A

SYSTEM

Nicholas William Kirkby

OF

ANATOMY.

FROM

MONRO, WINSLOW, INNES,

And the LATEST AUTHORS.

ARRANGED,

AS NEARLY AS THE NATURE OF THE WORK WOULD ADMIT,

IN THE

Order of the LECTURES delivered by the PROFESSOR of ANATOMY in the UNIVERSITY of EDINBURGH.

IN TWO VOLUMES.

ILLUSTRATED WITH COPPERPLATES.

VOL. II.

EDINBURGH:

Printed for C. ELLIOT, PARLIAMENT-SQUARE; and G. ROBINSON, LONDON.

M.DCC.LXXXIV.

CONTENTS

OF THE SECOND VOLUME.

PART V.

Defcription of the Integuments.

	Page.
Of the Common Integuments, - -	9
The Cuticula, - -	10
Corpus Mucofum, - -	12
Cutis Vera - -	13
Glands of the Skin, - -	16
Ufes of the Skin, - -	17
Membrana Adipofa and Fat, - -	20
The Nails, - -	24
The Hairs, - - -	25
Suppofed Integuments of the Ancients, -	27

PART VI.

Defcription of the Vifcera and Organs.

CHAP. I. *Of the Head,* - -	30
Sect. I. *Of the Brain and its Appendages,*	31
§ 1. *Dura Mater,* - -	32
§ 2. *Pia Mater,* - -	42
§ 3. *Cerebrum,* - -	43
§ 4. *Cerebellum,* - -	53
§ 5. *Medulla Oblongata,* -	56
§ 6. *Medulla Spinalis,* - -	60

§ 7. *The Nerves of the Brain and Spinal Marrow, from their origin to their going out of the Cerebrum and Spine,* - 63
§ 8. *Blood-vessels of the Brain and Medulla Spinalis,* - - 71
§ 9. *Uses of the Brain and its Appendages in general,* - - 75
§ 10. *A Dissertation on the Anatomy of the Brain by Mr Steno, read in the Assembly held at M. Thevenot's house in the year* 1688, - 79
Sect. II. *The Eye,* - - 106
§ 1. *The Eye in general,* - ib.
§ 2. *The Globe or Ball of the Eye,* - 108
§ 3. *The Coats of the Eye in particular,* 109
§ 4. *The Humours of the Eye, and their Capsulæ,* - - 113
§ 5. *The Tunica Albuginea, and Muscles of the Globe of the Eye,* - 116
§ 6. *The Supercilia, and Musculi Frontales, Occipitales, and Superciliares* - 121
§ 7. *The Palpebræ and Membrana Conjunctiva,* - - 124
§ 8. *The Muscles of the Palpebræ,* - 129
§ 9. *The Vessels of the Eye and its Appendages,* 132
§ 10. *The Nerves of the Eye and its Appendages,* - - 134
§ 11. *The Uses of the Eye and its Appendages in general,* - - 136
Sect. III. *The Nose,* - - 137
Sect. IV. *The Ear,* - - 148
Sect. V. *The Mouth,* - - 171
§ 1. *The Larynx,* - - 172
§ 2. *The Pharynx* - - 182
§ 3. *The Palate, Uvula, &c.* - 186
§ 4. *The Tongue,* - - 190
§ 5. *The Cheeks, Lips, and Gums,* - 200
§ 6. *The Salival Glands, &c.* - 208

CHAP. II. *Of the Thorax*, - - - 212
§ 1. *Introduction* - - - ib.
§ 2. *Mammæ*, - - - 214
§ 3. *Pleura and Mediastinum*, - 218
§ 4. *Thymus*, - - 221
§ 5. *Cor*, - - 222
§ 6. *Pulmones*, - - 234
§ 7. *Oesophagus*, - - 246
§ 8. *Ductus Thoracicus*, - - 247
CHAP. III. *Of the Abdomen*, - 248
§ 1. *Peritonæum*, - - 252
§ 2. *Ventriculus*, - - 256
§ 3. *The Intestines in general, and Intestinum Duodenum in particular*, - 264
§ 4. *Intestinum Jejunum*, - - 269
§ 5. *Intestinum Ileum* - - 272
§ 6. *The Intestina Crassa in general, and Intestinum Cæcum in particular*, - 273
§ 7. *The Intestinum Colon*, - - 275
§ 8. *Intestinum Rectum and Anus*, - 279
§ 9. *Mesenterium and Mesocolon*, - 283
§ 10. *The Blood vessels and Nerves of the Intestines*, - - 287
§ 11. *Hepar and Vesicula Fellis*. - 291
§ 12. *Pancreas*. - - 305
§ 13. *Lien*, - - 307
§ 14 *Omentum and Appendices Epiploicæ*, 312
§ 15. *Uses of the Abdominal Viscera*, 316
§ 16 *Rens et Ureteres* - - 321
§ 17. *Glandulæ Renales, vulgo Capsulæ Atrabiliariæ*, - - 329
§ 18. *Vesica Urinaria*, - 332
§ 19. *The Parts of Generation in Males*, 336
§ 20. *The Parts of Generation in Females*, 360
§ 21. *Of the Gravid Uterus* *, - 374

* From Professor HAMILTON'S *First Lines of the Theory and Practice of Midwifery*.——This acknowledgment was omitted to be made in its proper place.

Art. I. *Of Conception,* - - 374
Art. II. *Structure of the Ovum in early Gestation,* - - 376
Art. III. *Evolution of the Fœtus,* - 379
Art. IV. *Contents of the Gravid Uterus in advanced Gestation,* - 380
Art. V. *Changes of the Uterine System from advanced Gestation.* - 386
Art. VI. *Manner of Circulation between the Mother and Fœtus,* - 391
Art. VII. *Circulation in the Fœtus,* 392
Art. VIII. *Position of the Fœtus in utero,* 393
Art. IX. *Peculiarities of the Fœtus,* 394
Explanation of Tab. IX. } from Chefelden. 395
Explanation of Tab. X. } from Chefelden. 396

PART VII.

Of the Veffels.

Chap. I. *Of the Arteries,* - - 397
Chap. II. *Of the Veins,* - - 446
§ 1. *Veins of the Head and Neck,* - 452
§ 2. *Veins of the Superior Extremities,* 458
§ 3. *Veins of the Thorax,* - - 462
§ 4. *Veins of the Chylopoietic and assistant Chylopoietic Viscera,* - 468
§ 5. *Veins of the Inferior Extremities,* - 474
§ 6. *Veins of the Pelvis.* - - 478
§ 7. *Veins on the Back-part of the Abdomen and Loins,* - - 481
Explanation of Tab. XI. *and* XII. - 484
Chap. III. *Of the Absorbent System,* . 487
Sect. I. *Of the Absorbent System in general,* 489
Sect. II. *A particular description of the Absorbent System in the Human Body,* - 492

Sect,

§ 1. *Lymphatic Vessels of the Lower Extremities,* - - 493
§ 2. *Absorbent Vessels of the Trunk,* - 497
§ 3. *Lymphatics of the Head and Neck,* 507
§ 4. *Lymphatics of the Upper Extremities,* 510
Explanation of Tab. XIII. - - 496
Explanation of Tab. XIV. - - 508

PART VIII.

Of the Nerves.

Chap. I. *Of the Nerves in general,* - 517
Chap. II. *Of the particular Nerves,* - 570
Explanation of Tab. XV. - - 577
Explanation of Tab. XVI. - - 578
Index, - - - - 579

A

SYSTEM

OF

ANATOMY.

PART V.

Containing a DESCRIPTION of the

INTEGUMENTS.

BY DR WINSLOW.

With ADDITIONS and IMPROVEMENTS.

OF THE COMMON INTEGUMENTS.

"ALL the parts of the human body are invested by several common and universal coverings, to which anatomists give the name of *integuments*.

"There have been many disputes about the number of these integuments. The ancients reckoned up five, viz. the *epidermis*, *skin*, *membrana adiposa*, *panniculus carnosus*, and *membrana musculorum communis*.

The

" The three firft of thefe coverings are truly common or univerfal, that is, extended over all parts of the body.

" The two other coverings are not univerfal, but confined to particular parts of the body.

" The moderns divide the integuments into *cuticula*, *rete mucofum*, *cutis vera*, and *corpus adipofum*.

THE CUTICULA.

" The outfide of the fkin is covered by a thin tranfparent infenfible pellicle, clofely joined to it, which is called *epidermis*, *cuticula*, or *fcarf-fkin*.

" The fubftance of the cuticle appears to be very uniform on the fide next the fkin; and to be compofed on the other fide, of a great number of very fine fmall fquamous laminæ, without any appearance of fibrous or vafcualr texture, except fome fmall filaments by which it is connected to the parts below.

" This fubftance is very folid and compact, but yet capable of being extended and thickened, as we fee by fteeping it in water, and by the blifters raifed on the fkin by veficatories or any other means; and from thence it would feem, that it is of a fpongy texture. It yields very much in fwellings; but not fo much as the fkin without breaking or cracking.

" With refpect to its origin, fome authors have fuppofed it to be formed by a moifture exhaled from the whole furface of the body, which gradually hardens when it is expofed to the air: but the fœtus in utero, where no air is admitted, is a proof againft this opinion; and it grows readily under plafters applied to any part of the body.—Leeuwenhoeck fuppofed its formation to be owing to the expanfion of the extremities of the excretory veffels, which are found every where upon the furface of the true fkin. Ruyfch attributed its origin to the nervous papillæ of the fkin; and Heifter thinks it probable that it may be owing both to the papillæ and the excretory veffels. Morgagni, on the other hand, contends, that it is nothing more than the furface of the

the cutis, hardened and rendered infenfible by the li-quor amnii in the uterus, or by the preffure of the air. In fact, we know little about its origin: but the regene-ration of it is very evident, fudden, and furprifing; for, let it be deftroyed ever fo often, it ftill grows again.

"Hard and reiterated frictions loofen it infenfibly; and prefently afterwards a new ftratum arifes; which thrufts the firft outward, and may itfelf be loofened and thruft outward by other ftrata.

"It is nearly in this manner that callofities are formed on the feet, hands, and knees; and the feveral lami-næ or ftrata obfervable at the fame time on many other parts of the body, are owing to the fame caufe, though many anatomifts have looked upon them to be natural. But it muft be acknowledged, that, on the palms of the hands and foles of the feet, the cuticle is commonly thicker than on any other part.

"The cuticle adheres very clofely to the cutaneous papillæ under it; but it may be feparated by boiling, or fteeping for a long time in cold water. It is not im-poffible to feparate it with the knife; but this manage-ment teaches us nothing of its ftructure.

"It adheres ftill clofer to the corpus mucofum, which is eafily raifed along with it; and they feem to be true portions or continuations of each other.

"The colour of the cuticle is naturally white; and the apparent colour thereof is owing to that of the corpus mucofum. For, if we examine the European and Afri-can, we find the cuticle to be nearly of the fame colour in both, whereas their corpus mucofum is very different.

"The cuticle covers the fkin through its whole extent, excepting at places where the nails lie. It is marked with the fame furrows and lozenges as the fkin, and has the fame openings and pores; and may be faid to co-ver not only the whole external part of the body, but to line many of the large paffages, as the alimentary ca-nal, the lungs, vagina, urethra, &c.

"When we examine narrowly the fmall paffages thro' which the febaceous matter of the fkin paffes, the cuticle feems to enter thefe, in order to complete the fecretory tubes. The foffulæ of the hairs have likewife the fame productions of the cuticle; and it feems to give a kind of covering to the hairs themfelves. Laftly, the almoft imperceptible ducts of the cutaneous pores are lined by it.

" If the fkin be macerated for a long while in water, the cuticle, with its elongations, may be feparated from it. By this obfervation we may explain how blifters may remain for a long time on the fkin without giving paffage through thefe holes to the matter which they contain; which holes one would think ought to be increafed by this dilatation and tenfion of the cuticle.

" But when the cuticle is feparated from the fkin, it carries along with it part of thefe cutaneous fibres; which being compreffed by the matter contained in the blifter, fhut the pores of the feparated cuticle like fo many valves; and it is probably thefe fmall portions which have been taken for valves of the cutaneous tubes.

CORPUS MUCOSUM.

" Under the cuticle, we meet with a fubftance of a greyifh colour, which has been thought to reprefent a net-work; hence it has got the name of *corpus reticulare*, or *mucofum*. It is of a foft, mucilaginous, and vifcid nature; and fills up the interftices of the fibres running between the cutis vera and cuticula. After raifing the cuticle in a negro, this fubftance appears of a black colour, and is compofed of two layers. It is this that chiefly gives the colour to the fkin; for it is black in the African; white, brown, or yellowifh, in the European.

" The origin of this mucous fubftance has not hitherto been fufficiently explained; nor has it been fully determined what purpofes it ferves in the human body. The reafon why it is black in the negro has been fuppofed posed to be for serving as a defence against the external heat, by preventing the rays of the sun from penetrating his body; but the matter still lies hid in obscurity.

CUTIS VERA.

"The cutis vera, or *skin* properly so called, is a substance of very large extent, made up of several kinds of fibres, closely connected together, and running in various directions, being composed of the extremities of numerous vessels and nerves."

This texture is what we commonly call *leather;* and it makes, as it were, the body of the skin. It is not easily torn; may be elongated in all directions, and afterwards recovers itself, as we see in fat persons, in women with child, and in swellings; and it is thicker and more compact in some places, than in others.

Its thickness and compactness are not, however, always proportionable: for on the posterior parts of the body, it is thicker and more lax than on the fore-parts; and on the palms of the hands, and soles of the feet, it is both very thick and very solid. It is generally more difficult to be pierced by pointed instruments in the belly, than in the back.

The outer surface of this substance is furnished with small eminences, which anatomists have thought fit to call *papillæ.* "They appear through its whole surface like small granulations; and seem to be calculated to receive the impressions of touch, being the most easily observed where the sense of feeling is the most delicate, as in the points of the fingers and palms of the hands; and are supposed by many to be the capillary filaments of the cutaneous nerves, which terminate by small radiated pencils: but they must be allowed to be formed like the other parts of the cutis; only the nervous fibrillæ will be found to be more numerous in them than in other parts."

These papillæ differ very much in figure and disposition in the different parts of the body, and they may be diſtinguiſhed into ſeveral kinds.

The greateſt part of them is flat, of different breadths; and ſeparated by ſulci, which form a kind of irregular lozenges. The pyramidal figure aſcribed to them, is not natural; and appears only when they are contracted by cold, by diſeaſes, by boiling, or by ſome other artificial preparation which alters their ordinary ſtructure.

The papillæ of the palm of the hand, of the ſole of the foot, and of the fingers and toes, are higher than on the other parts of the body; but they are likewiſe ſmaller, cloſely united together, and placed as it were endwiſe with reſpect to each other, in particular rows, which repreſent on the ſkin all kinds of lines, ſtraight, crooked, waving, ſpiral, &c. Theſe ſeveral lines are often diſtinctly viſible in thoſe parts of the palm of the hand which are next the firſt phalanges of the fingers.

The red part of the lips is made up of papillæ, repreſenting very fine hairs or villi cloſely united together.

There is another particular kind under the nails; the papillæ being there more pointed, or in a manner conical, and turned obliquely toward the ends of the fingers. Thoſe which are found in the hairy ſcalp, ſcrotum, &c. are ſtill of other kinds.

In inflammations, we obſerve a reticular texture of capillary veſſels, more or leſs extended on the ſurface of the ſkin; and curious anatomiſts demonſtrate the ſame thing by fine injections, which may be looked upon as artificial inflammations. But neither of theſe methods proves, that, in the natural ſtate, theſe veſſels are blood-veſſels; that is, that they contain the red portion of the blood.

It

* "Something ſimilar to this has been injected lately by Mr Baynham of London, who thought it *rete mucoſum*; and afterwards by Mr Cruikſhank, who calls it *cuticula quarta*. See *Mr Cruikſhank's Letter to Mr Clare*."

It is more probable that this vafcular texture is only a continuation or production of the very fmall capillaries of the arteries and veins; which, in the natural ftate, tranfmit only the ferous part of the blood, while the red part continues its courfe through wider ramifications, which more properly retain the name of *blood-veffels*.

This vafcular texture is of various forms and figures in the different parts of the body. It is not the fame in the face with what it is elfewhere; neither is it alike on all the parts of the face, as may be difcovered by the moft ordinary microfcopes: and from hence we might perhaps be enabled to give a reafon, why one part of the body turns red more eafily than another.

The fkin has feveral confiderable openings, fome of which have particular names; fuch as the fiffure of the palpebræ, the nares, the mouth, the external foramen of the ears, the anus, and openings of the parts of generation.

Befides thefe, it is perforated by an infinite number of fmall holes, called *pores*, which are of two kinds. Some are more or lefs perceivable by the naked eye; fuch as the orifices of the milky ducts of the mammæ, the orifices of the excretory canals of the cutaneous glands, and the paffage of the hairs.

The other pores are imperceptible to the naked eye, but vifible through a microfcope; and their exiftence is likewife proved by the cutaneous tranfpiration, and by the effects of topical applications; and from thefe two phænomena, they have been divided into arterial and venal pores.

We ought likewife to obferve the adhefions and folds of the fkin. It is everywhere united to the corpus adipofum; but it adheres to it much more clofely in fome parts than in others, as in the palm of the hand, fole of the foot, elbow, and knee.

Some plicæ or folds in the fkin depend on the ftructure of the membrana adipofa or cellularis, as thofe in the neck and buttocks: others do not depend on that membrane, fuch as the rugæ in the forehead, palpebræ, &c. which are formed by cutaneous mufcles, and difpofed more or lefs in a contrary direction to thefe mufcles. Thefe folds increafe with age.

There is befides a particular kind of folds in the fkin of the elbow, knee, and condyles of the fingers and toes; which are owing neither to the conformation of the membrana adipofa, nor to any mufcle.

Laftly, there is a kind of plicæ, or rather lines, which crofs the palm of the hand, fole of the foot, and correfponding fides of the fingers and toes, in different directions. Thefe ferve for employment to fortune-tellers; whofe pretended art is contrary to religion, and defpifed by all men of fenfe.

GLANDS OF THE SKIN.

"In different parts of the body, we meet with fmall glands or follicles of an oval form, and feated chiefly under the fkin in the corpus adipofum.

"They are compofed of convoluted veffels; but in fome parts of the body they appear to be formed of fmall cylindrical tubes or fimple follicles, continued from the ends of the arteries, and difcharging, by fmall excretory ducts, a fat and oily matter, that ferves to lubricate and moiften the furface of the fkin. When the fluid they fecrete has acquired a certain degree of thicknefs, it approaches to the colour and confiftence of fuet: and from this appearance they have derived the name of *febaceous glands*. They are found chiefly on the nofe, ears, axillæ, likewife round the nipple, and about the external parts of generation in both fexes.

"Befides the febaceous glands, anatomical writers mention other fmall fpherical bodies placed every where over the furface of the body, in much greater abundance than thofe juft mentioned, and named *miliary*. They are faid to have excretory ducts that open on the

the ſurface of the cuticle, and diſtil the ſweat and matter of inſenſible perſpiration; but after all that has been ſaid by different authors about them, their exiſtence is now generally denied."

USES OF THE SKIN.

It is chiefly and properly the filamentary ſubſtance, called the *body of the ſkin*, which is the univerſal integument of the body, and the baſis of all the other cutaneous parts; each of which has its particular uſes.

The ſkin is able to reſiſt external injuries to a certain degree, and ſuch impreſſions, frictions, ſtrokes, &c. to which the human body is often liable, as would hurt, wound, and diſorder the parts of which it is compoſed, if they were not defended by the ſkin.

The papillæ are the organ of feeling, and contribute to an univerſal evacuation, called *inſenſible tranſpiration*. They likewiſe ſerve to tranſmit from without, inwards, the ſubtle particles or impreſſions of ſome things applied to the ſkin. The firſt of theſe three uſes depends on the extremities of the nerves; the ſecond on the arterial productions; and the third on the productions of the veins.

The cutaneous glands ſecrete an oily humour of different conſiſtences; and they are likewiſe the origin of ſweat. But without the epidermis, both papillæ and glands would be diſturbed in their functions; on which great diſorders muſt enſue.

In order to explain the mechaniſm of feeling, or of the touch, we ſhould firſt be made acquainted with the ſenſes in general, for which this is not a proper place; and therefore all that I ſhould obſerve here, is, that there are at leaſt two ſorts of feeling; one general, the other particular.

Particular feeling is accompanied with a certain determinate impreſſion, by which we are enabled to diſcern objects in a very diſtinct manner; and this is properly what is called the *touch*, the proper organ of which

which is at the infide of the ends of the fingers. General feeling is indeterminate and indiftinct, not being accompanied with the fame impreffion as the former.

Thefe differences, in the fenfe of feeling, depend on thofe of the papillæ; which, in effect, appear to be more clofe, and made up of a greater number of nervous filaments, at the ends of the fingers than any where elfe; for the nervous ropes that go to the fingers are prooortionably larger than thofe that go to any other part of the body.

The epidermis ferves to keep the pencils or nervous filaments of the papillæ in an even fituation, and without confufion; and it likewife moderates the impreffions of external objects. Particular, as well as general feeling, is more or lefs perfect, in proportion to the thinnefs of the epidermis; callofities in which, weaken, and fometimes deftroy both.

Another ufe of the epidermis is to regulate the cutaneous evacuations already mentioned; the moft confiderable of which is infenfible tranfpiration. By this we underftand a fine exhalation, or a kind of fubtle fmoke, which flows out of the body imperceptibly, and in different quantities. It might be called *cutaneous tranfpiration*, to diftinguifh it from *pulmonary tranfpiration*; of which hereafter.

This cutaneous exhalation becomes fenfible, by applying the end of the finger, or palm of the hand, to the furface of a looking-glafs, or of any other polifhed body; for it prefently looks dull, and appears to be covered with a condenfed vapour. It feems to me, that the convex fide of the hand and fingers does not furnifh fo great a quantity of this exhalation as the palm of the hand, and the infides of the fingers, efpecially the extremities; which points out one ufe of this tranfpiration, *viz.* to keep the nervous filaments in due order for particular feeling.

Another proof of infenfible tranfpiration, is the famous experiment of Sanctorious, continued for thirty years

years without interruption; by which he found, that this evacuation in one day was equal to all the fenfible evacuations for fifteen days.

This calculation is not agreeable to what has been made in other countries, particularly thofe from the like experiments made by M. Dodart and Morin of the royal academy of fciences, and by Dr James Keill as publifhed in his *Statica Britannica*. Neither can the balance inform us, whether the cutaneous tranfpiration is greater or lefs than the pulmonary.

A long time ago, I difcovered a method to render this tranfpiration vifible, to the diftance of about half a foot from the body; and I mentioned it in a thefis printed at Copenhagen. If we look at the fhadow of a bare head on a white wall, in a bright funfhiny day, and in the fummer-feafon, we will perceive very diftinctly the fhadow of a flying fmoke rifing out of the head, and mounting upward, though we cannot fee the fmoke itfelf. We may try the fame experiment with a dog or fowl, &c.

It is much in the fame manner, that the invifible exhalations from burning charcoal throw a very diftinct fhadow; and that the invifible fmoke of a chafing-difh, warming-pan, ftove, &c. make all diftant objects appear trembling, when viewed either over or on either fide of thofe utenfils.

The infenfible cutaneous evacuation is performed fimply, and without any artifice, through the fmall pores already mentioned, much in the fame manner as we obferve the fmoke to arife from the entrails of an animal newly killed and opened. It is a particular and continual difcharge of the ferum of the blood through the capillary veffels of the fkin.

It is naturally very moderate; and it is more abundant in the fummer, before a good fire, after ftrong exercife, and during the diftribution of the chyle, than in the winter, in cold places, during inaction, and before meals.

The

The tranfpired matter appears to be in fome degree faline, as may be obferved by applying the tongue to the palm of the hand when it has not been wafhed lately before. This is perhaps the reafon why we feel lefs pain when a wound is touched with the finger covered with filk, than with the naked finger: but this inconveniency might eafily be prevented by wafhing the hands and fingers very well immediately before we begin to drefs wounds.

The matter of the other two cutaneous evacuations, the fweat and thick oily fubftance, comes chiefly from the glands of the fkin. Each of them differs according to the different parts of the body where they are found, as may be obferved both of the filth and fweat of the head, arm-pits, hands, feet, &c.

This filth or naftinefs of the fkin, is an unctuous or fatty matter, collected infenfibly on the epidermis, where it thickens, and forms a fort of varnifh, which in time becomes prejudicial, by ftopping up the paffages of cutaneous tranfpiration.

This collection is more readily made in winter than in fummer; and this is the reafon why it is more difficult to keep the hands clean in cold than in warm weather. And while I am diffecting in winter, the oftener I wafh my hands the lefs fenfible they are of cold.

MEMBRANA ADIPOSA, AND FAT.

The laft univerfal integument of the human body, is the membrana adipofa, or corpus adipofum. This is not, however, a fingle membrane, but a congeries of a great number of membranous laminæ, joined irregularly to each other at different diftances, fo as to form numerous interftices of different capacities, which communicate with each other. Thefe interftices have been named *cellulæ*, and the fubftance made up of them the *cellular fubftance*.

The thicknefs of the membrana adipofa is not the fame all over the body, and depends on the number of laminæ

laminæ of which it is made up. It adheres very clofely to the fkin; runs in between the mufcles in general, and between their feveral fibres in particular; and communicates with the membrane which lines the infide of the thorax and abdomen.

This ftructure is demonftrated every day by butchers, in blowing up their meat when newly killed; in doing which, they not only fwell the membrana adipofa, but the air infinuates itfelf likewife in the interftices of the mufcles, and penetrates even to the vifcera, producing a kind of artificial emphyfema.

Thefe cellular interftices are fo many little bags or fatchels, " which communicate freely with each other, and are" filled with an unctuous or oily juice, more or lefs liquid, which is called fat; the different confiftence of which depends not only on that of the oily fubftance, but on the fize, extent, and fubdivifion of the cells.

It is generally known, that the illuftrious Malpighi took a great deal of pains about this fubftance; that in birds and frogs, the vifcera and veffels of which are tranfparent, he thought he faw a kind of ductus adipofi; and that, by preffing thefe ducts, he obferved oily drops to run diftinctly into the fmall ramifications of the vena portæ.

The manufacture of foap, the compofition of the unguentum nutritum, and the different mixtures of oils with faline and acid liquors, give us fome idea, at leaft, of the formation of the fat in the human body; but the organ which feparates it from the mafs of blood, which ought to be the fubject of our prefent inquiry, is not as yet fufficiently known.

Fat is more fluid in living than in dead bodies. It melts with the heat of the fingers in handling it; and its fluidity is in part obftructed by the facculi which contain it. To take it entirely out of thefe bags, the method is to fet the whole over the fire in a proper veffel; for then the bags burft, and fwim in clufters in a true oily fluid.

This

This ſubſtance increaſes in quantity in the body by reſt and good living; and, on the contrary, diminiſhes by hard labonr and a ſpare diet. Why nouriſhment ſhould have this effect, is eaſily conceived; and it is likewiſe eaſy to ſee, that an idle ſedentary life muſt render the fat leſs fluid, and conſequently more capable of blocking up the paſſages of inſenſible tranſpiration, through which it would otherwiſe run off.

Hard labour diſſolves it, and conſequently fits it for paſſing out of the body, with the other matter of inſenſible tranſpiration. Some are of opinion, that it returns into the maſs of blood, " by the lymphatics;" and that it can, for ſome certain time, ſupply the want of nouriſhment.

By this, they think, the long abſtinence of ſome animals may be explained; but I am apt to believe, that the mere decreaſe of cutaneous tranſpiration, occaſioned by the continual reſt and inaction of theſe animals, has a great ſhare in this effect.

The proportional differences, in the thickneſs of this membrana adipoſa, are determined, and may be obſerved to be regular in ſome parts of the body, where either beauty or uſe require it.

Thus we find it in great quantities where the interſtices of the muſcles would otherwiſe have left diſagreeable hollow or void places; but being filled, and as it were padded with fat, the ſkin is raiſed, and an agreeable form given to the part.

The appearance of a perſon moderately fat, of a perſon extremely lean, and of a dead carcaſe from which all the fat has been removed, proves ſufficiently what I have ſaid.

In ſome parts of the body the fat ſerves for a cuſhion, pillow, or mattreſs; as on the buttocks, where the laminæ and cells are very numerous. In other parts, this membrane has few or no laminæ, and conſequently little or no fat; as on the forehead, elbows, &c.

In ſome places it ſeems to be braced down by a kind of of natural contraction in form of a fold; as in that fold which ſeparates the baſis of the chin from the neck, and in that which diſtiinguiſhes the buttocks from the reſt of the thigh. We obſerve it likewiſe to be entirely ſunk, or as it were perforated by a kind of dimple or foſſula, as in the navel of fat perſons.

Theſe depreſſions and folds are never obliterated, let the perſon be ever ſo fat; becauſe they are natural, and depend on the particular conformation of the membrana adipoſa, the laminæ of which are wanting at theſe places.

The fat is likewiſe of great uſe to the muſcles in preſerving the flexibility neceſſary for their actions, and in preventing or leſſening their mutual frictions. This uſe is of the ſame kind with that of the unctuous matter found in the joints, which was explained in the deſcription of the freſh bones.

Laſtly, the fat, as a fine oily ſubſtance in its natural ſtate, may be ſome defence againſt the cold, which we find makes more impreſſion on lean than on fat perſons. It is for this reaſon, that to guard themſelves againſt the exceſſive colds of hard winters, and to prevent chilblains, travellers rub the extremities of their bodies, and eſpecially their feet, with ſpirituous oils, ſuch as that of turpentine, &c.

This maſs of fat, which makes an univerſal integument of the body, is different from that which is found in the abdomen, thorax, canal of the ſpina dorſi, articulations of the bones, and in the bones themſelves.

But the difference of all theſe particular maſſes of fat conſiſts chiefly, as I have ſaid, in the thickneſs or fineneſs of the pellicles, in the largeneſs or ſmallneſs of the cells, and in the conſiſtence, fluidity, and ſubtilty of the oily matter.

THE

THE NAILS.

The nails are looked upon by ſome as productions of the cutaneous papillæ, and by others as a continuation of the epidermis. This laſt opinion agrees with experiments made by maceration, by means of which the epidermis may be ſeparated entire from the hands and feet, like a glove or ſock.

In this experiment we ſee the nails part from the papillæ, and go along with the epidermis, to which they remain united like a kind of appendix; and yet their ſubſtance and ſtructure appears to be very different from that of the epidermis.

Their ſubſtance is like that of horn, and they are compoſed of ſeveral planes of longitudinal fibres ſoldered together. Theſe ſtrata end at the extremity of each finger; and are nearly all of an equal thickneſs, but of different lengths.

The external plane or ſtratum is the longeſt, and the reſt decreaſe gradually, the innermoſt being the ſhorteſt; ſo that the nail increaſes in thickneſs from its union with the epidermis where it is thinneſt, to the end of the finger where it is thickeſt.

The graduated extremities or roots of all the fibres of which theſe planes conſiſt, are hollowed for the reception of the ſame number of very ſmall oblique papillæ, which are continuations of the true ſkin, which having reached to the root of the nail, forms a ſemilunar fold in which that root is lodged.

After this ſemilunar fold, the ſkin is continued on the whole inner ſurface of the nail, the papillæ inſinuating themſelves in the manner already ſaid. The fold of the ſkin is accompanied by the epidermis, to he root of the nail exteriorly, to which it adheres very cloſely.

Three parts are generally diſtinguiſhed in the nail; the root, body, and extremity. The root is white and in in form of a crefcent; and the greateft part of it is hid under the femilunar fold already mentioned.

The crefcent and the fold lie in contrary directions to each other. The body of the nail is naturally arched, tranfparent, and appears of the colour of the cutaneous papillæ which lie under it. The extremity of the nail does not adhere to any thing, and ftill continues to grow as often as it is cut.

The principal ufe of the nails is to ftrengthen the ends of the fingers and toes, and to hinder them from being inverted towards the convex fide of the hand or foot, when we handle or prefs any thing hard. For in the hand, the ftrongeft and moft frequent impreffions are made on the fide of the palm; and in the foot, on the fole: and therefore the nails ferve rather for buttreffes than for fhields.

"The nails feem to poffefs feveral properties in common with the cuticle:—like it they are neither vafcular nor fenfible; and when the cuticle is feparated from the true fkin by maceration or other means, the nails come away without it."

THE HAIRS.

The hairs belong as much to the integuments as the nails. The roots or bulbs lie toward that fide of the fkin which is next the membrana adipofa. The trunk or beginning of the ftem perforates the fkin, and the reft of the ftem advances beyond the outer furface of the fkin, to a certain diftance, which is very various in the different parts of the body.

When the different hairs are examined by a microfcope, we find the roots more or lefs oval, the largeft extremity being either turned toward or fixed in the corpus adipofum. The fmalleft extremity is turned towards the fkin, and in fome places fixed in the fkin.

This oval root is covered by a whitifh ftrong membrane, in fome meafure elaftic; and it is connected either to the ſkin, to the corpus adipoſum, or to both, by a great number of very fine veſſels and nervous filaments.

Within the root, we obſerve a kind of glue, ſome very fine filaments of which advance toward the ſmall extremity, where they unite and form the ſtem, which paſſes through this ſmall extremity to the ſkin. As the ſtem paſſes through the root, the outer membrane is elongated in form of a tube, which cloſely inveſts the ſtem, and is entirely united to it.

The ſtem having reached the ſurface of the ſkin, pierces the bottom of a ſmall foſſula between the papillæ, or ſometimes a particular papilla; and there it meets the epidermis, which ſeems to be inverted round it, and to unite with it entirely. A ſort of unctuous matter tranſudes through the ſides of the foſſula, which is beſtowed on the ſtem, and accompanies it more or leſs, as it runs out from the ſkin, in form of an hair.

Hairs differ in length, thickneſs, and ſolidity, in the different parts of the body. Thoſe on the head, are called in Engliſh by the general name of *hairs;* thoſe which are diſpoſed archwiſe above the eyes, *ſupercilia* or the *eye-brows;* thoſe on the edges of the palpebræ, *cilia* or the *eye-laſhes;* and thoſe which ſurround the mouth, and cover the chin, the *beard.* In other parts of the body, they have no particular names; and their different lengths, thickneſſes, &c. in all theſe parts, are ſufficiently known.

Their natural figure ſeems to be rather cylindrical than angular, which is chiefly accidental. Their colour is probably the ſame with that of the glue, or medullary matter of the root, the different conſiſtence of which makes the hairs more or leſs hard, flexible, &c. Laſtly, their ſtraight or crooked direction muſt depend on that of the holes through which the ſtems paſs.

The uſe of the hairs, with reſpect to the human body " in general, is not ſufficiently known to be determined

ned with certainty. Their ufes with regard to fome particular parts may be difcovered; as we fhall fee in the defcription of thefe parts.

THE SUPPOSED INTEGUMENTS OF THE ANCIENTS.

" Besides the integuments which I have already defcribed, the ancients reckoned the panniculus carnofus, and membrana communis mufculorum.

" The panniculus carnofus is found in quadrupeds, but not in men, whofe cutaneous mufcles are in a very fmall extent, except that which I call *mufculus cutaneus* in particular; but even that mufcle cannot in any tolerable fenfe be reckoned a common integument.

" There is no common membrane of the mufcles, which covers the body like an integument; it being no more than particular expanfions of the membranes of fome mufcles, or aponeurotic expanfions from other mufcles.

" The elongations from the lamina of the membrana adipofa or cellularis, may likewife have given rife to this miftake, efpecially in fuch places where this membrane is clofely united to the proper membrane of the mufcles."

A

SYSTEM OF ANATOMY.

PART VI.

Containing a DESCRIPTION of the

VISCERA AND ORGANS.

By DR WINSLOW.

With ADDITIONS and IMPROVEMENTS.

CHAP. I.

Of the HEAD.

" IN deſcribing the head, I ſhall firſt explain the parts which ſurround the cranium, and afterward thoſe which are contained within it; and it is very proper that the reader ſhould review what has been ſaid concerning the ſtructure of the cranium in both treatiſes of the bones, before he begins this chapter.

THE PERICRANIUM.

" Beſides the external integuments of the head, viz.

 the

the hair, ſkin, and cellular ſubſtance, there is another aponeurotic expanſion, which covers the head like a cap, and is ſpread round the neck and on the ſhoulders like a riding hood.

This aponeuroſis is very ſtrong on the head, and it is made up of layers of fibres croſſing each other. As it is ſpread on the neck it becomes gradually thinner, and ends inſenſibly on the clavicles. It ſends out a production on each ſide, from above downwards, and from without inward, which having paſſed over the ſuperior extremity of the muſculus ſterno-maſtoidæus, runs behind that muſcle toward the tranſverſe proceſs of the vertebræ of the neck, where it is connected with the ligamenta intertranſverſalia.

"The external ſurface of all the bones of the head, as well as of all other bones of the body excepting the teeth, and where tendons or ligaments are fixed, is covered by a particular membrane, of which that portion which particularly inveſts the cranium is named *pericranium*, and that which inveſts the bones of the face is ſimply termed *perioſteum*..

"The internal part of the pericranium, which has by ſome been taken for a membrane peculiar to the upper part of the head, covers immediately all the bony parts of this region; and the external part has been looked upon as a membrane diſtinct from the internal, and named *pericranium* partieularly.

"The external part of the pericranium ſeparates from the other, at the ſemicircular plane upon the ſide of the cranium, mentioned in the deſcription of the bones; and becomes a very ſtrong aponeuroſis, which covers the temporal muſcle, and is afterwards fixed to the external proceſs of the os frontis, and to the upper edge of all the zygoma. The other parts of the pericranium are connected to the neighbouring parts of the head."

The head, being conſidered in general as one of the three

three principal cavities of the human body, has this peculiar to it, that its outſide is the ſeat and baſis of ſeveral very complex particular organs, whereas on the inſide it contains only one, which is indeed the organ of organs, and the primum mobile of the whole animal œconomy; I mean, the brain; the mechaniſm of which is very little known; and the ſtructure of its different parts, even of thoſe which we are ſuppoſed to be moſt acquainted with, is very difficult to be demonſtrated.

SECT. I. *Of the* BRAIN *and its* APPENDAGES.

THE name of *brain* is given to all that maſs which fills the cavity of the cranium, and which is immediately ſurrounded by two membranes, called *meninges* by the Greeks, and *matres* by other ancients, becauſe they were commonly of opinion that theſe membranes were the origin, and, as it were, the mother, of all the other membranes of the body.

This general maſs is divided into three particular portions; the cerebrum or *brain* properly ſo called, the cerebellum, and medulla oblongata. To theſe three parts contained within the cranium, a fourth is added, which fills the great canal of the ſpina dorſi, by the name of *medulla ſpinalis*, being a continuation of the medulla oblongata.

The meninges, or membranes, are two in number; one of which is very ſtrong, and lies contiguous to the cranium; the other is very thin, and immediately touches the brain. The firſt is named *dura mater;* the ſecond *pia mater*. This laſt is again divided into two; the external lamina being termed *arachnoides*, the internal retaining the common name of *pia mater*. I begin with theſe meninges.

§ 1. *Dura Mater.*

Situation in general. The dura mater inclofes the brain and all its appendages. It lines the infide of the cranium, and fupplies the place of an internal periofteum, being fpread in holes and depreffions, and covering all the eminences in fuch a manner as to prevent their being hurtful to the brain.

Divifion. In defcribing the dura mater, we muft take notice, 1. Of its compofition. 2. Its adhefions to the cranium. 3. Its folds or fepta. 4. Its productions, veffels, and nerves.

Compofition. The dura mater is compofed of one lamina; although it may, by maceration, be divided into two or more. Their texture is very clofe and ftrong, appearing to be partly ligamentous and partly tendinous.

Adhefion. The dura mater fticks clofely to the cranium by a great number of filaments of the external lamina, which enter the pores of the bones, almoft every where, but more particularly at the futures both above and below; and by penetrating thefe joints, they communicate with the external periofteum. Thefe filaments are, for the moft part, fmall veffels, which being broken in feparating the dura mater from the fkull, a great number of red points appear on the external furface of that membrane.

It adheres much more to the whole inner furface of the cranium in children and young perfons than in thofe of an advanced age; the filaments become then very fmall, being compreffed by the contraction of the bony pores; and confequently they are more eafily ruptured by any force applied to them.

Internal lamina. Thefe adhefions are formed entirely by the outer furface of this membrane, the inner part of it being very fmooth and polifhed, and is alfo continually moiftened by a fine fluid difcharged thro' its

its pores, much in the ſame manner as the peritonæum and pleura.

Folds and ſepta. The dura mater ſends off ſeveral proceſſes; three of which form particular ſepta that divide the brain into certain parts. One of them is ſuperior, repreſenting a kind of mediaſtinum between the two great lobes of the brain: The ſecond is in a middle ſituation like a diaphragm, between the cerebrum and cerebellum: the third is inferior, between the lobes of the cerebellum. The ſuperior ſeptum is longitudinal in form of a ſcythe, from whence it is termed the *falx of the dura mater;* and it may likewiſe be called *ſeptum ſagittale*, *verticale*, or *mediaſtinum cerebri*. The middle ſeptum is tranſverſe; and might be called *the floor of the cerebrum*, *the diaphragm of the brain*, *tentorium cerebelli*. The inferior ſeptum is very ſmall, and runs down between the lobes of the cerebellum; on which account it may be termed either ſimply *ſeptum cerebelli*, or *ſeptum occipitale minus*, the middle partition being looked upon as the ſeptum occipitale majus.

The ſuperior or vertical ſeptum, called the *falx of the dura mater*, is a long and broad fold or duplicature of the internal lamina, reaching from the edge of the criſta Oſſis Cribroſi, along the ſagittal ſuture, to the middle of the tranſverſe ſeptum; which it joins in ſuch a manner, as that the lateral laminæ of the falx are continuous on each ſide with the neighbouring portions of the ſuperior lamina of the middle ſeptum.

It is broader where it joins the middle ſeptum than at the os ethmoides; and it is thicker at that edge which adheres to the cranium, than at the other, which lies looſe and is very ſharp; and from this reſemblance to a ſcythe, it had the name of *falx*.

The tranſverſe or middle ſeptum is fixed to the os occipitis along the grooves of the lateral ſinuſes, and thoſe of the great angles of the apophyſes petroſæ all the way to the poſterior clinoide apophyſes of the os ſphenoidale. By this ſituation it forms a ſort of floor, tent, or ſhallow

low vault, on the fore-part of which is a large notch almoſt of an oval figure.

This ſeptum divides the cranium into two cavities, one large or ſuperior, and the other ſmall or inferior, which communicate together by the great oval notch. It is formed by a particular fold, and a very broad membrane of the internal lamina of the dura mater; and in the natural ſtate it is very tenſe, becauſe of its union or rather continuity with the falx.

This union or continuity of theſe two ſepta, keeps them both very tenſe, ſo that the middle ſeptum is capable of ſuſtaining a conſiderable weight without ſinking downward; and the falx is able to reſiſt lateral preſſures, without giving way to the right hand or to the left.

We may be convinced of this reciprocal tenſion, by firſt touching theſe two ſepta in their natural ſtate; and again, after they have been cut one after the other according to their breadth; or rather after having cut in this manner the falx in one ſubject, and the tranſverſe ſeptum in another: for as ſoon as the falx is cut, the other will be perceived immediately to looſe its tenſion and firmneſs; and the ſame thing will be obſerved in the falx as we cut the ſeptum medium.

The ſmall occipital ſeptum is both very ſhort and narrow. It runs down from the middle of the tranſverſe ſeptum to the edge of the great occipital hole, being fixed to the internal ſpine of the os occipitis. It is formed by a fold and duplicature of the internal lamina of the dura mater, in the ſame manner as the other two, and diſtinguiſhes the lower part of the occipital cavity of the cranium into two lateral parts. In ſome ſubjects this ſeptum is double, anſwering to the double ſpine of the os occipitis.

Sphenoidal folds. Beſides theſe large folds, there are two ſmall lateral ones on each ſide of the ſella turcica, each running from the poſterior to the anterior clinoide apophyſis on the ſame ſide. Theſe two folds, together with

with the anterior or poſterior parts of the ſella turcica, form a ſmall foſſula, in which the pituitary gland is lodged. There are likewiſe two anterior folds at the edges of the ſphenoidal or ſuperior orbitary fiſſures, which augment the depth of the middle foſſulæ of the baſis cranii. Thus we have ſeven folds of this membrane, three large and four ſmall, which may be termed *internal productions* or *proceſſes of the dura mater.*

Elongations. The elongations of the dura mater go beyond the general circumference, and paſs out of the cranium, through the openings deſcribed in the treatiſe of the ſkeleton, and may be named *external productions of the dura mater.*

The moſt conſiderable of theſe elongations paſſes through the great occipital foramen, and runs down the common canal of the vertebræ in form of a tube, lining the inſide of that canal, and incloſing the medulla ſpinalis, by the name of the *dura mater* of that medulla. The other elongations accompany the nerves out of the cranium in form of vaginæ, which are more numerous than the nervous trunks reckoned in pairs. For the olfactory nerves, there is the ſame number of diſtinct vaginæ as there are holes in the lamina ethmoidalis; and ſome nerves are accompanied by ſeveral vaginæ through one hole, as thoſe of the ninth pair.

There are two particular elongations which form the perioſteum of the orbits, together with the vaginæ of the optic nerves. Theſe orbitary elongations go out by the ſuperior orbitary fiſſures, "or foramina lacera of the ſphenoid bone;" and, increaſing in breadth in their paſſage, line the whole cavity of the orbits, at the edges of which they communicate with the pericranium and perioſteum of the face. They communicate likewiſe, through the ſpheno-maxillary or inferior orbitary fiſſures, with the pericranium of the temporal and zygomatic foſſæ; and by theſe communications we may ex-

explain the accidents which happen to these parts in wounds of the head.

The elongations of the dura mater which accompany the blood-veſſels through the foramina of the cranium, unite with the pericranium immediately afterwards. Such, for inſtance, are the elongations which line the foſſulæ of the foramina lacera or jugularia, and the bony or carotid canals of the apophyſis petroſa, &c.

Arteries. The veſſels of the dura mater are arteries, veins, and ſinuſes. The arteries in general are diſtinguiſhed into anterior, middle, and poſterior; and come from the carotids and vertebrales on each ſide. The external carotid ſends a branch through the ſpinal hole of the os ſphenoidale, which is the middle artery of the dura mater; and is called, by way of eminence, *arteria duræ matris.* It is divided into a great number of branches, which are plentifully diſperſed through the ſubſtance of the external lamina as high as the falx, where theſe ramifications communicate with their fellows from the other ſide. The impreſſions of this artery are ſeen on the inſide of the parietal bones; the anterior and lower angle of which, inſtead of a ſimple impreſſion, contains a canal for the paſſage of a trunk or branch of this artery; on which account ſeveral accidents happen in fractures of the ſkull, as I demonſtrated at the royal garden above eight years ago.

The external carotid ſends another ſmall ramus thro' the corner or ſmall end of the ſphenoidal or ſuperior orbitary fiſſure; where there is ſometimes a little notch on purpoſe, mentioned in the deſcription of the ſkeleton. This branch is the anterior artery of the dura mater; and it gives off ramifications in the ſame manner as the former with which it communicates, but its ramifications are not ſo numerous. The internal carotid, as it enters the cranium, gives off a ſmall branch to the ſubſtance of the dura mater.

The two vertebral arteries enter by the great occipital foramen, and unite in one trunk on the anterior or ſphe-

ſphenoidal apophyſis of the os occipitis. Immediately afterwards they enter the ſubſtance of the dura mater on both ſides, each of them by one or two branches. Theſe are the poſterior arteries of the dura mater; and they communicate by ſome ramifications with the middle or ſpinal artery above mentioned.

Veins and ſinuſes. The dura mater contains in its duplicature ſeveral particular canals; into which the venous blood, not only of that membrane, but of the whole brain, is carried. Theſe canals are termed *ſinuſes;* and ſome of them are diſpoſed in pairs, others in uneven numbers: that is, ſome of them are placed alone in a middle ſituation; others are diſpoſed laterally on each ſide of the brain. The moſt ancient anatomiſts reckoned only four; to which we can now add four times as many.

Theſe ſinuſes are in the duplicature of the dura mater; and their cavities are lined on the inſide by particular very fine membranes. They may be enumerated in this manner: The great ſinus of the falx, or ſuperior longitudinal ſinus, which was reckoned the firſt by the ancients. Two great lateral ſinuſes, the ſecond and third of the ancients. The ſinus, called *torcular Herophili*, the fourth of the ancients. The ſmall ſinus of the falx or inferior longitudinal ſinus. The poſterior occipital ſinus, which is ſometimes double. Two inferior occipital ſinuſes, which form a portion of a circle, and may likewiſe be called *the inferior and lateral ſinuſes.* Six ſinus petroſi; three on each ſide, one anterior, one middle or angular, and one inferior. The two inferior, together with the occipital ſinuſes, complete a circular ſinus round the great foramen of the os occipitis. The inferior tranſverſe ſinus. The ſuperior tranſverſe ſinus. Two circular ſinuſes of the ſella ſphenoidalis; one ſuperior and one inferior. Two ſinus cavernoſi, one on each ſide. Two orbitary ſinuſes, one on each ſide.

All theſe ſinuſes communicate with each other, and with

with the great lateral finufes, by which they difcharge themfelves into the internal jugular veins, which are only continuations of thefe lateral finufes. They likewife unload themfelves, partly into the vertebral veins, which communicate with the fmall lateral or inferior occipital finufes; and partly into the external jugular veins, by the orbitary finufes, which communicate with the venæ angulares, frontales, nafales, maxillares, &c. as the lateral finufes likewife communicate with the venæ occipitales, &c.

