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 confequence of particular founds, occafionally felt that difagreeable fenfation which is ufually called, *fetting the teeth on edge*; and the caufe of this fenfation may be traced to the communication which the portio dura of the auditory nerve has with the branches of the fifth pair, that are diftributed to the teeth, being probably occafioned by the violent tremor produced in the membrana tympani, by thefe very acute founds. Upon the fame principle we may explain the ftrong idea of found which a perfon has who holds a vibrating ftring between his teeth.

The

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 ſtapeus, affecting the auditory nerve in ſuch a manner as to produce the idea of ſound. An ingenious philoſophical writer (*o*) 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.

(*o*) *See* Elliot's *Philoſophical Obſervations, on the Senſes of Viſion and Hearing*, 8vo.

SECTION V.

Of Viſion.

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 globe of the eye is immediately covered by two *eye-lids* or *palpebræ*, which are compoſed of muſcular fibres (*p*) 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

(*p*) *See* page 136.

likewiſe

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 (*q*).

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*.

(*q*) It is obſervable, that the eye-brows are peculiar to the human ſpecies.

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* (r); 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 (s).

(r) 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*.

(s) 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*.

The motions of the eye are performed by fix mufcles; four of which are *ftraight* and two *oblique*. The *ftraight* mufcles are diftinguifhed by the names of *elevator*, *depreffor*, *adductor*, and *abductor*, from their feveral ufes in elevating and depreffing the eye, drawing it towards the nofe, or carrying it from the nofe towards the temple. All thefe four mufcles arife from the bottom of the orbit, and are inferted by flat tendons into the globe of the eye. The *oblique* mufcles are intended for the more compound motions of the eye. The firft of thefe mufcles, the *obliquus fuperior*, does not, like the other four mufcles we have defcribed, arife from the bottom of the orbit, but from the edge of the foramen that tranfmits the optic nerve, which feparates the origin of this mufcle from that of the others. From this beginning it paffes in a ftraight line towards a very fmall cartilaginous ring, the fituation of which is marked in the fkeleton by a little hollow in the internal orbitar procefs of the os frontis. The tendon of the mufcle after paffing through this ring, is inferted into the upper part of the globe of the eye, which it ferves to draw forwards, at the fame time turning the pupil downwards.

The *obliquus inferior* arifes from the edge of the orbit, under the opening of the ductus lachrymalis, and is inferted fomewhat pofteriorly into the outer fide of the globe, ferving to draw the eye forwards and turn the pupil upwards. When either of thefe two mufcles acts feparately, the eye is moved on its axis; but when they act together, it is compreffed both above and below.—The eye itfelf, which is now to be defcribed with its tunics, humours, and component parts, is nearly of a fpherical figure. Of its tunics, the *conjunctiva* has been already defcribed as a partial covering, reflected from the inner furface of the eye-lids over the anterior portion of the eye. What has been named *albuginea*, cannot properly be confidered as a coat of the eye, being in fact nothing more than the tendons of the ftraight mufcles fpread over fome parts of the fclerotica.

The immediate tunics of the eye, which are to be demonftrated when its partial coverings and all the other parts with which it is furrounded are removed, are the *fclerotica*, *choroides* and *retina*.

THE *ſclerotica*, which is the exterior coat, is every where white and opaque, except at its anterior part, where it has more convexity than any other part of the globe, and being exceedingly tranſparent, is called *cornea* (*t*).— 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, Zinn, and others. The truth

(*t*) 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*.

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

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 its 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.

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

and dilatation of the pupil are fuppofed to depend on the action of thefe proceffes. Some have confidered them as mufcular, but they are not of an irritable nature; others have fuppofed them to be filaments of nerves; but their real ftructure has never yet been clearly afcertained.

BESIDES thefe ciliary proceffes, anatomifts ufually fpeak of the circular fibres of the iris, but no fuch feem to exift.

THE pofterior furface of the iris, the ciliary proceffes, and part of the tunica choroides, are covered by a black mucus for the purpofes of accurate and diftinct vifion; but the manner in which it is fecreted, has not been determined.

IMMEDIATELY under the tunica choroides we find the third and inner coat, called the *retina*, which feems to be merely an expanfion of the pulpy fubftance of the optic nerve, extending to the borders of the cryftalline humour.

THE greateft part of the globe of the eye, within thefe feveral 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 *cryſtalline 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.—That 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

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 (*u*).—Both theſe ſpaces are completely filled with the aqueous humour (*x*).

The eye receives its arteries from the internal carotid, and its veins empty themſelves chiefly into the external jugulars. 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

(*u*) I am 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.

(*x*) 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 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.

ſufficiently

fufficiently remarkable to be diftinguifhed by the name of *circulus anteriofus*, though perhaps improperly, as they are chiefly branches of veins.

The optic nerve paffes in at the pofterior part of the eye, in a confiderable trunk, to be expanded for the purpofes of vifion, of which it is now univerfally fuppofed to be the immediate feat. But Meffrs. Mariotte and Mery contended, that the choroides is the feat of this fenfe; and the ancients fuppofed the cryftalline to be fo.—Befides the optic, the eye receives branches from the third, fourth, fifth, and fixth pair of nerves.

The humours of the eye, together with the cornea, are calculated to refract and converge the rays of light in fuch a manner, as to form at the bottom of the eye a diftinct image of the object we look at; and the point where thefe rays meet, is called the *focus* of the eye. —On the retina, as in a *camera obfcura*, the object is painted in an inverted pofition; and it is only by habit that we are enabled to judge of its true fituation, and likewife of its diftance and magnitude. To a young gentle-

man,

man, who was born blind, and who was couched by Mr. Chefelden, every object, (as he expreffed himfelf) feemed to touch his eyes, as what he felt did his fkin; and he thought no objects fo agreeable as thofe which were fmooth and regular, although for fome time he could form no judgment of their fhape, or guefs what it was in any of them that was pleafing to him.

In order to paint objects diftinctly on the retina, the cornea is required to have fuch a degree of convexity, that the rays of light may be collected at a certain point fo as to terminate exactly on the retina.—If the cornea is too prominent, the rays, by diverging too foon, will be united before they reach the retina, as is the cafe with near-fighted people or *Myopes*; and on the contrary, if it is not fufficiently convex, the rays will not be perfectly united when they reach the back part of the eye; and this happens to long-fighted people or *Prefbi*, being found conftantly to take place as we approach to old age, when the eye gradually flattens (*y*).—Thefe defects are to be fupplied

(*y*) Upon this principle they who in their youth are near-fighted may expect to fee better as they advance in life, and their eyes gradually become more flat.

 by

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.

THE END.

ERRATA.

P. 144, laſt line, *for* callls, *read* calls.
146, 5th line from the bottom, *for* uſed, *read* uſe.
—— 4th - - - - - - - ſtylo-hoideus, *read* ſtylo-hyoideus.
150, 3d - - - - - - - - ptery-pharyngæus, *r.* pterygo-pharyngæus.
158, 5th - - - - - - - Boyle, *read* Bayle
159, 4th - - - - - - - from, *read* form
163, 4th - - - - - - - faſcculi, *read* faſciculi.
164, 5th - - - - - - - ayer, *read* layer.
182, in the note, *for* Spigalius, *read* Spigelius.
279, 8th line from the top, *for* glandular, *read* cellular.

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