Thus the blood, which is carried to the dura mater, &c. by the external and internal carotid, and by the vertebral arteries, is returned to the heart by the external and internal jugular and vertebral veins; fo that, when the paffage of the blood is obftructed in any particular place it finds another way by virtue of thefe communications, though not with the fame eafe. This obfervation is of confequence, in relation not only to obftructions, but to the different fituations of the head.

The great finus of the falx reaches from the connection of the ethmoidal crifta with the os frontis, along the upper edge of the falx, all the way to the pofterior edge of the tranfverfe feptum, where it ends by a bifurcation in the great lateral finufes. It is very narrow at its anterior extremity, and from thence becomes gradually wider all the way to its pofterior extremity.

The cavity of this finus is not cylindrical, but triangular, having in a manner three fides; one fuperior, parallel to the cranium; and two lateral, inclined to the plane of the falx. The upper fide is formed by the external lamina of the dura mater; and through the middle of its breadth a kind of fine raphe or future runs from one end to the other.

The two lower or lateral fides are productions of the "inner furface of the dura mater;" which having parted from the external, are inclined toward each other, and then unite; forming firft the finus, and afterwards the duplicature of the falx. This finus is lined

ned intériorly by a fine proper membrane, which forms likewiſe a kind of raphe or ſuture along the bottom of the ſinus, that is, along the union of the two lateral ſides.

In this ſinus we obſerve ſeveral openings and ſeveral ligamentary fræna. The openings are orifices of veins; the ſmalleſt of which belong to the dura mater, the largeſt to the brain. The veins of the brain enter the ſinus, for the moſt part, obliquely from behind forward, after they have run about a finger's breadth in the duplicature of the dura mater.

It has been thought that the arteries of the dura mater diſcharged themſelves immediately into the ſinuſes; becauſe injections made by the arteries, or a hog's briſtle thruſt into them, have been found to paſs into theſe ſinuſes: but, on a more cloſe examination, it has been diſcovered, that the injections paſſed from the arteries into the veins, and from thence into the ſinuſes, through the ſmall orifices already mentioned; and that the hog's briſtle pierced the ſides of the artery, which near the ſinuſes are very thin.

This miſtake gave riſe to another, that the dura mater had no veins; and what confirmed it was, that the arteries of the dura mater cover the veins ſo entirely, that the edges of the veins are hardly perceivable on either ſide of the arteries. There are, however, ſome places where the veins being broader than the arteries, their two edges are ſeen on each ſide of the arteries like capillary veſſels. Theſe veins are, for the moſt part, branches of the ſinuſes; and the ſmall trunks of ſome of them open into the head of the vena jugularis interna. We may eaſily be ſatisfied that the arteries on both ſides of the dura mater communicate with each other above the falx, either by injecting or blowing into them.

The internal fræna of this great ſinus appear to be tendinous, and to be deſigned to prevent the too great dilatation of the ſinus by the blood. They vary, however,

ever, in different fubjects, and do not always reach from one fide to the other. It has been pretended, that glands have been found there; but we ought to take care not to miftake for fuch certain fmall corpufcles, "which feem to have about them very little of the nature of glands."

The inferior finus of the falx is fituated in the lower edge of its duplicature, being very narrow, and, as it were, flatted on both fides. It communicates immediately with the fourth finus of the ancients; and in fome fubjects feems even to be a continuation thereof. It likewife communicates with the great or fuperior finus by fmall veins which go from one to the other, and with the veins of the cerebrum by the fame means.

The lateral finufes reprefent two large branches of the fuperior longitudinal finus, one going to the right hand, the other to the left, along the great circumference of the tranfverfe feptum, all the way to the bafis of the apophyfis petrofa of the offa temporum. From thence they run down, having firft taken a large turn, and then a fmall one; and being ftrongly fixed in the lateral grooves of the bafis cranii, they follow the courfe thereof all the way to the foramina lacera and foffulæ of the jugular veins.

They do not always arife by an equal and fymmetrical bifurcation of the fuperior longitudinal finus; for, in fome fubjects, one of the lateral finufes appears to be a continuation of the longitudinal, and the other to be a branch from it. This variety may happen on either fide; and, in a word, we fometimes find one of thefe finufes higher or lower, larger or fmaller, than the other.

The cavity of thefe lateral finufes is likewife triangular, and furnifhed with a proper membrane and with fræna: and it has alfo the fmall venal openings; which indeed are common to it, not only with the longitudinal finus, but with moft part of the others. The pofterior or outer fide of this cavity, is formed by the external

ternal part of the dura mater, and the other two by the internal part.

As these two sinuses go out by the posterior portions of the openings of the basis cranii, called *foramina lacera*, they are dilated into a kind of bag, proportioned to the fossulæ of the venæ jugulares, where they terminate in these veins.

Near the concourse of the superior longitudinal and lateral sinuses, we observe an opening (sometimes double), which is the orifice of a sinus situated along the union of the falx and transverse septum. It does not always end directly at the lower part of the superior sinus, but sometimes opens at the beginning of one of the lateral sinuses, especially when the bifurcation is not equal; and in this case it often terminates in that lateral sinus, which appears like a branch from the common trunk of the superior and other lateral sinus.

This sinus has been named *torcular Herophili*, from an ancient author, who imagined that the blood was in a manner in a press, at the union of these four sinuses. Its diameter is but small; and it forms a kind of bifurcation with the inferior longitudal sinns, and with a vein of the cerebrum, which is sometimes double, called *vena magna Galeni*.

The cavernous or lateral sinuses of the os sphenoides, are reservatories of a very particular kind; containing not only blood, but considerable vessels and nerves, as we shall see hereafter; and likewise a spongy or cavernous substance full of blood, much like that of the corpus cavernosum of the urethra.

Nerves and glands. We observe some nervous filaments which go to the dura mater, from the trunk of the fifth pair, at the entry of the cavernous sinus; and from the common trunk of the eighth pair and nervus accessorius or spinalis, as they pass through the foramen lacerum. The small tubercles sometimes found on the lateral sides of the longitudinal sinus of the falx, deserve still to be examined before we can determine

 any

any thing about them. The whole infide of the dura mater is moiftened in the fame manner as the peritonæum and pleura.

The prominent fibres interfecting each other in different manners which appear on the infide of the dura mater, efpecially near the falx and tranfverfe feptum, and which have been taken for a kind of flefhy fibres, feem to be only ligamentary and elaftic. The univerfal adhefion of this membrane to the cranium, proves that it can have no particular motion, and confequently that fuch flefhy or mufcular fibres would be altogether ufelefs. This adhefion was plainly demonftrated by Vefalius, Riolan, &c. long before Roonhuyfen.

§. 2. *Pia Mater.*

Situation in general. "This membrane is a much fofter and finer fubftance than the former; being exceedingly delicate, tranfparent, and vafcular;" and is connected to the dura mater only by the veins which open into the finufes as has been already faid.

Structure. "It is compofed of two laminæ, of which the external one is named *tunica arachnoidea*, from its refemblance to a cobweb. They adhere clofely to each other at the upper part of the brain; but are eafily feparable at the bafis, and through the whole length of the fpinal marrow.

"The tunica arachnoidea is fpread uniformly over the furface of the brain, inclofing all the circumvolutions, but without entering in between any of them; while the pia mater," or internal lamina, forms a great number of plicæ, duplicatures, and fepta; which "not only cover the brain in general, but" infinuate themfelves into all the folds and circumvolutions, and between the different ftrata of the cerebrum and cerebellum, "and are likewife continued into the different cavities."

The

The two laminæ of the pia mater are not ſo cloſely united as thoſe of the dura mater; being connected only by a cellular ſubſtance, which accompanies them thro' their whole extent, except at ſome places of the baſis of the cerebrum, &c. where, the internal lamina continuing its inſertions, the external remains uniformly ſtretched over the prominent parts, the interſtices of which are entirely ſeparated from the other lamina without any cellular ſubſtance between them. Theſe ſeparate portions of the external lamina have made it be looked upon as a third membrane of the brain, diſtinct from the pia mater.

§ 3. *Cerebrum.*

Situation and figure. THE cerebrum properly ſo called, is a kind of medullary maſs, of a moderate conſiſtence, and of a greyiſh colour on the outer ſurface, filling all the ſuperior portion of the cavity of the cranium, or that portion which lies above the tranſverſe ſeptum. The upper part of the cerebrum is of an oval figure, like half an egg cut lengthwiſe, or rather like two quarters of an egg cut lengthwiſe, and parted a little from each other. It is flatter on the lower part, each lateral half of which is divided into three eminences, called *lobes*, one anterior, one middle, and one poſterior.

Subſtance. The ſubſtance of the cerebrum is of two kinds, diſtinguiſhed by two different colours; one part of it, which is ſofteſt, being of a greyiſh or aſh colour; the other, which is more ſolid, being very white. The aſh-coloured ſubſtance lies chiefly on the outer part of the cerebrum like a kind of cortex, from whence it has been named *ſubſtantia corticalis* or *cinerea*. The white ſubſtance occupies the inner part, and is named *ſubſtantia medullaris*, or ſimply *ſubſtantia alba*.

Diviſion and lobes. The cerebrum is divided into two lateral portions, ſeparated by the falx, or great longitudinal feptum of the dura mater. They are generally termed *hemifpheres*, but they are more like quarters of an oblong fpheroide. Each of thefe portions is divided into two extremities, one anterior, and one pofterior, which are termed the *lobes of the cerebrum*, between which there is a large inferior protuberance which goes by the fame name; fo that in each hemifphere there are three lobes, one anterior, one middle, and one pofterior.

The anterior lobes lie upon thofe parts of the os frontis which contribute to the formation of the orbits and of the frontal finufes, commonly called the *anterior foffæ of the bafis cranii*. "The middle lobes lie in the middle or lateral foffæ of the bafis cranii, and the pofterior lobes on the tranfverfe feptum of the dura mater called the *tentorium*."

Sides and inequalities. Each lateral portion of the cerebrum has three fides; one fuperior, which is convex; one inferior, which is uneven; and one lateral, which is flat, and turned to the falx. Through the whole furface of thefe three fides we fee inequalities or windings like the circumvolutions of inteftines, formed by weaving ftreaks or furrows very deep and narrow, into which the fepta or duplicatures of the pia mater infinuate themfelves, and thereby feparate thefe circumvolutions from each other.

Near the furface of the cerebrum, thefe circumvolutions are at fome diftance from each other, reprefenting ferpentine ridges; and in the interftices between them, the fuperficial veins of the cerebrum are lodged, between the two laminæ of the pia mater, from whence they pafs into the duplicature of the dura mater, and fo open into the finufes.

Thefe circumvolutions are fixed through their whole depth to the fepta or duplicatures of the pia mater, by an infinite number of very fine vafcular filaments, as may be feen by pulling the circumvolutions a little afunder with the fingers.

When

When they are cut tranfverfely, we obferve that the fubftantia alba lies in the middle of each circumvolution, fo that there is the fame number of internal medullary circumvolutions as of external cortical ones; the firft reprefenting white laminæ invefted by others of an afh-colour; but the cortical fubftance is in many places thicker than the medullary.

Figure. The anterior and middle lobes of the cerebrum on each fide are parted by a deep narrow fulcus, which afcends obliquely backward, from the temporal ala of the os fphenoides to near the middle of the os parietale; and the two fides of this divifion have each their particular ridges and circumvolutions, which gives a very great extent to the cortical fubftance. This fulcus is termed *fiffura magna Silvii*, or fimply *fiffura cerebri*.

Corpus callofum. Having cut off the falx from the crifta galli, and turned it backward; if we feparate gently the two lateral parts or hemifpheres of the cerebrum, we fee a longitudinal portion of a white convex body which is named *corpus callofum*. It is a middle portion of the medullary fubftance, which under the inferior finus of the falx, and alfo a little toward each fide, is parted from the mafs of the cerebrum, to which it is fimply contiguous from one end of that finus to the other; fo that, at this place, the edge of the infide of each hemifphere only lies on the corpus callofum, much in the fame manner as the anterior and pofterior lobes lie on the dura mater. Both extremities of this medullary body terminate by a fmall edge bent tranfverfely downward.

The furface of the corpus callofum is covered by the pia mater, which runs in between the lateral portions of this body, and the lower edge of each hemifphere. Along the middle of its furface from one end to the other, there is a kind of raphe formed by a particular intertexture of fibres which crofs each other; for though thefe fibres appear to be tranfverfe, yet they are really a little oblique, and thofe that come from the right fide interfect thofe that come from the left. This raphe is made more perceivable by two fmall medullary cords which accompany it on each fide, and adhere clofely to the tranfverfe fibres.

Medullary arch and centrum ovale. The corpus callofum becomes afterwards continuous on each fide, with the medullary fubftance, which, through all the remaining parts of its extent, is entirely united with the cortical fubftance, and together with the corpus callofum forms a medullary arch or vault of an oblong or oval figure. To perceive this, the whole cortical fubftance, together with the medullary laminæ mixed with it, muft be cautioufly and dexteroufly cut in the fame direction with the convexity of the cerebrum. After which we will obferve a medullary convexity much fmaller than that which is common to the whole cerebrum, but of the fame form; fo that it appears like a medullary nucleus of the cerebrum, efpecially when we confider it together with the medullary fubftance of the inferior part or bafis of the cerebrum. And from thence M. Vieuffens took occafion to name this nucleus the *centrum ovale.*

Ventriculi laterales. Under this arch are two lateral cavities, much longer than they are broad, and very fhallow, feparated by a tranfparent medullary feptum, of which hereafter. Thefe cavities are generally named *the anterior fuperior ventricles of the cerebrum*, to diftinguifh them from two other fmaller cavities which are fituated more backward, as we fhall fee prefently; but the name of *lateral* or *great ventricles* given them by Steno, is more proper than either of the other two.

The lateral ventricles are broad, and rounded at thofe extremities which lie next the tranfparent feptum. They go from before backward, contracting in breadth, and feparating from each other gradually in their progrefs. Afterwards they bend downward, and return obliquely from behind forward, in a courfe like the

the turning of a ram's horn, and terminate almoſt under their ſuperior extremities, only a little more backward and outward.

At the poſterior part where they begin to bend downward, there is on each ſide a particular elongation, which runs backward, and terminates in a triangular pointed cavity turned a little inward, the two points reſembling horns. Theſe ventricles are every where lined with a continuation of the pia mater.

Septum lucidum. The tranſparent partition, or *ſeptum lucidum*, as it is commonly called, lies directly under the raphe or ſuture of the corpus calloſum, of which it is a continuation and a kind of duplicature. It is made up of two medullary laminæ, more or leſs ſeparated from each other by a narrow medullary cavity, ſometimes filled with a ſerous ſubſtance. This cavity, in ſome ſubjects, reaches a great way backward; and ſeems to communicate with the third ventricle.

Fornix. The ſeptum lucidum is united, by its lower part, to the anterior portion of that particular medullary body, called improperly *the fornix* with three pillars, becauſe of ſome reſemblance it is thought to bear to the arches of ancient vaults. It is in reality nothing but the corpus calloſum; the lower ſide of which is like a hollow ceiling with three angles, one anterior and two poſterior; and three edges, two lateral and one poſterior. The lateral edges are terminated each by a large ſemicylindrical border, like two arches; which uniting at the anterior angle, form by their union what is called *the anterior pillar of the fornix*; and as they run backward ſeparately toward the two poſterior angles, they have then the name of *the poſterior pillars*.

The anterior pillar being double, is larger than either of the poſterior; and the marks of this duplicity always remain. Immediately below the baſis of this pillar we obſerve a large, white, ſhort, medullary rope ſtretched tranſverſely between the two hemiſpheres, and commonly called *the anterior commiſſure of tht cerebrum.* It is to this pillar that the ſeptum lucidum adheres. The poſterior pillars are bent downward, and continued through the lower portions of the ventricles all the way to their extremities, reſembling a ram's horn, which is a name that has been given to them. They diminiſh gradually in thickneſs during this courſe; and at their outſides they have each a ſmall, thin, flat, collateral border, to which the name of *corpora fimbriata* is applied.

"The poſterior pillars of the crura of the fornix unite with two medullary protuberances called *pedes hippocampi.*"——The inferior ſurface of the triangular ceiling, which lies between theſe arches, is full of tranſverſe, prominent, medullary lines; for which reaſon the ancients called it *pſalloides* and *lyra*, comparing it to a ſtringed inſtrument, ſomething like what is now called a *dulcimer.*

"Under the fornix, and immediately behind its anterior crura, there is a hole of a conſiderable ſize, by which the two lateral ventricles communicate; and another paſſage leads down from this, under the different appellations of *foramen commune anterius*, *vulva*, *iter ad infundibulum*, but more properly *iter ad tertium ventriculum.*"

Eminences. The fornix being cut off and inverted, or quite removed, we ſee firſt of all a vaſcular web, called *plexus choroides*, and ſeveral eminences more or leſs covered by the expanſion of that plexus. There are four pairs of eminences which follow each other very regularly, two large and two ſmall. The firſt two great eminences are named *corpora ſtriata;* and the ſecond, *thalami nervorum opticorum.* The four ſmall eminences are cloſely united together; the anterior being called *nates*, and the poſterior *teſtes;* but it would be better to call them ſimply *anterior* and *poſterior tubercles.* Immediately before theſe tubercles there is a ſingle eminence, called *glandula pinealis.*

Cor-

Corpora ſtriata. The corpora ſtriata got that name, becauſe in ſcraping them with the knife we meet with a great number of white and aſh-coloured lines alternately diſpoſed, which are only the tranſverſe ſection of the medullary and cortical laminæ mixed together in a vertical poſition in the baſis of the cerebrum, as appears evidently by inciſions made from above downward. Theſe two eminences are of a greyiſh colour on the ſurface, oblong, roundiſh, pyriform, and larger on the fore than on the back part, where they are narrow and bent.

They lie in the bottom of the ſuperior cavity of the lateral ventricles, which they reſemble in ſome meaſure in ſhape, their anterior parts being near the ſeptum lucidum, from which they ſeparate gradually as they run backward, and diminiſh in ſize. They are in reality the convex bottoms of the ventricles; and it is at the lower part of the interſtice between the largeſt portions of them, that we obſerve the great tranſverſe cord, named *the anterior commiſſure of the cerebrum*, which I mentioned already in deſcribing the anterior pillar of the fornix calloſus. This cord communicates more particularly with the bottom of the corpora ſtriata, by a turn toward each ſide.

Thalami nervorum opticorum. The thalami nervorum opticorum, are ſo named, becauſe theſe nerves ariſe chiefly from them. They are two large eminences placed by the ſide of each other, between the poſterior portions or extremities of the corpora ſtriata. Their figure is ſemiſpheroidal and a little oval; and they are of a whitiſh colour on the ſurface; but their inner ſubſtance is partly greyiſh and partly white, ſo that, in cutting them, we ſee ſtreaks of different colours like thoſe of the corpora ſtriata.

Theſe two eminences are cloſely joined together; and at their convex part they are ſo far united, as really to become one body, the whitiſh outer ſubſtance being continued uniformly over them both.

Im-

Immediately within this whitiſh common ſubſtance theſe two eminences are cloſely contiguous till about the middle of their thickneſs : and from thence they ſeparate inſenſibly toward the bottom, where, by the ſpace left between them, a particular cavity is formed, named *the third ventricle ;* one extremity of which opens forward, the other backward, as we ſhall ſee hereafter. Some anatomiſts have miſtaken the ſuperficial connection of theſe eminences for the pons Varolii.

At the bottom theſe two eminences are elongated downward toward both ſides, into two thick, round, whitiſh cords, which ſeparate from each other like horns by a large curvature ; and afterwards, by a ſmall curvature turned forward in an oppoſite direction to the former, and repreſenting the tip of an horn, they approach each other again. The ſize of theſe nerves diminiſhes gradually from their origin to their anterior reunion. I ſhall have occaſion to mention them in another place in ſpeaking of the optic nerves.

Tubercula. The tubercles are four in number, two anterior and two poſterior ; adhering together as if they made but one body ſituated behind the union of the thalami nervorum opticorum. They are tranſverſely oblong ; the anterior being a little more rounded, and broader or larger from before backward, than the poſterior. Their ſurface is white, and their inner ſubſtance greyiſh. " The names of *nates* and *teſtes*, given by the ancients to theſe tubercles, are not very proper, there being no great reſemblance between them and the things from which the names are taken. Some of the moderns, with perhaps ſtill leſs propriety, have called them *tubercula quadrigemina.* We ſhall uſe the names, however, as we find them."

Directly uuder the place where the tubercles of one ſide are united to thoſe of the other ſide, lies a ſmall middle canal, " called *iter ad quartum ventriculum*," which communicates by its anterior opening with the third ventricle,

ventricle, under the thalami nervorum opticorum, and, by its poſterior opening, with the fourth ventricle, which belongs to the cerebellum, as we ſhall afterwards ſee.

Foramen commune poſterius. Where the convex parts of the two anterior tubercles join theſe poſterior convex parts of the thalami nervorum opticorum, an interſtice or opening is left between theſe four convexities; but it does not communicate with the third ventricle: "for the bottom of it is ſhut up by the pia mater. It has the ridiculous name of *anus* applied to it."

Glandula pinealis. The glandula pinealis is a ſmall ſoft greyiſh body, about the ſize of an ordinary pea, irregularly round, and ſometimes of the figure of a pine-apple, ſituated behind the thalami nervorum opticorum above the tubercula quadrigemina. It is fixed like a ſmall button to the lower part of the thalami by two very white medullary pedunculi, which at the gland are very near each other, but ſeparate almoſt tranſverſely toward the thalami.

It ſeems to be moſtly of a cortical ſubſtance, except near the footſtalks, where it is ſomewhat medullary. The footſtalks are ſometimes double, as if they belonged to the two anterior tubercles. This body adheres very cloſe to the plexus choroides, by which it is covered, as we ſhall ſee hereafter; and it therefore requires ſome dexterity to ſeparate it from the glandula, without altering its ſituation or breaking the pedunculi. This gland has been often found to contain gravel. Below the glandula pinealis there is a medullary tranſverſe cord, called the *poſterior commiſſure of the hemiſpheres of the cerebrum*.

" Immediately under the union or beginning of the thalami nervorum opticorum, lies a particular cavity, called the *third ventricle* of the cerebrum. This cavity communicates at its upper and fore-part with the paſſage between the two lateral ventricles, and ſends down from its under and fore part a paſſage through the in-

ſunfundibulum. It opens backwards into the paſſage called *iter ad quartum ventriculum.*"

Infundibulum. Between the baſis of the anterior pillar of the fornix, and the anterior part of the union of the optic thalami, lies a ſmall medullary canal, named *infundibulum.* It runs down towards the baſis of the cerebrum, contracting gradually, and terminates in a ſtraight courſe by a ſmall membranous canal, in a ſoftiſh body ſituated in the ſella turcica, named *glandula pituitaria.*

Plexus choroides. The plexus choroides is a very fine vaſcular texture, conſiſting of a great number of arterial and venal ramifications, partly collected in two looſe faſciculi, which lie on each lateral ventricle, and partly expanded over the neighbouring parts, and covering in a particular manner the thalami nervorum opticorum, glandula pinealis, tubercula quadrigemina, and the other adjacent parts both of the cerebrum and cerebellum, to all which it adheres.

In each lateral portion of this plexus we obſerve a venal trunk; the ramifications of which are ſpread through the whole extent of the two portions. Near the glandula pinealis theſe two trunks approach each other; and uniting behind that gland, they open into the torcular or fourth ſinus of the dura mater. When we blow into one of theſe trunks toward the plexus, the air paſſes into all its ramifications; and in ſome ſubjects, theſe two veins form one trunk which opens into the ſinus.

The ventricular or looſe portions of the plexus often appear to contain a great number of tubercles like glands; which in the natural ſtate are extremely ſmall, but grow bigger in diſeaſes. To be able to examine them as we ought, the looſe portions muſt be made to ſwim in clear water, and be there carefully expanded. Then, by the help of a microſcope, we will ſee theſe tubercles in the natural ſtate, like ſmall folliculi or little bags more or leſs flatted.

Beſides

Befides this vafcular web or plexus of the feptum lucidum, the fides of the fornix, of the eminences, ventricles, canals, and infundibulum, are all covered by a very fine membrane, in which, by injections or inflammations, we difcover a great number of very fine veffels. This membrane is in a manner a continuation of the plexus, and that feems to be a detachment from the pia mater. By the fame means we likewife difcover an extremely thin membrane on the infides of the duplicature of the feptum, though, in fome fubjects, thefe fides touch each other.

Glandula pituitaria. The pituitary gland is a fmall fpungy body lodged in the fella turcica, between the fphenoidal folds of the dura mater. It is of a fingular kind of fubftance, which feems to be neither medullary nor glandular. On the outfide it is partly greyifh and partly reddifh, and white within. It is tranfverfely oval or oblong; and on the lower part, in fome fubjects, it is divided by a fmall notch into two lobes, like a kidney-bean. It is covered by the pia mater as by a bag, the opening of which is the extremity of the infundibulum; and it is furrounded by the fmall circular finufes which communicate with the finus cavernofi.

§ 4. *Cerebellum.*

Situation and figure. The cerebellum is contained under the tranfverfe feptum of the dura mater. It is broader laterally than on the fore or backfides, flatted on the upper fide, and gently inclined both ways, anfwerable to the feptum, which ferves it as a kind of tent or ceiling. On the lower fide it is rounder; and on the back-fide it is divided into two lobes, feparated by the occipital feptum of the dura mater.

Structure. It is made up, like the cerebrum, of two fubftances, but it has no circumvolutions on its furface. Its fulci are pretty deep, and difpofed in fuch a manner as to form thin flat ſtrata, more or leſs horizontal, between which the internal lamina of the pia mater inſinuates itſelf by a number of ſepta equal to that of the ſtrata.

Under the tranſverſe ſeptum, it is covered by a vaſcular texture, which communicates with the plexus choroides. It has two middle eminences called *apendices vermiformes;* one anterior and ſuperior, which is turned forward; the other poſterior and inferior, which goes backward. There are likewiſe two lateral appendices, both turned outward. They are termed *vermiformes*, from their reſemblance to a large portion of an earth-worm.

Beſides the diviſion of the cerebellum into lateral portions, or into two lobes, each of theſe lobes ſeems to be likewiſe ſubdivided into three protuberances, one anterior, one middle or lateral, and one poſterior: but they are not in all ſubjects equally diſtinguiſhed either by their convexity or limits; but they may always be diſtinguiſhed by the direction of their ſtrata, thoſe of the middle and anterior protuberance being leſs tranſverſe than the poſterior.

Fourth ventricle. When we ſeparate the two lateral portions or lobes, having firſt made a pretty deep inciſion, we diſcover, firſt of all, the poſterior portion of the medulla oblongata, of which hereafter; and in the poſterior ſurface of this portion, from the tubercula quadrigemina, all the way to the poſterior notch in the body of the cerebellum, and a little below that notch, we obſerve an oblong cavity which terminates backward like the point of a writing pen. This cavity is what is called the *fourth ventricle.* "Hence the under end of it is called *calamus ſcriptorius.*"

At the beginning of this cavity we meet with a thin medullary lamina, which is looked upon as a valve between that canal and the fourth ventricle. A little behind this lamina, the cavity grows wider towards both ſides, and then contracts again to its firſt ſize. It is lined

lined interiorly by a thin membrane, and ſeems often to be diſtinguiſhed into two lateral parts, by a kind of ſmall groove, from the valvular lamina to the point of the calamus ſcriptorius.

This membrane is a continuation of that part of the pia mater which lines the ſmall canal, the third ventricle, infundibulum, and the two great ventricles. To be able to ſee the fourth ventricle in its natural ſtate, in which it is narroweſt, it muſt be laid open while the cerebellum remains in the cranium; and in order to that, the os occipitis muſt be ſawed very low down.

On each ſide of this ventricle, the medullary ſubſtance forms a trunk which expands itſelf in form of laminæ through the cortical ſtrata. We diſcover theſe medullary laminæ according to their breadth, by cutting the cerebellum in ſlices almoſt parallel to the baſis of the cerebrum; but if we cut one lobe of the cerebellum vertically from above downward, the medullary ſubſtance will appear to be diſperſed in ramifications through the cortical ſubſtance. Theſe ramifications have been named *arbor vitæ*, and the two trunks from whence theſe different laminæ ariſe are called *pedunculi cerebelli*.

We cannot go on with the deſcription of the other middle parts of the baſis of the cerebellum, before that of the middle parts of the baſis of the cerebrum; becauſe theſe two kinds of parts are united, and jointly form the medulla oblongata. I ſhall only add here, that the ſtrata of both ſubſtances of the cerebellum are not always of the ſame extent in the ſame portions or protuberances of each lobe. This appears merely by viewing the convex or outer ſurface of the cerebellum; for there we ſee, at different diſtances, ſome cortical ſtrata ſhorter than others, and likewiſe that the extremities of the ſhort ſtrata diminiſh gradually in thickneſs till they are quite loſt between two long ones.

If we make a ſmall hole in the external lamina of the

the pia mater over one of the lobes of the cerebellum, without touching the inner lamina, and then blow into the cellular fubftance, by which thefe two laminæ are connected, through a fmall pipe introduced into the hole; the air will gradually fwell that fubftance, and feparate the ftrata more or lefs equally from each other through their whole extent; and we will fee at the fame time the difpofition of all the membranous fepta or duplicatures of the internal lamina of the pia mater, with the numerous diftribution of the fine blood-veffels which run upon it, efpecially after a lucky injection, or in an inflammatory ftate of thefe membranes.

§ 5. *Medulla oblongata.*

The medulla oblongata is a medullary fubftance, fituated from before backward in the middle part of the bafes of the cerebrum and cerebellum, without any difcontinuation, between the lateral parts of both thefe bafes: and therefore it may be looked upon as one middle medullary bafis common to both cerebrum and cerebellum, by the reciprocal continuity of their medullary fubftances, through the great notch in the tranfverfe feptum of the dura mater; which common bafis lies immediately on that portion of the dura mater which lines the bafis of the cranium. The medulla oblongata is therefore juftly efteemed to be a third general part of the whole mafs of the brain, or as the common production or united elongation of the whole medullary fubftance of the cerebrum and cerebellum.

It is extremely difficult, if not altogether impoffible, to examine or demonftrate it as we ought, in its natural fituation; but we are obliged to do both on a brain inverted.

The lower fide of the medulla oblongata, in an inverted fituation, prefents to our view feveral parts, which are in general either medullary productions, trunks of nerves, or trunks of blood-veffels.

The

The chief medullary productions are theſe; the large or anterior branches of the medulla oblongata, which have likewiſe been named *crura anteriora*, *femora* and *brachia medullæ oblongatæ*, and *pedunculi cerebri*: the tranſverſe protuberance, called likewiſe *proceſſus annularis* or *pons Varolii*: the ſmall or poſterior branches, called *pedunculi cerebelli*, or *crura poſteriora medullæ oblongatæ*: the extremity or cauda of the medulla oblongata, with two pairs of tubercles; one of which is named *corpora olivaria*, the other *corpora pyramidalia*; and to all theſe productions we muſt add a production of the infundibulum and two medullary papillæ.

The great branches of the medulla oblongata are two very conſiderable medullary faſciculi; the anterior extremities of which are ſeparated, and the poſterior united, ſo that, taken together, they ſomewhat repreſent a Roman V. Theſe faſciculi are flat, much broader before than behind; their ſurfaces being compoſed of ſeveral longitudinal and diſtinctly prominent medullary fibres. Their anterior extremities ſeem to be loſt at the lower part of the corpora ſtriata; and it is for that reaſon that they are looked upon as the pedunculi of the cerebrum.

The tranſverſe annular, or rather ſemi-annular, protuberance, is a medullary production, which ſeems at firſt ſight to ſurround the poſterior extremities of the great branches; but the medullary ſubſtance of this protuberance is in reality intimately mixed with that of the two former. Varolius, an ancient Italian author, viewing thoſe parts in an inverted ſituation, compared the two branches to two rivers, and the protuberance to a bridge over them both; and from thence it has the name of *pons Varolii*. Its ſurface is tranſverſely ſtreaked; and it is divided into two lateral parts by a very narrow longitudinal depreſſion, which does not penetrate into its ſubſtance.

The ſmall branches of the medulla oblongata are lateral productions of the tranſverſe protuberance, which by their roots seem to encompass that medullary portion in which the fourth ventricle or calamus scriptorius is formed. They form in the lobes of the cerebellum, on each side, these medullary expansions, a vertical section of which shows the white ramifications commonly called *arbor vitæ;* and they may be justly enough styled *pedunculi cerebelli.*

The extremity is no more than the medulla oblongata contracted in its passage backward to the anterior edge of the foramen magnum of the os occipitis, where it terminates in the medulla spinalis; and in this part of it several things are to be taken notice of. We see first of all, four eminences, two named *corpora olivaria*, and the other two *corpora pyramidalia.* Immediately afterwards, it is divided into two lateral portions by two narrow grooves, one on the upper side, the other on the lower. They both run into the substance of the medulla, as between two cylinders, flatted on that side by which they are joined together.

When we separate these ridges with the fingers, we observe a crucial intertexture of several small medullary cords, which go obliquely from the substance of one lateral portion into the substance of the other. M. Petit, member of the royal academy of sciences, and doctor of physic, is the author of this discovery, by which we are enabled to explain several phænomena both in physiology and pathology; of which in another place.

The corpora olivaria and pyramidalia are whitish eminences situated longitudinally near each other on the lower side of the extremity or cauda, immediately behind the transverse or annular protuberances. The corpora olivaria are in the middle, so that the interstice between them, which is only a kind of superficial groove, answers to the inferior groove of the following portion.

The corpora pyramidalia are two lateral eminences depending on the olivaria. Willis gave the name of *pyra-*

pyramidalia to what I have called *olivaria*, after the late M. Duverney in his treatiſe of the organ of hearing. Theſe four eminences are ſituated on the lower half of the medulla; which obſervation I here repeat, to make it be remembered, that, in all the figures and demonſtrations, theſe parts are repreſented as ſuperior, which in their natural ſituation are inferior. Thus theſe eminences are under the fourth ventricle, and under the pedunculi cerebelli.

The tubercula mammillaria, which are ſituated very near the production of the infundibulum, have been taken for glands; probably becauſe of their greyiſh inner ſubſtance, which, however, does not ſeem to be different from that of ſeveral other eminences of the medulla oblongata. And for that reaſon I chooſe rather to call them, from their figure, *tubercula mammillaria*, than *papillæ medullares*.

Theſe tubercles ſeem to have ſome immediate relation to the roots or baſes of the anterior pillar of the fornix; ſo that they might be named, as M. Santorini has done, *the bulbs of theſe roots*, though they appear to be likewiſe partly a continuation of other portions of the cortical and medullary ſubſtance, of a particular texture.

The beak or tube of the infundibulum is a very thin production from the ſides of that cavity; and it is ſtrengthened by a particular coat given to it by the pia mater. It is bent a little from behind forward, toward the glandula pinealis, and afterwards expands again round this gland.

The membrana arachnoidus, or external lamina of the pia mater, appears to be very diſtinctly ſeparated from the internal lamina, in the interſtices between all theſe eminences on the lower ſide of the medulla oblongata, without any viſible cellular ſubſtance between them. The internal lamina adheres much more to the ſurface of theſe interſtices than to that of the eminences. The external lamina is as it were buoyed up by the eminences, and equally ſtretched between their moſt prominent parts, to which it ſticks very cloſe; and in this reſpect, the roots or great cornua of the optic nerves may be joined to theſe eminences.

We muſt obſerve in general concerning the eminences of the medulla oblongata, that thoſe which are medullary on their outſides or ſurfaces, are interiorly either entirely cortical, or partly cortical and partly medullary, or formed by a ſingular mixture of theſe two ſubſtances, which ſtill remains to be unfolded, as well as many other particularities obſervable in examining the internal ſtructure of the brain.

From this common portion of the cerebrum and cerebellum, ariſe almoſt all the nerves which go out of the cranium, through the different foramina by which its baſis is perforated. It likewiſe produces the medulla ſpinalis, which is no more than a common elongation of the cerebrum and cerebellum, and of their different ſubſtances; and therefore the medulla oblongata may juſtly be ſaid to be the firſt origin or primitive ſource of all the nerves which go out through the ſpina dorſi, and conſequently of all the nerves of the human body.

§ 6. *Medulla ſpinalis.*

The medulla ſpinalis is only an elongation of the extremity of the medulla oblongata; and it has its name from its being contained in the bony canal of the ſpina dorſi. It is conſequently a continuation or common appendix of the cerebrum and cerebellum, as well becauſe of the two ſubſtances of which it is compoſed, as becauſe of the membranes by which it is inveſted.

In the deſcription of the freſh bones, I mentioned a ligamentary tube which lines the inner ſurface of this bony canal from the great occipital foramen to the os ſacrum, repreſenting a very long flexible funnel. I like-

likewiſe mentioned the yellowiſh and very elaſtic ligaments that lie in the great poſterior notches of all the vertebræ, and adhere very cloſely to the ligamentary tube.

The dura mater, after it has lined the whole internal ſurface of the cranium, goes out by the foramen magnum occipitis; and forms a kind of funnel, in its progreſs downward, through the bony canal of the vertebræ. As it goes out at the occipital hole, it joins the beginning of the ligamentary funnel already mentioned, and adheres very ſtrongly to it. That portion of the pericranium which terminates exteriorly at the edge of the great foramen, joins the funnel likewiſe; which by all theſe ſucceſſions becomes very ſtrong, and capable of reſiſting the greateſt violences.

This adheſion of the dura mater to the ligamentary funnel is gradually diſcontinued below the firſt vertebra; and from thence the dura mater forms a ſeparate tube, which runs down in the bony canal all the way to the os ſacrum, the capacity of it anſwering to that of the canal; but it does not adhere cloſely to the ſides, as it does to that of the cranium. It is ſurrounded by a ſlimy ſubſtance, which, near the lower end of the canal, reſembles fat.

The ſpinal marrow is made up of a cortical and medullary ſubſtance, as the cerebrum and cerebellum; but with this difference, that the aſh-coloured ſubſtance lies within the other; and in a tranſverſe ſection of this medulla the inner ſubſtance is "ſomewhat of an oblong form, but has its ſides bent inwards."

The body of the medulla ſpinalis runs down all the way to the firſt vertebra of the loins, where it terminates in a point. The ſize of it is proportionable to that of the bony canal, ſo that it is larger in the vertebræ of the neck than thoſe of the back. It is a little flatted on the fore and back ſides; ſo that we may diſtinguiſh in it two ſides, one anterior, the other poſterior, and two edges. It is likewiſe in a manner divided into two lateral halves by a groove, which runs along the middle of each ſide, being a continuation of thoſe in the extremity of the medulla oblongata.

Each lateral portion ſends off from both the fore and back ſides, between the grooves and the edges, at different diſtances, flat faſciculi of nervous filaments turned toward the neareſt edge. The anterior and poſterior faſciculi having got a little beyond the edge of the medulla, unite in pairs, and form on each ſide a kind of knots called *ganglions* by anatomiſts, each of which produces a nervous trunk. Theſe ganglions are made up of a mixture of cortical and medullary ſubſtance, accompanied by a great number of ſmall blood-veſſels.

The dura mater which inveſts the medulla, ſends out on each ſide the ſame number of vaginæ, as there are ganglions and nervous trunks. Theſe vaginæ are productions of the external lamina; the internal lamina, which is very ſmooth and poliſhed on the inſide, being perforated by two ſmall holes very near each other, where each vagina goes off, through which holes the extremities of each anterior and poſterior faſciculus are tranſmitted; and immediately after their paſſage through the internal lamina, they unite.

The triangular ſpaces left between the anterior and poſterior faſciculi and edge of the medulla, are filled from one extremity to the other by an indented ligament, very thin and ſhining, having the ſame number of indentations as there are pairs of faſciculi. It is fixed at different diſtances to the edge of the medulla, from whence it ſends filaments to the internal lamina of the dura mater, by which the anterior faſciculi are diſtinguiſhed from the poſterior.

The membrana arachnoides is here very diſtinct from the internal lamina of the pia mater: ſo that, by blowing through a hole made in the arachnoides, it will ſwell from one end to the other, like a tranſparent gut. The internal lamina, called in this place ſimply the *pia mater*,

mater, adheres very clofely to the medulla fpinalis, and fends many productions and fepta through its fubftance. When we blow through a hole made in the pia mater, through the fubftance of one lateral portion of the medulla, the air penetrates through the whole, and the pia mater, which covers the other lateral portion, is feparated from it.

The membrana arachnoides adheres here more clofely to the pia mater at the lower than at the upper part, being in a manner fufpended by the indented ligament which runs along both edges of the medulla, and is fixed by a filament to the internal lamina of the dura mater in each interftice between the nervous fafciculi, as has been already faid. It alfo gives off elongations in the fame manner as the dura mater to each nervous trunk or rope, as we fhall fee hereafter.

§ 7. *The Nerves of the Brain and Spinal Marrow, from their origin to their going out of the Cranium and Spine.*

We fhall afterward find, that the nerves arife either from the brain, medulla oblongata, or fpinalis; that they go out in fafciculi difpofed in pairs; that then pairs are reckoned to belong to belong to the brain and medulla oblongata, of which nine go out through the foramina of the cranium, and the tenth arifes from the extremity of this medulla as it paffes through the great occipital hole; and laftly, that about 30 pairs are reckoned to belong to the medulla fpinalis, of which feven pafs through the lateral notches of the vertebræ cervicis, twelve through thofe of the back, five through thofe of the loins, and five or fix through the anterior holes of the os facrum, and one at the fides of the os coccygis.

My defign is here principally to mention fome particular obfervations about the nerves, while they remain within the cranium; the reft of the courfe through the whole body fhall be afterward fufficiently defcribed.

Nerves of the medulla oblongata. The firſt pair of nerves that ariſe from the medulla oblongata are the olfactory, anciently called *proceſſus mammillares.* Theſe are two very flat and ſoft medullary ropes, each ariſing firſt by medullary fibres from the outſide of the lower part of the corpora ſtriata, between the anterior and middle lobe, on each ſide of the cerebrum, and afterwards by another filament more internally, and by a third, which is more poſterior and very long. They run under the anterior lobes of the cerebrum, being lodged in two ſuperficial grooves in the baſis of theſe lobes, and lying immediately on the dura mater, from the clinoide apophyſes to the os ethmoides.

They are firſt of all conſiderably incurvated from without inwards or toward each other, and having reached near the back-ſide of the os ethmoides, they run for a ſmall ſpace parallel to and at ſome diſtance from each other. Backward they are very thin; but they gradually increaſe in bulk in their courſe forward, toward each ſide of the criſta of the ethmoidal bone, where they terminate in elongated papillæ, the ſubſtance of which appears to be ſofter and leſs white than that of the ropes.

Theſe papillæ lie on the two ſides of the lamina cribroſa, and ſend down a nervous filament into each hole of that lamina. At the ſame place, the dura mater ſends off the ſame number of vaginæ which inveſt and accompany the nervous filaments and their ramifications on the internal parts of the noſe.

I have already related the origin of the ſecond pair, or optic nerves, from the eminences called *thalami nervorum opticorum;* and I have deſcribed their great curvature, and traced them all the way to their re-union, which happens immediately before the ſuperior part of the glandula pituitaria, and conſequently before the beak or production of the infundibulum. The internal carotids run upon the outſides of theſe nerves, immediately

diately after their union, and before they paſs thro' the foramina optica.

Beſides their origin from the optic thalami, theſe nerves have likewiſe a kind of communication with the tubercula quadrigemina anteriora by very fine filaments, one extremity of which is loſt in the tubercles, the other in the roots of the great arches or bodies of the optic nerves. The internal ſtructure of theſe nerves ſeems to change at their entrance into the optic holes, as we ſhall ſee in another place.

The union of theſe nerves by the ſmall curvatures of their cornua, is very difficult to be unfolded in human bodies. This union is commonly found to be very cloſe: but, in ſome ſubjects, it ſeems to be no more than a ſtrong adheſion; in others, to be partly made by an interſection or croſſing of fibres. They have been found quite ſeparate; and in other ſubjects one of them has been obſerved to be very much altered both in ſize and colour through its whole paſſage, the other remaining in its natural ſtate.

The third pair, called *nervi motores, oculi communes, oculares communes*, and *oculo-muſculares*, ariſe from the union of the anterior edge of the great tranſverſe protuberance, with the two great branches of the medulla oblongata. They pierce the dura mater behind the lateral parts of the poſterior apophyſis of the ſella ſphenoidalis, and paſs afterwards each in the neighbouring ſinus cavernoſi, by the ſide of the carotid artery, and all the way to the broad portion of the ſuperior orbitary fiſſure, where they are divided in the manner to be afterward deſcribed.

The fourth pair, called *nervi trochleares, muſculares obliqui ſuperiores*, and moſt commonly *pathetici*, are very ſmall and tender, and, in proportion, very long. They ariſe each behind the tubercula quadrigemina, and from the lateral part of the valviform expanſion at the entry of the fourth ventricle. From thence they take their courſe forward all the way to the edge of the anterior

ex-

extremities of the tranfverfe finus, where on each fide they enter the duplicature of the dura mater, and advancing into the finus cavernofi, they accompany the third pair to the fuperior orbitary fiffure.

The fifth pair, called *nervi innominati*, or *trigemini*, are at firft large trunks arifing chiefly from the lateral and pofterior parts of the great tranfverfe protuberance, and a little from the corpora olivaria and pyramidalia. They run down obliquely forward on the extremity of the upper or anterior fide of the apophyfis petrofo, very near the fide of the fella fphenoidalis, where they enter the duplicature of the dura mater and finus cavernofi.

At their entry into the finus, they form a kind of flat irregular ganglion, from which fome filaments are fent off to the dura mater; and immediately afterward, each of them is divided into three great branches, one fuperior or anterior, one middle, and one inferior or pofterior. The firft branch, which may be termed *ocularis* or *ophthalmicus*, accompanies the nerves of the third and fourth pairs, to the fuperior or orbitary fiffure. The fecond, called *maxillaris fuperior*, goes out by the fuperior maxillary hole; and the third, named *maxillaris inferior*, by the inferior maxillary hole. As the great trunk of this nerve runs down, it perforates the membrana arachnoides, which at this place forms a kind of cieling.

The fixth pair, named *motores oculorum externi*, *oculares* or *opthalmici externi*, and *oculo-mufculares externi*, are fmall nerves, but ftill not fo fmall as the fourth pair; and I have fometimes found them double. They arife partly from the oblong inferior eminences, immediately behind the tranfverfe protuberance, and partly from this protuberance; and paffing immediately under it, they pierce the dura mater behind the occipital fymphyfis of the fphenoidal bone.

They run on each fide in the duplicature of the dura mater to the cavernous finus; and having entered that finus, each of them accompanies the firft branch of of the fifth pair to the ſuperior orbitary fiſſure. In this courſe they communicate with the firſt branch juſt mentioned, and are increaſed on the fore-part by a filament or two, which ariſe from the great ſympathetic nerve, and run up with the carotid.

The ſeventh pair, named *auditorii*, ariſe from the lateral and poſterior part of the tranſverſe protuberance, near the pedunculi of the cerebellum, by two cords, one ſmall and ſolid, the other large and ſoft, which from thence is called *portio mollis*, and the firſt, *portio dura*, or, as I have named it, *nervus ſympatheticus minimus*. The two nerves on each ſide accompany each other very cloſely, all the way to the internal foramen auditorium.

The eighth pair, named *par vagum*, *nervi vagi*, or *ſympathetici medii*, ariſe from the poſterior extremities of the large branches or crura of the medulla oblongata, from the tranſverſe protuberance, and from the anterior part of the inferior oblong eminences behind the tranſverſe protuberances, by numerous filaments, which all together make a broad band on each ſide, which runs toward the foramen lacrum, where it pierces the dura mater, and goes out through the anterior part of that hole, having been firſt joined by a nervous portion that runs up from the medulla ſpinalis through the great occipital foramen by the name of *nervus acceſſorius octavi paris*, or *nervus ſpinalis*. This additional nerve goes out with that of the eighth pair through the foramen lacerum, lying behind it, but diſtinguiſhed from it by a membranous ſeptum.

The ninth pair, called *nervi hypogloſſi externi*, *hypogloſſi majores*, and commonly *guſtatorii*, ariſe each from the lateral part of the extremity of the medulla oblongata, between the oblong inferior eminences, by ſeveral filaments, which uniting together, form commonly two ſmall ropes on each ſide, which pierce the dura mater ſeparately, and preſently afterwards form one rope,

which

which goes out of the cranium through the anterior condyloide hole.

The tenth pair, called *nervi ſub-occipitales*, ariſe under the ninth pair, chiefly from the anterior and a little from the lateral part of the extremity of the medulla oblongata, oppoſite to the poſterior part of the condyloide apophyſis of the occipital bone, by a ſingle plane or faſciculus of ſmall filaments which pierce the dura mater directly from within outward, at the ſame place where the vertebral arteries perforate it from without inwards.

Nerves of the medulla ſpinalis. The nerves formed by the lateral union of the anterior and poſterior filaments of the medula ſpinalis, go out of the bony canal of the ſpina dorſi, toward each ſide, through the interverte-bral holes, through the anterior holes of the os ſacrum, and the lateral notches of the os coccygis; and from thence they have the general name of *nervi vertebrales.* They are divided in the ſame manner as the vertebræ, into ſeven pair of cervical nerves, twelve pair of dorſal, five pair of lumbar, and five or ſix pair of nervi ſacri.

I begin the enumeration of the vertebral nerves by thoſe which go out between the firſt and ſecond verte-bræ; and the ſituation of the dorſal or coſtal nerves, which are true intercoſtals, determined me to this diſ-poſition, the firſt pair of theſe nerves paſſing between the firſt and ſecond true ribs.

As the ſpinal marrow which furniſhes all theſe nerves ſeldom goes lower than the firſt or ſecond vertebra of the loins, the ſituation of the faſciculi of nervous fila-ments muſt be different from that of the holes through which they paſs; and ſeveral of theſe faſciculi, both anterior and poſterior, muſt be longer than the reſt. This we find from experience to be the caſe in the fol-lowing manner.

The faſciculi of nervous filaments of the medulla ſpi-nalis, which produce the cervical nerves, run more or leſs tranſverſely toward each ſide from their origin to their

their paſſage through the intervertebral holes. The faſciculi which form the dorſal nerves run a little obliquely downward from their origin to the intervertebral holes; and thoſe which form the lumbar nerves run down more and more longitudinally from the medulla to the holes by which they go out.

Therefore the cervical faſciculi are very ſhort in the ſpinal canal; the dorſal faſciculi are longer, and the faſciculi from the loins and os ſacrum very long. It muſt likewiſe be obſerved, that the faſciculi of the four loweſt pairs of the cervical nerves, and firſt pair of the dorſal nerves, are broader and more compounded than the following, becauſe the brachial nerves are a continuation of theſe. The filaments belonging to the lumbar nerves, and thoſe of the os ſacrum, are likewiſe very broad, and made up of numerous filaments, as being the roots of the large nerves which go to the lower extremities. The dorſal filaments are very ſmall.

The cervical and lumbar faſciculi are not only broader and made up of more filaments than the dorſal, but alſo ſituated much cloſer to each other, the lumbar faſciculi being ſtill more ſo than the cervical; whereas in the dorſal, a conſiderable interſtice is left between the faſciculi.

Theſe lumbar faſciculi, from their origin to the extremity of the os ſacrum, form, through the whole canal of the lumbar vertebræ and of the os ſacrum, a large bundle of nervous ropes, called by anatomiſts *cauda equina*, becauſe of ſome reſemblance which it bears to a horſe's tail, eſpecially when taken out of the canal, and extended in clear water.

Though the medulla ſpinalis ends at the firſt vertebra of the loins, the vagina of the dura mater by which it is inveſted, is continued through the reſt of the bony canal all the way to the extremity of the os ſacrum, and involves the great bundle or cauda equina, the cords of which pierce it on each ſide nearly oppoſite to the places where they paſs through the intervertebral holes,

holes, and the anterior holes of the os ſacrum, almoſt in the ſame manner as was ſaid above in deſcribing the general formation of the vertebral nerves.

This vagina of the dura mater being ſeparated from the canal of the vertebræ, and the lateral elongations which ſerve for particular vaginæ to the cords being cut off, it preſently ſhrinks up and contracts in the ſame manner as all the other elaſtic parts of the human body; for inſtance, as an artery does when cut tranſverſely ſoon after death. Therefore its true length muſt be taken while it is *in ſitu*, and likewiſe the true ſituation of the lateral elongations.

From all this a concluſion may be drawn of great importance, not only in anatomical and philoſophical inquiries, but alſo for underſtanding local diſeaſes, wounds, &c. which is, that when we have occaſion to conſider any particular nerves near the vertebræ of the back or loins, or near the os ſacrum, we muſt remember, that in the ſpina dorſi, the origin of theſe nerves is not even with their paſſage out of the ſpine, but proportionably higher. If, for inſtance, we inquire about any of the loweſt nervi ſacri near the os coccygis, we muſt not ſtop at the extremity of the os ſacrum, but trace its origin as high as the laſt vertebra of the back, or firſt of the loins.

The membrana arachnoides accompanies the original faſciculi ſeparately, to their paſſage through the lateral elongations of the dura mater, forming a kind of duplicature, breaks, or diſcontinuations, between the cords which run in the vagina of the dura mater. The internal lamina of the pia mater, or the pia mater ſimply, as it is here reckoned, adheres very cloſely both to the faſciculi and filaments of which they are compoſed.

Among the original productions of the nerves of the medulla ſpinalis, we ought ſtill to reckon the formation of the nervi acceſſorii of the eighth pair, or of thoſe that I call *ſympathetici medii*. They ariſe from the lateral

teral parts of this medulla by ſeveral filaments; about the third or fourth vertebræ of the neck, and ſometimes lower. And, if my memory does not fail me, I once traced them to the middle of the back. They run up on each ſide between the anterior and poſterior ranks of the nervous faſciculi, increaſing gradually in ſize by the acceſſion of new filaments from the poſterior faſciculi.

Having reached above the firſt vertebra of the neck, they have a kind of adheſion or communication with the neighbouring ganglions of the nervi ſub-occipitales, or thoſe of the tenth pair. Above this adheſion they receive two filaments each, from the back-ſide of the medulla, and afterwards continue their courſe towards the great occipital foramen. As they enter the cranium, they communicate with the nerves of the ninth and tenth pairs; and afterwards they join thoſe of the eighth pair, with which they return out of the cranium.

§ 8. *Blood-veſſels of the brain and medulla ſpinalis.*

Arteries. THE arteries which ſupply the cerebrum, cerebellum, and medulla oblongata, come partly from the carotids which enter the cranium through the canals in the apophyſes petroſæ of the oſſa temporum, and partly from the vertebrales which enter by the great occipital foramen, and ſend off the arteriæ ſpinales into the canal of the ſpine for the medulla lodged there.

All theſe arteries are divided into ſeveral branches, which ſend out a great number of ramifications diſtributed through both ſubſtances of the brain, and thro' the whole extent of the pia mater. The dura mater, both of the cerebrum and cerebellum, has arteries peculiar to it, which have been already deſcribed.

The internal carotid on each ſide enters the cranium by the great canalis petroſus, in an angular or winding courſe, as was obſerved in the deſcription of the ſkeleton. The inner ſurface of this canal is lined by a production

duction common to the dura mater and inferior pericranium; to which the artery adheres only by a looſe filamentary ſubſtance, in which the plexiform filaments run that belong to the great ſympathetic nerve, commonly called the *intercoſtal.*

Having paſſed through the bony canal, it immediately bends upward toward a notch in the ſphenoidal bone, and through that notch it enters the cranium. Immediately after this, it penetrates the cavernous ſinus on the ſide of the ſella ſphenoidalis; where having formed a third curvature, it goes out from it, from below, upwards; and is bent a fourth time round the anterior clinoide apophyſis, from before backward. By this courſe it is in a manner bathed in the blood of the cavernous ſinus, together with the third, fourth, fifth, and ſixth pairs of nerves.

After this fourth curvature, the internal carotid having now reached the ſide of the infundibulum, and conſequently being very near its fellow, theſe two arteries communicate ſometimes by a very ſhort tranſverſe arterial production. At this place each of them, "after ſending a branch through the foramen opticum to the eye," divides into two principal branches, one anterior, the other poſterior; and ſometimes into three, in which caſe there is a middle branch between the two former.

The anterior branch runs, firſt of all, forward under the baſis of the cerebrum, ſeparating a little from the ſame branch of the other carotid. They approach each other again under the interſtice between the two olfactory nerves, communicating by a very ſhort anaſtomoſis, and ſending ſmall twigs to that pair of nerves. They afterwards ſeparate, being each divided into two or three rami.

The firſt ramus of the anterior branch goes to the anterior lobe of the cerebrum. The ſecond, which is ſometimes double, is inverted on the corpus calloſum, to which it gives ramifications, as alſo to the falx of the dura

dura mater and middle lobe of the cerebrum. The third, which is ſometimes a diſtinct branch, ſometimes only an additional ramus to the ſecond, goes to the poſterior lobe of the cerebrum. This third ramus is ſometimes ſo conſiderable as to deſerve to be reckoned the middle branch of the three principal ones.

The poſterior branch communicates firſt of all with the vertebral artery of the ſame ſide, and then is divided into ſeveral rami on the ſuperficial circumvolutions of the cerebrum, and between theſe circumvolutions all the way to their bottom. The anterior and middle branches, when there are three, diſtribute the ſame kind of ramifications to the circumvolutions, and to their interſtices.

All theſe different ramifications run on the duplicature of the pia mater, from which they receive a kind of additional coats; and the capillaries being diſtributed upon it in a reticular manner, do afterwards penetrate the cortical and medullary ſubſtance; in which laſt they terminate inſenſibly.

The vertebral arteries enter through the great occipital foramen, having firſt pierced on each ſide the elongations of the dura mater at the ſame place where the ſub-occipital nerves, or thoſe of the tenth pair, pierce it as they go out; the arteries in this place lying above the nerves.

At their entry into the cranium they ſend each ſeveral ramifications to the cauda of the medulla oblongata, and to the corpora olivaria and pyramidalia: which ramifications are diſtributed on the ſides of the fourth ventricle; produce the plexus choroides; are ſpread on the whole ſurface of the cerebellum; inſinuate themſelves between the ſtrata, always inveſted by the duplicature of the pia mater; and are at length loſt in both ſubſtances of the cerebellum.

Afterwards the two vertebral arteries turn toward each other, for the moſt part immediately under the poſterior edge of the great tranſverſe or ſemi-annular

 pro-

protuberance of the medulla oblongata, where they unite and form one common trunk. This trunk paſſes directly from behind forward, under the middle of the great protuberance, and partly in the middle groove of the convex ſurface of that protuberance, at the anterior edge of which it terminates.

In its paſſage through the groove, this trunk ſends off ſeveral ſmall branches on each ſide, which ſurround tranſverſely the lateral portions of the protuberance, being partly lodged in the ſmall lateral grooves of theſe portions. Theſe lateral branches are afterwards diſtributed to the neighbouring parts of the cerebrum, cerebellum, and medulla oblongata.

This common or middle trunk of the vertebral arteries having reached the edge of the great protuberance, is divided again into ſmall branches; each of which ſoon communicates with the trunk of the internal carotid on the ſame ſide. Inſtead of this bifurcation, the two laſt or moſt anterior lateral branches ſend each ſometimes a ſmall branch forward, which form the anaſtomoſes with the internal carotids.

The principal arteries of the medulla ſpinalis, called commonly *arteriæ ſpinales*, are two in number, one anterior and one poſterior, lodged in the grooves by which the medulla is divided into lateral portions on both ſides. They ariſe from the vertebral arteries, a little above the great occipital foramen, where theſe arteries ſend each a ſmall ramus downward, as ſoon as they enter the cranium; and having got under the extremity of the medulla oblongata, they ſend off two other branches backward.

The firſt two branches uniting ſoon after their origin, form the arteria ſpinalis anterior, which runs down within the canal of rhe vertebræ along the anterior groove of the medulla. The other two ſmall branches are inverted on the ſides of the medulla oblongata, and from thence running backward, they unite much in the ſame manner with the firſt two, and form the arteria ſpinalis

ſpinalis poſterior, which runs down along the poſterior groove of the medulla ſpinalis.

The two ſpinal arteries, in their courſe downward along the medulla, ſend off on each ſide lateral ramifications, by which they frequently communicate with each other, and likewiſe with the vertebral arteries of the neck, with the intercoſtals, and ſometimes they are in a manner ſplit for a little way, and then unite again.

The veins of the cerebrum and cerebellum, &c. may in general be looked upon as not only forming the longitudinal ſinus of the dura mater, and the two great lateral ſinuſes, but alſo all the inferior ſinuſes of that membrane; in all which ſinuſes the veins terminate by different trunks, in the manner already ſaid in the deſcription of the great ſuperior ſinus. Their principal ramifications accompany all the cortical circumvolutions of the cerebrum, and directions of the ſtrata of the cerebellum, running always in the duplicature of the pia mater. The veins of the plexus choroides, in general, are of the number of thoſe already mentioned.

The veins of the medulla ſpinalis terminate partly in the ſuperior extremities of the two vertebral veins, partly in the two venal ropes termed *ſinus venoſi*, which run down both ways laterally on the anterior convex ſide of the production of the dura mater, and form at different diſtances reciprocal communications, by ſemiannular arches, as by ſo many ſubordinate ſinuſes. The two longitudinal ſinuſes communicate likewiſe in their paſſage with the vertebral veins, in the ſame manner as the neighbouring arteries.

§ 9. *Uſes of the Brain, and of its appendages in general.*

We are obliged to the great Malpighi for the firſt and beſt inſtructions concerning the manner of examining the ſtructure of the brain, eſpecially that of the two fubftances of which it is made up, and for putting us in a condition to be able to conjecture fomething about its ufes. The experiments and obfervations of that illuftrious and faithful fearcher into nature, having been repeated by feveral excellent philofophers, and confirmed by comparative anatomy, leave us no room to doubt that the brain is a fecretory organ, or, as it is called by anatomifts, *a gland*.

It is to no purpofe to difpute about words, when we are agreed as to things themfelves. Anatomifts have, for many years paft, underftood by the word *gland*, an organ fitted to feparate fome particular fluid from the mafs of blood, as univerfally as they mean by the word *mufcle* all forts of flefhy fibres capable of contraction; and this laft term might be cavilled at and rejected as juftly as the other.

The whole matter of fecretions muft be owned to be very obfcure; but it is to be hoped that the brain and liver will fome time or other lead us fo far from the knowledge of it, as at leaft to be able to diftinguifh truth from falfehood.

The greyifh or afh colour of the cortical fubftance is not the effect of a particular mixture of red and white; at leaft we have no experiment to prove it. The blood indeed gives this fubftance a flight reddifh caft; but the afh-colour, which feems to be the characteriftic of the ftructure of thefe fecretory organs, is not owing to that.

We learn from M. Ruyfch's anatomical injections, that the cortical fubftance is chiefly compofed of veffels; that, by making thefe veffels fwim in a clear pellucid liquor, their extremities reprefent an infinite number of fine brufhes or vafcular tufts; and that his injection fills even the fmalleft filaments of thefe tufts. He tells us likewife, that in thefe laft filaments the ftructure is altered; and that by the mechanifm of this change, the functions attributed to glands may be performed.

But ftill thefe injections and preparations do not unravel

ravel the myftery: neither is the exiftence of thefe pencils or tufts fufficiently demonftrated; for they are only the laft extremities of the fmall arteries macerated in water, or fome other liquor, after being injected, and then artfully feparated from the other effential parts of the organ.

In the firft place, they are feparated from the venal extremities which muft anfwer to thefe tufts, in what manner foever that be brought about. Secondly, they are feparated from the membranous filaments of the pia mater, which in the natural ftate tie thefe arterial extremities to each other, and give them a different difpofition from that of tufts or pencils. Thirdly, by this feparation, the arterial extremities are feparated from their connections with the medullary fubftance; which both experiments and comparative anatomy fhow to be fibrous.

It is nowife furprifing, that thefe capillary extremities, thus ftripped, fhould float loofely and freely when moved in a fluid, and that they fhould put on the appearance of pencils or tufts, being in this ftate only the truncated extremities of fmall veffels. When we confider thefe circumftances attentively, we find ourfelves obliged to return to the fmall glandular bodies and folliculi, &c. of Malpighi; of which in another place; and at the fame time we muft acknowledge, that Ruyfch's fine injections have difcovered thefe minute bodies to be of a vafcular fubftance, the ftructure of which we are ftill ignorant of.

In a word, Malpighi has difcovered the glandular tubercles and folliculi, without deftroying their natural connections. Ruyfch has difcovered a confiderable part of their ftructure by deftroying their connections. We are therefore very much beholden to both thefe illuftrious anatomifts; and it is only by joining their obfervations to each other that we can ever be able to form an idea of the fecretory organs, which will anfwer all the phænomena concerning the different ſecretions in the human body.

The infinite number of theſe ſmall ſecretory cluſters, ſtrain or filter the maſs of blood carried to them by the numerous ramifications already mentioned, and ſeparate from it an exceſſively fine fluid; the remaining blood being conveyed back by the ſame number of venal extremities into the ſinuſes of the dura mater, and from thence into the jugular and vertebral veins.

This ſubtle fluid, called commonly *animal ſpirit*, *nervous juice*, or *liquor of the nerves*, is continually forced into the medullary fibres of the white portion of the cerebrum, cerebellum, medulla oblongata, and medulla ſpinalis; and, by the intervention of theſe fibres, ſupplies and fills the nerves, which are a continuation of them.

All the nervous ropes, as they paſs through the foramina of the cranium and vertebræ, are accompanied by particular elongations of the pia and dura mater. Thoſe of the dura mater ſerve them for vaginæ in their paſſage through the bony openings. Thoſe of the pia mater not only accompany and inveſt each nervous rope, but alſo form internal ſepta between all the filaments of which each rope conſiſts. It is known from many experiments, that the nerves are the primitive or original organs of all muſcular motion and of all animal ſenſation; and that theſe two functions depend in general on the brain: but we are ignorant of the nature of this dependence, and of the particular uſes of the medullary fibres of the nervous fluid, and of the membranous productions which accompany the fibres and nerves.

Neither is there any thing certain in what has been ſaid concerning the deſign or particular uſes of the ſuperficial conformation of the cerebrum and cerebellum, or of the different configuration of their turnings, circumvolutions, eminences, depreſſions, expanſions, and various folds. It may be affirmed in general, that by this

this ſtructure the extent of the ſecretory organ of the nervous fluid is increaſed very conſiderably, and the particular functions of each nervous rope diſtinguiſhed, and likewiſe their general and reciprocal correſpondence, both in regard to the exquiſiteneſs of the organs of ſenſation, and the activity of the organs of motion.

The falx of the dura mater hinders one portion of the cerebrum from preſſing on the other, when we lie on one ſide. The tranſverſe ſeptum ſerves for a tent to the cerebellum, and defends it from a mortal compreſſion, which it muſt otherwiſe be liable to from the cerebrum, eſpecially when we walk or jump.

The ſeptum and productions of the pia mater connect and ſtrengthen all the circumvolutions, diviſions, and ridges, of the cerebrum, cerebellum, &c. and ſuſtain, in a general and almoſt incomprehenſible manner, all the branches and ramifications of the blood-veſſels, all the medullary filaments, and all the elongations and ropes that depend on theſe.

§ 10. *A Diſſertation on the Anatomy of the Brain, by* M. Steno, *read in the Aſſembly held at M.* Thevenot'*s Houſe in the year* 1668.

Gentlemen,

Inſtead of promiſing that I ſhall ſatisfy your curioſity in what relates to the anatomy of the brain, I begin by publicly and frankly owning that I know nothing of the matter. I wiſh I were the only perſon under a neceſſity of talking in this manner, becauſe I might in time become acquainted with what others know; and it would be a great bleſſing to mankind, if this moſt delicate part, and which is liable to ſo many dangerous diſeaſes, were as well underſtood as the generality of anatomiſts and philoſophers imagine it to be. In this, few imitate the ſincerity of Silvius, who never talks poſitively concerning the brain, though he has been at more pains about it than any man that I know. The number of thoſe who think every thing eaſy, is infinitely the greateſt; and they give us the hiſtory of the brain, and diſpoſition of its parts, with the ſame confidence and aſſurance, as if they had been preſent at the formation of this ſurpriſing machine, and had been let into all the deſigns of the great Architect. Though the number of theſe poſitive gentlemen may be very great, and though I cannot pretend to anſwer for the ſentiments of all the reſt, I am nevertheleſs very much convinced, that they who ſearch for ſolid knowledge, will find nothing ſatiſfactory in all that has been written about the brain. It it very certain that it is the principal organ of the ſoul, and the inſtrument by which it works very wonderful effects. The ſoul, which imagines it can penetrate into every thing without it, and that nothing in the world can ſet bounds to its knowledge, is nevertheleſs utterly at a loſs to deſcribe its own habitation, and is no where more to ſeek than at home. We need only view a diſſection of that large maſs the brain, to have ground to bewail our ignorance. On the very ſurface you ſee varieties which deſerve your admiration: but when you would look into its inner ſubſtance, you are utterly in the dark, being able to ſay nothing more, than that there are two ſubſtances, one greyiſh, the other white, which laſt is continuous with the nerves diſtributed all over the body; that the greyiſh ſubſtance ſerves in ſome places for a cortex to the white, and that in other places it ſeparates the white filaments from each other.

If we are aſked what theſe ſubſtances are, in what manner the nerves are joined in the white ſubſtance, or how far their extremities penetrate into it? all we can do is to own our ignorance, except we be reſolved to increaſe the number of thoſe who prefer the applauſe of the public to ſincerity and truth. For to ſay that the white ſubſtance is only an uniform body like wax, without any art concealed in it, would be to think too meanly of this great maſterpiece of nature. We are ſure,

ſure, that wherever there are fibres in the body, they always obſerve a certain regular order, more or leſs complex in proportion to the functions for which they are appointed. If this ſubſtance is every where fibrous, as it appears in many places to be, you muſt own that theſe fibres are diſpoſed in the moſt artful manner; ſince all the diverſity of our ſenſations and motions depends upon them. We admire the contrivance of the fibres of every muſcle, and ought ſtill more to admire their diſpoſition in the brain, where an infinite number of them, contained in a very ſmall ſpace, do each execute their particular offices without confuſion or diſorder.

The ventricles or cavities of the brain are no leſs unknown than its ſubſtance. They who place the animal ſpirits there, think they are as much in the right as they who make them receptacles of the excrements; but they are both equally puzzled when they are deſired to explain the origin of theſe ſpirits and excrements. They may come from the veſſels found in theſe cavities as well as from the ſubſtance of the brain; and it is equally difficult to determine how they get out.

Among thoſe who place the animal-ſpirits in the ventricles, ſome make them paſs from the anterior to the poſterior ventricles, there to meet with the entries of the nerves; while others affirm, that theſe entries are in the anterior ventricles. Some imagine, that the excrements of the brain are contained in the ventricles, becauſe they ſee ſomething like excrements there; but they own that there is a ready paſſage for them from the brain down to the medulla, as into the infundibulum; and ſuppoſing they go into the infundibulum, they may be carried from thence into the ſinuſes of the dura mater; and there is ſome reaſon to believe that they may have an immediate paſſage into the eyes, nares, and mouth.

We are ſtill more uncertain about what relates to the animal-

animal-ſpirits. Are they blood, or a particular ſubſtance ſeparated from the chyle by the glands of the meſentery? or may they not be derived from a lymphatic ſerum? Some compare them to ſpirit of wine, and it may be doubted whether they are not the matter of light. Our common diſſections cannot clear up any of theſe difficulties.

The true manner of diſſecting the brain is as little known as its ſubſtance. I need not mention the method of cutting it into ſlices, becauſe it is owned by every body that nothing can be learned that way. The ſecond method of unfolding all the plicæ is ſomething more artful; but it only ſhows us the outer ſurface of what we want to know, and even that very imperfectly.

The third method of unfolding the plicæ, and ſeparating the two ſubſtances, goes no further than the ſurface of the medulla. Theſe three methods have been differently combined; and they may be ſtill more diverſified, according as they are executed longitudinally, tranſverſely, &c.

As for my own part, it is my opinion, that the true method of diſſection would be to trace the nervous filaments through the ſubſtance of the brain, to ſee which way they paſs, and where they end; but this method is accompanied with ſo many difficulties, that I know not whether we may hope ever to ſee it executed without a particular manner of preparing. The ſubſtance of the brain is ſo ſoft, and the fibres ſo tender, that they can hardly be touched without breaking. Since, therefore, anatomy has not hitherto arrived to that degree of perfection, as to make the true diſſection of the brain, let us, without flattering ourſelves any longer, freely acknowledge our ignorance, that we may not firſt deceive ourſelves, and others afterwards, by promiſing to ſhow them the true ſtructure of this organ.

I ſhould tire your patience inſtead of entertaining you, were

were I to mention particularly all the difputes that have arifen about the brain: books are but too full of them; and therefore I fhall only relate the principal miftakes that ftill fubfift among anatomifts, and which may be corrected by anatomy; and they may be reduced to thefe heads. Some pretend to fhow parts in the brain as feparate, which are only a continuance of the fame fubftance; and others would perfuade us, that the parts touch each other without any connection, though they are vifibly joined together by filaments or veffels. Some fituate the parts in the manner which is moft agreeable to the fyftems they have framed, without confidering that they are quite otherwife fituated by nature. They fhow you the pia mater, for inftance, in places where it never was; and do not fee the dura mater in places where it is very vifible; and, in cafe of need, they will make the very fubftance of the brain pafs for a membrane.

I have too good an opinion of men of learning in general, to believe that they do this with a defign to deceive others; but the principles which they have eftablifhed, and the method of diffection to which they have accuftomed themfelves, oblige them to it. All anatomifts would demonftrate the parts the famé way, if they made ufe of the fame method; and therefore we ought not to be furprifed if their fyftems are very ill founded.

The ancients were fo far prepoffeffed about the ventricles as to take the anterior for the feat of common fenfe, the pofterior for the feat of memory; that the judgment, which they faid was lodged in the middle, might more eafily reflect on the ideas which came from either ventricles. I would only afk thofe who are ftill of the fame opinion, to give us the reafon why we fhould believe them, for there is nothing fatisfactory in all that has been hitherto faid in favour of it; and as that fine arched cavity of the third ventricle where they placed the throne of judgment does not fo much as exift, we may eafily eaſily ſee what judgment is to be pronounced on the reſt of this ſyſtem.

Willis is the author of a very ſingular hypotheſis. He lodges common ſenſe in the corpora ſtriata, the imagination in the corpus calloſum, and the memory in the cortical ſubſtance: but without being at pains to enter into the detail of his whole hypotheſis, we need only make the following remarks upon it. He deſcribes the corpus ſtriatum as having two ſorts of ſtriæ, one aſcending, the other deſcending; and yet, if you ſeparate the cortical from the white ſubſtance, you will perceive that theſe ſtriæ are all of the ſame nature, that is, that they are part of the ſubſtance of the corpus calloſum, which runs toward the medulla ſpinalis, parted into different lamellæ by the intervention of the aſh-coloured ſubſtance.

How can he, then, be ſure that theſe three operations are performed in the three bodies which he pitches upon? Who is able to tell us whether the nervous fibres begin in the corpora ſtriata, or if they paſs through the corpus calloſum all the way to the cortical ſubſtance? We know ſo little of the true ſtructure of the corpus calloſum, that a man of tolerable genius may ſay about it whatever he pleaſes.

M. Deſcartes knew too well how imperfect an hiſtory we have of the human body to attempt an expoſition of its true ſtructure; and accordingly in his *Tractatus de Homine*, his deſign is only to explain a machine capable of performing all the functions done by man. Some of his friends have indeed expreſſed themſelves on this ſubject differently from him; but it is evident from the beginning of that work, that he intended no more than what I have ſaid; and in this ſenſe it may juſtly be ſaid that M. Deſcartes has gone beyond all the other philoſophers. He is the only perſon who has explained mechanically all the human actions, and eſpecially thoſe of the brain. The other philoſophers deſcribe to us the human body itſelf. M. Deſcartes ſpeaks only of a machine

chine; but in ſuch a manner as to convince us of the inſufficiency of all that has been ſaid before him, and to teach us a method of inquiring into the uſes of the parts with the ſame evidence with which he demonſtrates the parts of his machine called a *man*, which none had done before him.

We muſt not therefore condemn M. Deſcartes tho' his ſyſtem of the brain ſhould not be found altogether agreeable to experience: his excellent genius, which ſhines nowhere more than in his *Tractatus de Homine*, caſts a veil over the miſtakes of his hypotheſis, eſpecially ſince even Veſalius himſelf and other anatomiſts of the firſt rank are not altogether free from ſuch miſtakes. And ſince we can forgive theſe great men their errors, who paſſed the greateſt part of their lives in diſſecting, why ſhould not Deſcartes meet with the ſame indulgence, who has happily employed his time in other ſpeculations?

The reſpect which I and all the world owe to ſuch ſuperior geniuſes, would have inclined me to continue only to admire this treatiſe as containing the deſcription of a fine machine invented by the author, if I had not met with ſeveral perſons who would make us believe that it is a faithful relation of the moſt ſecret ſprings of the real human body. Since theſe perſons are not convinced by Silvius's repeated demonſtrations, that M. Deſcartes's deſcriptions do not agree with what appears in diſſecting the human body, I find myſelf obliged to point out ſome parts of his ſyſtem, without relating the whole, in which they muſt ſee, if they have a mind to be inſtructed, the vaſt difference there is between Deſcartes's imaginary machine and the real machine of the human body.

The glandula pinealis has lately been the ſubject of the greateſt diſputes touching the anatomy of the brain; but before I enter upon that matter, or endeavour to determine the place where it lies, I muſt firſt give Deſcartes's own opinion in his own words, contained

in

in the following paſſages, to which I have added ſeveral others taken from the ſame treatiſe, at the end of this diſcourſe.

"The ſurface of the glandula pinealis has a relation "to the inner ſurface of the brain.

"In the concavity of the brain, the pores are directly "oppoſite to thoſe of the ſmall gland.

"The ſpirits run from all ſides of the gland into the "concavities of the brain.

"The gland may perform its functions, though it "be inclined ſometimes to one ſide, ſometimes to the "other.

"The ſmall tubes on the ſurface of the concavities "are always turned to the gland, and may eaſily be "turned toward the different points of this gland."

From all theſe paſſages, it is certain that he believed the glandula pinealis to lie entirely in the cavities of the brain. And though, in ſome other places, he ſays, that it is ſituated at the entry of theſe cavities, yet we are not to think that this is contrary to what he advances in the paſſages here quoted; for as it is but a very ſmall body, it may lie either at the entry, or in any other place of the cavities, and yet ſtill be within them, which he declares to be his opinion in many other places.

We are now to examine whether this opinion be not contrary to experience. It is very certain, that the baſis of this gland reaches immediately from the paſſage of the third ventricle to the fourth; but the poſterior part, that is, one half of the gland, may evidently be perceived to be altogether without the cavities, by only removing the cerebellum, and one or both of the tubercles of the third pair, with dexterity and care; upon which the poſterior part of the gland will be brought into view, and yet no paſſage will appear, by which the air or any other fluid can paſs into the ventricles.

To prove that the anterior part of the gland is not in the lateral cavities, we need only look upon them after they

they have been opened, either in Silvius's way, or in that of the ancients; for the ſubſtance of the brain will always be found to lie between theſe lateral cavities and the gland. The ſame thing may be demonſtrated without cutting the ſubſtance of the brain, by ſeparating from its baſis the part which contains theſe cavities; for the gland will then appear to be ſo far out of the cavities, that it can have no manner of relation to them, being hindered by the inſertions by which this part is fixed to the baſis. The ancients knew very well that the fornix is not continuous with the baſis of the brain, but that it forms a third cavity on its under ſide, and by forcing in air through the fiſſure between the tubercles of the ſecond pair, we raiſe the fornix, and thus, by breaking the filaments which connect it to the baſis, a large cavity is formed; from whence ſome have imagined that when the ſpirits ſwell the cavities, the fornix riſes, and that all ſides of the ſurface of the gland are turned toward the cavities.

I ſay ſome have imagined this; becauſe, though the fornix be raiſed in the manner already ſaid, only the anterior ſurface of the gland can be turned towards the lateral cavities; but no preparation whatever can turn the poſterior ſurface toward the poſterior ventricles. But if the brain has ſuffered no violence, either in opening the cranium, forcing in air, or by any other method, the cavity of this third ventricle will be found very narrow at the middle, and to contain nothing but the great vein which forms the fourth ſinus, and the glandular bodies which accompany this vein.

I own, that behind this fiſſure, and immediately below its poſterior opening, there is a cavity lined on the fore and lateral parts by that part of the plexus choroides which runs up toward the fourth ſinus, and at the back-part cloſed by the glandula pinealis, the anterior portion of which is perfectly continuous; and when the fornix is removed, this cavity remains entire under the firſt, in the ſhape of a kind of inverted horn.

What

What Descartes says, that the glandula pinealis may perform its functions, though it inclines sometimes to one side, sometimes to another, experience shows to be groundless; because it is so hedged in between all the parts of the brain, and so fixed to them on all sides, that it cannot be moved in the least without violence, and without breaking the fibres by which it is connected. It is easy to show likewise that M. Descartes has not represented it in its true situation; which is neither perpendicular, as he represents it, nor inclined forward, as other very great anatomists believe; but its point is always turned toward the cerebellum, and makes nearly half a right angle with the basis.

The supposed connection of this gland with the brain by means of arteries, is likewise groundless; for the whole basis of the gland adheres to the brain, or rather the substance of the gland is continuous with that of the brain, though the contrary be affirmed by Descartes.

The hypothesis of arteries meeting round the gland, and from thence running up to the great *euripus*, as it is called, is of great moment in Descartes's system, because the separation and motion of the spirits depend upon it. But if we can believe our eyes, this is no more than a collection of veins from the corpus callosum, from the anterior substance of the brain, from the plexus choroides, from different places of the basis of the brain, and from the gland itself; the office of which veins is to carry back the blood from the brain to the heart, and not to bring it from the heart to the brain. Some have thought that M. Descartes designed to carry the nerves to the gland; but he never had any such intention.

Such of M. Descartes's friends who look upon his man only as a machine, will be so good as to believe that I do not here speak against his machine, the contrivance of which I have always admired; but as for those who pretend to demonstrate that M. Descartes's man

man is made like other men, anatomical obfervations may eafily convince them that this is a fruitlefs attempt. And if they fhould plead the fame experience on their fide, we may readily anfwer, that there nothing more common than not to perceive the miftakes we commit in diffecting the brain, as will evidently appear in the fequel of this differtatiou.

I defigned to have mentioned the other fyftems of the brain by which the animal actions have been accounted for, and the origin and compofition of the fluids contained in the brain been explained; but I confidered afterwards, that this undertaking requires more application and leifure than my journey will allow me.

Diffections or preparations being liable to fo many miftakes, and anatomifts having hitherto too readily formed fyftems, and moulded thefe foft parts in the manner that was moft agreeable to each, we cannot be furprifed to find fo little exactnefs in their figures. But this want of accuracy in the figures is not owing to bad diffections only. The ignorance of drawers has contributed very much; and the difficulty of expreffing the feveral eminences and depreffions of the parts, and of underftanding what the anatomifts chiefly infift upon, furnifhes them with a never-failing excufe. The beft figures of the brain are thofe of Willis; but even thefe contain a great number of important miftakes, and they want many things to perfect them. In the third figure he reprefents the fuperior or pineal gland like a round ball; and confequently, according to this figure, the apex of that gland cannot be faid to be turned either forward or backward. Befides, we fee here nothing of the fubftance of the brain on the fore-fide of the gland, and which goes from one fide to the other; all which the figure would make us believe to be annihilated. Behind the gland, a fpace appears on the bafis of the brain between the two tubercles of the third pair, which, in the natural ftate, has a quite different appearance. The thin expanſion of the white ſubſtance of the cerebrum, which is continued to the middle of the cerebellum, where it is very thick, is quite wanting; as alſo the origin of the nervi pathetici, which go out from this expanſion. He likewiſe repreſents the ſecond pair of tubercles as diſtinct, which commonly adhere to each other. The under ſide of the fornix appears to be uniform, which is of an uneven and very elegant ſtructure. When we cut the corpus ſtriatum tranſverſely, we ſee radii very different from what they are exhibited in Willis's eighth figure. The white radii appear there to be continuous with the fore-part of the corpus ſtriatum, which, nevertheleſs, is of an aſh-coloured ſubſtance; and as it runs in between the white radii, does not appear, in that method of diſſecting, to adhere to any other body whatever.

In the third figure, the infundibulum has no reſemblance to nature. The nervi motores oculorum are ſtraight, and not oblique as they ought to be; neither do we ſee the true origin of the filaments, of which theſe nerves are compoſed, from the baſis of the brain. The pons Varolii might have been better and more diſtinctly expreſſed; and the anterior roots of the fornix are not ſeparated as in the ſeventh and eighth figures, but touch each other at the upper part, and form an acute angle. The line marked G. G. G. in the ſeventh figure appears to be a continued line, though the part between the roots of the fornix which is repreſented has no connection with the extremities; and in the ſame figure the glandula pinealis is connected to the ſubſtance of the brain by two funiculi. I need ſay nothing of the figures of Veſalius, Caſſerius, &c. for ſince theſe, which are the lateſt and beſt, are ſo very imperfect, we may eaſily imagine how little regard is to be paid to the others.

I have ſeen but three figures of Varolius, which expreſs in a wretched manner the beſt obſervations that have ever been publiſhed on the brain. I do not know whether

whether the figures of the firſt edition at Padua in 1573 may not be better than thoſe which I have ſeen publiſhed at Frankfort in 1591, and again in Bauhinus's anatomy. Among Bartholinus's figures, there are three which repreſent the brain diſſected after Silvius's method; but the author himſelf owns that they are faulty. But, to paſs over many other miſtakes in all theſe figures, there is not one amongſt them which repreſents truly the ſituation of the glandula pinealis; the duct of the third ventricle; the plexus choroides; the ramifications of the veins contained in the lateral cavities; the diſtribution of the arteries; the concourſe of the veins which forms the fourth ſinus; or the numerous glandular bodies lodged there.

From all this you ſee how the brain has been hitherto diſſected, how little knowledge has been gained from theſe methods of diſſection, and how falſely the figures repreſent the parts for which they are deſigned. It is eaſy to conclude from hence how little regard is to be paid to the ſyſtems built on theſe bad foundations, in framing of which the authors, by an unaccountable ſort of misfortune common to this with all other arts, have employed obſcure terms, metaphors, and compariſons, all of them ſo ill choſen, as to be equally puzzling to thoſe who have made ſome progreſs in this ſcience and thoſe who begin to learn it. Beſides, the greateſt number of theſe terms are ſo low, and ſo unworthy of the moſt noble part of the body of man, that I am at a loſs whether I ought moſt to wonder at the bad turn of thought of thoſe who firſt made uſe of them, or at the indolence of their ſucceſſors, who continue ſtill to retain them. What neceſſity could there be to employ the words *nates*, *teſtes*, *anus*, *vulva*, and *penis*, which in their common ſignification have no relation at all to the parts expreſſed by them in the anatomy of the brain? And, accordingly, what one author calls *nates*, another calls *teſtes*, &c.

The *third ventricle* is a very equivocal term. The ancients

cients underftood by this word, a cavity under the fornix, which they believed to be feparated from the bafis of the brain: and they have reprefented it with three legs, that it might fupport the brain, which lies upon it. M. Silvius calls the third ventricle a *canal*, founded in the fubftance of the bafis of the brain, between the infundibulum and the paffage which goes under the two pofterior pairs of the tubercles of the brain, towards the fourth ventricle. Some anatomifts having feparated the bodies of this fecond pair of tubercles, take the fpace between them, which is owing to their manner of diffection, for the third ventricle, which is confequently fometimes the fiffure above and fometimes the canal below; and fome will have it to be the fpace between the fiffure and canal, which is likewife owing to the rupture of the parts already mentioned. We have therefore three *third ventricles*, the fecond of which alone is the true one; the firft and third arifing entirely from the methods of preparing the parts. To thefe a fourth *third ventricle* might be added, if the fmall fiffure under the fornix could be looked upon as a paffage between the two anterior ventricles and the fourth. But it is fo fmall, and fo full of the veffels and glands of the plexus choroides, that I doubt very much whether there can be any communication that way, between the anterior and pofterior ventricles, efpecially fince Silvius's third ventricle is fufficient for that purpofe, and likewife anfwers the defign fo perfectly well, that whatever goes from the lateral to the pofterior ventricle, muft firft of all fill the infundibulum and this canal.

Two glands are reckoned to belong to the brain, tho' we know not if either of them refembles glands in any thing more than in the figure; and even that, when well examined, will be found to be different from what it is in the reft. The fuperior or pineal gland is not like a pine-apple, either in brutes or in man; and it is not known whether the inferior or pituitary gland acts in any refpect on the pituita.

The

The plexus choroides reprefents a vafcular texture, in which the veins are feen very diftinct from the arteries, and the diftribution of each may be traced feparately. The name of *fornix* gives the idea of an arched or vaulted part, which, however, is not to be found when looked for in a proper manner. The corpus callofum, in the common fignification, means the white fubftance of the brain which comes into view when the two lateral parts are feparated; but as it entirely refembles the reft of the fubftance of the brain, there can be no reafon for giving a particular name to one part of this fubftance.

There are but two ways of coming at the knowledge of a machine; either to be taught the whole contrivance by the maker; or to take it quite to pieces, and to examine each by itfelf, and as it ftands in relation to the reft. Thefe are the only true ways of learning the contrivance of any machine; but the generality of inquirers have thought that they had better guefs at it, than be at pains to examine it thoroughly. They have fatisfied themfelves with obferving its motions; and on thefe obfervations they have built fyftems which they believed to be true, becaufe, by their help, they imagined they could explain all the effects which they knew. They never confidered, that the fame thing may be explained in different manners; and that the fenfes alone are capable of informing us whether our ideas be conformable to nature. As the brain is a machine, we muft not flatter ourfelves that we can difcover the contrivance of it by any other means than are made ufe of for knowing other machines; and we have no way left but to take it to pieces, and to confider what every part is capable of in a feparated and in an united ftate. In this fearch, we may truly fay that few anatomifts have difcovered any great degree of curiofity. Chemiftry has in all ages found both private men and princes very ready to erect laboratories; but few have purfued anatomy with equal ardour. This neglect is not owing to princes, among whom many have had curiofity

riofity enough for fuch an important part of knowledge, to build magnificent anatomical theatres, which they have often honoured with their prefence. But the diffectors being always willing to appear complete mafters of this fcience, never have had the fincerity to own that any thing ftill remained to be known; and, to conceal their ignorance, have contented themfelves with demonftrating what is to be found in the writings of the ancients.

Anatomifts might have reafon to blame me, if I did not fhow by a farther explanation, that they are not fo much in the wrong as I feem to infinuate, by faying, that they do not apply themfelves fufficiently to anatomical inquiries. They that ftudy anatomy are generally either phyficians or furgeons, who being both obliged to vifit their patients, have too little time left for ftudy, after they have attained to a tolerable degree of reputation. But they ought not to undertake the cure of a body, the make of which they do not know; that is, they ought not to endeavour to rectify a machine, till they are previoufly acquainted with its nature. Others who do not vifit fick perfons, and have no other bufinefs than that of teaching anatomy in public fchools, do not look upon themfelves as more obliged to purfue anatomical inquiries than the practifing phyficians and furgeons. The defign of their profeffion is to teach to thofe who are to practife phyfic and furgery, the defcriptions left us by the ancients of the ftructure of the human body; and when they have clearly demonftrated all that is contained in the works of the ancients, and their hearers have as diftinctly underftood them, they both imagine that they have done their duty. The bounds of thefe different profeffions of teaching and practifing have been fo very ill fettled, that the true knowledge of the human machine, tho' the moft neceffary branch, is neglected, as belonging neither to the anatomift, phyfician, nor furgeon.

To make the neceffary inquiries for the difcovery of truth, a man's whole time muft be taken up; and pro-

professors of anatomy, who are obliged to make public demonstrations, which employ a great deal of time and labour, cannot be proper for this study, for the reasons already given, and for the following, which are no less evident.

1. There is so much time and application required to examine each part as it ought, that every thing else must be laid aside, and we must mind nothing but that. Physicians and surgeons cannot comply with this, because of their practice; nor professors, because of their public demonstrations. Whole years may sometimes be necessary to discover what may afterwards be demonstrated to others in the space of an hour. I do not question but that Pecquet was a great while in carrying the chyle from the mesentery to the subclavian vein; and perhaps I should not be believed, were I to mention what difficulties I found before I could show the true insertion of Pecquet's duct, of which Bilsius had given us a figure; whereas at present they may be both prepared and demonstrated in half an hour.

2. Though anatomists open a thousand bodies in the schools, it is by mere accident if every they discover any thing new. They are obliged to demonstrate the parts as described by the ancients, and in doing this, it is necessary they should follow a certain method; whereas, inquiries admit of no settled method, but must be pursued in every manner that can be thought of. In the schools, every thing must be removed that lies in the way of the part which they want to show: but in particular searches, no part must be cut off till we have first examined it; and if any such thing were attempted in public dissections, the demonstrator would be looked upon as ignorant, and the spectators would be often in the right to complain of loss of time, because he would not always be sure to find what he proposed to show them.

It is evident from these considerations, that professors have not hitherto been obliged to make inquiries in anatomy, and even that it is impossible for them to do it, were they ever ſo willing; ſo that it is not their fault that greater progreſs has not been made in that ſcience.

Anatomy in general has, we ſee, been managed hitherto with very little ſucceſs; and the inquiries into the brain have ſucceeded leſs than any others, becauſe they have not been made with that care and diligence which the difficulty of the ſubject requires. Let us now conſider the true method, and examine if any perſon has hitherto found it out.

Bilſius applied himſelf to anatomy, without having ſtudied the writings of the ancients; and I make no queſtion but that he would have made a greater progreſs, if, after having learned all that is good in theſe writings, he had employed his time and application in making new diſcoveries. We muſt own, that the works of our predeceſſors contain very fine experiments, which we might ſtill have been ignorant of, if they had not handed them down. And they have ſometimes told us truths, which their ſucceſſors, for want of ſufficient application, have not been able to ſee. It muſt, however, be owned, that all that both ancients and moderns have told us about the brain is ſo uncertain, that the books which contain the anatomy of this organ may be ſaid to be chiefly a collection of doubts, diſputes, and controverſies; but ſtill a great advantage may be made of their labour, and even of their miſtakes. I here ſpeak of the authors who have diſſected; for as for thoſe who only copy the works of others, the beſt that can be ſaid of them is, that it may ſometimes be proper to read their books by way of diverſion. But they would have deſerved a great deal more commendation, and been more uſeful to thoſe who diſſect, if they had given us only an exact relation of all that anatomiſts have wrote about the brain; if they had explained, according to the laws of a true analyſis, all the different ways of accounting for the animal-actions mechanically; or if they had made an exact liſt of all the propoſitions found in theſe writings, diſtinguiſhing thoſe which

which are founded on facts and experience, from thofe which contain reafonings and conclufions drawn from the former. None of thefe methods have hitherto been purfued by the compilers, and therefore we muft confine ourfelves moftly to the original authors.

The firft thing to be confidered is the hiftory of the parts; and in this we ought precifely to determine what is true and certain, that we may be able to diftinguifh that from what is falfe or uncertain. Neither is it fufficient that we ourfelves are fatisfied about any thing; the evidence of our demonftrations ought to be fo clear, as to oblige every body elfe to affent to them; for otherwife the number of difputes would rather increafe than diminifh. Every anatomift who diffects the brain, demonftrates from experience what he advances. This foft and pliable fubftance fo readily yields to every motion of his hand, that the parts are imperceptibly formed in the fame manner as he had conceived them before diffection; while the fpectator, who often fees two contrary experiments made on the fame part, is either puzzled very much to know which he ought to embrace, or obliged to reject both to make himfelf eafy. Therefore, to prevent this inconvenience, it is abfolutely neceffary to carry diffections the length of a convincing certainty; which, though very difficult, is very far from being impoffible. For I would not have you imagine, from what I have faid, that I believe there is nothing certain in anatomy; or that all who follow that ftudy, make the parts appear as they have a mind, without any danger of being difcovered. You may indeed juftly doubt, if parts which are fhown you feparated, were ever united; but it would be impoffible to fhow them united together, if they were not naturally fo. To clear up any doubt that might arife on this fubject, and to be certain whether the parts which are fhown you were naturally joined or not, you need only examine them in their natural ftate, without ufing

any

any kind of violence, but allow thofe whom you have a mind to convince, to do all that is in their power to fhow that they are united. We may come at the fame degree of certainty in other circumftances, and particularly when we inquire into the fituation of parts, provided we touch nothing without having firft examined it, and fet down every moment what we touch. In order to this, we muft not only be very attentive to the part which we examine, but alfo reflect on all that we did before we reached it, to fee if thefe operations may have changed it from its natural ftate in any refpect. For by often handling more exterior parts, we may eafily affect thofe that lie within them ; and when thefe come in fight, we are apt to imagine that they are naturally fuch as they then appear, without confidering how far we may have altered their fituation and connection with other parts. The moft famous anatomical difpute which this age has produced, may ferve for an example of what I fay. They who deny the continuation of the glandula pinealis with the fubftance of the brain, and the adhefion of the fornix to the bafis of the brain, would not talk fo pofitively concerning a matter of fact, if they did not believe it to be proved by incontestible experiments and obfervations. But in making thefe experiments, they muft neceffarily have forgot the changes which happen in feparating the exterior parts, and that they deftroy all the connections by which the dura mater adheres to the cranium ; and I have often obferved, that, in raifing the fuperior part of the cranium, the middle of the dura mater continued ftill to adhere to it, even after I had opened it fufficiently, to thruft in three fingers between the feparated parts of the cranium. Now, how can the dura mater be thus raifed, without making the interior parts to which it is fixed fuffer violence ? The glandula pinealis adheres to the fourth finus, which is connected with the falx ; fo that the dura mater cannot be raifed at that place without affecting the gland. This falx receives

ceives likewife all the veins which pafs between the fornix and the bafis of the brain, and by which thefe two parts are connected. There is a pretty ftrong connection between the upper part of the brain and the dura mater; and when that membrane is raifed, the brain muft follow it; and the fourth finus being carried upward, breaks the connection between the fornix and the bafis. I have many times been deceived about this when I firft began to diffect the brain; and I ufed to wonder why thefe connections were not always fenfible. But obferving afterwards, in horfes, fheep, cats, &c. where that part of the dura mater which feparates the cerebrum from the cerebellum is offified, that I deftroyed a great many of the inner parts in extracting this bone, I began to perceive the caufe of this miftake, and that it was not an eafy matter to feparate the cranium as it ought. The common way is to divide the cranium by a circular fection, to remove the upper fegment; but if this fegment were again divided by a fection perpendicular to the former, it would be much more eafily removed, without doing any violence to the brain; for fciffars, faws, and forceps, cannot be handled without fhaking and difordering the parts. A fmall circular faw might be contrived which would not fhake the parts very much, efpecially if it were turned upon a proper axis placed between two pointed pillars. This faw might likewife be employed for feveral other purpofes in feparating the cranium; but if any liquor could be difcovered to diffolve or foften the bones in a fmall fpace of time, this would be by far the beft way of feparating the cranium.

It is not fufficient to be continually attentive; we muft likewife make ufe of different methods of diffection, which are fo many different proofs of the truth of our operations, in order to fatisfy ourfelves, and to convince others.

This will appear a very ftrange doctrine to thofe who believe that there are ftated laws for the diffection of every

every part, and that the anatomical adminiſtrations taught us by the ancients, ought to be inviolably obſerved, without any change or addition. I own that the ancients might have given us unalterable rules for the diſſection of each part, had they been ſufficiently acquainted with them themſelves; but as they certainly knew leſs about many parts than we do, they were at leaſt as unfit as we are to preſcribe rules, which can never be fixed or conſtant till more diſcoveries have been made. It will here be objected, that ſome method muſt be followed in diſſecting the parts already known. This I readily grant, and alſo that the method of the ancients is to be made uſe of till a better is found out; but I would not have that method looked upon as perfect or unalterable. The principal reaſon why a great many anatomiſts have remained in their miſtakes, and why they have gone no greater a length than the ancients in diſſection, is, becauſe they believe that every thing has been already taken notice of, and that there is nothing left for the moderns to do; and as they have looked upon the ancient laws as inviolable rules in diſſection, they ſpent their whole lives in demonſtrating the ſame parts in the ſame manner; whereas anatomy ought to be confined by no rules, every new diſſection requiring a different method. The advantage of proceeding in this manner is, that if we miſs of new diſcoveries, we at leaſt are put in a condition to find out any miſtakes that may have happened in former diſſections, eſpecially in controverted points; in which the ſpectators ought to have the liberty of preſcribing the rules of diſſection.

This method of diſſection makes indeed but a very ſmall ſhew, and a man cannot well diſplay his learning at the ſame time that he acknowledges his ignorance; but as for my own part, I much rather chooſe to own what I do not know, than to impoſe upon my hearers ancient opinions, which will ſome time or other be demonſtrated to be falſe. We have ſeen great anatomiſts expoſed expofed to this mortification; and we ftill fee many who believe that more regard will be paid to their ftiffnefs and pofitivenefs in opinion, than to ocular demonftration. I wifh thefe gentlemen much joy of their felf-conceit, while I endeavour to follow the laws of philofophy, by which we are taught to fearch after truth in fo cautious a manner, as never to believe we have found it till it brings demonftration along with it.

I cannot prove to you the neceffity of often changing the methods of diffection better than by the two following examples. ' It is a confirmed experiment, that by blowing into the beginning of the fiffure under the fornix, the fornix is feparated from the bafis, and a confiderable cavity left between them; and the fame thing happens when we feparate the cranium with violence, as I have already faid. This is fo evident, that both the diffector and the fpectators are fully convinced of it; but if any perfon fhould ftill be in doubt, there is no other way to clear it up, but to endeavour to demonftrate this cavity in another manner. For if it be natural, we muft always find it the fame, in whatever manner we look for it; but if, by any other method, you find that it is wanting, and that the parts between which it ought to lie, are connected together without leaving any void fpace between them, you ought from that moment to be convinced of the falfity of the former demonftration, and that it was the force of the air to which the appearance of a cavity was owing.

If the brain is diffected according to the method of Varolius or Willis, after having taken it out of the cranium, you will commonly fee the fecond pair of tubercles feparated at the middle of that white fubftance which lies before the glandula pinealis, and which is very often broken. When we make the diffection, leaving the brain in the cranium, we fee both the tubercles and the white fubftance entire; and then we fee plainly, that the caufe of the firft miftake was owing to the

the weight of the lateral parts which break thofe in the middle.

Having made a true and exact plan of the parts of the brain, having difcovered the miftakes and the caufes of thefe miftakes, and having fettled the true method of demonftrating thefe parts, with all the neceffary precautions; the next ftep is to exprefs, by good figures, all that we have difcovered: for we had better be without figures than not have them true and faithful. When we cannot have recourfe to the originals, the reprefentation ferves to keep us in mind of them; and many perfons never have an opportunity of feeing the parts in any other way, their averfion for blood hindering them from fatisfying their curiofity by examining dead bodies; and therefore, if the figures are not true, they give falfe ideas to thofe who would learn anatomy by their help, and puzzle others who make ufe of them only to refrefh their memory.

We ought therefore to leave nothing undone to procure exact figures; in order to which a good drawer is as neceffary as a good anatomift. We muft likewife apply ourfelves very particularly to fee in what manner we ought to diffect and difpofe the parts, fo as to exhibit all that is to be feen in the brain, there being difficulties peculiar to this organ. The other parts require only a preparation to complete the figures we defign; whereas the brain, never fo well prepared, fubfides before the figure can be taken; and we muft have feveral frefh fubjects before one figure can be finifhed. To this, perhaps, it is owing, that no anatomical figures are fo imperfect as thofe of the brain.

I have hitherto faid nothing of the ufes of the parts, nor of the animal-actions, as they are called; becaufe it is impoffible to explain the movements of a machine till we know the contrivance of its parts. A reafonable man muft, in his own mind, laugh at thefe pofitive anatomifts, who having made a long harangue about the ufe of parts, the ftructure of which is altogether

ther unknown to them, give this as the only reaſon of all they advance, that God and nature do nothing in vain. They deceive themſelves in the application of this general maxim; and the part which they raſhly judge to have been made by God for one end, is afterwards diſcovered to have been made for another. We had therefore much better own our ignorance, be more reſerved in our deciſions, and not undertake, upon ſuch ſlight conjectures, to explain matters which are in their own nature ſo difficult.

All that I have hitherto mentioned is but a very ſmall part of what ought to be done in order to acquire the knowledge of the brain. We ought moreover to examine the heads of all animals, and in all the different ſtates of each animal. In the fœtus of animals, we ſee how the brain is gradually formed; and what could not be ſeen in a ſound healthy brain, may perhaps be diſcovered in one that is diſeaſed.

In living animals, we ought to conſider every thing that may cauſe the leaſt alteration in the actions of the brain; whether the cauſes be external, as from liquors, wounds, medicines, &c. or internal, as a great number of diſeaſes reckoned up by phyſicians. There is likewiſe this advantage attending the diſſection of the brains of animals, that we may manage them as we pleaſe. We may learn to trepan or to perform any other chirurgical operation upon them: we may examine whether the brain has any motion in theſe operations; and whether the application of any medicines to the dura mater, or to the ſubſtance or ventricles of the brain, may not produce ſome particular effects.

We might likewiſe make different trials without opening the cranium, by applying medicines exteriorly, by mixing them with the food, and by injections into the veſſels, in order to diſcover what diſturbs the animal-actions, and what is moſt proper to reſtore them when diſordered.

The brain is different in different animals; and this

is

is another reaſon why we ſhould examine them all. The brains of birds and fiſhes are not at all like that of man; and even in animals where there is the greateſt likeneſs to the human brain, I have always found a very great variety. Whatever this difference be, it may always afford us ſome new light, and teach us what it is abſolutely neceſſary we ſhould know. In ſome animals, the fibres are more eaſily ſeen than in men; and the parts which in the human brain are mixed and joined together, are ſometimes diſtinct and ſeparate in animals; and we ofteen meet with the ſubſtance more or leſs ſolid, and the ſize and ſituation different.

I need not inſiſt any longer on this ſubject, becauſe I believe we are all convinced that we are indebted to the diſſection of animals for almoſt all the new diſcoveries of this age; and that there are many parts which would never have been found in the human brain, if they had not firſt been obſerved in animals.

What I have hitherto ſaid concerning the inſufficiency of all the ſyſtems of the brain, concerning the want of a true method in diſſecting it, concerning the infinite number of inquiries that ought to be made about it in man and in brutes in all their different ſtates, concerning the barrenneſs of all the writers on this ſubject, and concerning the precautions that muſt be uſed in handling theſe tender parts, ought certainly to undeceive thoſe who ſatisfy themſelves with what they find in the books of the ancients. We muſt always remain in ignorance if we ſit down with what the ancients have taught us, and if men capable of making ſuch inquiries do not contribute their labour, induſtry, and ſtudy, in order to arrive at the knowledge of truth, which is the principal aim of all who ſearch for it ſincerely.

The

The paſſages from Deſcartes referred to in this diſſertation, are theſe.

Pag. 11. For we muſt know that the other veſſels which bring the blood from the heart, having been divided into an infinite number of ſmall branches diſpoſed in a reticular manner, and which are ſpread like a thin web in all the cavities of the brain, are collected round a certain ſmall gland ſituated almoſt in the middle of the ſubſtance of the brain at the entry of the cavities, and have in this place a great number of ſmall holes, through which the moſt ſubtle parts of the blood which they contain may be conveyed to the gland, becauſe they are too ſmall to allow the groſſer parts to paſs. Theſe arteries do not terminate here; but ſeveral of them being united into one, run up in a ſtraight courſe to that great veſſel, which like an euripus ſupplies all the exterior ſurface of the brain.

Pag. 12. This gland is to be looked upon as a rich ſource from which the fineſt and moſt agitated parts of the blood run on all hands into the cavities of the brain.

Pag. 63. Imagine the ſurface which is turned toward the cavities to be a piece of cloſe net-work or plexus, all the meſhes of which are ſo many ſmall holes thro' which the animal ſpirits may paſs; and being turned toward the gland from which all theſe ſpirits proceed, they can eaſily be directed toward all the different points of this gland.

Pag. 65. The ſpirits do not ſtop any where; but in proportion as they enter the cavities of the brain by the holes of the ſmall gland, they run directly toward thoſe of the ſmall tubes which are over againſt them.

Pag. 72. In explaining how figures are marked in the ſpirits on the ſurface of the gland, he determines plainly enough the relation which he ſuppoſes to be

 be-

between the inner furface of the brain and that of the gland.

Pag. 77. It ought likewife to be confidered, that the gland is compofed of a foft matter, and that it is not all united to the fubftance of the brain, but only connected to fmall arteries (the coats of which are very loofe and pliable), and fupported in its fituation by the force of the blood in thefe arteries; fo that a very fmall matter may incline it to either fide, and, by fo doing, difpofe the fpirits which it contains, to run toward one part of the brain rather than to another . . . . . If the fpirits were of equal force, the gland would always be kept in an immoveable erect pofture in the centre of the head.

Pag. 77. As the fpirits flow out more readily from one part of the brain than from another, they may have force enough to turn the fmall tubes in the inner furface of the brain into which they run, towards the place from whence they flow out, if they do not find them in that direction.

SECT. II. *The* EYE.

§ 1. *The Eye in general.*

Situation and compofition. THE eyes are commonly two in number, fituated at the lower part of the forehead, one at each fide of the root of the nofe; and they are made up of hard and foft parts. The hard parts are the bones of the cranium and face; which form two pyramidal or conical cavities, like funnels, to which we give the name of *orbits*. The foft parts are of feveral kinds.

The principal and moft effential foft part in each organ is the globe or ball of the eye; the others are partly external and partly internal. The external parts are the

the ſupercilia or eye-brows, the palpebræ or eye-lids, the caruncula lachrymalis, and the puncta lachrymalia; and the internal parts are the muſcles, fat, lachrymal gland, nerves, and blood-veſſels.

The orbits. Seven bones are concerned in the compoſition of each orbit, viz. the os frontis, os ſphenoidale, os ethmoides, os maxillare, os malæ, os unguis, and os palati. In each orbit we are to conſider the edge, ſides, and bottom. The edge is formed by the os frontis, os maxillare, and os malæ; the bottom by the os ſphenoides and os palati; and all theſe bones except the os palati, contribute to form the ſides. The bottom is perforated by the foramen opticum of the os ſphenoides; and the external ſide near this foramen, by two orbitary fiſſures, one ſuperior, called *ſphenoidalis*, the other inferior, called *ſpheno-maxillaris*, as has been already ſaid in the deſcription of the ſkeleton.

All the cavity of the orbit is lined by a membrane, which is an elongation or production of the dura mater; and it comes partly through the foramen opticum of the os ſphenoides, and partly through the ſphenoidal or ſuperior orbitary fiſſure. This membrane, which may be looked upon as the perioſteum of the orbit, communicates with the perioſteum of the baſis cranii, by the inferior orbitary fiſſure, and with the perioſteum of the face at the edge of the orbit. At the upper part of the edge of the orbits, the two perioſtea form a kind of broad ligament, and a narrow one at the lower part of this edge, which I ſhall call *ligaments of the palpebræ*.

The particular ſituation of the orbits repreſents nearly two funnels, placed laterally at a ſmall diſtance from each other, in ſuch a manner as that their apices are almoſt joined, their neareſt ſides almoſt parallel, and the other ſides turned obliquely backward; and for this reaſon the middle of the great circumference or edge of each orbit, is at a much greater diſtance from the ſeptum narium, than the bottom or apex; and the edge or great circumference is very oblique, the temporal or external angle of the orbit lying more backward than the naſal or internal angle.

§ 2. *The Globe or Ball of the Eye.*

Compoſition. The globe of the eye being the moſt eſſential of all the ſoft parts belonging to the organ of ſight, and being likewiſe a part which we are obliged to mention as often as we ſpeak of the other ſoft parts, muſt be firſt deſcribed. It is made up of ſeveral proper parts, ſome of which being more or leſs ſolid, repreſent a kind of ſhell formed by the union of ſeveral membranous ſtrata called the *coats of the globe of the eye;* and the other parts being more or leſs fluid, and contained in particular membranous capſulæ, or in the interſtices between the coats, are termed *the humours of the globe of the eye.* Theſe capſules are likewiſe termed *coats.*

The coats of the globe of the eye are of three kinds. Some form chiefly the ſhell of the globe; ſome are additional, being fixed only to a part of the globe; and ſome are capſular, which contain the humours. "The coats which form the globe of the eye are, The ſclerotic, to which the convexity of the globe is owing; the cornea, which forms the anterior part of the globe; the iris, choroides, and retina." The additional coats are two; one called *tendinoſa* or *albuginea*, which forms the white of the eye; and the other, *conjunctiva.* The capſular tunicæ are likewiſe two, the vitrea and cryſtallina.

The globe of the eye thus formed, ſends out backward a pretty large pedicle, which is the continuation of the optic nerve. It is ſituated about the middle of the orbit in the manner which we ſhall afterwards ſee; and it is tied to it by the optic nerve, by ſix muſcles, by the tunica conjunctiva, and by the palpebræ. The back-part of the globe, the optic nerve, and muſcles, are ſurrounded by a ſoft fatty ſubſtance, which fills the reſt of the bottom of the orbit.

The

The humours are three in number; the aqueous, vitreous, and cryſtalline. The firſt may properly enough be called an *humour*, and is contained in a ſpace formed in the interſtices of the anterior portion of the coats. The ſecond or vitreous humour is contained in a particular membranous capſula, and fills above three-fourths of the ſhell or cavity of the globe of the eye. It has been named *vitreous*, from its ſuppoſed reſemblance to melted glaſs; but it is really more like the white of a new-laid egg.

The cryſtalline humour is ſo called from its reſemblance to cryſtal, and is often named ſimply the *cryſtalline*. It is rather a gummy maſs than an humour, of a lenticular form, more convex on the back than on the foreſide, and contained in a fine membrane called *membrana* or *capſula cryſtallina*. What I have here ſaid is ſufficient to give a general idea of the three humours of the globe of the eye.

§ 3. *The Coats of the Eye in particular.*

"The moſt external, the thickeſt, and ſtrongeſt coats of the eye, are the ſclerotica and cornea. They inveſt all the other parts of which the globe is compoſed—The ſclerotic is made up of many fibres cloſely connected; and is of a firm texture, reſembling parchment." About the middle of its poſterior convex portion, where it ſuſtains the optic nerve, it is in a manner perforated, and thicker than any where elſe, its thickneſs diminiſhing gradually toward the oppoſite ſide, and its ſubſtance is penetrated obliquely in ſeveral places by ſmall blood-veſſels. The courſe of the nervous filaments thro' this coat is very ſingular: they enter the convex ſide at ſome diſtance from the optic nerve; and running from thence through its ſubſtance, they pierce the concave ſide near the cornea.

The cornea is made up of ſeveral ſtrata or laminæ cloſely united, and of a different texture from the former. When macerated in cold water, it ſwells; and then its ſtrata may be ſeparated from each other.

This portion is ſomething more convex than the ſclerotica, ſo that it repreſents the ſegment of a ſmall ſphere added to the ſegment of a greater; but this difference is not equally great in all perſons. The circumference of the convex ſide is not circular as that of the concave ſide, but tranſverſely oval: for the ſuperior and inferior portions of the circumference terminate obliquely; but this obliquity is more apparent in oxen and ſheep than in man.

The cornea is perforated by a great number of imperceptible pores, through which a very fine fluid is continually diſcharged, which ſoon afterwards evaporates; but we diſcover it evidently by preſſing the eye ſoon after death, having firſt wiped it very clean; for we then ſee a graduall collection of a very ſubtle liquor, which forms itſelf into little drops; and this experiment may be ſeveral times repeated on the ſame ſubject. It is this dew that forms a kind of pellicle on the eyes of dying perſons, which ſometimes cracks ſoon after, as is obſerved in the Memoirs of the Academy for 1721.

Tunica choroides. The next coat of the globe of the eye is the choroides, which is of a blackiſh colour, more or leſs inclined to red; and adheres, by means of a great number of ſmall veſſels, to the ſclerotica, from the inſertion of the optic nerve all the way to the cornea, where it leaves the circumference of the globe; "and turns inward, to form a number of little proceſſes termed *ciliary*, which are ſituated at the edge of the cryſtalline lens."

The external lamina of the choroides is ſtronger than the internal, and both appear blackiſh becauſe of their tranſparency. At a very ſmall diſtance from the cornea this lamina is moſt cloſely united to the ſclerotica. Round this adeſion it changes colour, and forms a whitiſh ring of the ſame breadth with the adheſion; and near

near the edge of the ſclerotica this ring is ſtronger and of a different texture from what it is any where elſe. It adheres ſo cloſely to the ſclerotica, that if we blow through a ſmall hole made therein without touching the choroides, the air will penetrate every where between the two coats, but cannot deſtroy this adheſion, or paſs to the cornea. This adheſion has been improperly named *ligamentum ciliare*. On the inner ſurface of this lamina we diſcover a great number of flat lines in a vortical diſpoſition, which are the veſſels named by Steno *vaſa vorticoſa*, or *vortices vaſculoſi*, of which hereafter.

The internal lamina of the choroides is thinner and of a darker colour than the external; and its ſurface, together with the correſponding ſurface of the other lamina, is covered by a blackiſh ſubſtance with ſome mixture of red, which eaſily ſeparates when touched, and immediately tinges the water in which the choroides is dipped. The origin of this ſubſtance has not as yet been obſerved; but, after a nice anatomical injection, I have obſerved a great number of vaſcular ſtars on the inner ſurface of this lamina. In Mr Ruyſch's works, it is termed *membrana Ruyſchiana*.

" At the anterior edge of the choroides we find the iris compoſed of two laminæ, the poſterior of which was called *uvea* by the antients. In the middle of the iris there is a hole termed *pupil:* this in a fœtus is covered with a membrane called *pupillaris*, which generally diſappears about the ſeventh month." Between the two laminæ of the iris we find two very thin planes of fibres which appear to be fleſhy; the fibres of one plane being orbicular, and lying round the circumference of the papilla; and thoſe of the other being radiated, one extremity of which is fixed to the orbicular plane, the other to the great edge of the iris.

The plicæ or proceſſus ciliares are ſmall radiated and prominent duplicatures of the anterior edge of the choroid coat; and their circumference anſwers partly to that of the white ring of the external lamina. They are oblong thin plates; their external extremities, or thofe next the choroides, being very fine and pointed; the internal are broad, prominent, and ending in acute angles. In the duplicature of each ciliary fold we find a fine reticular texture of veffels; and fome pretend to have feen flefhy fibres in the fame place, lying in fmall grooves of the membrana vitrea, as we fhall fee hereafter.

The fpace between the cornea and iris, contains the greateft part of the aqueous humour, and communicates by the pupilla with a very narrow fpace behind the iris, or between that and the cryftalline. Thefe two fpaces have been termed *the two chambers of the aqueous humour*, one anterior, the other pofterior, as I fhall obferve in defcribing this humour in particular.

Retina. The laft coat proper to the eye is of a very different texture from that of the other two coats. It is white, foft, and tender, and, in a manner, medullary, or like a kind of pafte fpread upon a fine reticular web. It reaches from the infertion of the optic nerve to near the edge of the cryftalline lens." At the place which anfwers to the infertion of the optic nerve, we obferve a fmall depreffion, in which lies a fort of medullary button, terminating in a point; and from this depreffion blood-veffels go out, which are ramified on all fides through the fubftance of the retina.

It is commonly faid, that the retina is a production or expanfion of the medullary fubftance of the optic nerve; the fclerotica, of the dura mater; and the choroides, of the pia mater, which accompanies this nerve. But this opinion is not altogether agreeable to what we obferve in examining the optic nerve, and its infertion in the globe of the eye. If we take a very fharp inftrument, and divide this nerve through its whole length, between where it enters the orbit and where it enters the globe, into two equal lateral parts, and then continue this fection through the middle or centre of its infertion, the following phenomena will appear.

That

That the nerve contracts a little at its infertion into the globe; that its outer covering is a true continuation of the dura mater; that this vagina is very different from the fclerotica both in thicknefs and texture, the fclerotica being thicker than the vagina, and of another ftructure; that the vagina from the pia mater forms, through the whole medullary fubftance of the nerve, feveral very fine cellular fepta; and that where it enters the globe of the eye, the pia mater does not directly anfwer to the choroides.

Laftly, that as the medullary fubftance of the nerve enters the globe, it is very much contracted, and feems to terminate only in the fmall tubercle or button already mentioned; but if we examine accurately, we fhall find that the retina is really a continuation of the fibres which compofe the medullary part of the nerve.

The infertion of the optic nerve in the globe of the eye is not directly oppofite to the pupilla, fo that the diftance between thefe two parts is not the fame when meafured on all parts of the globe. The greateft diftance is on the fide next the temples; and the fmalleft, next the nofe. I have obferved an inequality of the fame kind in the breadth of the uvea, which in many fubjects is lefs near the nofe than near the temples; fo that the centre of the pupilla is not the fame with that of the great circumference of the iris; and I have feen the fame difference in the breadth of the corona ciliaris.

§ 4. *The Humours of the Eye and their Capfulæ.*

The vitreous humour. The vitreous humour is a clear and very liquid gelatinous fluid contained in a fine tranfparent capfula, called *tunica vitrea*, together with which it forms a mafs nearly of the confiftence of the white of an egg. It fills the greateft part of the globe of the eye, that is, almoft all that fpace which anfwers to the extent of the retina, except a fmall portion behind

hind the uvea, where it forms a foſſula, in which the cryſtalline lens is lodged. This humour being dexteroully taken out of the globe, preſerves its conſiſtence for ſome time in the capſula, almoſt like the white of an egg; and then runs off by little and little, till it quite diſappears.

The tunica vitrea is compoſed exteriorly of two laminæ very cloſely connected, which quite ſurround the maſs of humour, and are immediately applied to the retina all the way to the great circumference of the corona ciliaris; but from thence to the circular edge of the foſſula of the cryſtalline, this coat is full of radiated ſulci, which contain the proceſſus ciliares of the uvea. At the edge of the foſſula the two laminæ ſeparate, and form a particular capſula, which belongs to the cryſtalline; as we ſhall ſee hereafter.

The internal lamina of the tunica vitrea gives off, through the whole ſubſtance of this humour, a great number of cellular elongations or ſepta ſo extremely fine, as not at all to be viſible in the natural ſtate, the whole maſs appearing then to be uniform and equally tranſparent through its whole ſubſtance; but they are diſcovered by putting the whole ſoon after it is taken out of the body into ſome aceſcent and gently coagulating liquor.

The radiated ſulci of the tunica vitrea, which may be termed *ſulci ciliares*, are perfectly black, when the coat is taken out of the body. This proceeds from the black ſubſtance with which the laminæ or proceſſus ciliares are naturally covered, as well as all the reſt of the choroides, and which remains in the bottom of the ſulci after the laminæ have been taken out. We obſerve very fine veſſels in this humour, which ſhall be deſcribed afterwards.

The cryſtalline humour. The cryſtalline lens is a ſmall lenticular body of a pretty firm conſiſtence, and tranſparent like cryſtal. It is contained in a tranſparent membranous capſula, and lodged in the anterior foſſula of of the vitreous humour, as has been already ſaid. It is very improperly called *an humour*, becauſe it may be handled and moulded into different ſhapes by the fingers, and ſometimes almoſt diſſolved by different reiterated compreſſions, eſpecially when taken out of the capſula.

The figure of the cryſtalline is lenticular; but its poſterior ſide is more convex than the anterior, the convexity of both ſides being very rarely equal. The internal ſtructure of this maſs has not been hitherto ſufficiently diſcovered, to be deſcribed with certainty, eſpecially in man, where I could never find that contorted diſpoſition of cryſtalline tubes which ſome pretend to have ſeen in the eyes of large animals.

The colour and conſiſtence of the cryſtalline varies in different ages, as was diſcovered by M. Petit the phyſician, and demonſtrated by him in the Academy of Sciences from a great number of human eyes; and his obſervations are inſerted in the Memoirs for 1726. Till the age of 30 it is very tranſparent, and almoſt without any colour. It afterwards becomes yellowiſh, and that yellowneſs gradually increaſes. The conſiſtence varies almoſt in the ſame manner, being of an uniform ſoftneſs till the age of 20, and afterwards growing gradually more ſolid in the middle of the maſs; but in this there are varieties, explained in the Memoirs for 1727.

The cryſtalline capſula or coat is formed by a duplicature of the tunica vitrea, as I have already ſaid. The external lamina covers the anterior ſide of the cryſtalline maſs; the internal lamina covers the backſide, and likewiſe the foſſula vitrea, in which the cryſtalline is lodged. The anterior portion of the cryſtalline capſula is thicker than the poſterior, and, in a manner, elaſtic; and both its thickneſs and elaſticity may be diſcovered in diſſection, without any other artifice.

The anterior portion ſwells when macerated in water,

ter, and then appears to be made up of two pelliculæ, united by a fine ſpungy ſubſtance. I demonſtrated this duplicature very plainly in the eye of an horſe by the knife alone; and I even carried the ſeparation of the two laminæ as far as the vitreous coat. Having made a ſmall hole in the middle of the capſula, and blown into it through a pipe, ſome part of the air remained between the edge of the cryſtalline maſs and that of the capſula in form of a tranſparent circle. This experiment was made with an ox's eye above ten years ago.

The aqueous humour is a very limpid fluid, reſembling a kind of lympha or ſerum, with a very ſmall degree of viſcidity; and it has no particular capſula like the cryſtalline and vitreous humours. It fills the ſpace between the cornea and iris, that between the iris and the cryſtalline, and the hole of the pupilla. Theſe two ſpaces are called the *chambers of the aqueous humour*, and they are diſtinguiſhed into the anterior and poſterior.

The two chambers are not of the ſame extent. The anterior, which is viſible to every body between the cornea and iris, is the largeſt; the other between the iris and cryſtalline is very narrow, eſpecially near the pupilla, where the iris almoſt touches the cryſtalline. This proportion between the two chambers has been ſufficiently proved, contrary to the opinion of many ancient writers, by M. Heiſter, Morgagni, and ſeveral members of the royal academy; but none has treated theſe matters at ſo great a length as M. Petit the phyſician, as appears by the printed Memoirs of that Society.

§ 5. *The Tunica Albuginea, and Muſcles of the Globe of the Eye.*

The tunica albuginea, called commonly the *white of the eye*, and which appears on all the anterior convex ſide of the globe, from the cornea to the beginning of the

the poſterior ſide, is formed chiefly by the tendinous expanſion of four muſcles in the manner preſently to be deſcribed. This expanſion adheres very cloſe to the ſclerotica, and makes it appear very white and ſhining, whereas the reſt of it is of a dull whitiſh colour. It is very thin near the edge of the cornea; in which it ſeems to be loſt, terminating very uniformly,

There are commonly ſix muſcles inſerted in the globe of the human eye; and they are divided, on account of their direction, into four recti and two obliqui. The recti are again divided, from their ſituation, into ſuperior, inferior, internal, and external; and, from their functions, into a levator, depreſſor, adductor, and abductor. The two oblique muſcles are denominated from their ſituation and ſize, one being named *obliquus ſuperior* or *major*, the other *obliquus inferior* or *minor*. The obliquus major is likewiſe called *trochlearis*, becauſe it paſſes through a ſmall cartilaginous ring, as over a trochlea or pulley.

The muſculi recti do not altogether anſwer to that name; for in their natural ſituation they do not at all lie in a ſtraight direction, as they are commonly repreſented in an eye taken out of the body. To underſtand this, we ought to have a juſt idea of the ſituation of the globe in the orbit, and at the ſame time to remember the obliquity of the orbits, as already explained. The globe is naturally placed in ſuch a manner, as that, during the inaction or equilibrium of all the muſcles, the pupilla is turned directly forward; the inner edge of the orbit is oppoſite to the middle of the inſide of the globe; the outer edge of the orbit, becauſe of its obliquity, is behind the middle of the outſide of the globe; and laſtly, the great circumference of the convexity of the globe between the pupilla and the optic nerve, runs directly inwards and outwards, upwards and downwards.

In this ſituation, the internal rectus alone is in a ſtraight direction, the other three being oblique; and the

the external rectus is the longest, the internal the shortest, and the superior and inferior of the same middle length between the two former. The external rectus is likewise bent round the outer convex side of the globe; the superior and inferior are also incurvated, but in a less degree; whereas the whole internus is almost streight: notwithstanding all this, I shall still continue to give them all the common name of *musculi oculi recti*.

These muscles are fixed by their posterior extremities at the bottom of the orbit near the foramen opticum in the elongation of the dura mater, by short narrow tendons, in the same order in which I have already named them. From thence they run wholly fleshy, toward the great circumference of the convexity of the globe, between the optic nerve and cornea, where they are expanded into flat broad tendons which touch each other, and afterwards unite. These tendons are fixed first of all by a particular insertion in the circumference just mentioned, and afterwards continue their adhesion all the way to the cornea, forming the tunica albuginea, as has been already said.

The superior oblique muscle is fixed to the bottom of the orbit, by a narrow tendon, in the same manner as the recti, between the rectus superior and internus. From thence it runs on the orbit opposite to the interstice between these two muscles, toward the internal angular apophysis of the os frontis, where it terminates in a thin tendon, which having passed thro' a kind of ring as over a pulley, runs afterwards in a vagina obliquely backward under the rectus superior, that is, between that muscle and the globe; and increasing in breadth it is inserted posteriorly and laterally in the globe, near the rectus externus.

The ring through which the muscle passes, is partly cartilaginous and partly ligamentous. The cartilaginous portion is flat, of a considerable breadth, and like half a ring. The ligamentous portion adheres strongly to the

the two ends of the cartilage, and is fixed in the ſmall foſſula which lies in the orbit on the angular apophyſis of the os frontis. By means of this ligament, the ring is in ſome meaſure moveable, and yields to the motions of the muſcle. To the anterior edge of the ring, a ligamentous vagina is fixed, which inveſts the tendon all the way to its inſertion in the globe.

The obliquus inferior is ſituated obliquely at the lower ſide of the orbit, under the rectus inferior, which conſequently lies between this muſcle and the globe. It is fixed by one extremity a little tendinous, to the root of the naſal proceſs of the os maxillare, near the edge of the orbit between the opening of the lacrymal duct, and the inferior orbitary fiſſure.

From thence it paſſes obliquely, and a little tranſverſely backward, under the rectus inferior; and is fixed to the poſterior lateral part of the globe by a flat tendon oppoſite to and at a ſmall diſtance from the tendon of the obliquus ſuperior; ſo that theſe two muſcles do in ſome meaſure ſurround the outer poſterior part of the globe.

Uſes of theſe muſcles. The rectus ſuperior moves the anterior portion of the globe upward when we lift up the eyes; the rectus inferior carries this portion downward; the internus toward the noſe, and the externus toward the temples.

When two neighbouring recti act at the ſame time, they carry the anterior portion of the globe obliquely toward that ſide which anſwers to the diſtance between theſe two muſcles: and when all the four muſcles act ſucceſſively, they turn the globe of the eye round, which is what is called *rolling the eyes*.

It is to be obſerved, that all theſe motions of the globe of the eye are made round its centre; ſo that in moving the anterior portion, all the other parts are likewiſe in motion. Thus, when the pupilla is turned toward the noſe or upward, the inſertion of the optic nerve is at the ſame time turned toward the temple, or downward.

The

The uſe of the oblique muſcles is chiefly to counterbalance the action of the recti, and to ſupport the globe in all the motions already mentioned. This is evident from their inſertions, which are in a contrary direction to thoſe of the recti, their fixed points with relation to the motions of the globe being placed forward, and thoſe of the recti backward, at the bottom of the orbit. The ſoft fat which lies behind the globe is altogether inſufficient to ſupport it: neither is the optic nerve more fit for this purpoſe; for I have ſhewn that this nerve follows all the motions of the globe, which would be impoſſible, were not the fat very pliable and without reſiſtance. And to this we muſt add, that the optic nerve at its inſertion in the globe has a particular curvature, which allows it to be elongated, and conſequently prevents it from ſuffering any violence in the different motions of the eyes.

The obliquity of theſe two muſcles does not hinder them from doing the office of a fulcrum; becauſe this is not a fulcrum diſtinct from the part moved, or on which the globe of the eye ſlides like the head of one bone in the articular cavity of another; but being fixed to the part, it eaſily accommodates itſelf to all the degrees of motion thereof. Had theſe muſcles lain in a ſtraight direction, they would have incommoded the recti; but their obliquity may be ſaid to be in ſome meaſure rectified by the inner ſurface of the orbit, and the rectus externus.

The inner ſurface of the orbit ſerves for a kind of collateral fulcrum, which hinders the globe from falling too far inward; as the joint action of the two obliqui prevents it in part from falling too far outward. The rectus externus, by being bent on the globe, not only hinders it from being carried outward, but alſo prevents the indirect motions of the obliqui from thruſting it out of the orbit toward the temples. The other uſes attributed to theſe muſcles ſeem to be without foundation, from the conſideration of their inſertions, and

and of the ſtructure of the parts with which they are concerned; both which reaſons are explained in the Memoirs of the Academy for 1721.

§ 6. *The Supercilia, and Muſculi frontales, occipitales, and ſuperciliares.*

Supercilia. THE ſupercilia or eye-brows are the two hairy arches ſituated at the lower part of the forehead, between the top of the noſe and temples, in the ſame direction with the bony arches which form the ſuperior edges of the orbits, and are peculiar to the human ſpecies. The ſkin in which they are fixed does not ſeem to be much thicker than that of the reſt of the forehead; but the membrana adipoſa is thicker than on the neighbouring parts. The colour of the eye-brows is different in different perſons; and often, in the ſame perſon, different from that of the hair on the head: neither is the ſize of them always alike. The hairs of which they conſiſt are ſtrong and pretty ſtiff; and they lie obliquely, their roots being turned to the noſe, and their points to the temples.

The ſupercilia have motions common to them with thoſe of the ſkin of the forehead, and of the hairy ſcalp. By theſe motions the eye-brows are lifted up; the ſkin of the forehead is wrinkled more or leſs regularly and tranſverſely; and the hair and almoſt the whole ſcalp is moved, but not in the ſame degree in all perſons; for ſome by this motion alone can move their hat, and even throw it off from their head. The eye-brows have likewiſe particular motions which contract the ſkin above the noſe; and all theſe different motions are performed by the following muſcles.

Muſculi frontales. The frontal muſcles are two thin, broad, fleſhy planes, of unequal lengths, lying immediately behind the ſkin and membrana adipoſa, on the anterior parts of the forehead, which parts they cover from the root of the noſe, and through about two-thirds of the arch of the eye-brows on each ſide, all the way to the lateral parts of the hair on the forehead. At the root of the nofe they touch each other as if they were but one mufcle; and at this place their fibres are fhort and longitudinal, or vertical.

The next fibres on each fide become gradually longer and more oblique; the moft anterior being always the fhorteft and ftraighteft; and the lateral, the longeft, and turned moft obliquely toward the temples at their upper extremities. By this difpofition an angular interftice is formed between the place where the two mufcles join, and the hair on the middle of the forehead; but this difpofition is not the fame in all fubjects, no more than the wrinkles and bounds of the hair on the forehead.

Thefe mufcles are fixed by their inferior extremities immediately in the fkin, running through the membrana adipofa. They cover the mufculi fuperciliares, and adhere clofely to them by a kind of intertexture. By the fame fibres they feem to be inferted in the angular apophyfes of the os frontis, and to be blended a little with the mufcles of the palpebræ and nofe. Their upper extremities are fixed to a tendinous expanfion which runs over the head to be inferted to the occipital mufcles. Each of their lateral portions covers a portion of the temporal mufcle on the fame fide, and adheres very clofely to it. The fuperior and inferior infertions are graduated.

Mufculi occipitales. The occipital mufcles are two fmall, thin, broad, and very fhort flefhy planes, fituated on the lateral parts of the occiput, at fome diftance from each other. They are inferted by the inferior extremities of their flefhy fibres in the fuperior tranfverfe line of the os occipitis, and alfo a little above it. From thence they run up obliquely from behind forward, and are fixed to the tendon mentioned above.

The breadth of thefe mufcles reaches from the pofterior middle part of the occiput toward the maftoide apophyfis, and they diminifh unequally in length as they ap-

approach theſe apophyſes. From this inequality in length, each of them appears as if it were double in ſome ſubjects; and in others they are ſo thin and pale, that they ſeem to be wanting. They are ſometimes covered by an aponeurotic expanſion of the trapezii.

The occipital and frontal muſcles appear to be true digaſtrici, both in regard to their inſertions and action. The fixed inſertions of the occipitales at the lower part of the occiput, and the moveable inſertions of the frontales in the ſkin of the forehead and of the ſupercilia, being well conſidered, together with their reciprocal inſertions in the ſame aponeuroſis, ſeem to be a very convincing proof that they are digaſtric muſcles.

Theſe four muſcles ſeem always to act in concert, the occipitales being only auxiliaries or aſſiſtants to the frontales, the office of which is to raiſe the ſupercilia, by wrinkling the ſkin of the forehead; theſe wrinkles following the direction of the eye-brows pretty regularly in ſome ſubjects, and very irregularly in others.

To be convinced of the co-operation of theſe four muſcles, we need only hold the hand on the occipitales, while we raiſe the eye-brows and wrinkle the forehead ſeveral times; and we will perceive the occipitales to move each time, though not in the ſame degree in all ſubjects. In ſome perſons the occipitales ſeem to be relaxed, while the frontales being in contraction move the whole ſcalp and pericranium forward, and then contract to bring them back to their natural ſituation.

Muſculi ſuperciliares. The muſculi ſuperciliares are fleſhy faſciculi ſituated behind the ſupercilia, and behind the inferior portion of the muſculi frontales from the root of the noſe to above one half of each ſuperciliary arch. They are ſtrongly inſerted, partly in the ſynarthroſis of the oſſa naſi with the os frontis, where they come very near the proper muſcles of the noſe, and partly in a ſmall neighbouring portion of the orbit. From thence they firſt run up a little, and afterwards more or leſs in the direction of the eye-brows. They are made up of ſeveral ſmall faſciculi of oblique fibres,

 all

all fixed by one end in the manner already faid, and by the other partly in the lower extremity of the mufcles by which they are covered, and partly in the fkin of the fupercilia. This laft portion is eafily confounded with a portion of the mufculus orbicularis palpebrarum.

The action of thefe mufcles is to deprefs the eyebrows. to bring them clofe together, and to contract the fkin of the forehead immediately above the nofe into longitudinal and oblique wrinkles, and the fkin which covers the root of the nofe into irregular tranfverfe wrlnkles. This action, as well as that of the frontales, and of the mufcles of the nofe and lips, is not always arbitrary, but fometimes mechanical and involuntary. Thefe mufcles may perhaps likewife ferve to keep the mufculi frontales in equilibrio during their inaction, they being moveable by both extremities.

§ 7. *The Palpebræ and Membrana conjunctiva.*

Palpebræ. THE palpebræ are a kind of veils or curtains placed tranfverfely above and below the anterior portion of the globe of the eye; and accordingly there are two eye-lids to each eye, one fuperior, the other inferior. The fuperior is the largeft and moft moveable in man. They both unite at each fide of the globe; and the places of their union are termed *angles*, one large and internal which is next the nofe, the other fmall or external which is next the temples.

Structure of the palpebræ. The palpebræ are made up of common and proper parts. The common parts are the fkin, epidermis, and membrana adipofa. The proper parts are the mufcles, the tarfi, the puncta or foramina lacrymalis, the membrana conjunctiva, the glandula lacrymalia, and the particular ligaments which fuftain the tarfi. The tarfi and their ligaments are in fome meafure the bafis of all thefe parts.

Tarfi

Tarſi. The tarſi are thin cartilages, forming the principal part of the edge of each palpebra; and they are broader at the middle than at the extremities. Thoſe of the ſuperior palpebræ are ſomething more than a quarter of an inch in breadth; but in the lower palpebræ they are not above the ſixth part of an inch; and their extremities next the temples are more ſlender than thoſe next the noſe.

Theſe cartilages are ſuited to the borders and curvature of the eye-lids. The lower edge of the ſuperior cartilage, and the upper edge of the inferior, terminate equally, and both may be termed the *ciliary edges*. The oppoſite edge of the upper tarſus is ſomething ſemicircular between its two extremities; but that of the inferior tarſus is more uniform, and both are thinner than the ciliary edges. Their inner ſides, or thoſe next the globe are grooved by ſeveral ſmall tranſverſe channels, of which hereafter; and the extremities of both cartilages are connected by a kind of ſmall ligaments.

Ligamenta tarſorum lata. The broad ligaments of the tarſi are membranous elongations formed by the union of the perioſteum of the orbits and pericranium along both edges of each orbit. The ſuperior ligament is broader than the inferior, and fixed to the ſuperior edge of the upper cartilage, as the inferior is to the lower edge of the lower cartilage; ſo that theſe ligaments and the tarſi, taken alone or without the other parts, repreſent palpebræ. This diſcovery I firſt communicated in my private courſes.

Membrana conjunctiva. The membrana conjunctiva is generally deſcribed among the coats of the globe of the eye; and I alſo mentioned it there, but have referred the deſcription of it to that of the palpebræ. It is a thin membrane, one portion of which lines the inner ſurface of the palpebræ, that is, of the tarſi and their broad ligaments. At the edge of the orbit it has a fold, and is continued from hence on the anterior half of the globe of the eye, adhering to the tunica albuginea; ſo that the palpebræ and the fore part of the globe of the eye are covered by one and the ſame membrane, which does not appear to be a continuation of the pericranium, but has ſome connection with the broad ligaments of the tarſi.

The name of *conjunctiva* is commonly given only to that part which covers the globe, the other being called ſimply *the internal membrane of the palpebræ;* but we may very well name the one *membrana oculi conjunctiva*, and the other *membrana palpebrarum conjunctiva*. That of the palpebræ is a very fine membrane adhering very cloſe, and full of ſmall capillary blood-veſſels. It is perforated by numerous imperceptible pores, thro' which a kind of ſerum is continually diſcharged; and it has ſeveral very evident folds which ſhall be ſpoken to hereafter.

The conjunctiva of the eye adheres by the intervention of a cellular ſubſtance; and is conſequently looſe, and as it were moveable; and it may be taken hold of, and ſeparated in ſeveral places from the tendinous coat. It is of a whitiſh colour; and being tranſparent, the albuginea makes it appear perfectly white: theſe two coats together forming what is called *the white of the eye*. The greateſt part of the numerous veſſels which run upon it contain naturally only the ſerous part of the blood, and conſequently are not diſcoverable, except by anatomical injections, inflammations, obſtructions, &c. With the point of a good knife we continue the ſeparation of this membrane over the cornea.

Glandula lacrymalis. The lacrymal gland is yellowiſh, and of the number of thoſe called *conglomerate glands*. It lies under that depreſſion obſervable in the arch of the orbit near the temples mentioned in the deſcription of the ſkeleton, and laterally above the globe of the eye. It is a little flatted, and divided as it were into two lobes; one of which lies toward the inſertion of the muſculus rectus ſuperior, the other toward the rectus externus. It adheres very cloſely to the

the fat which furrounds the mufcles and pofterior convexity of the eye, and it was formerly named *glandula innominata*.

From this gland feveral fmall ducts go out, which run down almoft parallel to each other, thro' the fubftance of the tunica interna or conjunctiva of the fuperior palpebra, and afterwards pierce it inwardly near the fuperior edge of the tarfus.

The borders of each palpebra taken together are formed by the edge of the tarfus, and by the union of the internal membrane with the fkin and epidermis. This border is flat, and of fome fenfible breadth from within about a quarter of an inch of the internal angle, all the way to the external angle, near which the breadth diminifhes. This breadth is owing only to the thicknefs of the palpebræ, which at this place have their edges oblique or flanting, in fuch a manner as when the two palpebræ touch each other flightly, a triangular fpace or canal is formed between them and the globe of the eye.

Cilia. The flat edge of each palpebra is adorned with a row of hairs called *cilia*, or the *eye-lafhes*. Thofe belonging to the fuperior palpebra are bent upward, and longer than thofe of the lower palpebra which are bent downward. Thefe rows are placed next the fkin; and are not fingle, but irregularfy double or triple. The hairs are longer near the middle of the palpebræ than toward the extremities; and for about a quarter of an inch from the inner angle, they are quite wanting.

Glandulæ ciliares. Along the fame border of the palpebræ near the internal membrane, or toward the eye, we fee a row of fmall holes, which may be named *foramina* or *puncta ciliaria*. They are the orifices of the fame number of fmall oblong glands which lie in the fulci, channels, or grooves on the inner furface of the tarfus. Thefe little glands are of a whitifh colour; and, when examined through a fingle microfcope, they appear like bunches of grapes, thoſe of each bunch communicating together; and when they are ſqueezed between two nails, a ſebaceous matter like ſoft wax, is diſcharged through the puncta ciliaria.

Puncta lacrymalia. Near the great or internal angle of the palpebræ, the flat portions of their edges terminate in another, which is rounder and thinner. By the union of theſe two edges an angle is formed; which is not perfectly pointed like a true angle, but rounded; and yet it ought not to be termed *an obtuſe angle*, becauſe that expreſſion in the mathematical ſtyle means ſomething different. For the ſame reaſon the name of *great angle* is improper; and we had better call it *the internal* or *naſal angle.*

At this place, the extremity of the flat portion is diſtinguiſhed from the round portion by a ſmall protuberance or papilla, which is obliquely perforated by a ſmall hole in the edge of each palpebra. Theſe two ſmall holes are very viſible, and often more ſo in living than in dead bodies; and they are commonly named *puncta lacrymalia*, being the orifices of two ſmall ducts which open beyond the angle of the eye into a particular reſervoir, termed *ſacculus lacrymalis*, which ſhall be deſcribed in the article of the *Noſe.*

The puncta lacrymalia are oppoſite to each other, ſo that they meet when the eye is ſhut. Round the orifice of each of theſe points, we obſerve a whitiſh circle, which ſeems to be a cartilaginous appendix of the tarſus, and which keeps the orifice always open. Theſe two oblique circles are ſo diſpoſed, that when the eye is but ſlightly ſhut, they touch each other only toward the ſkin, and not toward the globe of the eye. The fine membrane which covers theſe circles, and paſſes through the puncta into the ducts, ſeem ſometimes to run into gathers when it is touched with a ſtilet. This obſervation was firſt made by the late M. Saint Yves a Pariſian oculiſt.

Caruncula lacrymalis. The caruncula lacrymalis is a ſmall fmall reddifh, granulated, oblong body, fituated precifely between the internal angle of the palpebræ and globe of the eye, but it is not flefhy as its name would infinuate. The fubftance of it feems to be wholly glandular; and it appears through a fingle microfcope, in the fame manner as the other conglomerate glands. We difcover upon it a great number of fine hairs covered by an oily, yellowifh matter; and on the globe of the eye, near this glandular body, we fee a femilunar fold formed by the conjunctiva, the concave fide of which is turned to the uvea, and the convex fide to the nofe.

This fold, which has the name of *membrana femilunaris*, appears moft when the eye is turned toward the nofe; " it is fhaped like a crefcent, the two points of which anfwer to the puncta lacrymalia, and conduct the tears into the puncta."

§ 8. *The Mufcles of the Palpebræ.*

THE mufcles of the palpebræ are commonly reckoned to be two; one peculiar to the upper eye-lid, named *levator palpebræ fuperioris;* the other common to both, called *mufculus orbicularis palpebrarum*, which has been fubdivided in different manners, as we fhall fee prefently.

Levator proprius. The levator palpebræ fuperioris is a very thin mufcle, fituated in the orbit above and along the rectus fuperior oculi. It is fixed to the bottom of the orbit, by a fmall narrow tendon, near the foramen opticum between the pofterior infertions of the rectus fuperior and obliquus fuperior. From thence its flefhy fibres run forward on the rectus, increafing gradually in breadth, and terminate by a very broad aponeurofis, in the tarfus of the fuperior palpebra.

Orbicularis palpebrarum. By the mufculus palpebrarum obliquus, we underftand all that extent of flefhy fibres which, by a thin ftratum, furrounds the edge of each orbit, and from thence, without any interruption,

tion, covers the two palpebræ all the way to the cilia. The fibres which run upon the edge of the orbit are nearly orbicular; but moſt of thoſe which cover the palpebræ are tranſverſely oval.

Almoſt all of them have a common tendon ſituated tranſverſely between the internal angle of the eye and the naſal apophyſis of the os maxillare. This is a ſlender ligamentous tendon, ſtrongeſt where it is fixed in the bone, and diminiſhing gradually as it approaches the angle of the palpebræ, where it terminates at the union of the points, or at the extremities of the two tarſi. The fleſhy fibres are fixed to it anteriorly; ſo that at the firſt ſight it appears to be no more than a linea alba.

From thence one portion of the fibres is turned upward, the other downward; and both meet again at the external angle, being united by a particular kind of intertexture very difficult to be explained. When, having inverted this portion of the muſcle, we examine its poſterior ſurface, we obſerve a ſmall thin tendinous rope, which runs through the fleſhy fibres, and divides them all the way from the union of the two tarſi to the temporal edge of the orbit, where it diſappears; the fibres which lie beyond it appearing to continue the main circuit of the muſcle.

I divide this muſcle into four portions; whereof the firſt is that which ſurrounds the orbit, and which does not appear to be interrupted toward the temples, the upper part of it lying between the ſupercilia and the lower part of the muſculi frontales. The ſecond portion is that which lies between the upper edge of the orbit and the globe of the eye, and which covers the inferior edge of the orbit below, ſome of its fibres being fixed to both edges of the orbit. Riolan divided this into two ſemicircular portions, one ſuperior, the other inferior; the firſt lying between the muſculus ſuperciliaris and the lower part of the muſculus frontalis, to both which it adheres very much.

The

The third portion ſeems to belong more particularly to the palpebræ, and the greateſt part of it is ſpent in the palpebra ſuperior. The fibres of this portion meet at the two angles of the eye, where they appear to make very acute inflexions without any diſcontinuation; but when examined on the other ſide next the globe of the eye, they have in ſome ſubjects appeared to me to be diſtinguiſhed into ſuperior and inferior. The greateſt part of theſe fibres form a tranſverſely oval circumference; the ſhorteſt diameter of which is longer when the eyes are open than when ſhut.

The fourth portion is an appendix to the third; from which it differs chiefly in this, that its fibres do not reach to the angles, and form only ſmall arches; the extremities of which terminate in each palpebra. This portion is really divided into two; one for the edge of the upper eye-lid, the other for that of the lower. Riolan names this portion *muſculus ciliaris*.

All theſe different portions of the orbicular muſcle adhere to the ſkin, which covers it from the upper part of the noſe to the temples, and from the ſupercilium to the upper part of the cheek. When they contract, ſeveral wrinkles are formed in the ſkin, which vary according to the different direction of the fibres; thoſe under the lower palpebra are very numerous, and run down very obliquely from before backward.

The ſkin of the ſuperior palpebra is folded archwiſe, almoſt in a parallel direction to that of the ſemioval fibres; the plicæ interſecting the levator, whereas the other folds only interſect the orbicularis. The radiated and oblique plicæ ſeldom appear in young perſons, except when the firſt and ſecond portions of the orbicularis are in action; but in aged perſons the marks thereof are viſible at all times.

In man, the ſuperior palpebra has much more motion than the inferior. The ſmall ſimple motions, called *twinkling*, which frequently happen, though not equally often in all ſubjects, are performed "by the alternate

ternate contraction of the levator palpebræ and orbicularis."

These ſlight motions, eſpecially thoſe of the upper palpebra, are not very eaſy to be explained according to the true ſtructure of the part. The motions which wrinkle the palpebræ, and which are commonly performed to keep one eye very cloſe ſhut, while we look ſtedfaſtly with the other, are explicable by the ſimple contraction of all the portions of the orbicularis. Theſe motions likewiſe depreſs the ſupercilia, which conſequently may be moved in three different manners, upwards by the muſculi frontales, downward by the orbiculares, and forward by the ſuperciliares. I ſhall take another occaſion to explain the difficulties here mentioned.

§ 9. *The Veſſels of the Eye and of its Appendages.*

The external carotid artery, by means of the arteria maxillaris externa, and the temporal and frontal arteries, give ſeveral ramifications to the integuments which ſurround the eye, and to all the portions of the muſculus orbicularis; and theſe ramifications communicate with thoſe which are diſtributed to the membrana conjunctiva palpebrarum, and to the caruncula. "Some ſmall branches alſo come in through the ſpheno-maxillary ſuture, to be diſtributed chiefly on the perioſteum and fat of the eye. The internal carotid artery having entered the cranium, ſends off a conſiderable branch called *ocular*, which accompanies the optic nerve, to be diſtributed to the muſcles and globe of the eye, to the levator palpebræ, to the fat, glandula lacrymalis, membrana conjunctiva, caruncula lacrymalis, &c. It likewiſe communicates with the external carotid, and ſends one or two very ſmall branches to the noſe. The branches which ſupply the globe of the eye perforate the back part of the tunica ſclerotica in in five or fix places, after having run a little way thro' its fubftance."

They next perforate the external lamina of the choroides in the fame number of places, and form between that and the internal lamina the vafa vorticofa of Steno, and the vafcular ftellæ mentioned in the defcription of this internal lamina. Some fmall vafcular filaments from thefe ramifications are likewife obferved to adhere very clofely to the tunica vitrea; and before they form the vafa vorticofa, they fend fmall arteries in a direct courfe to the circumference of the uvea, where they form a vafcular circle, which fends out capillaries as far as the membrana cryftallina, which are very eafily injected in new-born children.

The veins of all thefe parts anfwer nearly to the arteries. The internal veins unload themfelves, partly into the internal jugular vein, by the finus orbitarii, cavernofi, and petrofi; and partly into the external jugular vein, by the vena angularis, or maxillaris externa, the maxillaris interna, temporalis, &c.

Befides the capillary veffels, eafily diftinguifhable by the red colour of the blood, there are great numbers of thofe which admit nothing but the ferous and lymphatic parts of the blood, and confequently do not appear in the natural ftate. They become vifible in fome places by inflammations and injections, as on the membrana conjunctiva of the eye; but thefe contrivances do not difcover them every where in aged perfons. In a fœtus, and in new-born children, a fine injection has fucceeded fo well as to difcover the veffels of the membrana cryftallina and vitrea; and in a fœtus of about fix months, the injected liquor feemed to me to have penetrated a part of the cryftalline and vitreous humour.

§ 10. *The*

§ 10. *The Nerves of the Eye and of its Appendages.*

I SHALL in this paragraph repeat and illuſtrate what has been already ſaid in the deſcription of the nerves, concerning thoſe of the eye. Beſides the optic nerve already deſcribed, the globe of the eye receives ſeveral ſmall ones, which run on each ſide along and about the optic nerve, from its entry into the orbit to its inſertion in the globe. Theſe filaments come chiefly from a ſmall lenticular ganglion, formed by very ſhort rami of the orbitary or ophthalmic branch of the fifth pair, and by a branch of the third pair, or motores oculi.

Theſe nervous filaments of the lenticular ganglion having reached the globe of the eye, are divided into five or ſix faſciculi; which having ſurrounded the optic nerve, and penetrated and perforated the ſclerotica, run at diſtances more or leſs equal between the ſclerotica and choroides towards the iris. There each of them is divided into ſeveral ſhort filaments, which terminate in the ſubſtance of the iris. Theſe ſmall nerves, which run from behind forward between the ſclerotica and the choroides, have formerly been taken for particular ligaments by very great anatomiſts.

The nerves which go to the other parts belonging to the eye, come from the third, fourth, ſixth, and firſt two branches of the fifth pair of nerves of the medulla oblongata, and likewiſe from the portia dura of the ſeventh pair. The third, fourth, and ſixth pairs give nerves to the muſcles of the globe of the eye. The two branches of the fifth pair, and the portio dura of the ſeventh, give nerves not only to the other parts which ſurround the globe, but alſo to the muſculi frontales and internal parts of the noſe.

The trunk of the third pair, or motores oculi, having entered the orbit through the ſuperior orbitary fiſſure, " or foramen lacerum of the ſphenoid bone," pro-

produces four branches. The firſt runs upward, and divides into two; one for the muſculus rectus ſuperior, and the other for the levator palpebræ ſuperioris. The trunk continuing its courſe, gives off the ſecond ſhort branch to the rectus inferior. The third branch is long, and goes to the obliquus inferior, contributing likewiſe to the formation of the lenticular ganglion already mentioned. The fourth branch is large, and ſupplies the rectus internus.

The firſt branch of the fifth pair, commonly termed *nervus ophthalmicus*, divides into three rami, as it enters the orbit; and ſometimes only into two, one of which is afterwards ſubdivided. Of theſe three branches one is ſuperior, which I term *nervus ſuperciliaris;* one internal, termed *naſalis;* and one external, to which the name of *temporalis* agrees better than that of *lacrymalis*, which may occaſion a miſtake.

The ſuperior or ſuperciliary ramus runs along the whole perioſteum of the orbit; and having paſſed thro' the ſuperciliary notch or foramen of the os frontis, is diſtributed to the muſculus frontalis, ſuperciliaris, and ſuperior portion of the orbicularis palpebrarum; and it communicates with a ſmall branch of the portio dura of the ſeventh pair.

The internal or naſal branch paſſes under the ramification of the nerve of the third pair; and running toward the noſe, is diſtributed thereto, and to the neighbouring parts of the orbicularis, the caruncula, &c. This branch ſends off a filament, which, paſſing thro' the internal anterior orbitary hole, enters the cranium, and preſently returns again through one of the ethmoidal holes to the internal parts of the noſe. I have ſometimes obſerved this naſal ramus to communicate with the ramus ſuperciliaris by a particular arch, before it enters the orbitary hole.

The external or temporal ramus, which is ſometimes a ſubdiviſion of the ſuperciliaris, is diſtributed to the

glan-

glandula lacrymalis, and ſends off a filament which pierces the orbitary apophyſis of the os malæ.

The ſecond branch of the fifth pair, called *nervus maxillaris ſuperior*, ſends off a ramus through the bony canal of the lower part of the orbit; which going out at the anterior inferior orbitary hole, is diſtributed to the neighbouring portion of the muſculus orbicularis, and communicates with a ramus of the portio dura. I ſhall here ſay nothing of the other diſtributions of this branch of the maxillaris ſuperior.

The portio dura of the ſeventh pair, or auditory nerve, which I call *nervus ſympatheticus minor*, gives branches to the ſuperior, inferior, and external lateral parts of the orbicularis palpebrarum; one of which communicates with the nervus ſuperciliaris, and another with the ſub-orbitarius, as I obſerved in the deſcription of the nerves.

§ 11. *The Uſes of the Eye and of its Appendages in general.*

Every body knows that the eye is the organ of viſion. The tranſparent parts of the globe modify the rays of light, by different refractions; the retina and choroides receive the different impreſſions of theſe rays; and the optic nerve carries theſe impreſſions to the brain. When objects are at a great diſtance or obſcure, the pupilla is dilated; and it is contracted when objects are near, or placed in a great light. The muſcles of the globe of the eye and of the palpebræ perform the motions already deſcribed.

The glandula lacrymalis continually moiſtens the forepart of the globe of the eye; and the lacrymal ſerum is equally ſpread over that globe by the motions of the ſuperior palpebra, the inner ſurface of which is in a ſmall meaſure villous. The union of the two palpebræ directs this ſerum towards the puncta lacrymalia; and the unctuous matter diſcharged through the foramina ciliaria hinders it from running out between the pal-

palpebræ. The large ſize and viſcid ſurface of the caruncula prevents it from running beyond the puncta; and thus forces it into them: “ but when from any particular cauſe this fine fluid is poured out through the excretory ducts of the lacrymal gland faſter than it can be carried off through the puncta, it trickles down the cheek, and forms what is properly called *tears*.”

The ſupercilia may hinder ſweat from falling on the eyes. The ſuperior cilia, which are longer than the inferior may have the ſame uſe; and they both ſerve to prevent duſt, inſects, &c. from entering the eyes when they are only a little open.

Sect. III. *The* Nose.

The parts of which the noſe is compoſed, may be divided in two different ways, viz. from their ſituation, into internal and external parts; and, from their ſtructure, into hard and ſoft parts.

The external parts are the root of the noſe, the arch, the back or ſpine of the noſe, the ſides of the noſe or of the arch, the tip of the noſe, the alæ, the external nares, and the part under the ſeptum.

The internal parts are the internal nares, the ſeptum narium, the circumvolutions, the conchæ ſuperiores, or oſſa ſpongioſa ſuperiora, conchæ inferiores, the poſterior openings of the internal nares, the ſinus frontales, ſinus maxillares, ſinus ſphenoidales, the ductus lacrymales, and ductus palatini.

The firm or hard parts are moſtly bony, and the reſt cartilaginous, viz. the os frontis, os ethmoides, os ſphenoides, oſſa maxillaria, oſſa naſi, oſſa unguis, oſſa palati, vomer, conchæ inferiores, and the cartilages. To theſe we may add the perioſteum and perichondrium, as parts belonging to the bones and cartilages.

The ſoft parts are the integuments, muſcles, ſacculus lacrymalis, membrana pituitaria, veſſels, nerves, and hairs of the nares. The bony parts have been all explained in the deſcription of the ſkeleton; and therefore I need only in this place ſet down the diſtribution and diſpoſition thereof, for the formation of ſome of the principal parts. The ſeptum is formed by the deſcending lamina of the os ethmoides, and by the vomer; and it is placed in the groove framed by the criſtæ of the oſſa maxillaria, and riſing edges of the oſſa palati. The back of the noſe is formed by the oſſa naſi; and the ſides, by the ſuperior apophyſes of the oſſa maxillaria.

The internal nares, or the two cavities of the noſe, comprehend the whole ſpace between the external nares and poſterior openings, immediately above the arch of the palate, from whence theſe cavities reach upwards as far as the lamina cribroſa of the os ethmoides, where they communicate forward with the ſinus frontales, and backward with the ſinus ſphenoidales. Laterally, theſe cavities are bounded on the inſide by the ſeptum narium, and on the outſide or that next the cheek by the conchæ, between which they communicate with the ſinus maxillaris.

The particular ſituation of theſe cavities deſerves our attention. The bottom of them runs directly backward, ſo that a ſtraight and pretty large ſtilet may eaſily be paſſed from the external nares, under the great apophyſis of the occipital bone. The openings of the maxillary ſinuſes are nearly oppoſite to the upper edge of the oſſa malarum. The openings of the frontal ſinuſes are more or leſs oppoſite to and between the pulleys or rings of the muſculi trochleares; and by theſe marks the ſituation of all the other parts may be determined.

The inferior portion of the external noſe is compoſed of ſeveral cartilages, which are commonly five in number, and of a pretty regular figure. The reſt are only additional, ſmaller, more irregular, and the number of them more uncertain. Of the five ordinary cartilages, one is ſituated in the middle, the other four laterally.

rally. The middle cartilage is the moſt conſiderable, and ſupports the reſt, being connected immediately to the bony parts; but the other four are connected to the middle cartilage, and to each other, by means of ligaments.

The principal cartilage of the noſe conſiſts of three parts, one middle and two lateral. The middle portion is a broad cartilaginous lamina, joined, by a kind of ſymphyſis, to the anterior edge of the middle lamina of the os ethmoides, to the anterior edge of the vomer, and to the anterior part of the groove formed by the oſſa maxillaria, as far as the naſal ſpines of theſe bones. This lamina completes the ſeptum narium, and indeed forms the principal part thereof.

The lateral portions are oblique and narrow, ſuited to the correſponding parts of the bony arch. Where they join the middle lamina, a ſuperficial groove is obſervable; which makes them ſometimes appear like two diſtinct pieces, ſeparated from the lamina, though they are really continuous. This ſhallow groove terminates below by a ſmall criſta.

The lateral cartilages are two, on each ſide of the inferior part of the lamina; one anterior, the other poſterior. The two anterior cartilages are very much bent forward, and form what is called the *tip of the noſe*; the ſpace between their incurvated extremities being commonly filled with a kind of fatty ſubſtance. The two poſterior cartilages form the alæ of the nares, being pretty broad, and of an irregular figure.

The ſpaces left between ſome portions of the anterior and poſterior cartilages, thoſe between the poſterior cartilages and the neighbouring parts of the oſſa maxillaria, and laſtly thoſe between theſe four lateral cartilages and the principal lamina, vary in different ſubjects; and are filled by ſmall additional cartilages, the number, ſize, and figure of which are as various as the interſtices in which they lie.

The ſub-ſeptum, or portion under the ſeptum narium,

rium, is a pillar of fat applied to the inferior edge of the cartilaginous partition, in form of a soft moveable apppendix. The thicknefs of the alæ narium, and especially that of their lower edges, is not owing to the cartilages, which are very thin, but to the same kind of solid fat with which these cartilages are covered. The great cartilage is immoveable by reason of its firm connection to the bony parts of the nose; but the lateral cartilages are moveable, because of their ligamentous connections, and they are moved in different manners by the muscles belonging to them.

The external nose is covered by the common integuments, the skin, epidermis, and fat. Those which cover the tip of the nose and alæ narium, are a great number of glandular bodies, called *glandulæ sebaceæ* by M. Morgagni, the contents of which may easily be squeezed out by the fingers. All these bony and cartilaginous parts have likewise the common periosteum or perichondrium.

Muscles of the nose. Six muscles are commonly reckoned to belong to the nose ; "two levatores, two depressores, and two compressores." In very muscular bodies, there are likewise some supernumerary muscles, or small accessorii. The nose may also be moved in some measure by the neighbouring muscles, which in many cases become assistants to the proper muscles of this organ.

The musculus levator alæ nasi on each side, is inserted by one extremity, in the synarthrosis of the os frontis and ossa nasi, where its fleshy fibres mix with those of the musculi frontales and superciliares. It is very flat, and runs down on the side of the nose, increasing gradually in breadth, and terminating by an aponeurosis, which represents the basis of a pyramid, and is inserted in the moveable cartilage which forms the ala of the nares.

" The depressor muscle is a thin, fleshy plane, arising from the os maxillare superius, opposite to the roots of the

the two dentes incifivi and dens caninus. From thence it runs up toward the ala narium, and is inferted in the moveable cartilage at the fide of the nofe, being covered partly by a portion of the former mufcle.

"The compreffor mufcle is fixed by one end to the cartilage at the fide of the nofe, and by the other to the fore-part of the os nafi, and nafal procefs of the fuperior maxillary bone, where it meets with the under and middle part of the frontal mufcle."

The firft pair of thefe mufcles raifes and dilates the ala of the nares, when they act. They likewife wrinkle the fkin on the fides of the nofe. "The fecond pair have the contrary effect; and the third pair comprefs the fides of the nofe to the feptum, as in fmelling."

Membrana pituitaria. The membrana pituitaria is that which lines the whole internal nares, the offa fpongiofa, the fides of the feptum narium, and, by an uninterrupted continuation, the inner furface of the finus frontales and maxillares, and of the ductus lacrymales, palatini, and fphenoidales. It is likewife continued down from the nares to the pharynx, feptum palati, &c. as we fhall fhow hereafter.

It is termed *pituitaria*, becaufe, through the greateft part of its large extent, it ferves to feparate from the arterial blood a mucilaginous lympha, called *pituita* by the ancients, which in the natural ftate is pretty liquid; but it is fubject to very great changes, becoming fometimes glutinous or fnotty, fometimes limpid, &c. neither is it feparated in equal quantities thro' the whole membrane.

When we carefully examine this membrane, it appears to be of a different ftructure in different parts. Near the edge of the external nares it is very thin, appearing to be the fkin and epidermis in a degenerated ftate. All the other parts of it in general are fpongy, and of different thickneffes. The thickeft parts are thofe on the feptum narium, on the whole lower portion of the internal nares, and on the conchæ; and if we make a ſmall hole in it at any of theſe places, and then blow thro' a pipe, we diſcover a very large cellular ſubſtance. In the ſinuſes it appears to be of a more ſlender texture.

On the ſide next the perioſteum and perichondrium, it is plentifully ſtored with ſmall glands, the excretory ducts of which are very long near the ſeptum narium, and their orifices very viſible; and by applying a pipe to any of theſe orifices, the ducts may be blown up almoſt through their whole extent; but, in order to this, the parts muſt firſt be very well cleaned and waſhed in lukewarm water.

In theſe places eſpecially, we likewiſe diſcover a very fine villous ſubſtance, when the parts are examined in clear water, in the manner which I have deſcribed in another place.

Sinus. The frontal, maxillary, and ſphenoidal ſinuſes open into the internal nares, but in different manners. The frontal ſinuſes open from above downward, anſwering to the infundibula of the os ethmoides deſcribed in the hiſtory of the ſkeleton. The ſphenoidales open forwards, oppoſite to the poſterior orifices of the nares; and the maxillares open a little higher, between the two conchæ or oſſa ſpongioſa. Therefore the ſinus frontales diſcharge themſelves moſt readily when we ſtand or ſit; and the ſphenoidales, when the head is inclined forward.

The ſinus maxillares cannot be emptied wholly or both at the ſame time in any one ſituation. Their opening, which in ſome ſubjects is ſingle, in others double, &c. lies exactly between the two oſſa ſpongioſa of the ſame ſide, about the middle of their depth: ſo that when the head is held ſtraight, or inclined forward or backward, they can only be half emptied; but when we lie on one ſide, the ſinus of the oppoſite ſide may be wholly emptied, the other remaining full.

It is proper here to obſerve the whole extent of the maxillary ſinus. Below, there is but a very thin partition

tion between it and the dentes molares, the roots of which do, in ſome ſubjects, perforate that ſeptum. Above, there is only a very thin tranſparent lamina between the orbit and the ſinus. Backward, above the tuberoſity of the os maxillare, the ſides of the ſinus are very thin, eſpecially at the place which lies before the root of the apophyſis pterygoides, thro' which the inferior maxillary nerve ſends down a ramus to the foramen palatinum poſterius, commonly called *guſtatorium*. Inward, or toward the conchæ narium, the bony part of the ſinus is likewiſe very thin.

Sacculus lacrymalis. The lacrymal ſacculus is an oblong membranous bag, into which the ſerous fluid is diſcharged from the eye through the puncta lacrymalia, already deſcribed, and from which the ſame fluid paſſes to the lower part of the internal nares. It is ſituated in a bony groove and canal, formed partly by the apophyſis naſalis of the os maxillare and os unguis, partly by the ſame os maxillare and lower part of the os unguis, and partly by this lower portion of the os unguis and a ſmall ſuperior portion of the concha narium inferior. This groove and canal are the bony lacrymal duct, about which I would adviſe beginners to conſult what was ſaid in the deſcription of the ſkeleton.

I have an obſervation or two to add in this place concerning the ſituation of this bony duct. It runs down for a little way obliquely backward, toward the lower and lateral part of the internal nares on each ſide, where its lower extremity opens on one ſide of the ſinus maxillaris under the os ſpongioſum inferius, nearly at the place from which a perpendicular line would fall in the interſtice between the ſecond and third dentes molares. The upper part of this duct is only an half canal or groove; the lower is a complete canal, narrower than the former.

The ſacculus lacrymalis may be divided into a ſuperior or orbitary portion, and an inferior or naſal portion.

The orbitary portion fills the whole bony groove, being ſituated immediately behind the middle tendon of the muſculus orbicularis. About one fourth of its length is above this tendon, and the reſt below. The naſal portion lies in the bony canal of the noſe, being narrower and ſhorter than the former.

The orbitary portion is diſpoſed at its upper extremity much in the manner of an inteſtinum cæcum, and at the lower extremity is continued with the portio naſalis. Towards the internal angle of the eye, behind the tendon of the orbicular muſcle, it is perforated by a ſmall ſhort canal formed by the union of the lacrymal ducts.

The naſal portion having reached the lower part of the bony duct under the inferior concha, terminates in a ſmall, flat, membranous bag, the bottom of which is perforated by a round opening, as I have always found it upon a careful examination, but which at firſt ſight appears oblong.

I uſed to attribute this difference to the force which I was obliged to uſe in ſeparating the concha inferior, in order to ſee this opening, which I have often found more backward than the middle of the bag at the extremity of this portion; and therefore, when I would either ſee or ſhow this opening in its natural ſtate, I do not ſeparate the inferior concha, but cut it gently with a ſharp knife, or with ſciſſars. If a tranſverſe line be drawn between the lower part of the noſe and os malæ, and another line be drawn directly upward, oppoſite to the third dens molaris, or oppoſite to the ſecond and third, theſe two lines will interſect each other nearly at the lower extremity of this ſacculus.

I have ſometimes found the upper extremity of this bag divided into an anterior and poſterior part, by a kind of valvula connivens lying in the anterior portion, a little lower than the tendon of the muſculus orbicularis. The ſmall common canal of the two lacrymal ducts opens in the poſterior portion, and conſequently behind the valve.

The

The ſubſtance of this ſacculus is ſomething ſpongy or cellulous, and pretty thick, being ſtrongly united by its convex ſide to the perioſteum of the bony canal, which may be very diſtinctly ſhown. This ſubſtance ſeems to be made up of two laminæ, joined together by a ſpongy membrane, the outermoſt of which is that which I have mentioned; the other appears to be glandular, and is in ſome ſubjects looſe and pliable, which I look upon as a diſeaſe.

Ductus inciſorii. The ductus inciſorii, or naſo-palatini of Steno, are two canals which go from the bottom of the internal nares croſs the arch of the palate, and open behind the firſt or largeſt dentes inciſorii. Their two orifices may be diſtinctly ſeen in the ſkeleton at the lower part of the naſal foſſæ, on the anterior and lateral ſides of the criſtæ maxillares; and we may likewiſe perceive their oblique paſſage through the maxillary bones, and laſtly their inferior orifices in a ſmall cavity or foſſula called *foramen palatinum anterius.* In freſh ſubjects they are not ſo apparent, eſpecially in human ſubjects; but in ſheep and oxen they are eaſily diſcoverable.

Santorini, in his Anatomical Obſervations, has deſcribed thoſe of the human body in a very pretty manner; and has given us his method of diſcovering them, which is nearly the ſame with that which I have always made uſe of in my private courſes, to ſhow at one view all the external parts which belong to the noſe.

By cutting the noſe longitudinally at a little diſtance from the ſeptum, I ſhow on that ſide from which all the ſepta have been ſawed off, the oſſa ſpongioſa entire, their convex ſides, the particular thickneſs of the membrana pituitaria on their lower edges, the orifice or orifices of the ſinus maxillaris, the ſituation of the orifice of the ſinus ſphenoidalis, the communicating ducts that go between the ſinus frontales and the ethmoidal cells, and interſtices between the two oſſa ſpongioſa and the ſtructure of the poſterior openings of the nares. I can

can ſhow likewiſe at the ſame time the orifice of the Euſtachian tube behind the poſterior opening of the nares, and the communication of the noſe with the mouth.

On the ſame ſide, I afterwards ſeparate gradually with a very ſharp knife, or with narrow ſharp-pointed ſciſſars, the ſuperior ſpongy bone, without doing any violence to the neighbouring parts; and then I can ſhow on the parts covered by that concha, a little oblong or oval foſſula, which runs down obliquely from before backward; at the poſterior and lower extremity of which, there is an orifice of about a quarter of an inch in diameter, which opens into the maxillary ſinus; and another at the anterior or ſuperior extremity, which opens into the frontal ſinus.

Immediately behind this foſſula there are two openings, one into the ſinus frontales, the other into the ethmoidal cellulæ of the os frontis. I ſhow likewiſe in the poſterior part of the os ethmoides, at leaſt two openings, by which the cells of that bone communicate with each other. All this is very different from what we ſee in the ſkeleton, or even when theſe parts are deprived of their membranes, &c. Neither is the ſtructure always the ſame in freſh ſubjects; for in ſome I have obſerved, a little before and above the opening of the maxillary ſinus, two ſmall grooves, which united in their paſſage to the frontal ſinuſes, the uppermoſt groove being a little contorted.

In the next place, I remove the concha inferior, or maxillaris, in the ſame manner, and with the ſame precautions; and then I obſerve, at the diſtance of about a quarter of an inch from the anterior extremity of this concha, or ſpongy bone, a ſmall opening, the diameter of which is not above the twelfth part of an inch, and it is turned obliquely backward. It ſeems to be the extremity of a duct of the ſame diameter; but when it is ſlit with ſharp-pointed ſciſſars, we diſcover a flat oval cavity, the diameter of which is a quarter of an inch in

length,

length, and lies in the fame direction with the feptum narium.

This oval cavity is the lower extremity of the facculus lacrymalis, which confequently is only contracted between this inferior cavity and the orbitary portion. Within this narrow or contracted portion we fee likewife the opening of a blind duct, which runs obliquely backward and upward for about a quarter of an inch; but I do not know precifely where it terminates, or for what it is defigned.

Arteries and veins. The arteries of all thefe parts come chiefly from the external carotid. Thofe of the external parts of the nofe are chiefly branches and rami of the arteria maxillaris externa or angularis, and of the temporalis; and the arteries of the internal parts are branches and ramifications of the maxillaris interna. The veins are, almoft in the fame manner, branches and ramifications of the external jugular; and they communicate with the orbitary finus, and, by that means, with the finufes of the dura mater, and with the internal jugulars.

Nerves. The principal nerves belonging to the nofe are filaments of the nervi olfactorii, which run down through the holes of the tranfverfe lamina of the os ethmoides, and are diftributed to the common membrane of the internal nares, efpecially to the villous portions thereof. The inner ramus of the orbitary or ophthalmic fends a filament through the internal anterior orbitary hole into the cranium, which comes out again in company with one of the filaments of the olfactory nerve through the ethmoidal lamina.

This internal ramus advances afterwards toward the os unguis; and is diftributed partly to the facculus lacrymalis, partly to the upper portion of the mufculus levator alæ nafi, and of the integuments of the nofe. The fuborbitary nerve, which is a branch of the maxillaris fuperior, having paffed through the inferior orbitary hole, fends filaments to the lateral external parts of of the nofe. Another ramus of the fuperior maxillary nerve goes to the pofterior opening of the nares, being fpent on the conchæ and other internal parts of the nofe.

Ufes. The nofe is the organ of fmelling, by means of the villous portion of the internal membrane, to which the olfactory nerves are chiefly diftributed. It is likewife of ufe in refpiration; and the mucilaginous fluid fpread over the whole pituitary membrane, prevents the air from drying that membrane, and fo rendering it incapable of being affected. The nofe ferves likewife to regulate and modify the voice, and to this the finufes likewife contribute. The facculus lacrymalis receives the ferum from the eyes, and difcharges it upon the palate, from whence the greateft part of it runs to the pharynx.

SECT. IV. *The* EAR.

The ear in general. EVERY one knows that the ears are two in number, that they are fituated in the lateral parts of the head, and that they are the organs of hearing. Anatomifts commonly divide or diftinguifh the ear into external and internal. By the external ear they mean all that lies without the external orifice of the meatus auditorius in the os temporis; and by the internal ear, all that lies within the cavities of that bone, and alfo the parts that bear any relation thereto.

The greateft part of the external ear confifts of a large cartilage very artificially framed, which is the bafis of all the other parts of which this portion of the ear is made up. The internal ear confifts chiefly of feveral bony pieces, partly formed in the fubftance of the offa temporum, and efpecially in that portion of it called *apophyfis petrofa*; and partly feparated from, but contained in a particular cavity of, that bone. All thefe bony

bony pieces have been explained in the defcription of the fkeleton, to which I muft therefore refer, defiring thofe who have a mind to underftand what I am now to fay about the other parts of this organ, carefully to revife the explication there given.

The external ear. The external ear, taken all together, refembles in fome degree the fhell of a mufcle, with its broad end turned upward, the fmall end downward, the convex fide next the head, and the concave fide outward. Two portions are diftinguifhed in the external ear taken all together; one large and folid, called *pinna*, which is the fuperior, and by much the greateft part; the other fmall and foft, called the *lobe*, which makes the lower part. We may likewife confider two fides in the outward ear; one turned obliquely forward, and irregularly concave; the other turned obliquely backward, and unequally convex; for all ears which have not been difordered by binding the head too tight in childhood, are naturally bent forward.

The forefide is divided into eminences and cavities. The eminences are four in number, called *helix*, *antihelix*, *tragus*, and *antitragus*. The helix is the large folded border or circumference of the great portion of the ear. The antihelix is the large oblong eminence or rifing furrounded by the helix. The tragus is the fmall anterior protuberance below the anterior extremity of the helix, which in an advanced age is covered with hairs. The antitragus is the pofterior tubercle, below the inferior extremity of the antihelix.

The cavities on the forefide are four in number: the hollow of the helix; the depreffion at the fuperior extremity of the antihelix, called *foffa navicularis;* the concha, or great double cavity that lies under the rifing termed *antihelix*, the upper bottom of which is diftinguifhed from the lower by a continuation of the helix in form of a tranfverfe crifta; and laftly, the meatus of the external ear, fituated at the lower part of the bottom of the concha.

The

The backſide of the external ear ſhows only one conſiderable eminence, which is a portion of the convex ſide of the concha, the other portion being hid by the adheſion of the ear to the os temporis. This adheſion hinders us likewiſe from ſeeing the hollow anſwering to the criſta, by which the cavity of the concha is divided.

I have already ſaid, that the external ear conſiſts chiefly of a cartilage, which is the baſis of all the other parts. Theſe other parts are ligaments, muſcles, integuments, ſebaceous and ceruminous glands, veſſels, and nerves: but I do not reckon among them a large gland, called by the Greeks *parotis*, altho' it lies very near the ear; the deſcription of this muſt be referred to that of the ſalivary glands, of which it is a very conſiderable one.

The cartilage of the outward ear is nearly of the ſame extent and figure with the large ſolid portion thereof already mentioned; but it is not of the ſame thickneſs, being covered by integuments on both ſides. In the lobe or ſoft lower portion of the ear, this cartilage is wanting. On the back-ſide, it ſhows all the eminences and cavities on the foreſide in an oppoſite ſituation with reſpect to each other, except the fold of the great circumference; and it conſiſts only of one piece from that circumference all the way to the meatus externus, except at the two extremities of the folded part of the helix, where there are two ſmall ſeparate portions connected to the great cartilage only by the integuments.

The cartilaginous portion of the external meatus auditorius does not make a complete circle; but rather a ſhort tube, in one ſide of which there is a break, and which terminates in an oblique border fixed to the edge of the bony canal by ſeveral ſmall inequalities, as by a kind of ingrailing; and from this obliquity it is, that the cartilaginous border terminates downward in a kind of apex or point. The lateral break in this cartilage is be-

between the upper and back part of its circumference; and on each ſide thereof the cartilaginous edges are rounded. There are likewiſe two or three other ſmall inciſures in this circumference, which, in regard to the meatus, repreſent obliquely tranſverſe fiſſures. The anterior fiſſure is in a manner quadrangular; neither are the intermediate parts always oppoſite to each other, for the uppermoſt is a little further from the os temporis than the poſterior.

The external ear is fixed to the cranium, not only by the cartilaginous portion of the meatus already mentioned, but alſo by ligaments which are two in number, one anterior, the other poſterior. The anterior ligament is fixed by one extremity to the root of the apophyſis zygomatica of the os temporis, at the anterior and a little toward the ſuperior part of the meatus oſſeus, cloſe to the corner of the glenoide cavity; and by the other extremity, to the anterior and ſuperior part of the cartilaginous meatus.

The poſterior ligament is fixed by one end to the root of the maſtoide apophyſis, and by the other to the poſterior part of the convexity of the concha; ſo that it is oppoſite to the anterior ligament. There is likewiſe a kind of ſuperior ligament, which ſeems to be only a continuation of the aponeuroſis of the frontal and occipital muſcles.

Of the muſcles of the external ear, ſome go between the cartilages and the os temporis, others are confined to the cartilages alone. Both kinds vary in different ſubjects, and are ſometimes ſo very thin as to look more like ligaments than muſcles. The muſcles of the firſt kind are generelly three in number, one ſuperior, one poſterior, and one anterior; and they are all very thin. The ſuperior muſcle is fixed in the convexity of the foſſa navicularis, and of the ſuperior portion of the concha; from whence it runs up to the ſquamous portion of the os temporis, expanding in a radiated manner, though not in the ſame degrees in all ſubjects, and

and is inſerted principally in the "aponeuroſis of the occipital and frontal muſcles; and has the name of *attollens aurem.*"

The anterior muſcle is ſmall, more or leſs inverted, and like an appendix to the ſuperior. It is fixed by one extremity above the root of the zygomatic apophyſis; and by the other, in the anterior part of the convexity of the concha; and is called *anterior auris.*

The poſterior muſcle is almoſt tranſverſe, and of a conſiderable breadth, being fixed by one end to the poſterior part of the convexity of the concha, and by the other in the root of the maſtoide apophyſis. It covers the poſterior ligament; "and is divided into two or three very diſtinct portions, which get the name of *poſteriores auris.*"

The ſmall muſcles which are confined to the cartilages, are only ſmall ſtrata of fibres found on both ſides of the cartilages. In many ſubjects they are of ſo pale a colour as not to look at all like muſcular fibres. Of this number are thoſe which Valſalva diſcovered in the different cavities on the backſide of the cartilage; and thoſe found by Santorini on the tragus, and along the convex part of the anterior portion of the helix. They are deſcribed in the treatiſe on the muſcles.

The ſkin of the external ear is in general a continuation of that which covers the neighbouring parts of the temporal region. The ſkin on the foreſide of the ear is accompanied by a very ſmall quantity of cellular ſubſtance; and therefore we find all the eminences and cavities of that ſide diſtinctly marked upon it, as far as the bottom of the external meatus auditorius. In what I have ſaid of the ſkin, the epidermis is likewiſe comprehended.

The backſide is covered by the ſkin continued from the foreſide; but as the folds are there very cloſe, it only paſſes over them, except that portion of the concha which ſurrounds the entry of the meatus auditorius, and which is joined to the os temporis by means of the cellular

lular ſubſtance. The hollow of that common fold which lies between the antihelix and concha does not appear on the backſide; for as it is filled with cellular ſubſtance, the ſkin paſſes over it.

The lobe of the ear, or that ſoft portion which lies under the tragus, antitragus, and meatus auditorius, is made up of nothing but ſkin and cellular ſubſtance. The meatus auditorius is partly bony and partly cartilaginous. The bony portion is the longeſt, and forms the bottom of the canal, as may be ſeen in the deſcription of the ſkeleton. The cartilaginous portion is the ſhorteſt; and, in adults, forms the external opening or orifice of the canal, as has been already ſaid.

Theſe two portions joined endwiſe to each other, form a canal of a conſiderable length, of different wideneſs in its different parts, and a little contorted. It is lined on the inſide by the ſkin and cellular membrane, through its whole length; and thus theſe integuments make up for the breaks in the cartilaginous portions, and form a kind of cutaneous tube in the other portion. The cellular membrane is confounded with the perichondrium and perioſteum of the meatus.

The ſkin which covers both ſides of the cartilage contains a great number of ſmall glands, which continually diſcharge an oily, whitiſh humour, collected chiefly near the adheſions of the ear to the head, and under the fold of the helix; and theſe glands are of the ſebaceous kind. The ſkin, which lines the meatus auditorius, contains another kind of glands, of a yellowiſh colour, and which may be plainly ſeen on the convex ſide of the cutaneous tube already mentioned.

Theſe glands are diſpoſed in ſuch a manner as to leave reticular ſpaces between them, and they penetrate a little way into the ſubſtance of the ſkin. They are called *glandulæ ceruminoſæ*, becauſe they diſcharge that matter which is named *cerumen* or the *wax* of the ear.

The inner ſurface of the cutaneous tube is full of fine hairs, between which lie the orifices of the ceruminous

 glands.

glands. The firſt place in which we meet with theſe glands is on that part of the convex ſide of the cutaneous tube, which ſupplies the breaks of the cartilaginous meatus.

The arteries of the external ear come anteriorly from the arteria temporalis, and poſteriorly from the occipitalis, all of which are branches of the external carotid. It is proper to obſerve here, that the occipital artery communicates with the vertebralis, and thereby with the internal carotid. The veins are rami of the jugularis externa; and the occipital vein, one of theſe rami, communicates, not only with the vena vertebralis, but with the neighbouring lateral ſinus of the dura mater.

The portio dura of the auditory nerve having paſſed out of the cranium through the foramen ſtylo-maſtodeum, in the manner that ſhall be afterwards deſcribed, gives off a ramus, which runs up behind the ear, to the backſide of which it ſends ſeveral filaments; and the trunk of this ramus ſends likewiſe filaments to the meatus and foreſide of the ear. The ſecond vertebral pair ſends alſo a ramus to the ear, the ramifications of which communicate with thoſe of the other ramus from the portio dura.

"After having deſcribed the external parts of the ear, we next proceed to examine its internal bony parts; and here we ſhall conſider them at ſome length, as they are purpoſely omitted in the oſteological part of this work.

"The bony part of the organ of hearing may be divided into four general parts: 1. The meatus auditorius externus; 2. The tympanum; 3. The labyrinth; 4. The meatus auditorius internus. It may likewiſe be divided into immoveable or containing parts, which take in all the four already mentioned; and moveable or contained parts, which are four little bones lodged in the tympanum, called *incus*, *malleus*, *ſtapes*, and *os orbiculare* or *lenticulare*.

"The

"The meatus externus at its outer end has its edges rough and prominent; but its back part is confiderably depreffed. The paffage itfelf is fomewhat more than half an inch in length, running obliquely from behind foreward in a curved direction. Its cavity is almoft oval, but wider at each end than in the middle. It terminates inwardly by an even circular edge, lying in a plane very much inclined, the upper part of it being turned outward, and the inner part inward; fo that the canal is longer on the lower than upper fide. The circular edge is grooved quite round for the attachment of the membrana tympani.

"In children, this bony canal is wanting, as well as the maftoid procefs; and the inner circular edge is a diftinct ring, which, in an advanced age, unites entirely, and becomes one piece with the reft. It is termed the bony circle in infants; and indeed it is very eafily feparated from all the other parts.

"It would feem, therefore, that the whole bony canal in adults is only a prolongation of the bony circle in children; becaufe even in a more advanced age, the whole canal may without much difficulty be taken out. The circular groove lies between the maftoid procefs and the articular fiffure mentioned in the defcription of the other parts of the temporal bone.

"*Tympanum.* The tympanum, or drum of the ear, is a cavity fomewhat fpherical, the bottom of which is turned inward, and the mouth joined to the circular groove already mentioned.

"The remarkable eminences are three in number: A large tuberofity, lying in the very bottom of the barrel, a little toward the back part; and a fmall irregular pyramid, fituated above the tuberofity, and a little more backward, the apex of which is perforated by a fmall hole: on one fide of the bafis two fmall bony filaments are often found in a parallel fituation; and indeed I believe they are feldom wanting, though their tender ftructure expofes them to be often broken. In the third eminence is a cavity ſituated at the upper and a little toward the anterior part of the bottom of the tympanum. This cavity is part of a half canal, which in a natural ſtate has one of the muſcles of the malleus lodged in it.

" The principal cavities in the tympanum, are, The opening of the maſtoid cells; the opening of the Euſtachian tube; the bony half canal; the feneſtra ovalis and rotunda; and to theſe may be added the ſmall hole in the pyramid.

" The opening of the maſtoid cells is at the poſterior and upper part of the edge of the tympanum. The cells themſelves which end there are hollowed out in the ſubſtance of the maſtoid proceſs, being very irregular and full of windings and turnings.

" The opening of the Euſtachian tube is at the anterior and upper part of the edge of the tympanum. It runs from the tympanum toward the poſterior openings of the noſtrils and arch of the palate. The bony portion thereof, of which alone I here ſpeak, is hollowed out in the pars petroſa, and is afterward lengthened out by the ſpinal proceſs of the os ſphenoides.

" The maſtoid cells, and the Euſtachian tube, from their ſituation, may be looked upon in ſome meaſure as prolongations of the tympanum.

" The bony half canal lies immediately above the Euſtachian tube, toward the upper ſide of the pars petroſa. In the recent ſubject, one of the muſcles of the malleus is lodged in it.

" The feneſtra ovalis is a hole of communication between the tympanum and labyrinth. It lies immediately above the tuberoſity; the upper ſide of it being a little rounded, the lower a little flattened, and has its longeſt diameter from before backwards. Toward the labyrinth, this opening has a little border round it, which renders it narrower at that place than any where elſe.

The feneſtra rotunda is ſomething leſs than the ovalis"

lis, and ſituated above it toward the lower and poſterior part of a large tuberoſity; the opening of it, which is the orifice of a particular duct in the labyrinth, lying obliquely backward and outward.

"The hole in the apex of the pyramid is the orifice of a cavity, which may be named the *ſinus* of this pyramid.

"*Officula auditus.* The tympanum contains ſeveral little bones, called the *bones of the ear.* They are generally four in number, demonſtrated from ſomething to which they are ſaid to bear a reſemblance, *viz.* incus, malleus, ſtapes, and os orbiculare or lenticulare.

"*Incus.* The incus, or anvil, reſembles, in ſome meaſure, one of the anterior dentes molares, with its roots at a great diſtance from each other. It may be divided into a body, and two branches or legs; one of the legs is long, the other ſhort. The body is turned foreward, the ſhort leg backward, and the long leg downward.

"The body of the incus is broader than it is thick. It has two eminences, and two cavities between them, much in the ſame manner as we ſee in the crown of the firſt dentes molares.

"The ſhort leg is thick at its origin; and from thence decreaſing gradually, it ends in a point. It is ſituated horizontally, its point being turned backward, and joined to the edge of the maſtoid opening of the tympanum.

"The long leg viewed through the external auditory paſſage appears to be ſituated vertically; but if we look upon it either on the fore or back ſide, we ſee it is inclined, the extremity of it being turned much more inward than the root or origin. The point of the extremity is a little flatted, bent inward like a hook, and ſometimes a little hollowed like a kind of ear-picker. By this we may diſtinguiſh the incus of one ear from that of the other, when out of their places: for turning

ing the ſhort leg backward, and the long leg downward, if the curvature of this long leg be toward the left hand, the bone belongs to the right ear; if toward the right, it belongs to the left ear.

" *Malleus.* The malleus, or hammer, is a long bone with a large head, a ſmall neck, an handle, and two proceſſes; one in the neck, the other in the handle.

" The top of the head is conſiderably rounded; and from thence it contracts all the way to the neck. Both head and neck are in an inclined ſituation; and the eminences and cavities of it anſwer to thoſe in the body of the incus. The handle is looked upon by ſome as one of the proceſſes of the malleus; and in that caſe it is the greateſt of the three. It forms an angle with the neck and head: near which it is ſomething broad and flat, and decreaſes gradually toward its extremity.

" The proceſs of the handle, termed by others the *ſmall* or *ſhort proceſs* of the malleus, terminates in the angle already mentioned, being extended toward the neck, and lying in a ſtraight line with that ſide or border of the handle which is next it. The proceſs of the neck, called alſo *proceſſus gracilis*, is, in a natural ſtate, very long; but ſo ſlender, that it is very eaſily broken, eſpecially when dry; which is the reaſon why the true length of it was for a long time unknown. It ariſes from the neck, and ſometimes appears much longer than it really is, by the addition of a ſmall dried tendon ſticking to it.

" When the malleus is in its true ſituation, the head and neck are turned upward and inward; the handle downward, parallel to the long leg of the incus, but more forward; the proceſs of the handle upward and outward, near the ſuperior portion of the edge of the tympanum, near the centre of which is the extremity of the handle; and the proceſſus gracilis forward, reaching all the way to the articular fiſſure in the os

temporis.

temporis. It is eaſy, after what has been ſaid, to diſtinguiſh the malleus of the right ſide from that of the left.

" *Stapes.* The ſtapes is a ſmall bone, very well denominated from the reſemblance it bears to a ſtirrup. It is divided into the head, legs, and baſis. The head is placed upon a ſhort flatted neck; the top of which is alſo ſometimes flat, ſometimes a little hollow.

" The two legs, taken together, form an arch like that of a ſtirrup; in the concave ſide of which is a groove which runs through their whole length. One leg is longer, more bent, and a little broader, than the other. The baſis reſembles that of a ſtirrup both in its oval ſhape and union with the legs, but it is not perforated. Round its circumference, next the legs, is a little border, which makes that ſide of the baſis appear a little hollow. The other ſide is pretty ſmooth; and one half of the circumference is more curved than the other.

" The ſubject being in an erect poſture, the ſtapes is to be conſidered as lying on its ſide, with the head turned outward, near the extremity of the leg of the incus; the baſis being fixed in the feneſtra ovalis; the longeſt leg backward, and both legs in the ſame plane. By this ſituation, it is eaſy to know the ſtapes belonging to each ear.

" *Os orbiculare.* The os orbiculare, or lenticular *bone*, is the ſmalleſt bone in the body. It lies between the head of the ſtapes and extremity of the long leg of the incus, being articulated with each of theſe.

" In dry bones it is found very cloſely connected, ſometimes to the ſtapes, ſometimes to the incus; and might, in that ſtate, be eaſily miſtaken for an epiphyſis of either of theſe bones.

" *Labyrinth.* The labyrinth is divided into three parts; the anterior, middle, and poſterior. The middle portion is termed *veſtibulum*, the anterior *cochlea*, and the poſterior *labyrinth in particular;* which comprehends the three ſemicircular canals.

"The cochlea lies forward and inward toward the extremity of the pars petroſa; the ſemicircular canals backward and outward toward the baſis of the proceſs; and the veſtibulum between the other two.

"*Veſtibulum.* The veſtibulum is an irregular round cavity, leſs than the tympanum, and ſituated more inward, and a little more forward. Theſe two cavities are in a manner ſet back to back, with a common partition between them, perforated in the middle by the feneſtra ovalis, by which the cavities communicate with each other. The cavity of the veſtibulum is likewiſe perforated by ſeveral other holes; on the back ſide by the five orifices of the ſemicircular canals; on the lower part of the foreſide by a hole, which is one of the paſſages of the cochlea; and on the foreſide, toward the meatus auditorius, oppoſite to the feneſtra ovalis, by a number of very ſmall holes, for the paſſage of the nerves; on the upper ſide there are only ſmall pores.

"*Semicircular canals.* The ſemicircular canals are only three in number; one vertical, one oblique, and one horiſontal. The vertical canal is ſituated tranſverſely with reſpect to the pars petroſa, the convex ſide of it being turned upward. The oblique canal lies farther back than the former, and runs parallel to the length of the proceſs, the convex ſide being turned backward, with one extremity upward, the other downward: the ſuperior extremity of this canal meets and loſes itſelf in the internal extremity of the former.

"The curvature and extremities of the horiſontal canal are almoſt on a level; the curvature lying obliquely backward; and the extremities forward, and under thoſe of the vertical canal, but a little nearer each other, the inner being almoſt in the middle ſpace between the extremities of the oblique canal.

"The horiſontal canal is generally the leaſt of the three;

three; the oblique is often, and the vertical ſometimes, the greateſt; and ſometimes theſe two are equal. All the three canals are larger than a ſemicircle, forming nearly three-fourths of one; they are broader at the orifices than in the middle. Theſe orifices open into the back-ſide of the veſtibulum, and are but five in number, becauſe two of them open into each other; ſo that in the poſterior part of the veſtibulum, two appear toward the inſide, and three toward the outſide.

" In children, the ſubſtance of theſe canals is compact, while that which ſurrounds them is ſpongy. Hence they may be eaſily ſeparated from the reſt of the pars petroſa. In adults, all the parts of the bone are ſo ſolid, that theſe canals appear only like paſſages formed in a piece of ivory. From this deſcription, it is eaſy to diſtinguiſh the right labyrinth from the left.

" *Cochlea.* The cochlea is a ſort of ſpiral body with two ducts, formed in the anterior part of the pars petroſa, ſomewhat reſembling the ſhell of a ſnail. The parts to be diſtinguiſhed in it, in its true ſituation, are, The baſis; the apex; the ſpiral lamina, or half ſeptum, by which its cavity is divided into two half canals; the modiolus, round which the cochlea turns; and, laſtly, the orifices and union of the two ducts. The baſis is turned directly inward toward the internal foramen auditorium, the apex outward; and the axis of the modiolus is nearly horiſontal; but in all of them allowance muſt be made for the obliquity of the pars petroſa in which they lie.

" The baſis of the cochlea is gently hollowed; and, toward the middle, perforated by ſeveral ſmall holes. The modiolus is a kind of ſhort cone with a very large baſis, which is the middle of the baſis of the cochlea: through its whole length runs a double ſpiral groove, which, through a microſcope, ſhows a great number of pores. The cochlea makes about two turns and a half from the baſis to the apex; and the two half canals being firmly united together through their whole courſe,

courſe, form a half ſeptum, called *lamina ſpiralis*; which muſt not be confounded with the complete ſeptum in the recent ſubject, as is often done. One edge of the lamina ſpiralis is ſtrongly joined to the modiolus, being thicker there than in any other place; whereas the other edge is terminated all round by a very thin border, lying in the middle cavity of the cochlea. In the natural ſtate, the other half of the ſeptum is membranous, and completes the partition between the two canals. The two half canals turn jointly about the modiolus; one being ſituated toward the baſis of the cochlea, the other toward the apex; for which reaſon I have always called one of them *internal*, the other *external*.

" The ſpiral or volute of the cochlea begins at the lower part of the veſtibule; runs from thence forward to the top, then backward down to the bottom, afterward upward and foreward; and ſo on from the baſis, which is turned inward to the apex, which is turned outward. From this deſcription, it is eaſy to know to what ear any cochlea belongs when we ſee it prepared: it likewiſe teaches us, that, in the right cochlea, the direction of the turnings is the ſame as in garden-ſnails, and almoſt all the other common ſhells; but in the left cochlea, the turnings are in a contrary direction, as in one kind of ſhell, which is rarely met with. The two half canals communicate fully at the apex of the cochlea. Their ſeparate openings are toward the baſis; one of them being immediately into the lower part of the foreſide of the veſtibulum, the other into the feneſtra rotunda. Theſe two openings are ſeparated by a particular turning, which ſhall be deſcribed afterwards.

" The meatus auditorius internus, is on the backſide of the pars petroſa, in ſome meaſure behind the veſtibule and baſis of the cochlea. It is a kind of blind hole, divided into two foſſulæ; one large, the other ſmall. The large one lies loweſt, and ſerves for the

portio

portio mollis of the auditory nerve or feventh pair. The fmall one is uppermoft, and is the opening of a fmall duct, through which the portio dura of the fame nerve paffes. The inferior foffula is full of little holes, which, in the natural ftate, are filled with nervous filaments of the portio mollis, which go to the veftibule, to the femicircular canals, and to thofe of the cochlea. It is this foffula which forms the fhallow cavity at the bafis of the fpindle of the cochlea. The paffage for the portio dura of the auditory nerve runs behind the tympanum, and its external orifice is termed *foramen ftylo-maftoideum*. It begins by the fmall foffula, and pierces from within outward the upper part of the pars petrofa, making there an angle or curvature; from thence it is inclined backward behind the fmall pyramid of the tympanum, and runs down to the foramen ftylo maftoideum; through which it goes out, and is diftributed in the manner to be defcribed hereafter. It communicates likewife by a hole with the finus of the pyramid, and lower down by another hole with the tympanum. At the upper part of the pars petrofa it is covered with a bony lamina, although fometimes it has been found open above."

The foft parts of the internal ear are chiefly the membrana tympani, the periofteum of the "tympanum, and of the officula auditus," labyrinth, and of all its cavities, the membrana maftoidæa interna, the mufcles of the officula, the parts which complete the formation of the Euftachian tube, the arteries, veins, and nerves. I find, myfelf, however, under a neceffity of beginning by the tuba Euftachiana, for two reafons: firft, becaufe the bony parts of that tube are but of very fmall ufe for the knowledge of its whole ftructure and compofition; and, fecondly, becaufe we are obliged to mention it in defcribing the mufcles.

The *ductus auris palatinus*, or Euftachian tube, as was

was obſerved in the deſcription of the ſkeleton, is a canal or duct which goes from the tympanum to the poſterior openings of the nares, or naſal foſſæ, and toward the arch of the palate; it is dug in the apophyſis petroſa along the carotid canal, and it is lengthened out by the ſpinal apophyſis of the os ſphenoidale.

In its natural ſtate, this duct reaches from the cavity of the barrel to the root or ſuperior part of the internal ala of the apophyſis pterygoides; and through this whole courſe it is made up of two portions, one entirely bony, and the other partly bony, partly cartilaginous, and partly membranous.

The bony portion lies through its whole length immediately above the fiſſure of the glenoide or articular cavity of the os temporis, and terminates at the meeting of the ſpinal apophyſis of the os ſphenoides with the pars petroſa of the os temporis.

The other or mixed portion reaches in the ſame direction from this place to the internal ala of the apophyſis pterygoides, or to the poſterior and outer edge of the nares. But to form a more exact idea of it, it will be proper to conſider it as divided into four parts, two ſuperior and two inferior.

The two upper parts or quarters are bony; and of theſe the innermoſt is formed by the ſide of the apophyſis petroſa, the outermoſt by the ſide of the apophyſis ſpinalis of the os ſphenoides. Of the two inferior parts, the internal or that next the os ſphenoides, is cartilaginous; and the external, or that next the pars petroſa, membranous.

The Euſtachian tube thus formed, is very narrow next the ear, but grows gradually wider, eſpecially near the poſterior nares, where the inner cartilaginous ſide terminates by a prominent edge, and the outer ſide joins that of the neighbouring noſtril. The cavity of the tube is lined by a membrane like that of the internal

ternal nares, of which it appears to be a continuation; and on the prominent edge, this membrane is confiderably increafed in thicknefs, reprefenting a kind of half pad.

The fituation of the two tubes is oblique, their pofterior extremities at the ears being at a greater diftance than the anterior at the nares; and the convex fides of the prominent edges are turned toward each other. The openings of the tubes are oval at this place; as is likewife their whole cavity, efpecially that of the mixed portion.

The membrana tympani is a thin, tranfparent, flattifh pellicle; the edge of which is round, and ftrongly fixed in the orbicular groove which divides the bony meatus of the external ear from the tympanum or barrel. This membrane is very much ftretched or very tenfe, and yet not perfectly flat: for on the fide next the meatus externus it has a fmall hollownefs, which is pointed on the middle; and on the fide next the tympanum, it is gently convex, and alfo pointed in the middle.

This membrane is fituated obliquely, the upper part of its circumference being turned outward, and the lower part inward, fuitably to the direction of the bony groove already mentioned. It is made up of feveral very fine laminæ, clofely united together. The external lamina is in fome meafure a production of the fkin and cuticula of the external meatus; for they may be pulled at the fame time like the finger of a glove. The internal lamina is a continuation of the periofteum of the tympanum; and when the membrane has been firft macerated in water, each of thefe laminæ may be fubdivided into feveral others, which I have fometimes made to amount in all to fix. In very young children, this membrane is covered on the outfide by a thick mucilaginous web.

The depreffion in the middle of the membrana tympani, is caufed by the adhefion of the malleus; the handle

handle of which is closely joined to the inside of the membrane, from the upper part of the circumference all the way to the centre, to which the end of the handle is fixed. This handle seems to lie in a very fine membranous duplicature; by means of which it is tied to the membrana tympani, and which serves it for a periosteum.

The periosteum of the tympanum, or barrel of the ear, produces that of the small bones; and it may be made visible by means of anatomical injections, which discover capillary vessels very distinctly ramified on the surface of the ossicula. It is likewise continued over the two fenestræ, and enters the Eustachian tube, where it is lost in the inner membrane of that duct.

The cellulæ mastoidæi are very irregular cavities in the substance of the mastoide apophysis, which communicate with each other, and have a common opening towards the inside, and a little above the posterior edge of the orbicular groove. These cells are lined by a fine membrane; which is partly a continuation of the periosteum of the tympanum, and partly seems to be of a glandular structure like a kind of membrana pituitaria. The mastoide opening is opposite to the small opening of the Eustachian tube, but a little higher.

The ligaments of the ossicula come next in order. The incus is tied by a strong short ligament fixed in the point of the short leg to the edge of the mastoide opening. Between the incus and malleus we find a small thin cartilage. The malleus is connected thro' the whole length of its handle to the inside of the membrana tympani, in the manner already said. I need only add here, that by help of a microscope we discover round the point of the handle, in the substance of the membrane, a small orbicular plane of a whitish colour, a little inclined to red.

The malleus has two distinct little muscles, one anterior, and one internal; and the stapes has one muscle.

The

The anterior muſcle of the malleus, called, from its uſe, *laxator tympani*, is fleſhy, long, and thin. It runs along the outſide of the Euſtachian tube; to which it adheres very cloſely through its whole length. Its anterior extremity is fixed in that ſide of the tube juſt before the ſphenoidal ſpine; and the poſterior extremity ends in a long thin tendon, which runs in the articular or glenoide fiſſure of the os temporis, through a ſmall oblique notch; in which fiſſure it enters the tympanum, and is inſerted in the long thin apophyſis of the malleus. It is partly accompanied by a nerve, which forms what is called the *chorda tympani*, as we ſhall ſee hereafter.

The internal muſcle of the malleus, called *tenſor tympani*, is very fleſhy and diſtinct. It lies along the inſide of the Euſtachian tube, partly on the cartilaginous, and partly on the bony portion, being fixed by one extremity in the apophyſis petroſa. Afterwards it runs along the cavity of the bony half canal of the tympanum; within which cavity it is inveſted by a portion of a membranous or ligamentary vagina, which being fixed to the edges of the half canal, forms an entire tube therewith, and this vagina muſt be cut open before we can ſee the muſcle.

At the poſterior extremity of this bony half canal, this muſcle ends in a tendon, which is bent round the tranſverſe bony or ligamentary ridge in the laſt-named cavity, as over a pulley; and is inſerted in the neck of the malleus above the ſmall apophyſis, advancing likewiſe as far as the handle. A third muſcle has by ſome been deſcribed under the name of *external* or *ſuperior muſcle of the malleus*; but this is much leſs diſtinct than thoſe already mentioned.

The muſcle of the ſtapes is ſhort and thick, and lies concealed within the ſmall bony pyramid at the bottom of the tympanum. The cavity which it fills, touches very nearly the bony canal of the portio dura of the auditory nerve; and it terminates in a ſmall tendon

don which goes out of the cavity thro' the ſmall hole in the apex of the pyramid. As it goes thro' the hole it turns forward, and is inſerted in the neck of the ſtapes on the ſide of the longeſt and moſt crooked leg of that bone.

The three parts of the labyrinth, that is, the veſtibulum, ſemicircular canals, and cochlea, are lined by a fine perioſteum, which is continued over all the ſides of their cavities, and ſhuts the two feneſtræ of the tympanum.

In all the ſubjects which I ever examined, I have found the ſemicircular canals ſimply lined by a perioſteum adhering to their inner ſurfaces without any particular membranous bands. The two half-canals of the cochlea are lined in this manner; the perioſteum of the two ſides of the bony ſpiral lamina advances beyond the edge of that lamina, and forms a membranous duplicature, which extending to the oppoſite ſide completes the ſpiral ſeptum.

The ſeptum ſeparates the two half-canals from the baſis to the apex; but there it leaves a ſmall opening, by which the ſmall extremities of the half-canals communicate with each other. The large extremity of the external half-canal ends by an oblique turn in the feneſtra rotunda, which is ſhut by a continuation of the perioſteum of that canal. The large extremity of the other half-canal opens into the veſtibulum; and theſe two extremities are entirely ſeparated by a continuation of the perioſteum.

" The whole internal cavity of the labyrinth is filled with a watery fluid ſecreted from the veſſels which are diſperſed upon the perioſteum. This fluid tranſmits to the nerves the vibrations it receives from the membrane ſituated between the tympanum and labyrinth.

" The ſuperfluous part of this fluid is ſuppoſed to paſs off through two ſmall canals called the *aquæducts of Cotunnius*, from the diſcoverer, an ingenious phyſician at Naples.

Naples. One of theſe ducts is ſent off from the cochlea, the other from the veſtibule; and after running through the pars petroſa, they are ſaid to open into the cavity of the cranium, where the fluid that paſſes thro' them is abſorbed: but future experience muſt determine this more fully."

All the perioſteum of the internal ear, eſpecially that of the oſſicula and tympanum, is in children no more than a mucilage; and in them likewiſe the membrana tympani is thick, opaque, and covered with a whitiſh, ſlimy matter.

Through the whole extent of the perioſteum of the internal ear, eſpecially on that of the oſſicula, ſemicircular canals, and half-canals of the cochlea, we diſcover a vaſt number of blood-veſſels, not only by anatomical injections, but in inflammations, and even without the help of a microſcope; for I have often ſhown them to the naked eye in the ſemicircular canals and half-canals of the cochlea. The arteries come partly from the internal carotid, and partly from the arteria baſilaris, which is a continuation of the vertebralis, the ſmall capillary ramifications of which may be obſerved to accompany the auditory nerve through the internal foramen auditorium.

The portio mollis of the auditory nerve ends, by its trunk, at the great foſſula of the internal auditory hole, from whence the filaments paſs through ſeveral ſmall holes in the baſis of the cochlea, "to be diſtributed thro' the cochlea, the veſtibule, and the ſemicircular canals."

The portio dura, which I name *nervus ſympatheticus minor*, runs firſt of all into the ſmall foſſula of the foramen auditorium internum, then paſſes through the whole bony duct called *aquæductus Fallopii*, and comes out again through the ſtylo-maſtoide hole of the os temporis. In this courſe it communicates with the dura mater on the upper or anterior ſide of the apophyſis petroſa, at the place where the bony duct is interrupted.

Having reached behind the ſmall pyramid in the bottom of the tympanum, this nerve ſends a ſmall filament to the muſcle of the ſtapes; and a little before it goes out by the ſtylo-maſtoide hole, it gives off another more conſiderable filament, which enters the tympanum from behind forward, paſſes between the long leg of the incus and handle of the malleus, and afterwards runs croſs the whole breadth of the tympanum a little obliquely, and goes out at the ſame place at which the tendon of the anterior muſcle of the malleus enters.

This ſmall nerve is generally called *chorda tympani*, becauſe in its paſſage thro' the tympanum it has been compared to the chord of a drum. Having left the cavity of the internal ear, it advances toward one ſide of the baſis of the tongue, where having joined the ſmall nervus lingualis, it is conſidered as a kind of recurrent; but the remaining part of its courſe muſt be referred to the deſcription of the tongue.

The portio dura of the auditory nerve having paſſed through the foramen ſtylo-maſtoidæum, is diſtributed in the manner to be afterwards mentioned in the deſcription of the nerves; and we ought very carefully to obſerve its different communications with the branches and rami of the nerves of the fifth pair, with the ſympatheticus medius or eighth pair, with the ſecond pair of cervical nerves, and with the nervi ſuboccipitales or tenth pair of the medulla oblongata, &c.

The ear is the organ of which we can moſt diſtinctly unfold the ſtructure, and demonſtrate the greateſt number of parts, that is, of ſmall machines of which it is made up. We know likewiſe in general that it is the organ of hearing: but when we endeavour to diſcover the uſes of each of theſe parts, that is, how each contributes to the great deſign of the whole; after having thoroughly examined them, we muſt be obliged to own,

that

that the greateſt part of what the moſt able philoſophers have ſaid upon this ſubject, is without any real foundation.

It is certain that the cavity of the external ear collects ſound or noiſe, and concenters it towards the bottom of the concha, all the way to the external meatus auditorius. This we learn from experience, by enlarging this cavity with the hand. It may likewiſe be affirmed with certainty, that in proportion as the membrana tympani is more or leſs ſtretched, ſounds become more or leſs ſenſible. This experience teaches us; for when this membrane is wetted by any liquor, our hearing is imperfect, but is reſtored again when the membrane is dry. By the muſcles of the oſſicula, we can demonſtrate that this membrane is capable of being ſtretched and relaxed, as occaſion requires; but the proſecution of this curious ſubject muſt be referred to another occaſion.

Sect. V. *The* Mouth.

Introduction. The word *mouth* may have two ſignifications: for, firſt, it means the tranſverſe ſlit between the noſe and chin, formed by the lips; and, ſecondly, it expreſſes the internal cavity, of which this tranſverſe ſlit is the external opening. For this reaſon the mouth may be diſtinguiſhed into external and internal; and the parts of which it conſiſts may likewiſe come under the ſame two general heads. The bony parts are the oſſa maxillaria, oſſa palati, maxilla inferior, and the teeth: to theſe we may add the os hyoides, and the upper vertebræ of the neck.

The external parts of the mouth are, The two lips, one upper, the other under; the borders or red parts of the lips; the corners or commiſſures of the lips; the foſſula of the upper lip, the baſis of the under lip; the chin, the bafis of the chin; the fkin; the beard; and even the cheeks, as being the lateral parts of the mouth in general, and of the lips in particular.

The internal parts of the mouth are, The gums, palate, feptum palati, uvula, amygdalæ, the tongue, the membrane which lines the whole cavity of the mouth, the falival ducts and glands, and the bottom of the mouth. We might likewife reckon among the internal parts of the mouth, all the mufcles that have any relation to it, as thofe of the lips, of the tongue, of the uvula, of the feptum palati, &c. and to thefe might be added the mufcles of the lower jaw, and of the os hyoides, which have been already defcribed.

The parts of the neck to be defcribed here, are only the larynx, pharynx, and glandulæ thyroideæ; and therefore, inftead of making a particular fection for fo fmall a number of parts, I choofe to bring them in under the defcription of the head; efpecially fince the larynx and pharynx have fo near a relation to the internal parts of the mouth, that I find myfelf under a neceffity of defcribing them before I proceed to the mouth in particular.

§ 1. *The Larynx.*

THE larynx forms the protuberance in the upper and anterior part of the neck, called commonly *pomum Adami*. Anatomifts term it the *head of the trachea arteria*, as I fhall explain particularly in the defcription of the thorax. This is larger and more prominent in men than in women.

It is chiefly made up of five cartilages, the names of which are thefe: Cartilago-thyroides, which is the anterior and largeft; cricoides, the inferior, and bafis of the reft; two arytenoides, the pofterior and fmalleft; and the epiglottis, which is above all the reft. Thefe cartilages are connected together by ligaments, and they

they have likewiſe muſcles, glands, membranes, &c. belonging to them.

Cartilago thyroidæa. The cartilago thyroidæa is large and broad, and folded in ſuch a manner as to have a longitudinal convexity on the foreſide, and two lateral portions which may be termed *alæ*. The upper part of its anterior middle portion is formed into an angular notch; the upper edge of each ala makes an arch; and, together with the middle notch, theſe two edges reſemble the upper part of an ace of hearts in playing cards.

The lower edge of each ala is more even, and the poſterior edges of both are very ſmooth, being lengthened out both above and below by apophyſes, which I name the *cornua of the thyroide cartilage*. The ſuperior apophyſes are longer than the inferior, and the extremities of all the four are rounded like ſmall heads, which in the inferior apophyſes have a ſhining ſurface on the inſide, reſembling an articular eminence.

On the outſide of each ala near the edge, is a prominent oblique line which runs from behind forward. The upper extremity of this line is near the ſuperior apophyſis or cornu; and both that and the lower extremity end in a ſmall tuberoſity, the loweſt being often the moſt conſiderable. Theſe tuberoſities ſerve for the inſertion of muſcles and ligaments. The inſide of the alæ and the convex ſide of the anterior portion are very uniform; and this cartilage oſſifies gradually in old age.

Cartilago cricoides. The cricoide cartilage reſembles a kind of thick, irregular ring, very broad on one ſide and narrow on the other; or it may be compared to a ſmall portion of a thick tube, cut horizontally at one end, and very obliquely at the other. I diſtinguiſh it into a baſis and top, into an anterior, poſterior, and two lateral ſides. The baſis is almoſt horizontal when we ſtand, and to this the aſpera arteria is connected; ſo that the cricoides may be looked upon as the upper extremity of the trachea.

The poſterior portion of the cricoides is larger than the reſt, and its poſterior or convex ſide is divided by a longitudinal eminence, or prominent line, into two diſtinct ſurfaces, for the inſertion of muſcles. The top is gently ſloped above this prominent line; and terminates on each ſide by a kind of obtuſe angle, formed between it and the oblique edge of each lateral portion of this cartilage. At the upper part of each of theſe angles, there is a very ſmooth articular ſurface, gently convex.

The whole poſterior ſide is diſtinguiſhed into two lateral portions by two prominent lines, each of which runs down almoſt in a ſtraight direction from the articular ſurface at the top, a little below the middle of this ſide, where it terminates in another articular line a little concave; and near theſe four articular ſurfaces there are ſmall tubercles. The two ſuperior ſurfaces are for the articulation of the cartilagines arytenoidææ, as we ſhall ſee preſently; and the two inferior, for the articulation of the inferior cornua or appendices of the cartilago thyroides.

Cartilagines arytenoidææ. The cartilagines arytenoidææ are two ſmall, equal, ſimilar cartilages, which joined together reſemble the ſpout of an ewer; and they are ſituated on the top of the cricoides. In each, we may conſider the baſis; cornua; two ſides, one poſterior and concave, the other anterior and convex; and two edges, one internal, the other external, which is very oblique. The baſes are broad and thick; and have each a concave articular ſurface, by which they are joined to the cricoides.

The cornua are bent backward, and a little toward each other. In ſome ſubjects they are very looſe, appearing like true appendices, and eaſily ſeparable from the reſt. Between their inner edges they form a kind of fiſſure, and their outer oblique edges terminate each by a thick prominent angle.

Epiglottis. The epiglottis is an elaſtic cartilage, nearly of the figure of a purſlane leaf, narrow and thick at at the lower part, thin and ſlightly rounded at the upper part, gently convex on the foreſide, and concave on the backſide. It is ſituated above the anterior or convex portion of the cartilago thyroides; and its lower extremity is tied by a ſhort, pretty broad, and very ſtrong ligament, to the middle notch in the upper edge of that cartilage. It is perforated by a great number of holes, ſomething like thoſe in the leaves of the hypericum or St John's wort, which are hid by the membranes that cover its two ſides.

Ligaments of the larynx. The cartilago thyroides is connected to the cricoides by ſeveral ſhort ſtrong ligaments, round the articulations of the two inferior cornua with the lateral articular ſurfaces of the cricoides. The apices of the ſuperior cornua are fixed to the poſterior extremities of the great cornua of the os hyoides, by ſlender round ligaments, about a quarter of an inch in length.

In the middle of each of theſe ligaments, we often meet with a ſmall cartilage of an oval figure, and much thicker than the ligaments. The thyroides is likewiſe connected to the os hyoides by a ſhort, broad, ſtrong ligament, one end of which is inſerted in the ſuperior notch of the cartilage, and the other in the lower edge of the baſis of the bone. It has alſo two ligaments at the middle of the concave ſide which belong to the arytenoidææ.

The cricoides is tied to the lower part of the thyroides by a ſtrong ligament; and by the ligaments already mentioned, to the inferior cornua of that cartilage. Its baſis is fixed to the firſt cartilaginous ring of the trachea arteria, by a ligament exactly like thoſe by which the other rings are connected together; and the membranous or poſterior portion of the trachea is likewiſe fixed to the poſterior part of the baſis of the cricoides.

Glottis. The cartilagines arytenoidææ are connected to the cricoides by ligaments, which ſurround their articulations with the top of that cartilage. Anteriorly the baſis of each arytenoides is fixed to one end of a ligamentary cord, which by its other end is inſerted about the middle of the concave ſide of the anterior portion of the thyroides. At their inſertions in the thyroides, theſe two ligaments touch each other; but a ſmall ſpace is left between them, where they are fixed in the two arytenoides; and they ſeem likewiſe to have a ſmall adheſion to the top of the cricoides. This is what is called *the glottis.*

Under theſe two ligamentary cords there are two others which run likewiſe from behind forward. The interſtice between the ſuperior and inferior cords on each ſide form a tranſverſe fiſſure, which is the opening of a ſmall membranous bag, the bottom of which is turned outward, that is, toward the ala of the thyroides. Theſe two ſacculi are the ventricles mentioned by the ancients, and reſtored by M. Morgagni, who has given an excellent deſcription of them. They are chiefly formed by a continuation of the internal membrane of the larynx, and the inner ſurface of their bottom appears ſometimes to be glandular.

On the anterior ſurface of the arytenoide cartilages, there is a ſmall depreſſion between the baſis and the convex upper part. This depreſſion is filled by a glandular body, which not only covers the anterior ſurface of each arytenoides, but is likewiſe extended forward from the baſis over the poſterior extremity of the neighbouring ligamentary cord. They are larger and more ſenſible in ſome ſubjects than in others; and they are covered by the membrane which lines the neighbouring parts. Theſe glands were diſcovered by M. Morgagni.

I have already deſcribed the ligaments which connect the epiglottis to the notch of the thyroides, and to the baſis of the os hyoides. Theſe two ligaments, and a third which ties the baſis of the os hyoides to the notch of the thyroides, form a triangular ſpace filled with a cellular or fatty ſubſtance, and with ſmall glands.

The epiglottis has likewiſe two lateral ligaments, by which it is connected to the arytenoides all the way to their points or cornua. It has alſo a membranous ligament,

gament, which, running along the middle of its anterior or concave ſide, ties it to the root or baſis of the tongue. This ligament is only a duplicature of the membrane which covers the epiglottis, continued to the neighbouring parts. Laſtly, there are two lateral membranous ligaments belonging to it, fixed near the glandulous bodies called *amygdalæ*.

The epiglottis is not only perforated by the regular holes already mentioned, but has likewiſe a great number of ſmall irregular fiſſures and breaks, which are ſo many different lacunæ ſituated between its two membranes, and filled with ſmall glands, the excretory orifices of which are chiefly on the back-ſide of this cartilage.

Muſcles of the larynx. The larynx gives inſertion to a great number of muſcles, which may be divided into common, proper, and collateral. The common muſcles, according to the general acceptation of that term, are all thoſe that move the whole body of the larynx, one extremity of them being inſerted in other parts; and theſe are reckoned to be four in number, two for each ſide, *viz.* ſterno-thyroidæi, thyro-hyoidæi or hyo thyroidæi.

The proper muſcles are thoſe inſerted wholly in the larynx, and which move the cartilages ſeparately. Theſe have been divided in various manners, but may be all reduced to the following pairs: Crico-thyroidæi; crico-arytenoidæi laterales; crico-arytenoidæi poſteriores; thyro-arytenoidæi; arytenoidæi; thyro-epiglottici; aryteno-epiglottici.

By the collateral muſcles, I underſtand thoſe which are inſerted by one portion in the larynx, without appearing to contribute any thing to the motions of it. Of this kind are the thyro-pharyngæi, crico-pharyngæi, &c.; of which hereafter.

The larynx may likewiſe be moved by muſcles, which are not immediately inſerted in it, but altogether in other parts. Such are the mylo-hyoidæi, genio-hyoidæi,

dæi, ſtylo-hyoidæi, omo-hyoidæi, ſterno-hyoidæi, and eſpecially the digaſtrici of the lower jaw, by reaſon of their particular adheſion to the os hyoides. It is likewiſe probable that thoſe muſcles of the pharynx which are inſerted in the baſis cranii, may, in certain circumſtances, move the larynx in ſome ſmall degree.

Sterno-thyroidæi. The ſterno-thyroidæi are two long, flat, narrow, thin muſcles, like ribands, broader above than below, and ſituated along that part of the neck which lies between the thyroide cartilage and the ſternum. They are covered by the ſterno-hyoidæi; and they cover the thyroide glands, paſſing immediately before them.

Each muſcle is fixed by its lower extremity, partly in the ſuperior portion of the inner or backſide of the ſternum, partly in the ligament and neighbouring portion of the clavicula, and partly in the cartilaginous portion of the firſt rib. Sometimes it runs a great way down on the firſt bone of the ſternum, and croſſes the muſcle on the other ſide. From thence it runs up on the aſpera arteria, cloſe by its fellow, paſſes before the thyroide glands over the cricoide cartilage, and is inſerted by its upper extremity in the lower part of the lateral ſide of the thyroide cartilage, and partly along that whole ſide. I have found this muſcle double, one diſtinct portion of it being inſerted in the baſis, and the other laterally.

Thyro-hyoidæi. The thyro-hyoidæi, or hyo-thyroidæi, are two flat thin muſcles, lying cloſe by each other, between and above the former. Each of them is inſerted by its upper extremity, partly in the baſis, and partly in the neighbouring part of the great cornu of the os hyoides; and, by its lower extremity, in the lower part of the lateral ſide of the thyroide cartilage, immediately above the ſuperior extremity of the ſterno-thyroidæus; and both this ſuperior extremity of the laſt-named muſcle, and the lower extremity of the thyro-hyoidæus, are, at their place of union, confounded a little

little with the thyro-pharyngæus inferior; of which hereafter.

Crico-thyroidæi. The crico-thyroidæi are two ſmall muſcles, ſituated obliquely at the lower part of the thyroide cartilage. They are inſerted by their lower extremities in the anterior portion of the cricoide cartilage near each other; and by their ſuperior extremities, laterally in the lower edge of the thyroide cartilage at a diſtance from each other. By this oblique ſituation, they repreſent a Roman V.

Each of theſe ſmall muſcles is in a manner double: its upper extremity, inſerted in the thyroide cartilage, being in ſome ſubjects very broad, and divided into two portions; one anterior, the other more lateral and more oblique. They may likewiſe be eaſily ſeparated into two diſtinct muſcles; whereof one may be called *crico-thyroidæus anterior ſive internus*, the other *lateralis ſive externus*.

Crico-arytenoidæi poſteriores. The two muſculi crico-arytenoidæi poſteriores, are ſituated poſteriorly at the large or back portion of the cricoides, filling almoſt the two longitudinal ſurfaces of that portion, and diſtinguiſhed by the prominent line between theſe two ſurfaces already mentioned. Each of them runs up obliquely, and is inſerted by its upper extremity in the poſterior part of the baſis of the arytenoide cartilage of the ſame ſide, near the angle of that baſis.

Crico-arytenoidæi laterales. The two crico-arytenoidæi laterales are ſmall, and ſituated more laterally than the former. Each muſcle is fixed by one end to the ſide of the broad part of the cricoides, and by the other to the lower part of the ſide of the neighbouring arytenoides.

Thyro-arytenoidæi. The two thyro-arytenoidæi are very broad, each muſcle being ſituated laterally between the thyroide and cricoides. It is fixed by a broad inſertion in the inſide of the ala of the thyroide cartilage; and the fibres contracting from thence run from before

back-

backward, and from below upward, towards the neighbouring arytenoide cartilage, in which they are inserted, from the glottis to the angle of the basis. In some subjects, these muscles cover almost both sides of the glottis.

Arytenoidæi. The arytenoidæi are three small muscles lying on the posterior concave sides of the arytenoide cartilages: "two of these are crucial, and one transverse."

The crucial muscles run each obliquely from the basis of one arytenoide cartilage to the middle and upper part of the other, the left muscle covering the right, as is observed by M Morgagni in his first Adversaria.

I look upon these muscles as superior crico-arytenoidæi, because I have always found them partly inserted in the upper neighbouring portion of the cricoides. The arytenoidæus transversalis is inserted more or less directly by both extremities in the two arytenoide cartilages; and this I look upon as the true musculus arytenoidæus.

Thyro-epiglottici The two thyro-epiglottici cross the thyro-arytenoidæi, being inserted in the inner lateral part of the thyroides, and laterally on the epiglottis.

Aryteno-epiglottici. The aryteno-epiglottici are small fleshy fasciculi; each of which is fixed by one extremity in the head of one of the arytenoide cartilages, and by the other in the nearest edge of the epiglottis.

Uses. The larynx serves particularly to admit and let out the matter of respiration; and the solidity of the pieces of which it is composed, hinders not only external objects, but also any hard thing which we swallow, from disordering this passage. The glottis being a narrow slit, modifies the air which we breathe; and as it is very easily dilated and contracted, it forms the different tones of the voice, chiefly by means of the different muscles inserted in the cartilagines arytenoidææ, to which the other muscles of the larynx, both proper and common, are assistants.

The

The whole larynx is likewife of ufe in deglutition, as has been already obferved, by means of its connection with the os hyoides, to which the digaftric mufcles of the lower jaw adhere; which mufcles raife the larynx together with the os hyoides every time we fwallow.

The facility of varying and changing the tone of the voice depends on the flexibility of the cartilages of the larynx, and decreafes in proportion as we advance in age; becaufe thefe cartilages gradually harden and offify, though not equally foon in all perfons: and this change happens not only in the cartilago thyroides, but alfo to the cricoides and arytenoides.

The mufculi fterno-thyroidæi ferve in general to pull down the thyroide cartilage, and the whole larynx along with it. They may likewife affift the fterno-hyoidæi in its action, and comprefs the thyroide gland; of which hereafter. The thyro-hyoidæi may, as occafion requires, either draw up the larynx toward the os hyoides, or draw that bone downward toward the cartilago-thyroides.

It is difficult to determine the ufe of the crico-thyroidæi from their fituation. They may either pull the cricoides obliquely backward, or the thyroides obliquely forward; and by this action the inferior cornua of the thyroides, and fmall articular furfaces of the cricoides, muft flide upon each other.

Both the lateral and pofterior crico-arytenoidæi may feparate the arytenoide cartilages, and thereby open or dilate the glottis; but they do not both perform this action in the fame manner. The lateral mufcles feparate thefe cartilages obliquely forward, and at the fame time loofen or relax the fides of the glottis; but the pofterior mufcles feparate them obliquely backward, and at the fame time ftretch or extend the fides of the glottis; and when both mufcles act equally, they feparate the cartilages directly.

The thyro-arytenoidæi acting together, draw both the arytenoide cartilages forward, and confequently loofen

loofen the glottis, and render it capable of the fmalleft quaverings of the voice. They may likewife probably comprefs the lateral finufes or ventricles of the larynx, and alfo the arytenoide glands.

The arytenoidæi bring the arytenoide cartilages clofe together, and prefs them againft each other; and when the cartilages are in this fituation, they may at the fame time be inclined either forward by the thyro-arytenoidæi, or backward by the crico-arytenoidæi pofteriores. By this means the glottis, when fhut, may be either relaxed or tenfe; and in this laft cafe it is entirely fhut, as when we hold in our breath in ftraining: but of this more in another place.

The general ufe of the epiglottis is to cover the glottis like a pent-houfe, and thereby hinder any thing from falling into it when we eat or drink; and for this purpofe it is depreffed in the manner that fhall be fhown hereafter. It ferves likewife to hinder the air which we infpire from rufhing directly upon the glottis; but by fplitting it, as it were, obliges it to enter by the fides, or in an oblique courfe. The mufcles of the epiglottis do not appear to be abfolutely neceffary for that cartilage; for in deglutition it may be fufficiently depreffed by the bafis of the tongue, and it may raife itfelf again by its own elafticity. The thyro-epiglottici and aryteno-epiglottici may ferve to fhut any lateral openings that might remain when the epiglottis is depreffed by the bafis of the tongue; and the hyo-epiglottici may pull it a little forward in ftrong refpirations, as in fighing, yawning, &c.

§ 2. *The Pharynx.*

The pharynx is a mufcular and glandular bag, the outer furface of which is clofely joined to the inner furface of all that fpace which is at the bottom of the mouth, behind the pofterior nares, uvula, and larynx, and which reaches from the cuneiform procefs of the os os occipitis all the way to the œſophagus, which is the continuation of the pharynx. This ſpace is bounded poſteriorly by the muſcles which cover the bodies of the firſt vertebræ of the neck, and laterally by the ſuperior portions of both the internal jugular veins, and of both the internal carotid arteries, by the ſpinal apophyſes of the os ſphenoides, by the extremities of the apophyſes petroſæ, by the os ſphenoides, immediately above the internal alæ of the apophyſes pterygoides, and by the neighbouring portion of both pterygoide muſcles.

From theſe limits and adheſions of the pharynx we may pretty nearly determine is figure. It may be compared to the wide part of a covered funnel, of which the œſophagus is the narrow part or tube; or it may be called the *broad end of the œſophagus*, that and the pharynx taken together being compared to a trumpet. The pharynx may be divided into three parts; one ſuperior, which is the arch of the pharynx; one middle, which is the body or great cavity; and one inferior, which is the bottom, narrow portion, or ſphincter. We are likewiſe to obſerve in it three openings; that of the arch, toward the nares; that of the body, toward the mouth; and that of the bottom, toward the œſophagus.

The arch is the broadeſt part of the pharynx; and ends on each ſide in angle or point, toward the jugular foſſulæ of the baſis cranii. Afterwards the great cavity contracts a little toward the ſides, all its other dimenſions continuing the ſame; and behind the larynx it is again enlarged on each ſide, a very ſmall ſpace being left between it and the cricoide cartilage. The extremity of the lower portion is very narrow, and joins the baſis of the cartilage juſt named.

The pharynx is made up partly of ſeveral diſtinct fleſhy portions, which are looked upon as ſo many different muſcles ſo diſpoſed as to form a large cavity; and partly of a membrane which lines the inner ſurface of this

this whole cavity, and is a continuation of that of the nares and palate.

This membrane is wholly glandular; and it is thicker on the ſuperior and middle portions of the pharynx, than on the bottom or lower portion. Immediately above the firſt vertebra it forms ſeveral longitudinal rugæ very thick, deep, and ſhort; and we generally find therein a collection of mucus in dead bodies. In the great cavity there are no rugæ, the membrane adhering, both there and in the upper part, very cloſely to the muſcles. At the lower part where it is thinneſt, it covers likewiſe the poſterior part of the larynx; and is very looſe, and formed into irregular folds. It runs in a little on each ſide between the edges of the pharynx.

Muſcles of the pharynx. Though almoſt all the muſcular or fleſhy portions of which the pharynx is compoſed, concur in the formation of one continued bag or receptacle, they are nevertheleſs very diſtinguiſhable from each other, not only by their different inſertions, from which they have been denominated, but alſo by the different directions of their fibres. They may be looked upon as three digaſtric muſcles, the middle tendons of which lie backward in one longitudinal line, which in ſome ſubjects appears plainly like a linea alba.

The conſtrictores pharyngis inferiores are inſerted in the lower ſide of the apophyſis baſilaris, or cuneiform proceſs of the os occipitis, about the middle of the poſterior part. From thence they ſeparate laterally, and ſometimes join the ſtylo-pharyngæi. Part of the linea alba of the pharynx is formed by the middle adheſion of theſe muſcles.

The conſtrictores pharyngis medii are faſciculi of muſcular fibres very diſtinctly inſerted by one end along the ligaments by which the ſuperior cornua of the cartilago thyroides are connected to the extremities of the great cornua of the os hyoides. “ From thence they run

run backward and upward, to meet in the linea alba, and to be fixed to the cuneiform procefs of the occipital bone." To be able to fee them diftinct from the other mufcles, the pharynx muft be filled with cotton, to give it a proper convexity, and to fupport its fides, which otherwife collapfe and fink inward, and thus prevent our feeing the direction and diftinction of feveral of the mufcles belonging to it.

The conftrictores pharyngis inferiores are very broad; and each mufcle is inferted along the outfide of the ala of the cartilago thyróides, between the edge of that and the oblique line in which the thyro-hyoidææ are fixed. "They are alfo fixed to the cricoid cartilage." From thence they run up obliquely backward; and meeting under the linea alba, they fometimes appear to be but one mufcle without any middle tendon. Sometimes they have appeared to me to be diftinguifhed into fuperior and inferior, becaufe their upper portion ran upward and backward, and their lower portion more tranfverfely.

The loweft of thefe mufcular fibres make a complete circle backward, between the two fides of the bafis of the cartilago cricoides. This circle is the beginning of the œfophagus, and has been thought by fome to form a diftinct mufcle called *œfophagus*. "Befides the mufcles which form the body of the pharynx, there are feveral other fmall ones connected with it; but of thefe fufficient defcriptions have been already given in a former part of the work."

The particular ufes of thefe mufcles are very difficult to be determined. It is certain that thofe of the middle and lower portions of the pharynx ferve chiefly for deglutition. Thofe of the upper portion, and fome of thofe of the middle portion, may, among other functions, be ufeful in modifying the voice, according to the opinion of M. Santorini.

§ 3. *The Palate, Uvula, &c.*

The palate is that arch or cavity of the mouth, surrounded anteriorly by the alveolary edge and teeth of the upper jaw, and reaching from thence to the great opening of this pharynx. The arch is partly solid and immoveable, and partly soft and moveable. The solid portion is that which is bounded by the teeth, being formed by the two offa maxillaria and two offa palati. The soft portion lies behind the other, and runs backward like a veil fixed to the edge of the offa palati, being formed partly by the common membrane of the whole arch, and partly by feveral mufcular fafciculi, &c.

The membrane that covers all this cavity is like that which lines the fuperior and middle portions of the pharynx. It is very thick fet with fmall glands, the orifices of which are not fo fenfible as in the pharynx, and efpecially in the rugæ of the fuperior portion thereof, where M. Heifter obferved a confiderable orifice, and a canal proportioned to that orifice, which he could eafily inflate with air. This is certainly the beft way of beginning thefe kinds of inquiries, efpecially if the pipe be held at firft only near the part, without endeavouring to force it in. To immerge the parts in clear water in the manner already mentioned, is likewife a very good way to difcover fmall orifices, by the help of a microfcope. Small ducts of the fame kind with what I have now mentioned, may be fuppofed to lie along the middle line or raphe of the arch of the palate, and along the alveolary edge, becaufe of fome fmall tubercles or points which appear there.

This membrane, together with that of the pofterior nares, forms, by an uninterrupted continuation, the anterior and pofterior furface of the foft portion, or feptum palati; fo that the mufcular fafciculi of this portion lie in the duplicature of a glandulous membrane. The mufcles

mufcles compofed of thefe fafciculi fhall be prefently defcribed.

The feptum, which may likewife be termed *velum* or *valvula palati*, terminates below by a loofe floating edge, reprefenting an arch fituated tranfverfely above the bafis or root of the tongue. The higheft portion or top of this arch fuftains a fmall, foft, and irregularly conical glandular body, fixed by its bafis to the arch, and its apex hanging down without adhering to any thing, which is called *uvula*.

On each fide of the uvula there are two mufcular half-arches, called *columnæ fepti palati*. They are all joined to the uvula by their upper extremities, and difpofed in fuch a manner as that the lower extremities of the two which lie on the fame fide, are at a little diftance from each other, and fo as that one half arch is anterior, the other pofterior, an oblong triangular fpace being left between them, the apex of which is turned toward the bafis of the uvula.

The two half arches on one fide, by joining the like half-arches on the other fide, form the entire arch of the edge of the feptum. The pofterior half-arches run by their upper extremities, more directly toward the uvula than the anterior. The anterior half-arches have a continuation with the fides of the bafis of the tongue, and the pofterior with the fides of the pharynx. At the lower part of the fpace left between the lateral half-arches on the fame fide, two glands are fituated, termed *amygdalæ*, which fhall be defcribed hereafter, together with the glandular ftructure of the uvula, among the other glands of the mouth.

The half-arches are chiefly made up of feveral flat flefhy portions, almoft in the fame manner with the body of the feptum. The membrane which covers them is thinner than the other parts of it towards the palate, pharynx, and tongue. Each portion is a diftinct mufcle, the greateft part of which terminates by one extremity in the fubftance of the feptum and of the half-arches, and by the other extremity in parts different from theſe.

As anatomiſts uſed formerly to aſcribe all theſe muſcles, as far as they knew them, to the uvula, without any regard to the ſeptum, they termed them in general either *ptery-ſtaphylini*, or *peri-ſtaphylini*. The laſt part of theſe two compound words expreſſes the uvula: the firſt part of the firſt word is an abridgement of pterygoides, and expreſſes the inſertion of theſe muſcles; but the firſt part of the ſecond word ſignifies no more than round, or about, &c.

I might make uſe of the term *peri-ſtaphylinus* as a general denomination for the muſcles belonging to the ſeptum, and then add the other terms, of which theſe names have been made up by modern writers. But "the reader will find it more agreeable to uſe the names expreſſed in the treatiſe on the muſcles already deſcribed."

Of theſe we find, firſt, the conſtrictores iſthmi faucium; which are two ſmall muſcles, fixed each in the lower and lateral part of the baſis of the tongue; from whence they run up obliquely backward, along the anterior half-arches of the ſeptum palati, and terminate inſenſibly on each ſide near the uvula, ſome of their fibres being ſpread through the ſeptum. The thickneſs of the anterior half-arches is chiefly owing to theſe two muſcles.

The palato-pharyngei are likewiſe two ſmall muſcles, each of them being fixed by one extremity to the lateral part of the muſculi conſtrictores pharyngis inferiores, as if they were portions detached from theſe muſcles. From thence they run up obliquely forward along the two poſterior half-arches of the ſeptum, and terminate in the ſeptum above the uvula, where they meet together, and ſeem to form an entire arch by the union of their fibres. The thickneſs of the two poſterior half-arches is owing to theſe muſcles.

The thyro-ſtaphylini are two ſmall muſcles, which may

may be confidered as making part of the former pair; they accompany the palato-pharyngei very clofely thro' their whole courfe, except that their pofterior extremities are fixed in the thyroide cartilages near the other mufcles. They likewife contribute to the thicknefs of the pofterior half-arches, and are interted in the feptum in the fame manner with the former.

The tenfores palati, are each fixed by one extremity, partly to the fphenoidal fide of the bony portion of the Euftachian tube, partly to the neareft foft portion of the fame tube. From thence it runs toward the external ala of the apophyfis pterygoides, into which one portion of this mufcle is inferted. The other portion runs to the end of the ala, and turns round to the forked extremity thereof as over a pulley, and is afterwards inferted in the feptum palati near the uvula.

" The levatores palati begin each by a tendinous and flefhy origin, from the extremity of the pars petrofa of the temporal bone, where it is perforated by the Euftachian tube; and alfo from the membranous part of the fame tube. From thence it runs toward the foft part of the palate, to which it is fixed, uniting with its fellow on the other fide."

The ftaphylinus, or azygos uvulæ, is a fmall flefhy rope, fixed by one extremity in the common point of the pofterior edges of the offa palati; and from thence runs downward and backward along the middle of the feptum, and likewife along the middle of almoft the whole uvula. This mufcle has been termed *azygos Morgagnii*, from the difcoverer.

The feptum palati ferves to conduct the lacrymal lymph, and that which is continually collected on the arch of the palate, into the pharynx. It ferves for a valve to hinder what we fwallow, and efpecially what we drink, from returning from the nares. The ufes of the different mufcles of the feptum are not as yet fufficiently known, nor the different motions of which it is capable, as may be obferved by looking for fome time into an healthy perſon's mouth opened wide. I ſhall endeavour to explain theſe things at greater length in another place.

§ 4. *The Tongue.*

Every one knows, that the tongue is a ſoft fleſhy body, which fills all that part of the cavity of the mouth that is ſurrounded by the alveolary border and teeth of the lower jaw, and extends ſtill farther back. All this ſpace is therefore in a manner the mould and meaſure of the length and breadth of the tongue, as well as of its thickneſs and figure.

The tongue is divided into the baſis and point; the upper and under ſides; and the lateral portions, or edges. The baſis is the poſterior and thickeſt part; the point, the anterior and thinneſt part. The upper ſide is not quite flat, but a little convex; and divided into two lateral halves, by a ſhallow depreſſed line, called *linea linguæ mediana*. The edges are thinner than the other parts, and a little rounded as well as the point. The lower ſide reaches only from the middle of the length of the tongue to the point.

The tongue is principally compoſed of very ſoft fleſhy fibres, intermixed with a particular medullary ſubſtance, and diſpoſed in various manners. Many of theſe fibres are confined to the tongue without going any farther; the reſt form ſeparate muſcles which go out from it in different ways, and are inſerted in other parts. All the upper ſide of the tongue is covered by a thick membrane of a papillary texture, upon which lies another very fine membrane like a kind of epidermis, which is likewiſe continued over the lower ſide, but without papillæ.

Three ſorts of papillæ may be diſtinguiſhed in the upper ſide of the tongue; capitatæ, ſemi-lenticulares, and villoſæ. Thoſe of the firſt kind are the largeſt, reſembling little muſhrooms with ſhort ſtems, or buttons with-

without a neck. They lie on the baſis of the tongue in ſmall ſuperficial foſſulæ.

They reſemble ſmall conglomerate glands ſeated on a very narrow baſis, and each of them has ſometimes a ſmall depreſſion in the middle of their upper or convex ſide. They occupy the whole ſurface of the baſis of the tongue, and they are ſituated near each other in ſuch a manner as that the moſt anterior form an angle. They are glandular papillæ, or ſmall ſalival or mucilaginous glands, of the ſame kind with thoſe that are to be deſcribed hereafter.

We commonly obſerve about the middle of this part of the tongue a particular hole of different depths, the inner ſurface of which is entirely glandular, and filled with ſmall papillæ, like thoſe of the firſt kind. It is called *foramen cæcum Morgagnii*, as being firſt deſcribed by that author. Since that time M. Vaterus has diſcovered a kind of ſalival ducts belonging to it: and M. Heiſter found two of theſe ducts very diſtinctly, the orifices of which were in the bottom of the foramen cæcum near each other. He obſerved the ducts to run backward, divaricating a little from each other; and that one of them terminated in a ſmall oblong veſicle, ſituated on the ſide of the ſmall cornua of the os hyoides. Later anatomiſts, however, have obſerved no ſuch ducts.

The papillæ of the ſecond kind, or ſemilenticulares, are ſmall orbicular eminences, only a little convex, their circular edge not being ſeparate from the ſurface of the tongue. When we examine them in a ſound tongue, with a good microſcope, we find their convex ſides full of ſmall holes or pores, like the end of a thimble.

They lie chiefly in the middle and anterior portions of the tongue; and are ſometimes moſt viſible on the edges, where they appear to be very ſmooth and poliſhed even to the naked eye, and ſometimes in living ſubjects. They ſoon loſe their conſiſtence after death;

 ſo

that, by rubbing them feveral times, they may be drawn out in form of fmall foft pyramids inclined to one fide.

The papillæ of the third kind, or villofæ, are the fmalleft and moft numerous. They fill the whole furface of the upper fide of the tongue, and even the interftices between the other papillæ. They would be more properly named *papillæ conicæ* than *villofæ*, from the figure which they appear to have when examined thro' a microfcope in clear water. They are naturally foftifh, but they become extremely flaccid after death; fo that by handling them they may be made fhort and thick, whereas they are naturally long and fmall.

The flefhy fibres of which the tongue is compofed, and which go no further than the tongue, may be termed *mufculi linguæ interiores*, and they are the fame which Spigelius named *mufculi linguales*. The fibres thefe mufcles confift of, are of three general kinds; longitudinal, tranfverfe, and vertical; and each of thefe fituations admits of different degrees of obliquity. The longitudinal fibres point to the bafis and apex of the tongue; and feem partly to be expanfions of the mufculi ftylo-gloffi, hyo-gloffi, genio-gloffi, and lingualis. The vertical fibres feem likewife to be in part produced by thefe mufcles.

Befides thefe mixed productions, there is a diftinct plane of longitudinal fibres, which run near the furface of the upper fide of the tongue, and a diftinct tranfverfe plane under them. All thefe fibres are partly interwoven, one portion of them terminating at the two edges of the tongue, and the other at the bafis and point, without going to any other part; and they lie immediately above thofe that belong to the genio-gloffi. To difcover all thefe different fibres, and their different degrees of direction, we need only cut the tongue longitudinally, after it has been boiled, or long macerated in ftrong vinegar.

The mufculi exteriores, are thofe which by one extremity make a part of the body of the tongue, and are fixed by the other in fome part without the tongue. Of thefe

thefe we commonly reckon three pairs; ftylo-gloffi, hyo-gloffi, genio-gloffi.

The mufcles which move the os hyoides belong likewife to the tongue, and are the principal directors of its motions. The names of thefe mufcles may be remembered to be as follows: *Mylo-hyoidæi*, *genio-hyoidæi*, *ftylo-hyoidæi*, *omo-hyoidæi*, *fterno-hyoidæi*.

The ftylo-gloffi are two long, fmall mufcles, which run down from the ftyloide apophyfes or epiphyfes, and form two portions of the lateral parts of the tongue. Each mufcle is fixed in the outfide of the apophyfis ftyloides by a long tendon, being the uppermoft of the the three mufcles fixed in that apophyfis, which at Paris go by the name of *Riolan's nofegay*. The ftylo-hyoidæus is the loweft; and the ftylo-pharyngæus is in the middle, but more backward.

As it runs down almoft oppofite to the infide of the angle of the lower jaw, it fends off a pretty broad and fhort lateral aponeurotic ligament, which, being fixed in that angle, ferves for a frænum or ligamentum fufpenforium to the mufcle in this part of its courfe. From thence it paffes on to the fide of the bafis of the tongue, where it firft of all adheres clofely to the lateral portion of the hyo-gloffus; and then forms, together with that mufcle, a large portion of the fide of the tongue.

The hyo-gloffi are each inferted in three parts of the os hyoides that lie near each other; in the bafis, in the root of the great cornua, and in the fymphyfis between thefe two: and on this account the hyo-gloffus has been divided by fome into two or three diftinct mufcles, called *bafio-gloffus*, *cerato-gloffus*, and *chondro-gloffus*. In fome fubjects they may be eafily feparated, the three portions being fimply contiguous to each other; but it is needlefs to burden the memory with fo many ufelefs names, and therefore I defcribe them all as one mufcle by the name of *hyo-gloffus*.

It is fituated on the infide, and a little lower than the ftylo-ſtylo-gloſſus, with which it forms the lateral part of the tongue. The portion inſerted in the baſis of the os hyoides lies more anteriorly, and is larger than the other two; that which is inſerted in the ſymphyſis is the leaſt, and that inſerted in the great cornua the moſt poſterior. This muſcle is partly ſuſtained by the mylo-hyoïdæus, as by a girth; and the anterior portion is diſtinguiſhed from the reſt by the paſſage of the nerves of the fifth pair, and of the arteries which accompany them.

The genio-gloſſi are ſituated cloſe to each other, on the lower ſide of the tongue. Each muſcle is inſerted in the inner or backſide of the ſymphyſis of the lower jaw, immediately above the genio-hyoidæus. From thence it runs backward toward the os hyoides, to which the loweſt fibres are connected by a ligamentary membrane; and in this courſe its fibres are ſpread through the ſubſtance of the tongue in a very ſingular manner.

Of theſe fibres, ſome run directly toward the os hyoides, all the way to the baſis of the tongue; ſome are inflected forward, and go to the point of the tongue; and the reſt are diſtributed in a radiated manner, forward, upward, and backward, in the ſubſtance of the tongue; and the middle fibres expand laterally toward the edges of the tongue.

The two genio-gloſſi run cloſe to each other, as if they formed but one maſs; but they are evidently divided by a very thin cellular membrane, or middle ſeptum, which penetrates a good way between the lateral or right and left halves of the tongue, lying in the ſame plane with the linea mediana of the upper ſide of the tongue.

When we ſeparate theſe two muſcles from the chin, they preſently contract ſo much, that their anterior extremities, which lay under the point of the tongue, are as far back as the middle of it. It is in this preternatural ſituation that we ſee theſe muſcles repreſented in fi-

figures given by very great anatomifts, and drawn and engraved by very good artifts, in which figures the whole beauty of their true mechanifm is loft.

Thefe two mufcles, by their pofterior ftraight fibres which go to the bafis, can draw the tongue out of the mouth, and bring it back again by their anterior bent fibres, which go to the point. They can either fucceffively, or all at once, make the tongue longitudinally hollow, or like a groove; and they can at the fame time contract it, by the lateral expanfion of the middle fibres. I pafs over many other motions which thefe mufcles are capable of performing, from whence I formerly ufed in my private courfes to call them *mufculi polychrefti*.

When either of the ftylo-gloffi acts, it turns the tongue toward the cheek, and forces the aliment between the upper and lower molares. When they act jointly with the lateral portions of the fuperior flefhy plane of the tongue, they turn the tongue obliquely upward to the teeth of the upper jaw, and near the cheeks, as when we bring down any part of the food that may have ftuck there after maftication. When they act jointly with the lateral portions of the hyo-gloffi, they turn the tongue downward between the lower teeth and the cheek.

When all the parts of the hyo-gloffi act together, they fhorten the tongue. They likewife turn the point of the tongue between the teeth and the under lip, and make it pafs over that lip. The fuperior flefhy plane of the body of the tongue bends it upward toward the palate, and makes it pafs along and lick the upper lip. The mylo-gloffi ferve as a frænum to one fide of the bafis, while the point is turned to the other fide. The ligamenta fufpenforia of the ftylo-gloffi may anfwer the fame purpofe, and even fupply the want of the mylo-gloffi.

Befides the membranes of the tongue already defcribed, it is cuftomary to mention another, called *membrana*

brana reticularis; which is commonly demonſtrated from the boiled tongues of oxen or ſheep; and ſome pretend to have ſhowed it in the human tongue, which I own I have never been able to do. It is now a long time ſince I ſhowed, that what they take from the tongues of oxen and ſheep is not a true membrane, but a kind of clear mucilaginous ſubſtance, which lies between the papillary and external membranes, and which by boiling becomes white, and acquires ſolidity enough to be taken out in large portions; and that the holes found in it are owing to the ſmall pyramidal papillæ.

The tongue is fixed in the mouth, not only by muſcles, but alſo by ligaments, which are for the moſt part membranous. The principal ligament is that called the *frænum*, which is the prominent fold that appears firſt under the tongue when we raiſe it, with the mouth opened; and is no more than a continuation or looſe duplicature of that membrane which covers the inferior cavity of the mouth. It covers the curvature of the anterior portion of the genio-gloſſi from the point of the tongue, almoſt as high as the middle interſtice between the lower dentes inciſorii.

The other ligaments of the tongue are the ſmall membranous fold which runs along the middle of the convex ſide of the epiglottis to the baſis of the tongue, and the membranous folds which cover the inferior half-arches of the ſeptum palati. Theſe three folds are continuations of the membrane which covers the neighbouring parts. The aponeurotic ligaments of the ſtylo-gloſſus may be looked upon as true lateral ligaments of the tongue; and they adhere a little to the lower part of the muſculus pterygöidæus internus or anterior.

The principal blood-veſſels of the tongue are thoſe that appear ſo plainly on its lower ſurface on each ſide of the frænum; and they conſiſt of one artery and one vein, which accompany each other, and are called *arteriæ et venæ ſublinguales* or *raninæ*. The veins lie next the

the frænum, and the arteries on the other ſide of the veins. The arteries are rami of the ſecond internal or anterior branch of the external carotid on each ſide, and communicate with the firſt external or poſterior branch of the ſame carotid, &c. The veins are commonly rami of a branch of the external anterior jugular vein, deſcribed among the other veins.

We obſerve four nervous ropes to go very diſtinctly to the baſis of the tongue, and to continue their courſe through its whole ſubſtance all the way to the point. Two of theſe ropes are rami of the inferior maxillary nerves, or of the third branch of the fifth pair from the medulla oblongata. The other two are the nerves of the ninth pair. The two firſt I have already named *linguales* or *hypo-gloſſi minores*, and the other two *linguales* or *hypo-gloſſi majores*. The majores are inferior and internal, the minores ſuperior and external or lateral. The ſmall portion or firſt branch of the nervus ſympatheticus medius, or of the eighth pair, ſends likewiſe a nerve to each ſide of the tongue.

The great lingual nerve on each ſide runs forward between the muſculus mylo-hyoidæus and hyo-gloſſus, under the genio-gloſſus, and is diſtributed to the fleſhy fibres all the way to the point of the tongue, communicating by ſeveral ſmall filaments with the lingualis minor, and with the nerve from the eighth pair. For the other diſtributions of it, I refer to the deſcription of the nerves.

The ſmall lingual nerve on each ſide goes off from the maxillaris inferior, ſometimes at, and ſometimes before, its paſſage between the pterygoide muſcles. Afterwards, ſeparating more and more from the trunk, it paſſes under the lateral part of the tongue, over the ſublingual gland; of which hereafter. It ſupplies the neareſt parts of the tongue as it paſſes; and then entering its ſubſtance, terminates at the point, having ſent a great number of filaments to the papillary membrane. It communicates, as has been ſaid, with the lin-

lingualis major, and with the nerve from the eighth pair.

This lingual nerve, a little after it leaves the maxillaris inferior, is accompanied by a ſmall diſtinct nerve, which runs upward and backward toward the articulation of the lower jaw in company with the lateral muſcle of the malleus; paſſes through the tympanum between the handle of the malleus and the long leg of the incus, by the name of *chorda tympani;* and afterwards, perforating the back-ſide of the tympanum, unites with the portio dura of the auditory nerve, as has been already ſaid in the deſcription of the ear.

This ſmall nervous rope has been looked upon by anatomiſts as a kind of ſmall recurrent of the nervus lingualis; but as in ſome ſubjects it appears to make ſimply an acute angle with the lingual nerve, and as this lingual nerve is ſomething larger after this angle, it ought rather to be believed to come from the tympanum, and to unite with the lingual nerve, than to ariſe from this nerve, and run up to the tympanum. In ſome ſubjects, the union of this nerve with the lingualis is in a manner plexiform, and very difficult to be unfolded.

The lingual nerve of the eighth pair, which is its firſt branch, runs firſt of all on the inſide of the digaſtric muſcle of the lower jaw, and ſupplies the geniohyoidæi, the neighbouring muſcles of the baſis of the tongue, and thoſe of the pharynx. Afterwards it ſends out the ramifications, and forms the communications deſcribed in the hiſtory of the nerves; and laſtly goes to the lower part of the tongue, where it communicates with the lingual ramus of the fifth pair, and with the lingual ramus of the ninth.

The tongue is the organ of the ſenſe called the *taſte*, by means of the papillæ, eſpecially the villoſæ or pyramidales. "The different ſtate of the papillæ with reſpect to their moiſture, figure, or covering, ſeems to produce a conſiderable difference in the taſte, not only in in different people, but in the same person in sickness and health. By the sensation of taste we are enabled ot distinguish wholesome and salutary food from that which is unhealthy: and we suppose that the degree of taste, in some animals, is in proportion to the length of these papillæ; for in the sheep and ox, where the sensation of taste is extremely acute, the papillæ are very long." It is not as yet discovered in what manner the papillæ semi-lenticulares contribute to the taste; and the capitatæ ought to be looked upon as salival glands.

The tongue is likewise one of the principal instruments of speech, and of the articulation of the voice. Riolan, in his Anthropographia, mentions a child of five years of age, who, though he had lost his tongue by the small-pox, but not the uvula, continued still to speak almost as distinctly as before. Probably the basis of the tongue still remained. M. de Jussieu has published an observation in the Memoirs of the Royal Academy concerning a little girl who could speak, though she was born without a tongue; in room of which there was only a kind of small tubercle.

The tongue serves also to collect all the morsels which we chew; to turn them in different manners, and to different parts of the mouth; and to rub off whatever sticks to the palate: and it is useful in spitting, sucking, &c. It bears a great part in deglutition, being assisted by the digastric muscles; which, by contracting at the same time that the other muscles press the lower jaw against the upper, raise the os hyoides, and fix it at a convenient height; that the stylo-glossi and hyo-glossi may make the basis of the tongue bear back upon the morsel which is to be swallowed, and so force it into the pharynx; the portions of which, that are at that time immediately above the morsel, do instantly contract, and push it into the œsophagus.

§ 5. *The*

§ 5. *The Cheeks, Lips, and Gums.*

The cheeks and lips form the ſides and entry of the cavity of the mouth. They are formed in general by the connection of ſeveral fleſhy portions of different breadths, fixed round the convex ſides of the two jaws, covered on the outſide with the ſkin and fat, and lined on the inſide by a glandulous membrane. Beſides all this, the lips ſeem likewiſe to have a ſoft ſpongy ſubſtance in their compoſition, which ſwells and ſubſides on certain occaſions, independently of the action of the muſcles belonging to them, and is mixed with fat.

The ſubſtance which forms the red border of the lips is very different from the reſt of the ſkin, being a collection of very fine, long, villous papillæ, cloſely connected together, and covered by a fine membrane, which ſeems to be both a continuation of the epidermis, and of that pellicle which covers the glandulous membrane of the cavity of the mouth. This ſubſtance is extremely ſenſible, and very painful when the outer membrane is by any accident deſtroyed. The internal membrane of the upper lip forms a ſmall middle frænum above the firſt dentes inciſorii.

The gums are that reddiſh ſubſtance like leather, which covers the two ſides of the whole alveolary border of both jaws, inſinuates itſelf between all the teeth, ſurrounds the collar of each tooth in particular, and adheres very ſtrongly to them. Therefore the outer and inner gums are continuous, and both together form juſt as many openings as there are teeth.

The ſubſtance of the gums is of a very ſingular ſtructure, reſembling, in ſome meaſure, the texture of a hat, ſuppoſed to be very compact and elaſtic. It is not immediately fixed to the bones of the jaws, but by the intervention of the perioſteum, with which it is perfectly united; and it is covered by a fine ſtrong even mem-

membrane, which ſticks very cloſe to the ſubſtance of the gums; and ſeems to be a continuation of that thin membrane which goes to the lips and cheeks, and of that which goes to the tongue.

The arteries which go to the lips, cheeks, and gums, are ramifications of the external carotid, and chiefly of thoſe branches called *maxillares externæ et internæ.* The veins are ramifications of the external anterior jugular.

The nerves of theſe parts come from the maxillaris ſuperior and inferior, which are branches of the fifth pair; and alſo from the portio dura of the auditory nerve, or ſympatheticus minimus; the ramifications of which are ſpread in great numbers on all theſe parts, and communicate in a pretty ſingular manner with the nerves of the fifth pair in ſeveral places, as may be ſeen in the deſcription of the nerves.

There is ſo much variety to be met with in the muſcles of the lips in different ſubjects, that it is not at all ſurpriſing to find the deſcriptions given of them by anatomiſts very unlike one another. In ſome ſubjects, portions of theſe muſcles are wanting; in ſome they can ſcarcely be diſtinguiſhed, becauſe of the paleneſs and attenuation of the fibres; and in others, there are really ſome particular faſciculi which are not generally to be found. About fifteen years ago I diſſected an old woman; in which ſubject alone I obſerved a great many ſingular things which I have not met with in great numbers of other ſubjects more proper for diſſection. In this ſubject, the muſcles of the face in general were very much multiplied, and very diſtinct.

The muſcles of the lips are commonly divided into common and proper. The common muſcles are thoſe which end at the angles or commiſſures of the two lips; and thoſe are proper which are fixed in one lip only; which are again ſubdivided into the proper muſcles of the upper lip, and proper muſcles of the under lip.

All theſe muſcles have particular names; ſome of which are taken from ſomething in the conformation of the muſcles, ſome from the inſertions or ſituation, and ſome from the uſes attributed to them.

The muſcles to which I confine myſelf may be enumerated in the following order. *Muſculi communes:* Semi-orbiculares, ſupra-ſemi-orbiculares, buccinatores, zygomatici majores. *Muſculi proprii labii ſuperioris:* Zygomatici minores, canini, inciſorii laterales, inciſorii medii. *Muſculi proprii labii inferioris:* Tringulares, tringularium collaterales, quadratus, inciſorii inferiores, cutanei *.

The upper lip is ſometimes moved by the action of the muſcles of the noſe, eſpecially of the pyramidales; and both lips, either jointly or ſeparately, are moved by ſuction, without the aſſiſtance of the muſcles belonging to them.

The ſemi-orbiculares are commonly looked upon as one muſcle ſurrounding both lips; from whence it is called *orbicularis:* but when we examine carefully the angles of the lips, we find that the fibres of the upper lip interſect thoſe of the under lip; and we eaſily diſtinguiſh the muſcular arch of one lip from that of the other: and for this reaſon I divide this muſcle into two, and I call them by the common name of *ſemi-orbicularis*, or I call one of them *ſemi-orbicularis ſuperior*, and the other *ſemi-orbicularis inferior;* but the name of *ſemiovales* would be ſtill more proper.

The ſuperior ſemi-orbicular muſcle is oftentimes broader than the inferior; and it has this peculiarity likewiſe, that all its fibres do not go to the corner of the mouth, but terminate by degrees between the middle and extremities of this arch, nearly like the ſemi-oval fibres of the upper palpebra. The inferior ſemi-orbicular muſcle is commonly more uniform in the diſpoſition of its fibres.

The

* For the other names of theſe muſcles, ſee Vol. I. part ii. chap. 6.

The buccinatores are two in number; each of them ſituated tranſverſely between the poſterior part of the two jaws and the corner of the mouth. They are broad backward and narrower forward, in the ſhape of a triangle or trapezium; and they form a conſiderable portion of the cheeks, and for that reaſon are ſometimes called the *muſcles of the cheeks*. To have a juſt idea of theſe muſcles, we muſt be made acquainted with a ligament on each ſide of the face, which I call *ligamentum inter-maxillare*, becauſe it connects the two jaws, and alſo gives inſertion to the poſterior fibres of the buccinator.

This ligament is ſtrong and pretty broad. It is fixed by one end to the outſide of the upper jaw above the laſt dens molaris, and at the ſide of the apophyſes pterygoides, where it adheres very cloſely to the muſculus pterygoidæus internus. By the other end it is fixed in the poſterior or ſuperior extremity of the oblique prominent line on the outſide of the lower jaw, below the laſt dens molaris. It ſerves likewiſe as a frænum to check and limit the depreſſion of the lower jaw in opening the mouth, and we may feel it ourſelves, with the end of the finger in the mouth, eſpecially when it is wide open.

The buccinator is inſerted poſteriorly in three different places. The middle fibres are fixed tranſverſely in the ligamentum intermaxillare, and run directly to the corner of the mouth. The ſuperior fibres run down in an oblique graduated manner, from the alveoli of the upper jaw to the corner of the mouth; and the interior fibres run up from the lower jaw in the ſame manner. All theſe fibres contract by degrees as they approach the commiſſure of the lips, where they run in behind the extremities and union of the ſemi-orbiculares, by which they are covered, and to which they adhere cloſely. There is a large hollow between this muſcle and the maſſeter filled with fat.

The zygomatici majores are two muſcles, ſituated one on each ſide, between the zygoma and the corner of the mouth. Each muſcle is thin, long, oblique, and fixed by one extremity to the lower edge of that portion of the os malæ, which is connected with the zygomatic apophyſis of the os temporis. From thence it runs down obliquely from behind forward, being in its paſſage commonly involved in fat. It ends at the commiſſure of the two lips, adhering ſtrongly to the buccinator which covers it. This muſcle is very often complex.

The zygomatici minores are two ſmall ſlender muſcles, lying above the great zygomatici, and almoſt parallel to them. Their ſuperior extremity ſeems to be a detachment from the lower fibres of the orbicularis palpebrarum; but they may always be diſtinguiſhed. Their lower extremity unites with the neighbouring inciſorius. Theſe muſcles are quite buried in fat, and for that reaſon often diſappear.

Each of the two canini is fixed by a broad inſertion in the upper jaw above the ſocket of the dens caninus, in a depreſſion below the inferior edge of the orbit near the os malæ. From thence it runs down a little obliquely, croſſing the lower extremity of the zygomaticus major, which covers it at this place. Afterwards it terminates at the extremity of the arch of the ſemi-orbicularis ſuperior, and communicates by ſome fibres with the triangularis. I formerly looked upon this as a neutral muſcle, that is, as being neither a proper muſcle of the upper lip, nor common to both.

Each of the two inciſorii laterales is a ſort of biceps, its upper part being divided into two portions which unite below. One of theſe ſuperior portions is larger than the other, and is fixed in the os maxillare below the middle tendon of the orbicularis palpebrarum, ſeeming to communicate by ſome fibres with the contiguous fibres of that muſcle. From thence it runs down a little obliquely toward the cheek, along the apophyſis naſalis, mixing with the pyramidalis naſi, and ſending ſome

ſome fibres to the nares. Afterwards it paſſes over and adheres to the myrtiformis or tranſverſalis naſi, and unites with the other portion.

This other portion is fixed by a broad inſertion immediately below the edge of the orbit, in the os maxillare, near the union of this bone with the os malæ; and likewiſe a little in the laſt named bone, being at this place covered by the inferior portion of the orbicularis palpebrarum, with which it has ſometimes a kind of communication. From thence it runs down obliquely toward the noſe, and unites with the firſt portion.

The two portions thus united and contracting in breadth, run behind the ſemi-orbicularis ſuperior, and are fixed therein oppoſite to the lateral dens inciſorius. Sometimes it ſends a ſmall faſciculus of fibres to the muſculus caninus, which may be reckoned an aſſiſtant to that muſcle, and named *caninus minor.*

The inciſorii medii are commonly called *inciſorii minores Cowperi*, or *inciſorii minores ſuperiores*. They are two ſmall ſhort muſcles ſituated near each other below the ſeptum narium. They are fixed by one extremity in the os maxillare, on the alveoli of the firſt inciſores behind the ſemi-orbicularis ſuperior, and by their other extremity in the middle and ſuperior part of the ſubſtance of the upper lip, near the nares, in which they likewiſe have an inſertion; and they ſometimes ſend lateral fibres to the ſemi-orbicularis.

Each of the two triangulares is fixed by a broad extremity in the outſide of the baſis of the lower jaw, from the maſſeter to the hole near the chin. From thence it aſcends, contracting in breadth in a bent triangular form; runs in between the extremities of the buccinator and zygomaticus major, to both which it adheres very cloſely; and terminates at the commiſſure of the lip, partly in the ſemi-orbicularis ſuperior, and partly, tho' not always equally, in the ſem-iorbicularis infe-

 rior.

rior. This muſcle ſeems ſometimes to be a continuation of the caninus major.

The quadratus forms the thick part of the chin below the under lip. It is a very complex muſcle, and very difficult to be prepared, becauſe its fibres are interwoven with a great quantity of fat, or a pellicular texture of the membrana adipoſa. It is firſt of all inſerted in the foreſide of the lower jaw, where it partly fills the broad foſſula on each ſide of the ſymphyſis. From thence it runs up, interſecting, along the ſymphyſis, the contiguous fibres of the ſkin, and terminates by a broad inſertion in the ſemi-orbicularis inferior. The direction of the other fibres of which it is compoſed varies in different ſubjects, and it communicates by ſome fibres with the cutanei.

The inciſorii inferiores are two ſmall muſcles, commonly mentioned with the addition of M. Cowper's name. Each of them is fixed by the ſuperior extremity, on the alveoli of the lateral inciſores of the lower jaw. From thence they run down, approaching each other, and are inſerted together in the lower part of the middle of the ſemi-orbicularis inferior.

On the outſide of the ſuperior inſertion of each of theſe muſcles, we meet with a faſciculus of fibres, which ſeem to be detached from it near the inciſores. This faſciculus goes off laterally in form of an arch, and unites with the fibres of the ſemi-orbicularis inferior, with which it may be eaſily confounded. It may be looked upon as a muſculus acceſſorius to the ſemi-orbicularis inferior, or as a collateralis to the inciſorius minor.

The two muſculi cutanei form a kind of fleſhy membrane, which covers the whole foreſide of the throat and neck, from the cheek and chin, all the way down below the claviculæ, and adheres very ſtrongly to the membranous or aponeurotic expanſion deſcribed above. This expanſion has a particular adheſion to the anterior portion of the baſis of the lower jaw, of the ſame kind with

with that at the lower part of the zygoma; and it is ſpread over all the muſcles that lie round the neck, and over the upper portion of the pectorales majores, deltoides, and trapezii.

The fibres of each cutaneous muſcle run obliquely upward and forward, and meet and ſeem to interſect thoſe of the other muſcle at acute angles, from the ſternum all the way to the chin. They adhere very cloſely to the ſkin by the intervention of the cellular ſubſtance. From the clavicles to the upper part of the neck theſe muſcles are very thin, and from thence increaſe a little in thickneſs as they approach the baſis of the lower jaw, and eſpecially from the maſſeter to the chin.

They adhere ſtrongly to the lower portion of the maſſeter, triangularis, and quadratus; and on the maſſeter and buccinator their fleſhy fibres become aponeurotic; but continue longer on the triangularis, being mixed with the fibres of that muſcle all the way to the commiſſure of the lips. They likewiſe advance a little on the neighbouring portion of the quadratus.

The portion of theſe muſcles which anſwers to the baſis of the triangularis, is in a manner divided into two fleſhy laminæ, the outermoſt of which is in what advances over the triangularis and quadratus, the other being inſerted ſeparately in the lower jaw. I have ſometimes obſerved a part of the fleſhy extremity of the right ſide, to paſs before the ſymphyſis of the chin, over a like part from the left ſide, the one covering the other.

The common muſcles of the lips either draw both corners of the mouth at once, or only one at a time, according to the different direction of their fibres. The proper muſcles pull the different parts of the lips in which they are inſerted. The buccinators in particular may ſerve to move the food in maſtication. An entire treatiſe might be written on the almoſt innumerable combinations of the different motions of all theſe mufcles, according to the different paffions, and according to the different poftures in which a man may put his face. None are more affecting than thofe produced by the cutanei alone, efpecially in weeping, which they do by their adhefions to the triangulares, &c. But by their infertions in the bone of the lower jaw, they draw up the lower part of the teguments of the neck, and thofe of the breaft next to thefe; for they cannot move the jaw. In old people, and in thofe who are very much emaciated, thefe mufcles may be perceived by the eye, under the chin, and on the neck.

§ 6. *The Salival Glands*, &c.

By faliva we mean in general, that fluid by which the mouth and tongue are continually moiftened in their natural ftate. This fluid is chiefly fupplied by glands, called for that reafon *glandulæ falivales*, of which they commonly reckon three pairs, two parotides, two maxillares, and two fublinguales. Thefe are indeed the largeft, and they furnifh the greateft quantities of faliva; but there are a great number of other leffer glands of the fame kind, which may be reckoned affiftants or fubftitutes to the former. All thefe may be termed *falival glands*, and they may be enumerated in the following manner: Glandulæ parotides, glandulæ maxillares, glandulæ fublinguales, glandulæ molares, glandulæ buccales, glandulæ labiales, glandulæ linguales, amygdalæ, glandulæ palatinæ, glandulæ uvulares, glaindulæ arytenoidææ, glandula thyroidæa.

The parotides are two large, whitifh glands, irregularly oblong and protuberant, fituated on each fide, between the external ear and the pofterior or afcending ramus of the lower jaw, and lying on fome part of the neighbouring maffeter mufcle. The fuperior portion of this gland lies before the cartilaginous meatus of the ear, and touches the apophyfis zygomatica of the os tem-

temporis; and it is extended forward and backward under the lobe of the ear, as far as the maſtoide apophyſis.

From the anterior and ſuperior portion of this gland, a white membranous duct or canal is produced by the union of a great number of ſmall tubes repreſenting ſo many roots. This duct runs obliquely forward on the outſide of the maſſeter; and then perforates the buccinator from without inward, oppoſite to the interſtice between the ſecond and third dentes molares, where the hole or orifice repreſents the ſpout of an ewer.

This canal is named *ductus ſalivalis Stenonis*, or *ductus ſuperior.* It is about the twelfth part of an inch in diameter, and in ſome ſubjects is partly covered by ſmall glandular bodies united with it in different quantities. The arteria and vena angularis run up over this duct, and the portio dura of the auditory nerve runs thro' the gland itſelf; and it alſo receives filaments from the ſecond vertebral pair.

The maxillary glands are ſmaller and rounder than the parotides; and are ſituated each on the inſide of the angle of the lower jaw, near the muſculus pterygoidæus inferior. From the inſide, or that which is turned to the muſculus hyo-gloſſus, each of them ſends out a duct in the ſame manner as the parotides; but it is ſmaller and longer, and goes by the name of *ductus ſalivalis Whartoni*, or *ductus inferior.*

This duct advances on the ſide of the muſculus genio-gloſſus, along the inner part and ſuperior edge of the glandula ſublingualis, to the frænum of the tongue, where it terminates by a ſmall orifice in form of a papilla.

The glandulæ ſublinguales are likewiſe two in number, of the ſame kind with the former, only ſmaller, ſomething oblong, and flatted like a blanched almond. They are ſituated under the anterior portion of the tongue, one on each ſide, near the lower jaw, on the lateral portions of the muſculi mylo-hyoidæi which ſuſtain

ſtain them. The two extremities of each gland are turned backward and forward, and the edges obliquely inward and outward.

They are covered on the upper ſide by a very thin membrane, which is a continuation of the membrane that covers the under ſide of the tongue. They ſend out laterally ſeveral ſmall ſhort ducts which open near the gums by the ſame number of orifices, all ranked in the ſame line, at a ſmall diſtance from the frænum, and a little more backward. In many animals we find particular ducts belonging to theſe glands, like thoſe of the glandulæ maxillares, but they are not to be found ſo diſtinctly in men. The muſculi genio-gloſſi lie between the two ſublingual glands, and alſo between the two maxillary ducts.

The molares are two glands nearly of the ſame kind with the former, each of them being ſituated between the maſſeter and buccinator; and in ſome ſubjects they may eaſily be miſtaken for two ſmall lumps of fat. They ſend out ſmall ducts which perforate the buccinator, and open into the cavity of the mouth, almoſt overagainſt the laſt dentes molares; and from thence M. Heiſter, who firſt deſcribed them, called them *glandulæ molares*.

All the inſide of the cheeks near the mouth, is full of ſmall glandulous bodies, called *glandulæ buccales*, which open by ſmall holes or orifices through the inner membrane of the mouth. The membrane which covers the inſide of the lips, a continuation of that on the cheeks, is likewiſe perforated by a great number of ſmall holes, which anſwer to the ſame number of ſmall glands, called *glandulæ labiales*: The glandulæ linguales are thoſe of the foramen cæcum of the baſis of the tongue, which have been already ſpoken to.

I have alſo explained the glandulæ palatinæ, or thoſe that belong to the arch and ſeptum of the palate; and the glandulæ arytenoidææ were deſcribed with the larynx. The uvular glands are only a continuation of the

the membrane of the palate in form of a ſmall bunch of grapes. We might likewiſe reckon among the ſalival glands thoſe of the ſuperior portion of the pharynx mentioned in the deſcription of that part, and alſo the glandular bodies of the membrana pituitaria of the nares, and of the ſinuſes which communicate with theſe.

The amygdalæ are two glandular bodies of a reddiſh colour, lying in the interſtices between the two lateral half-arches of the ſeptum palati, one on the right, the other on the left ſide of the baſis of the tongue. Their appearance is not unlike that of the outſide of an almond ſhell, both becauſe their ſurface is uneven, and becauſe it is full of holes big enough to admit the head of a large pin.

Theſe holes, which reproſent a ſieve, or a piece of net-work, are continued to an irregular ſinus or cavity within the gland, filled commonly with a viſcid fluid, which comes from the bottom of the ſinus, and is from thence gradually diſcharged through theſe holes into the throat. To ſee the true ſtructure of the amygdalæ, they muſt be examined in clear water, having firſt been waſhed in lukewarm water, and handled very gently.

The thyroide gland is a large whitiſh maſs which covers the anterior convex ſide of the larynx. It ſeems at firſt ſight to be made up of two oblong glandular portions united by their inferior extremities, below the cricoide cartilage, in ſuch a manner as to have ſome reſemblance to a creſcent, with the cornua turned upward. It is of a moderate thickneſs, and bent laterally like the thyroide cartilage, from which its name is taken. The two lateral portions lie on the muſculi thyrohyoidæi, and the middle or inferior portion on the crico-thyroidæi. The thyro-pharyngæi inferiores ſend fibres over this gland; and they communicate on each ſide, by ſome ſuch fibres, with the ſterno-thyroidæi and hyo-thyroidæi.

This gland ſeems to be of the ſame kind with the other

other ſalival glands, but it is more ſolid. Some anatomiſts thought they had diſcovered the excretory duct, but they miſtook a blood-veſſel for it. We ſometimes meet with a kind of glandular rope which runs before the cartilago-thyroides, and diſappears before the baſis of the os hyoides.

This glandular rope goes out from the common baſis of the lateral portions of the thyroide gland; and is loſt between the muſculi ſterno-hyoidæi, behind the baſis of the os hyoides, or between that baſis and the epiglottis. I have likewiſe ſhown, in my private courſes, ſmall openings on the ſide of the anterior ligament of the epiglottis, or that by which it is connected to the baſis of the tongue. One of theſe openings appears like a ſmall papilla; and this is the fartheſt that I have been able to trace the glandular rope.

The glandulæ lymphaticæ will come in more properly in a latter part of this work, with the deſcription of the abſorbent ſyſtem.

CHAP. II.

Of the THORAX.

§ 1. *Introduction.*

BY the thorax, we commonly underſtand all that part of the body which anſwers to the extent of the ſternum, ribs, and vertebræ of the back, both outwardly and inwardly.

The thorax is divided into the anterior part, called commonly the *breaſt*; the poſterior part, called the *back*; and the lateral parts, called the *right* and *left ſides*.

The

The external parts of the thorax, beſides the ſkin and membrana adipoſa, are principally the mammæ; and the muſcles which cover the ribs, and fill the ſpaces between them.

The muſcles are the pectorales, majores, and minores, ſubclavii, ſerrati majores, ſerrati ſuperiores poſtici, latiſſimi dorſi, and vertebrales; and to theſe we may add the muſcles which cover the ſcapula.

The internal parts of the thorax are contained in the large cavity of that portion of the trunk which the ancients called the *middle venter*, but the moderns name it ſimply the *cavity of the breaſt*. This cavity is lined by a membrane named *pleura*, which forms the mediaſtinum; and contains the heart and lungs, with the veſſels, &c. which go into or out from them: through it likewiſe the œſophagus paſſes to the ſtomach, and part of the nerves are contained in it which go to the contents of the abdomen.

External conformation of the thorax. The whole extent of the thorax in a living ſubject, is commonly determined not only by the ſternum, vertebræ of the back and ribs, but alſo by all that ſpace contained between the articulations of the two arms with the ſcapulæ and claviculæ; and in this ſenſe, the outſide of the thorax is broader above than below in a healthy ſubject who has a moderate ſhare of fleſh on his bones.

The breadth of the upper part of the breaſt is owing to the pectorales majores and latiſſimi dorſi viewed directly forward or backward. But when we take a direct lateral view of the breaſt, it appears narrower above than below, not only in an entire ſubject, but even after every thing has been removed that covers the ſides of the thorax, and in the ſkeleton itſelf.

The common integuments of the thorax are the ſame with thoſe of the abdomen; and the convex ſide of this part of the body is likewiſe covered by ſeveral muſcles. Anteriorly, we find the pectorales majores and minores, a large portion of the ſerrati majores, the ſub-

ſubclavii, a portion of the ſcaleni and of the obliqui abdominis externi. Poſteriorly, we have all the muſcles which cover both ſides of the ſcapula, the ſerrati poſtici, and a part of the ſacro-lumbares, longiſſimi dorſi, vertebrales, &c. as in the hiſtory of the muſcles. Among all the external parts of the thorax, only two are peculiar to it in the human body. I mean the two eminences called *mammæ*, which muſt therefore be deſcribed in this chapter.

Cavity of the thorax. The hard parts which form the ſides of the cavity of the thorax, are, The twelve vertebræ of the back, all the ribs, and the ſternum. The ſoft parts which complete the ſides, are, The membrane called *pleura*, which lines the cavity; and the muſculi intercoſtales, ſterno-coſtales, and diaphragma, already deſcribed among the muſcles.

All theſe hard and ſoft parts taken together, repreſent a kind of cage, in ſome meaſure of a conical figure, flatted on the foreſide, depreſſed on the backſide, and in a manner divided into two nooks by the figure of the vertebræ of the back, and terminated below by a broad arched baſis inclined backward. The intercoſtal muſcles fill up the interſtices betwixt the ribs, and ſo complete the ſides of the cavity: the baſis is the diaphragm; and the pleura not only covers the whole inner ſurface of the cavity, but, by forming the mediaſtinum, divides it into two, one on the right, the other on the left.

§ 2. *Mammæ.*

THE name of *mammæ*, or *breaſts*, is given to two eminences more or leſs round, ſituated in the anterior, and a little toward the lateral parts of the thorax, their centre or middle part lying almoſt oppoſite to the bony extremity of the ſixth true rib on each ſide. Their ſize and figure vary in the different ſexes and different ages.

In

In children of both ſexes, and in males of all ages, they are commonly no more than cutaneous tubercles, or ſoft verrucæ of a red diſh colour, called *papillæ* or *nipples*; each of them being ſurrounded by a ſmall, thin, and pretty broad circle or diſk, more or leſs of a browniſh colour and an uneven ſurface, termed *areola*.

In females come to the age of puberty, which is ſometimes ſooner, ſometimes later, a third part is joined to the two former, which is a convex protuberance, more or leſs round, of about five or ſix fingers in breadth; the papilla and areola being ſituated near the middle of its convex ſurface. This is what is properly termed *mamma*; and it may be termed the *body of the breaſt*, when compared with the other two parts. It increaſes with age, and is very large in women with child, and in thoſe that give ſuck. In old age it decreaſes and becomes flabby, loſing its natural conſiſtence and ſolidity.

Body of the Mammæ. The body of the mammæ is partly glandular, and partly made up of fat; or it is a glandular ſubſtance mixed with portions of the membrana adipoſa, the cellulous pelliculæ of which ſupport a great many blood-veſſels, lymphatics, and ſerous or lactiferous ducts, together with ſmall glandular moleculæ, which depend on the former; all of them being cloſely ſurrounded by two membranes continued from the pelliculæ.

The innermoſt of theſe two membranes, which is, in a manner, the baſis of the body of the mamma, is thick and almoſt flat, adhering to the muſculus pectoralis major. The ſecond or external membrane is thinner, forming a particular integument for the body of the mamma, more or leſs convex, and adhering cloſely to the ſkin.

The corpus adipoſum of the mamma in particular, is a ſpungy cluſter, more or leſs interlarded with fat, or a collection of membranous pelliculæ, which, by the particular diſpoſition of their outer ſides, form a kind of mem-

membrane in ſhape of a bag, in which all the reſt of the corpus adipoſum is contained. The anterior or outer portion of this bag, or that which touches the ſkin, is very thin; but that ſide next the pectoralis major is thick.

Ductus lactiferi. The glandular body contains a white maſs, which is merely a collection of membranous ducts, narrow at their origin, broad in the middle, and which contract again as they approach the papilla, near which they form a kind of circle of communication. They are named *ductus lactiferi*; "which, in their courſe, are accompanied by a ligamentous elaſtic ſubſtance, which terminates with them in the nipple: both this ſubſtance, and the ducts 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."

Areola. The coloured circle or diſk already mentioned, is formed by the ſkin; the inner ſurface of which ſuſtains a great number of ſmall glandular moleculæ, of that kind which Morgagni calls *glandulæ ſebaceæ.* They appear very plainly all over the areola, even on the outſide, where they form little flat heights or eminences at different diſtances quite round the circle.

Theſe tubercles are perforated by ſmall holes, through which a kind of ſebaceous matter, more or leſs liquid, "is poured out to defend the areola and nipple. Sometimes one or more of the lactiferous ducts have been found to terminate upon the ſurface of the areola."

Papilla. The tubercle which lies in the centre of the areola, is termed *papilla*, or the *nipple.* It is of different ſizes in different ages and conſtitutions, and in the different conditions of females in particular. In women with child, or who give ſuck, it is pretty large, and generally longer or higher than it is thick or broad; and

and when it happens to be ſhort, it cauſes great uneaſineſs to the child.

The texture of the nipple is ſpongy, elaſtic, and liable to divers changes of conſiſtence, being ſometimes harder, ſometimes more flaccid. It ſeems to be made up chiefly of ligamentary faſciculi; the extremities of which form the baſis and apex of the nipple. Theſe faſciculi appear to be gently folded, or curled, during their whole length; and if, by drawing the fibres out, theſe folds be deſtroyed, they return again as ſoon as that action ceaſes.

Between theſe ſpongy and elaſtic faſciculi lie from ſeven to twelve particular tubes at ſmall diſtances from each other, and all in the ſame direction. Theſe tubes end at the baſis of the papilla in the irregular circle of communication of the lactiferous ducts, and at the apex in the ſame number of almoſt imperceptible holes or orifices; and as they are cloſely united to the elaſtic faſciculi, they are folded in the ſame manner with them.

The body of the papilla is covered by a thin cutaneous production, and by the epidermis. Its outer ſurface is uneven, being full of ſmall tubercles and wrinkles; among which thoſe near the circumference of the nipple ſeem to have a tranſverſe or annular diſpoſition, which, however, is not uniform.

This diſpoſition or direction ſeems to be owing to the elaſtic folds already mentioned: and from this ſimple ſtructure it is eaſy to explain how infants in ſucking the nipple, and women in drawing the teats of cows, bring out the milk. For the excretory tubes being wrinkled in the ſame manner as the faſciculi, do, by theſe wrinkles or folds, as by ſo many valves, hinder the milk contained in the ducts from flowing out; but when the nipple is drawn and elongated, the tubes loſe their folds, and the paſſage becomes ſtraight. Beſides this, when they are drawn with a conſiderable force, the whole body of the mamma is increaſed in length and

and contracted in breadth, and thereby the milk is preſſed into the open tubes; and thus by barely preſſing the body of the breaſt, the milk may be forced toward the nipple, and even through the tubes: "but thoſe who underſtand the principles of the air-pump will more readily conceive the manner in which the child draws out the milk."

Arteries, veins, nerves, &c. The arteries and veins diſtributed through the mammæ, are ramifications of the arteriæ and venæ mammariæ; of which one kind comes from the ſubclaviæ, and are named *mammariæ internæ;* the others from the axillares, called *mammariæ externæ.*

Theſe veſſels communicate with each other, with thoſe near them, and with the vaſa epigaſtrica, as was obſerved in the deſcription of the arteries and veins. The nerves come chiefly from the coſtales, and, by means of theſe, communicate with the great nervi ſympathetici.

Uſes. The uſe of the mammæ in the nouriſhment of children is known to all the world; but it is not certainly known what the papillæ and areolæ in males can be deſigned for. Milk has been obſerved in them in children of both ſexes; and this happened to one of my own brothers when he was about two years of age.

§ 3. *Pleura and Mediaſtinum.*

THE pleura is a membrane which adheres very cloſely to the inner ſurface of the ribs, ſternum, and muſculi intercoſtales, ſub-coſtales, and ſterno-coſtales, and to the convex ſide of the diaphragm. It is of a very firm texture, and plentifully ſtored with blood-veſſels and nerves, in all which it reſembles the peritonæum; and likewiſe in that it is made up of an inner true membranous lamina, and a cellular ſubſtance on the outſide, which is a production or continuation of the lamina.

The

The cellular portion goes quite round the inner ſurface of the thorax, but the membranous portion is diſpoſed in a different manner. Each ſide of the thorax has its particular pleura, entirely diſtinct from the other, and making, as it were, two great bladders, ſituated laterally with reſpect to each other in the great cavity of the breaſt, in ſuch a manner as to form a double ſeptum or partition running between the vertebræ and the ſternum, their other ſides adhering to the ribs and diaphragm.

This particular duplicature of the two pleuræ is termed *mediaſtinum*. The two laminæ of which it is made up are cloſely united together near the ſternum and vertebræ; but in the middle, and toward the lower part of the foreſide, they are ſeparated by the pericardium and heart, as we ſhall ſee hereafter. A little more backward they are parted in a tubular form by the œſophagus, to which they ſerve as a covering; and in the moſt poſterior part, a triangular ſpace is left between the vertebræ and the two pleura from above downward, which is filled chiefly by the aorta.

Before the heart, from the pericardium to the ſternum, the two laminæ adhere very cloſely, and there the mediaſtinum is tranſparent, except for a ſmall ſpace near the upper part, where the thymus is ſituated: ſo that in this place there is naturally no interſtice or particular cavity. The apparent ſeparation is owing entirely to the common method of raiſing the ſternum, as was plainly demonſtrated by Bartholinus, my firſt maſter in anatomy, in his Treatiſe of the Diaphragm, publiſhed at Paris in 1676.

The mediaſtinum does not commonly terminate along the middle of the inſide of the ſternum, as the common opinion has been. I demonſtrated in the year 1715, to the Royal Academy of Sciences, that from above downward it inclines toward the left ſide; and that if, before the thorax is opened, a ſharp inſtrument be run through the middle of the ſternum, there will be almoſt the breadth of a finger between the inftrument and the mediaftinum, provided that the fternum remain in its natural fituation, and the cartilages of the ribs be cut at the diftance of an inch from it on each fide.

From all this we fee, not only that the thorax is divided into two cavities entirely feparated from each other by a middle feptum without any communication; but alfo that, by the obliquity of this partition, the right cavity is greater than the left; and from hence we may judge of the uncertainty of trepanning the fternum, which the ancients have recommended in fome cafes.

The cellular portion of the pleura connects the membranous portion of the fternum, ribs, and mufcles, to the diaphragm, pericardium, thymus, and veffels, and, in a word, to whatever lies near the convex fide of the membranous portions of the pleura. It likewife infinuates itfelf between the laminæ of the duplicature of which the mediaftinum is formed, and unites them together. It even penetrates the mufcles, and communicates with the cellular fubftance in their interftices, all the way to the membrana adipofa on the external convex fide of the thorax. In this the pleura refembles the peritonæum.

The furface of the pleura turned to the cavities of the breaft, is continually moiftened by a lymphatic ferofity which tranfudes through the pores of the membranous portion. This fluid is faid to be fecreted by imperceptible glands; but the exiftence of thefe glands has not been hitherto demonftrated, as was likewife obferved of the glands of the peritonæum.

Arteries and veins. The arteries and veins of the pleura are chiefly ramifications of the intercoftals; and thefe ramifications are exceedingly numerous, and for the moft part very fmall. The mammariæ internæ and diaphragmaticæ likewife fend branches hither, which communicate very frequently with thofe that come from the intercoftals.

The

The mediaſtinum has particular veſſels, called *arteriæ* and *venæ mediaſtinæ*, which are commonly branches of the ſubclaviæ. The mammariæ internæ ſend likewiſe ramifications to the fore-part of it, the diaphragmaticæ to the lower part, and the intercoſtales and œſophageæ to the back-part.

Nerves. The nerves are ramifications of the true intercoſtales, called otherwiſe *coſtales* and *dorſales*. Near the vertebræ they communicate with the great ſympathetic nerves, improperly called *intercoſtales*, and but very little with the middle ſympathetici, or thoſe of the eighth pair.

Uſe: The pleura ſerves in general for an inner integument to the cavity of the thorax. The mediaſtinum cuts off all communication between the two cavities, and hinders one lung from preſſing on the other when we lie on one ſide. It likewiſe forms receptacles for the heart, pericardium, œſophagus, &c.; and it is continued over the lungs in the manner which ſhall be explained hereafter.

Before we leave the pleura, it muſt be obſerved that theſe portions of it which adhere immediately to the ribs, may be looked upon as the perioſteum of their inner ſides. This adheſion keeps the pleura ſtretched, and hinders it from ſlipping or giving way. It likewiſe renders this membrane extremely ſenſible of the leaſt ſeparation cauſed by a coagulated lympha or accumulated blood; the nervous filaments being likewiſe in this caſe very much compreſſed in inſpiration by the ſwelling of the intercoſtal muſcles.

§ 4. *Thymus.*

THE thymus is an oblong glandular body, round on the upper part, and divided below into two or three great lobes; of which that toward the left hand is the longeſt. In the fœtus it is of a pretty large ſize; leſs in children, and very little in aged perſons. In children

ren it is of a white colour, ſometimes mixed with red; but in an advanced age its colour is generally dark.

The greateſt part of the thymus lies between the duplicature of the ſuperior and anterior portion of the mediaſtinum, and the great veſſels of the heart; from whence it reaches a little higher than the tops of the two pleuræ, ſo that ſome part of it is out of the cavity of the thorax; and in the fœtus and in children it lies as much without the thorax as within it.

Its particular inward ſtructure and ſecretions are not as yet ſufficiently known to determine its uſes; which, however, ſeem to be deſigned more for the fœtus than for adults. It has veſſels belonging to it, called *arteriæ* and *venæ thymicæ*.

§ 5. *Cor.*

Situation in general and conformation. The heart is a muſcular body ſituated in the cavity of the thorax, on the anterior part of the diaphragm, between the two laminæ of the mediaſtinum. It is in ſome meaſure of a conical figure, flatted on the ſides, round at the top, and oval at the baſis. Accordingly we conſider in the heart the baſis, apex, two edges, and two ſides; one of which is generally flat, the other more convex.

Beſides the muſcular body, which chiefly forms what we call the *heart*, its baſis is accompanied by two appendices, called *auriculæ*, and by large blood-veſſels; of which hereafter: and all theſe are included in a membranous capſula, named *pericardium*.

It is hollow within, and divided by a ſeptum which runs between the edges into two cavities, called *ventriculi*; one of which is thick and ſolid, the other thin and ſoft. This latter is generally termed the *right ventricle*, the other the *left ventricle*; though, in their natural ſituation, the right ventricle is placed more anteriorly than the left, as we ſhall ſee hereafter.

Each ventricle opens at the baſis by two orifices; one of of which anſwers to the auricles, the other to the mouth of a large artery; and accordingly one of them may be termed the *auricular orifice*, the other the *arterial orifice*. The right ventricle opens into the right auricle, and into the trunk of the pulmonary artery; the left into the left auricle, and into the great trunk of the aorta. At the edges of theſe orifices are found ſeveral moveable pelliculæ, called *valves* by anatomiſts; of which ſome are turned inward toward the cavity of the ventricles, called *triglochines*, or *tricuſpides;* others are turned toward the great veſſels, called *ſemilunares*, or *ſigmoidales*. The valvulæ tricuſpides of the left ventricle are likewiſe termed *mitrales*.

Ventriculi. The inner ſurface of the ventricles is very uneven, many eminences and cavities being obſervable therein. The moſt conſiderable eminences are thick fleſhy productions, called *columnæ*. To the extremities of theſe pillars are faſtened ſeveral tendinous cords, the other ends of which are joined to the valvulæ tricuſpides. There are likewiſe other ſmall ſhort tendinous ropes along both edges of the ſeptum between the ventricles. Theſe ſmall cords lie in an obliquely tranſverſe ſituation, and form a kind of network at different diſtances.

The cavities of the inner ſurface of the ventricles are ſmall deep foſſulæ or lacunæ placed very near each other, with ſmall prominent interſtices between them. The greateſt part of theſe lacunæ are orifices of the venal ducts, to be deſcribed hereafter.

Structure of the ventricles. The fleſhy or muſcular fibres of which the heart is made up, are diſpoſed in a very ſingular manner, eſpecially thoſe of the right or anterior ventricle; being either bent into arches, or folded into angles.

The fibres which are folded into angles are longer than thoſe which are only bent into arches. The middle of theſe arches, and the angles of the folds, are turned toward the apex of the heart, and the extremities of the fibres toward the bafis. Thefe fibres differ not only in length, but in their directions, which are very oblique in all, but much more fo in the long or folded fibres than in the fhort ones, which are fimply bent.

It is commonly faid that this obliquity reprefents the figure 8; but the comparifon is very falfe, and can only agree to fome bad figures drawn by perfons ignorant of the laws of perfpective.

All thefe fibres, regard being had to their different obliquity and length, are difpofed in fuch a manner, as that the longeft form partly the moft external ftrata on the convex fide of the heart, and partly the moft internal on the concave fide; the middle of the arches and the angles meeting obliquely and fucceffively to form the apex.

The fibres fituated within thefe long ones grow gradually fhorter and ftraighter all the way to the bafis of the heart, where they are very fhort and very little incurvated. By this difpofition, the fides of the ventricles are very thin near the apex of the heart, and very thick toward the bafis.

Each ventricle is compofed of its proper diftinct fibres, but the left ventricle has many more than the right. Where the two ventricles are joined, they form a feptum which belongs equally to both.

There is this likewife peculiar to the left ventricle, that the fibres which form the innermoft ftratum of its concave fide, form the outermoft ftratum of the whole convex fide of the heart, which confequently is common to both ventricles; fo that, by carefully unravelling all the fibres of the heart, we find it to be made up of two bags contained in a third.

The anterior or right ventricle is fomewhat larger than the pofterior or left, as was well obferved by the ancients, and clearly demonftrated by M. Helvetius. They are both nearly of the fame length in men; "the left is fometimes a little longer than the right," and in fome ſome ſubjects they end exteriorly in a kind of double apex.

All the fibres are not directed the ſame way, though they are all more or leſs oblique: for ſome end toward the right hand, others toward the left, ſome forward, ſome backward, and others in the intermediate places; ſo that, in unravelling them, we find that they croſs each other gradually, ſometimes according to the length of the heart, and ſometimes according to its breadth.

The tubes which croſs each other tranſverſely are much more numerous than thoſe which croſs longitudinally; which ought to be taken notice of, that we may rectify the falſe notions that have been entertained concerning the motion of the heart; namely, that it is performed by a contortion or twiſting like that of a ſcrew, or that the heart is ſhortened in the time of contraction, and lengthened in dilatation.

The fibres which compoſe the inner or concave ſurface of the ventricles do not all reach to the baſis; ſome of them running into the cavity, and there forming the fleſhy columnæ, to which the looſe floating portion of the tricuſpidal valves is faſtened by tendinous ropes.

Beſides theſe fleſhy pillars, the internal fibres form a great many eminences and depreſſions, which not only render the inner ſurface of the ventricles uneven, but give it a great extent within a ſmall compaſs. Some of theſe depreſſions are the orifices of the venal ducts found in the ſubſtance of the ventricles, which have been already mentioned. The circumferences of the great openings at the baſis of the heart are tendinous, and may be looked upon as the common tendon of all the fleſhy fibres of which the ventricles are compoſed.

Valvulæ. The valves at the orifices of the ventricles are of two kinds: one kind allows the blood to enter the heart, and hinders it from going out the ſame way; the other kind allows the blood to go out of the heart, but hinders it from returning. The valves of the firſt kind terminate the auriculæ; and thoſe of the ſecond lie

lie in the openings of the great arteries. The firſt are termed *ſemilunar* or *ſigmoidal valves*; the others *triglochines*, *tricuſpidal*, or *mitral*.

The tricuſpidal valves of the right ventricle are fixed to its auricular orifice, and turned inward toward the cavity of the ventricle. They are three triangular productions, very ſmooth and poliſhed on that ſide which is turned towards the auricle; and on the ſide next the cavity of the ventricle, they have ſeveral membranous and tendinous expanſions, and their edges are notched or indented. The valves of the auricular orifice of the left ventricle are of the ſame ſhape and ſtructure, but they are only two in number; and, from ſome ſmall reſemblance to a mitre, they have been named *mitrales*.

Theſe five valves are very thin, and faſtened by ſeveral tendinous ropes to the fleſhy columnæ of the ventricles. The cords of each valve are fixed to two pillars; and between theſe valves there are other ſmall ones of the ſame figure. They may all be termed *valvulæ tricuſpides*, *auriculares*, or *venoſæ cordis*.

The ſemilunar valves are ſix in number, three belonging to each ventricle, ſituated at the mouths of the great arteries; and they may be properly enough named *valvulæ arteriales*. Their concave ſides are turned toward the cavity of the arteries, and their convex ſides approach each other. In examining them with a microſcope, we find fleſhy fibres lying in the duplicature of the membranes of which they are compoſed.

They are truly ſemilunar, or in form of a creſcent, on that ſide by which they adhere: but their looſe edges are of a different figure, each of them repreſenting two ſmall creſcents; the two extremities of which meet at the middle of this edge, and there form a kind of ſmall papilla.

The aorta in general. The great artery that goes out from the left ventricle, is termed *aorta*. As it goes out, it turns a little toward the right hand, and then bends obliquely backward, to form what is called *aorta deſcendens*;

ſcendens; which I ſhall have occaſion to mention again hereafter. From about the middle of the convex ſide of this curvature three great branches ariſe, which furniſh an infinite number of ramifications to the head and upper extremities of the body; as the deſcending aorta does in the ſame manner to the thorax, abdomen, and lower extremities.

The arteria pulmonaris in general. The trunk of the artery which goes out from the right ventricle, is called *arteria pulmonaris*. This trunk, as it is naturally ſituated in the thorax, runs firſt of all directly upward for a ſmall ſpace; then divides laterally into two principal branches, one for each lung; that which goes to the right lung being the longeſt, for a reaſon that ſhall be given hereafter.

Auriculæ. The auricles are muſcular bags ſituated at the baſis of the heart, one towards the right ventricle, the other towards the left, and joined together by an inner ſeptum and external communicating fibres, much in the ſame manner with the ventricles; one of them being named *the right auricle*, the other *the left*. They are very uneven on the inſide, but ſmoother on the outſide; and terminate in a narrow, flat, indented edge, repreſenting a cock's comb, or in ſome meaſure the ear of a dog; " this properly gets the name of *auricle*, the larger and ſmooth part of the cavity being called *ſinus venoſus*, but as the two parts make one general cavity, the name of *auricle* is commonly applied to the whole." They open into theſe orifices of each ventricle, which I name *auricular orifices*; and they are tendinous at their opening, in the ſame manner as the ventricles.

The right auricle is larger than the left; and it joins the right ventricle by a common tendinous opening, as has been already obſerved. It has two other openings united into one, and formed by two large veins which meet and terminate there, almoſt in a direct line, called *vena cava ſuperior* and *inferior*. The notched edge of of this auricle terminates obliquely in a kind of obtuſe point, which is a ſmall particular production of the great bag, and is turned toward the middle of the baſis of the heart.

The whole inner ſurface of the right auricle is uneven, by reaſon of a great number of prominent lines which run acroſs the ſides of it, and communicate with each other by ſmaller lines, which lie obliquely in the interſtices between the former. The lines of the firſt kind repreſent trunks, and the other ſmall branches in an oppoſite direction to each other. In the interſtices between theſe lines, the ſides of the auricle are very thin and almoſt tranſparent, ſeeming to be formed merely by the external and internal coats of the auricle joined together, eſpecially near the point.

The left auricle is in the human body a kind of muſcular bag or reſervoir, of a pretty conſiderable thickneſs and unequally ſquare, into which the four veins open called *venæ pulmonares*, and which has a diſtinct appendix belonging to it, like a third ſmall auricle. This bag is very even on both " ſurfaces, and is therefore called *ſinus venoſus;* but to diſtinguiſh it from the one on the right ſide, it is called *ſinus venoſus ſiniſtra.*" However, the bag and appendix have but one common cavity; and therefore may ſtill be both comprehended under the common name of the *left auricle*. In men, the ſmall portion may likewiſe be named *the appendix of the left auricle;* but in other animals, the caſe is different.

This ſmall portion or appendix of the left auricle is of a different ſtructure from that of the bag or large portion. Exteriorly, it reſembles a ſmall oblong bag, bent different ways, and indented quite round the edges. Interiorly, it is like the inſide of the right auricle. The whole common cavity of the left auricle is ſmaller in an adult ſubject than that of the right; and the fleſhy fibres of this left auricle croſs each other obliquely, in ſtrata differently diſpoſed.

Are

Arteriæ & venæ coronariæ. Befides the great common veffels, the heart has veffels peculiar to itfelf, called *the coronary arteries* and *veins*, becaufe they in fome meafure crown the bafis of the heart. The coronary arteries, which are two in number, go out from the beginning of the aorta, and afterwards fpread themfelves round the bafis of the heart, to the fubftance of which they fend numerous ramifications.

The exterior courfe of the veins is pretty much the fame with that of the arteries; but they end chiefly in the right auricle, and partly in the right ventricle. They likewife terminate in the left ventricle, but in fmaller numbers; and in both they end by certain venal ducts, which open into the foffulæ or lacunæ already taken notice of, in the uneven inner fides of the ventricles. There are likewife lacunæ of the fame kind in the auricles between the prominent lines before-mentioned; and in the great bag of the left auricle, we find likewife fmall holes which feem to have the fame ufe.

There are feldom more than two arteries; of which one lies toward the right hand, the other toward the left of the anterior third part of the circumference of the aorta. The right coronary artery runs in between the bafis and right auricle, all the way to the flat fide of the heart, and fo goes half way round. The left artery has a like courfe between the bafis and left auricle; and before it turns on the bafis, it fends off a capital branch, which runs in between the two ventricles. Another principal branch goes off from the union of the two arteries on the flat fide of the heart, which running to the apex, there joins the other branch.

The coronary veins are diftributed exteriorly, much in the fame manner. Their trunk opens principally into the right auricle by a particular orifice furnifhed with a femilunar valve. All the coronary veins and their ramifications communicate with each other; fo that if we blow through a fmall hole made in any of thefe branches, having firft compreffed the auricles and

large

large veſſels, we obſerve that the air ſwells all the veſ-ſels, and the ventricles likewiſe, by paſſing thro' the ductus venoſi.

Particular ſituation of the heart. The heart lies almoſt tranſverſely on the diaphragm, the greateſt part of it being in the left cavity of the thorax, and the apex being turned toward the bony extremity of the ſixth true rib. The baſis is toward the right cavity; and both auricles, eſpecially the right, reſt on the diaphragm.

The origin or baſis of the pulmonary artery is, in this natural ſituation, the higheſt part of the heart on the foreſide; and the trunk of this artery lies in a perpendicular plane, which may be conceived to paſs between the ſternum and ſpina dorſi. Therefore ſome part of the baſis of the heart is in the right cavity of the thorax; and the reſt, all the way to the apex, is in the left cavity; and it is for this reaſon that the mediaſtinum is turned toward that ſide.

According to this true and natural ſituation of the heart, the parts commonly ſaid to be on the right ſide are rather anterior, and thoſe on the left ſide poſterior; and that ſide of the heart which is thought to be the foreſide is naturally the upper ſide, and the backſide conſequently the lower ſide.

The lower ſide is very flat, lying wholly on the diaphragm; but the upper ſide is a little convex thro' its whole length, in the direction of the ſeptum between the ventricles. And it may be proper here to remark, that tho' commonly received terms of art may ſtill be retained, yet it is neceſſary to prevent their communicating falſe ideas to thoſe who have not had an opportunity of making obſervations themſelves, or of being inſtructed by others.

Pericardium. The heart, with all the parts belonging to it, is contained in a membranous capſula called *pericardium;* which is in ſome meaſure of a conical figure, and much bigger than the heart. It is not fixed ed to the baſis of the heart, but round the large veins above the auricles before they ſend off the ramifications, and round the large arteries before their diviſions.

The pericardium is made up of three laminæ; the middle and chief of which is compoſed of very fine tendinous filaments, cloſely interwoven, and croſſing each other in different directions. The internal lamina ſeems to be a continuation of the outer coat of the heart, auricles, and great veſſels. The trunks of the aorta and pulmonary artery have one common coat, which contains them both as in a ſheath, and is lined on the inſide by a cellular ſubſtance, chiefly in that ſpace which lies between where the trunks are turned to each other, and the ſides of the ſheath. There is but a very ſmall portion of the inferior vena cava contained in the pericardium.

It is the middle lamina which chiefly forms the pericardium; and the figure of this bag is not ſimply conical, its apex or point being very round, and the baſis having a particular elongation which ſurrounds the great veſſels, as has been already ſaid, as amply as the other portion ſurrounds the heart.

The pericardium is cloſely connected to the diaphragm, not the apex, but exactly at that place which anſwers to the flat or lower ſide of the heart; and it is a very difficult matter to ſeparate it from the diaphragm in diſſection. This adhering portion is in ſome meaſure of a triangular ſhape, anſwering to that of the lower ſide of the heart; and the reſt of the bag lies upon the diaphragm, without any adheſion.

The internal lamina, or common covering, as it may be called more properly, is formed by the duplicature of the mediaſtinum. It adheres to the proper bag of the pericardium by the intervention of the cellular ſubſtance in that duplicature, but leaves it where the pericardium adheres to the diaphragm, on the upper ſurface

face of which it is ſpread, as being a continuation of the pleura.

The internal lamina is perforated by an infinite number of very ſmall holes, through which a ſerous fluid continually tranſudes, in the ſame manner as in the peritonæum. This fluid being gradually collected after death, makes what is called *aqua pericardii*, which is found in conſiderable quantities in opening dead bodies while they remain freſh. Sometimes it is of a reddiſh colour, which may be owing to a tranſudation of blood through the fine membrane of the auricles.

Uſes in general. The heart and parts belonging to it are the principal inſtruments of the circulation of the blood. The two ventricles ought to be conſidered as two ſyringes ſo cloſely joined together as to make but one body, and furniſhed with ſuckers placed in contrary directions to each other, ſo as that, by drawing one of them, a fluid is let in, and forced out again by the other.

The heart is made up of a ſubſtance capable of contraction and dilatation. When the fleſhy fibres of the ventricles are contracted, the two cavities are leſſened in an equal and direct manner, not by any contortion or twiſting, as the falſe reſemblance of the fibres to a figure of 8 has made anatomiſts imagine. For if we conſider attentively in how many different directions and in how many places theſe fibres croſs each other, as has been already obſerved, we muſt ſee clearly, that the whole ſtructure tends to make an even, direct, and uniform contraction, more according to the breadth or thickneſs, than according to the length of the heart, becauſe the number of fibres ſituated tranſverſely, or almoſt tranſverſely, is much greater than the number of longitudinal fibres.

The fleſhy fibres thus contracted do the office of ſuckers, by preſſing upon the blood contained in the ventricles; which blood being thus forced toward the baſis of the heart, preſſes the tricuſpidal valves againſt each other,

other, opens the ſemilunares, and ruſhes with impetuoſity through the arteries and their ramifications, as through ſo many elaſtic tubes.

Syſtole. The blood thus puſhed on by the contraction of the ventricles, and afterwards preſſed by the elaſtic arteries, enters the capillary veſſels, and is from thence forced to return by the veins to the auricles, which like retirements, porches, or antichambers, receive and lodge the blood returned by the veins during the time of a new contraction. This contraction of the heart is by anatomiſts termed *ſyſtole.*

Diaſtole. The contraction or ſyſtole of the ventricles, ceaſes immediately, by the relaxation of their fleſhy fibres; and in that time the auricles which contain the venal blood, being contracted, force the blood through the tricuſpidal valves into the ventricles, the ſides of which are thereby dilated, and their cavities enlarged. This dilatation is termed *diaſtole.*

Circulation. In this manner does the heart, by the alternate ſyſtole and diaſtole of its ventricles and auricles, puſh the blood through the arteries to all the parts of the body, and receive it again by the veins. This is called the *circulation of the blood*, which is carried on in three different manners.

The firſt and moſt univerſal kind of circulation is that by which almoſt all the arteries of the body are filled by the ſyſtole of the heart, and the greateſt part of the veins evacuated by the diaſtole.

The ſecond kind of circulation oppoſite to the firſt, is through the coronary veſſels of the heart, the arteries of which are filled with blood during the diaſtole of the ventricles, and the veins emptied during the ſyſtole.

The third kind of circulation is that of the left ventricle of the heart; through the venal ducts of which a ſmall quantity of blood paſſes, without going through the lungs, which is the courſe of all the remaining maſs of blood.

Besides these three different kinds of circulation, there are some peculiarities in the course of the blood, which may be looked upon as particular circulations. Such is the passage of the blood through the liver, spleen, corpora cavernosa of the parts of generation, and thro' the cavernous sinuses of the ..ura mater. I do not here examine the circulation peculiar to the fœtus.

§ 6. *Pulmones.*

Situation in general and figure. The lungs are two large spongy bodies, of a reddish colour in children, greyish in adult subjects, and bluish in old age; filling the whole cavity of the thorax, one being seated in the right side, the other in the left, parted by the mediastinum and heart; and of a figure answering to that of the cavity which contains them, that is, convex next the ribs, concave next the diaphragm, and irregularly flatted and depressed next the mediastinum and heart.

When the lungs are viewed out of the thorax, they represent in some measure an ox's foot, with the fore-part turned to the back, the back-part to the sternum, and the lower part to the diaphragm.

Division and figure in particular. They are distinguished into the right and left lung; and each of these into two or three portions called *lobi*, of which the right lung has commonly three, or two and a half, and the left lung two. The right lung is generally larger than the left, answerably to that cavity of the breast, and to the obliquity of the mediastinum.

At the lower edge of the left lung, there is an indented notch or sinus opposite to the apex of the heart, which is therefore never covered by that lung even in the strongest inspirations, and consequently the apex of the heart and pericardium may always strike against the ribs; the lungs not surrounding the heart in the manner

ner commonly taught. This ſinus is expreſſed in Euſtachius's tables.

Structure. The ſubſtance of the lungs is almoſt all ſpongy, being made up of an infinite number of membranous cells, and of different ſorts of veſſels ſpread among the cells, in innumerable ramifications.

Coats. This whole maſs is covered by a membrane continued from each pleura, which is commonly ſaid to be double; but what is looked upon as the inner membrane, is only an expanſion and continuation of a cellular ſubſtance, which ſhall be ſpoken to after I have deſcribed the veſſels of this viſcus.

Bronchia. The veſſels which compoſe part of the ſubſtance of the lungs are of three or four kinds; the air-veſſels, blood-veſſels, and lymphatics, to which we may add the nerves. The air-veſſels make the chief part, and are termed *bronchia.*

Theſe bronchia are conical tubes, compoſed of an infinite number of cartilaginous fragments, like ſo many irregular arches of circles, connected together by a ligamentary elaſtic membrane, and diſpoſed in ſuch a manner as that the lower eaſily inſinuate themſelves within thoſe above them.

They are lined on the inſide by a very fine membrane, which continually diſcharges a mucilaginous fluid; and in the ſubſtance of the membrane are a great number of ſmall blood-veſſels, and on its convex ſide many longitudinal lines, which appear to be partly fleſhy, and partly made up of an elaſtic ſubſtance of another kind.

The bronchia are divided in all directions into an infinite number of ramifications, which diminiſh gradually in ſize; and as they become capillary, change their cartilaginous ſtructure into that of a membrane. Beſides theſe very ſmall extremities of this numerous ſeries of ramifications, we find that all the ſubordinate trunks from the greateſt to the ſmalleſt, ſend out from all ſides a vaſt number of ſhort capillary tubes of the ſame kind.

Veſiculæ bronchiales. Each of theſe numerous bronchial tubes is widened at the extremity, and thereby formed into a ſmall membranous cell commonly called *a veſicle* Theſe cells or folliculi are cloſely connected together in bundles; each ſmall branch producing a bundle proportionable to its extent and the number of its ramifications.

Lobuli. Theſe ſmall veſicular or cellulous bundles are termed *lobules;* and as the great branches are divided into ſmall rami, ſo the great lobules are divided into ſeveral ſmall ones. The cells or veſicles of each lobule have a free communication with each other, but the ſeveral lobules do not communicate ſo readily.

Interlobular ſubſtance. The lobules appear diſtinctly to be parted by another cellulous ſubſtance, which ſurrounds each of them in proportion to their extent, and fills up the interſtices between them. This ſubſtance forms likewiſe a kind of irregular membranous cells, which are thinner, looſer, and broader, than the bronchial veſicles.

This ſubſtance is diſperſed through every part of the lungs, forms cellulous or ſpongy vaginæ, which ſurround the ramifications of the bronchia and blood-veſſels, and is afterwards ſpread over the outer ſurface of each lung, where it forms a kind of fine cellular coat, joined to the general covering of that viſcus.

When we blow into this interlobular ſubſtance, the air compreſſes and flattens the lobuli; and when we blow into the bronchial veſicles, they preſently ſwell; and if we continue to blow with force, the air paſſes inſenſibly into the interlobular ſubſtance. We owe this obſervation to M. Helvetius.

Vaſcular texture. All the bronchial cells are ſurrounded by a very fine reticular texture of the ſmall extremities of arteries and veins which communicate every

every way with each other. The greateſt part of this admirable ſtructure is the diſcovery of the illuſtrious Malpighi.

Blood-veſſels. The blood-veſſels of the lungs are of two kinds; one common, called *the pulmonary artery and veins;* the other proper, called *the bronchial arteries and veins.*

The pulmonary artery goes out from the right ventricle of the heart: and its trunk having run directly upward as high as the curvature of the aorta, is divided into two lateral branches; one going to the right hand, called *the right pulmonary artery;* the other to the left, termed *the left pulmonary artery.* The right artery paſſes under the curvature of the aorta, and is conſequently longer than the left. They both run to the lungs, and are diſperſed through their whole ſubſtance by ramifications nearly like thoſe of the bronchia, and lying in the ſame directions.

The pulmonary veins having been diſtributed thro' the lungs in the ſame manner, go out on each ſide, by two great branches which open laterally into the reſervoir or muſcular bag of the right auricle.

The ramifications of theſe two kinds of veſſels in the lungs, are ſurrounded every where by the cellular ſubſtance already mentioned, which likewiſe gives them a kind of vagina; and the rete mirabile of Malpighi, deſcribed above, is formed by the capillary extremities of theſe veſſels. It muſt be obſerved, that the ramifications of the arteries are more numerous and larger than thoſe of the veins, which in all other parts of the body exceed the arteries both in number and ſize.

Bronchial arteries and veins. Beſides theſe capital blood-veſſels, there are two others called *the bronchial artery and vein.* The artery has become very famous of late, by the deſcription given of it by M. Ruyſch. The vein was doubted of for ſome time; but it exiſts as really as the artery, and may be eafily demonftrated.

Thefe two veffels are very fmall, appearing only like very fine arteries and veins coming from the aorta, vena cava, and their branches, in the manner already faid in the defcription of the arteries and veins; and they feem to have no other ufe but that of nourifhing the lungs.

The varieties in the origins of the bronchial arteries and veins, efpecially of the arteries, their communications or anaftomofes with each other and with the neighbouring veffels, and above all, the immediate anaftomofis of the bronchial artery with the common pulmonary vein, are of fo great confequence in the practice of phyfic, that it will be proper to repeat here what I have faid about them elfewhere, that the attention of the readers may not be diverted by being obliged to turn to another place of this work.

The bronchial arteries come fometimes from the anterior part of the aorta defcendens fuperior, fometimes from the firft intercoftal artery, and fometimes from one of the œfophagææ. They go out fometimes feparately, toward each lung; fometimes by a fmall common trunk, which afterwards divides to the right and left, near the bifurcation of the afpera arteria hereafter to be defcribed, and follow ramifications of the bronchia.

The left bronchial artery comes pretty frequently from the aorta; and the right, from the fuperior intercoftal on the fame fide, becaufe of the fituation of the aorta. There is likewife another which arifes from the aorta pofteriorly near the fuperior intercoftal, and above the anterior bronchialis.

The bronchial artery gives off a fmall branch to the auricle of the heart on the fame fide, which communicates immediately with the coronary artery.

Sometimes one bronchial artery gives origin to feveral fuperior intercoftales; and fometimes feveral bron-

bronchial arteries fend off feparately the fame number of intercoftals.

The bronchial veins, as well as arteries, were known to Galen. Thefe veins are fometimes branches of the azygos, coming from the upper part of the curvature or arch. The left vein is fometimes a branch of the common trunk of the intercoftales of the fame fide; and fometimes both veins are branches of the gutturalis.

Nervi. The lungs have a great many nerves diftributed through them by filaments which accompany the ramifications of the bronchia and blood-veffels, and are fpread on the cells, coats, and all the membranous parts of the lungs. The nervi fympathetici medii and majores, commonly called the *nerves of the eighth pair* or *the intercoftals*, form behind each lung a particular intertexture, called *plexus pulmonaris*, from whence nervous filaments go out, which communicate with the plexus cardiacus and ftomachicus.

Vafa lymphatica. On the furface of the human lungs, between the external and cellular coat, we obferve fomething that looks like lymphatic veffels; but we ought to take care not to miftake for fuch veffels a tranfparent reticular fubftance obfervable on the furface of the lungs after blowing ftrongly into the lobuli; this appearance being entirely owing to the air which paffes through the bronchial veficles into the interlocular cells, and which, by feparating a certain number of lobuli, finds room to lodge between them. The true lymphatic veffels of the lungs are moft vifible in brutes; and in a horfe particularly, I have obferved one of thefe veffels to run along a great part of one edge of the lungs.

Ligaments. Under the root of each lung, that is, under that part formed by the fubordinate trunk of pulmonary artery, by the trunks of the pulmonary veins, and by the trunk of the bronchia, there is a pretty broad membranous ligament which ties the poſterior edge of each lung to the lateral parts of the vertebræ of the back, from that root all the way to the diaphragm.

Trachea arteria. The bronchia already deſcribed, are branches or ramifications of a large canal, partly cartilaginous, and partly membranous, called *trachea* or *aſpera arteria.* It is ſituated anteriorly in the lower part of the neck, from whence it runs down into the thorax between the two pleuræ, through the upper ſpace left between the duplicature of the mediaſtinum, behind the thymus.

Having reached as low as the curvature of the aorta, it divides into two lateral parts, one toward the right hand, the other toward the left, which enter the lungs, and are diſtributed through them in the manner already ſaid. Theſe two branches are called *bronchia ;* and that on the right ſide is ſhorter than that of the left, whereas the right pulmonary artery is the longeſt.

The trachea is made up of ſegments of circles of cartilaginous hoops, diſpoſed in ſuch a manner as to form a canal open on the back-part, the cartilages not going quite round ; but this opening is filled by a ſoft glandular membrane, which completes the circumference of the canal.

Each circle is about the twelfth part of an inch in breadth, and about a quarter of that ſpace in thickneſs. Their extremities are round ; and they are ſituated horizontally above each other, ſmall interſtices being left between them, and the lower edge of the ſuperior ſegments being turned toward the upper edge of thoſe next below them.

They are all connected by a very ſtrong elaſtic membranous ligament fixed to their edges. I have obſerved the firſt three ſegments united into one bent alternately in two different places according to its breadth. Sometimes two are continuous in the ſame manner.

The canal of the aſpera arteria is lined on the inſide by a particular membrane, which appears to be partly

ſleſhy

flefhy or mufcular, and partly ligamentary, performed by an infinite number of fmall holes more or lefs imperceptible, through which a mucilaginous fluid continually paffes, to defend the inner furface of the trachea againft the acrimony of the air which we breathe.

This fluid comes from fmall glandular bodies difperfed through the fubftance of the membrane, but efpecially from glands fomething larger than the former, which lie on the outer or pofterior furface of that ftrong membrane by which the circumference of the canal is completed. The fame ftructure is obfervable in the ramifications of the trachea from the greateft to the fmalleft.

All the veffels of which the lungs are chiefly compofed, that is, the air-veffels or bronchia, and the blood-veffels, or the pulmonary andbronchial arteries and veins, accompany each other through this whole vifcus.

They are difpofed commonly in fuch a manner, even to the laft ramifications, as that a fubordinate trunk or branch of the bronchia lies between the like trunks or branches of the pulmonary artery and vein; the bronchial veffels being immediately joined to the bronchia. In fome places thefe three kinds of veffels touch each other in fuch a manner as to leave a triangular fpace in the middle.

The bronchia are divided into a very great number of ramifications; and the laft rami are the pedicles or footftalks of the fmall lobuli. All the lobuli are angular, oblong, broad, thin, &c. The footftalks fend out other fmaller membranous pedicles, which are very fhort, and terminate in the bronchial veficles or cells, of which they are continuations. The fubordinate trunks and rami detach a great number of thefe pedicles from their convex furface.

When we blow into the lungs, the bronchial cells neareft their outer furface appear like fmall portions of of round veficles; and from this appearance, all the bronchial cells have got the name of *veficles*, though they are all angular, except thofe which I have now mentioned.

When we examine a lung without blowing it up, we find that the cartilaginous fegments of the bronchia lie fo near as to be engaged in each other; and in drawing out any portion of the bronchia by the two ends, thefe fegments are parted; and the whole canal is increafed in length; but it contracts again, by means of its elaftic membrane, as foon as that force is taken off.

When we open lengthwife any portion of the pulmonary artery and vein in the fame lung, we meet with a great number of tranfverfe rugæ, which are deftroyed when thefe veffels are elongated. This is an obfervation made by M. Helvetius.

By virtue of this ftructure, all the ramifications both of the bronchia and pulmonary arteries and veins, have conftantly the fame direction, whether the lung be inflated or collapfed; and they contract in length, without being either contorted or folded. In expiration thefe veffels are elongated, and fhortened in infpiration.

Thefe three veffels lie in a fort of cellular vagina, which accompanies all their ramifications; and is a continuation of their interlobular cells, or cellular fubftance in the interftices of the lobuli. The pelliculæ which compofe it, are, however, there difpofed in a more regular manner, and more longitudinally, than in other places, and thereby appear to form a true vagina.

When we blow through a pipe introduced fo far as to touch immediately a trunk of the blood-veffels or bronchia, the air runs at firft through all the cells that lie neareft that trunk or its branches; but if we continue to blow, it infinuates itfelf through the whole interlobular fubftance.

Bronchial glands. At the angle of the firft ramification

tion of the trachea arteria, we find on both the fore and back ſides, certain ſoft, roundiſh, glandular bodies, of a bluiſh or blackiſh colour, and of a texture partly like that of the thymus already deſcribed, and partly like that of the glandula thyroides, of which hereafter. There are other glands of the ſame kind at the origin of each ramification of the bronchia, but they decreaſe proportionably in number and ſize. They are fixed immediately to the bronchia, and covered by the interlobular ſubſtance; and they ſeem to communicate by ſmall openings with the cavity of the bronchia.

The trachea has ſeveral coats, as has been already obſerved. The outermoſt or common covering ſurrounds that part of the trachea which lies in the thorax; but out of the thorax, this firſt coat is derived from the aponeurotic expanſions of the muſcles of the neck; and it is between this and the following covering that the glands already mentioned are ſituated.

The ſecond is a proper coat, being a continuation of the cellular covering of the lungs; and the pelliculæ thereof neareſt the cartilaginous ſegments, ſerve them for an external perichondrium. The third membrane lies on the inſide, adhering cloſely to the ſame cartilages, and ſupplying to theſe the place of an internal perichondrium.

The fourth membrane is that which completes the circumference of the cartilaginous circles of the trachea. It conſiſts chiefly of two laminæ or ſtrata, partly muſcular and partly tendinous; the external or poſterior lamina being made up of longitudinal fibres; and the internal, or anterior, of tranſverſe fibres. This membrane is perforated by the ſmall ducts of the abovementioned glands, which diſcharge a fluid when preſſed; and being examined through a microſcope they appear veſicular or folliculous, much like that of the ſtomach.

The ligaments between the cartilaginous circles are very ſtrong and elaſtic; and each of them is confined to to two cartilages, without communicating with any of the reſt; being fixed to the edges of theſe cartilages, much in the ſame manner as the intercoſtal muſcles are inſerted in the ribs.

As the bronchia penetrate into the ſubſtance of the lungs, they gradually loſe their cartilages; but the muſcular lines or columnæ of M. Morgagni appear as much, and ſometimes more than before. The two planes above-mentioned continue likewiſe to be viſible; and we obſerve very diſtinctly, ſometimes even without a microſcope, a great many ſmall holes in the pellicles of the lobuli, and bronchial veſicles or cells, which open from within outwards.

Uſes. Reſpiration is performed by organs of two kinds, one of which may be looked upon as active, the other as paſſive. The lungs are of the ſecond kind, and the firſt comprehends chiefly the diaphragm and intercoſtal muſcles.

As ſoon as the intercoſtal muſcles begin to contract, the arches of the ribs are raiſed together with the ſternum, and placed at a greater diſtance from each other; by which means the cavity of the thorax is enlarged on the two lateral and anterior ſides.

At the ſame inſtant the diaphragm is flatted or brought toward a plane by two motions, which are apparently contrary; that is, by the contraction of the diaphragm, and the dilatation of the ribs in which it is inſerted. The external ſurface of the thorax being thus in a manner increaſed, and the cavity of the bronchia being at the ſame time, and by the ſame means, leſs reſiſted or preſſed upon, the ambient air yields to the external preſſure, and inſinuates itſelf into all the places where the preſſure is diminiſhed; that is, into the aſpera arteria, and into all the ramifications of the bronchia, all the way to the veſicles. This is what is called *inſpiration.*

This motion of inſpiration is inſtantaneous, and ceaſes in a moment by the relaxation of the intercoſtal muſcles;

muſcles; the elaſtic ligaments and cartilages of the ribs bringing them back at the ſame time to their former ſituation. This motion by which the ribs are depreſſed and brought nearer to each other, is termed *expiration*.

The pulmonary arteries and veins which accompany the bronchia through all their ramifications, and ſurround the veſicles, tranſmit the blood through their narrow capillary extremities, and thereby change or modify it, at leaſt in three different manners.

The firſt change or modification which the blood undergoes in the lungs, is to have the coheſions of its parts broken, to be attenuated, pounded, and, as it were, reduced to powder. The ſecond is, to be deprived of a certain quantity of ſerum, which tranſpires through the lungs, and is what we commonly call the *breath*. The third is, to be in a manner reanimated by the impreſſion of the air, whether the whole body of the air enters the blood, whether the common air is only the vehicle of ſome finer parts which are conveyed to it, or whether the air only compreſſes and ſhakes the blood as it paſſes round the bronchial veſicles in the reticular capillary extremities of the veſſels.

The cartilages of the aſpera arteria and bronchia ſerve in general to compoſe a canal; the ſides of which will not ſink in or ſubſide by compreſſion, but will nevertheleſs yield to certain preſſures and impulſes without breaking. As theſe cartilages are not complete circles or rings, and as their circumferences are completed by elaſtic membranes, they allow of thoſe dilatations and contractions which modulate the voice; and as they are connected by elaſtic ligaments of a conſiderable breadth, the alternate elongation and contraction of the bronchia is facilitated in the motions of reſpiration.

The larynx is commonly looked upon as the upper part of the aſpera arteria: but we have already deſcribed it in the preceding chapter *of the Head*, with which

which it has a particular connection in relation to the tongue.

§ 7. *Oesophagus.*

Situation and figure. The œſophagus is a canal partly muſcular and partly membranous, ſituated behind the trachea arteria, and before the vertebræ of the back, from near the middle of the neck down to the lower part of the thorax; from whence it paſſes into the abdomen through a particular hole of the ſmall or inferior muſcle of the diaphragm, and ends at the upper orifice of the ſtomach.

Structure and coats. It is made up of ſeveral coats almoſt in the ſame manner as the ſtomach, of which it is the continuation. The firſt coat, while in the thorax, is formed only by the duplicature of the poſterior part of the mediaſtinum, and is wanting above the thorax and in the neck, where the outer coat of the œſophagus is only a continuation of the cellular ſubſtance belonging to the neighbouring parts.

The ſecond coat is muſcular, being made up of ſeveral ſtrata of fleſhy fibres. The outermoſt are moſtly longitudinal; but they are not all continued from one end of the canal to the other. The following ſtrata are obliquely tranſverſe, and the innermoſt are turned a little obliquely the contrary way. They croſs each other irregularly in many places, but are neither ſpiral nor annular.

The third is termed the *nervous coat*, and is like that of the ſtomach and inteſtines. It is differently folded or plaited, according to its length, being much wider than the muſcular coat; and it is ſurrounded by a whitiſh, ſoft, fine filamentary ſubſtance, like a kind of cotton, which, when ſteeped in water, ſwells and grows thicker.

The fourth or innermoſt coat reſembles in ſome meaſure that of the inteſtines; except that, inſtead of the villi,

villi, it has ſmall and very ſhort papillæ. It is folded lengthwiſe like the third coat; ſo that the œſophagus, when cut acroſs, repreſents one tube within another. Through the pores of this coat, a viſcid lympha is continually diſcharged.

The œſophagus, from its very beginning, turns a little to the left hand, and naturally runs along the left extremities of the cartilages of the aſpera arteria. The thyroid gland, and thoſe which lie behind the middle of the œſophagus, are deſcribed in another place. The pharynx and the larynx have been already deſcribed in the preceding chapter.

§ 5. *Ductus Thoracicus.*

The thoracic duct is a thin tranſparent canal, which runs up from the receptaculum chyli along the ſpina dorſi, between the vena azygos and aorta, as high as the fifth vertebra of the back, or higher. From thence it paſſes behind the aorta toward the left hand, and aſcends behind the left ſubclavian vein, where it terminates, in ſome ſubjects, by a kind of veſicula, in others by ſeveral branches united together, and opens into the back-ſide of the ſubclavian vein near the outſide of the internal jugular.

This canal is plentifully furniſhed with ſemilunar valves turned upward. Its opening into the ſubclavian vein in the human body, is, in the place of valves, covered by ſeveral pelliculæ, ſo diſpoſed as to permit the entrance of the chyle into the vein, and hinder the blood from running into the duct. It is ſometimes double, one lying on each ſide; and ſometimes it is accompanied by appendices, called *pampiniformes.*

CHAP.

CHAP. III.

Of the ABDOMEN.

THE whole fore-part of the abdomen forms an oblong convexity like an oval vault, more or lefs prominent in the natural ftate, in proportion to the quantity of fat upon it and of food contained in it, or to the different degrees of pregnancy in women. The hypogaftric and umbilical regions are more fubject to thefe varieties than the epigaftric region.

On the fides, between the hypochondria and offa ilium or haunch, the abdomen is commonly a little contracted; and backward, about the middle of the regio lumbaris, it is gently depreffed, forming a kind of tranfverfe cavity, anfwering to the natural incurvation of the lumbar portion of the fpina dorfi.

This anterior convexity, and pofterior cavity, change as we fit, ftand, kneel, lie at our full length, or with the thighs bent; and thefe variations depend on the particular fituation of the offa innominata in thefe different poftures.

In ftanding, the convexity of the belly, and cavity of the loins, are more confiderable than in moft other fituations; for then the lower extremity of the os facrum is turned very far back, and confequently the os pubis very much down. In this fituation of the pelvis, the inteftines fall naturally forward, and thus increafe the

the convexity of the abdomen; and as the vertebræ of the loins are very much bent at the fame time, the cavity in that place muft likewife be very confiderable.

In kneeling, the offa pubis are ftill lower than when we ftand: and this not only increafes the hollow of the loins, and throws the abdomen and its vifcera more outward or forward, but alfo in fome meafure ftrains the abdominal mufcles; which is fo uneafy to fome perfons, as to caufe them to faint away.

This depreffion of the os pubis in kneeling depends partly on the tenfion of the two mufculi recti anteriores; the lower tendons of which are, in this fituation, drawn with violence under the condyloide pulley of the os femoris.

When we fit in the common manner, that is, with the thighs ftretched out in a plane parallel to that of the feat, the convexity of the belly and hollow of the loins diminifh.

For the pelvis being in this fituation fupported on the tubercula ifchii, and thefe tubercles being very near the fore-part of the pelvis, the trunk of the body preffing on the os facrum muft lower the pelvis behind, and raife it before.

When we lie upon the back at full length, and with the thighs extended, the belly is lefs convex, but more ftretched and hard; whereas, when the thighs are bent, it is foft and lax. In this fituation, the regio lumbaris is almoft flat, and very little depreffed.

When we lie on the back, and raife the head, or endeavour to raife it, we feel a tenfion in the fore-part of the abdomen, which increafes in proportion to the force we ufe in raifing the head.

Thefe varieties of the external conformation of the abdomen have a near relation to fo great a number of other phænomena in the animal œconomy of the human body, that it would require a whole volume to explain all the particulars thereof: neither are details of this kind very proper in a work defigned to be purely

 ana-

anatomical; in which, consequently, our main business is to give a full and accurate description of the true structure of the parts, and only to point out in general their principal uses.

Integuments of the abdomen. The anterior portion of it is not only thinner and more compact than the posterior, as has been already observed, but it has this likewise peculiar to it, that it may be naturally increased very much in breadth, and sometimes in a very extraordinary manner, without losing any thing of its thickness, in proportion to what it gains in breadth.

This peculiarity likewise belongs to the epidermis. I here speak only of what is observable in the natural state of corpulency or pregnancy; but I have not as yet been able to discover what it is in the texture or structure of the skin and epidermis, on which this peculiarity depends. All that I have been able to remark about it was in the dead body of a woman, whose belly was contracted and fallen; namely, that on the surface of the skin there was a great number of lozenges disposed in a reticular manner.

The marks of these superficial lozenges were in the epidermis. They were composed of several fine lines, which all together extended to a sensible breadth. The areas or meshes of these lozenges, which seemed to be about the sixth part of an inch in breadth, were very flat and thin.

In the manner in which Steno used to open bodies, by making two longiiudinal incisions in the integuments, and so leaving a middle band made up of the skin and fat in their true places, it is easy to demonstrate the union of the aponeurotic or tendinous productions with the arteries, veins and nerves, in order to form the skin of the abdomen; and the same use might be made of this method in other parts of the skin, as I shall show in another place.

The cells of the membrana adiposa, which covers the convex part of the abdomen, are disposed in a very regular

gular manner, as I diſcovered by that method of opening bodies, which I have always made uſe of, both in my public and private courſes. This method is to make two oblique inciſions in the integuments, from the navel to the groins, and to ſeparate this angular portion of the integuments, and throw it down over the parts of generation, that they may be covered during the demonſtration.

This triangular portion being thus inverted, there appears on the inner ſurface of the membrana adipoſa a longitudinal line like a kind of raphe, produced by the meeting of theſe cellular rows, which form angles ſucceſſively, one above another, oppoſite to the linea alba of the abdomen. The cells in theſe rows are more oblong than the reſt, and in a mannner oval, or like a grain of wheat.

Cavity of the abdomen. The appendix enſiformis of the ſternum, the cartilaginous portions of the laſt pair of true ribs, thoſe of the firſt four pairs of falſe ribs, all the fifth pair, the five lumbar vertebræ, the oſſa innominata, the os ſacrum, and os coccygis, form the bony ſides of the cavity of the abdomen.

The diaphragm, the muſcles called particularly *muſculi abdominis*, the *quadrati lumborum*, *pſoai*, *iliaci*, the *muſcles of the coccyx*, and of the *inteſtinum rectum*, form the chief part of the circumference of this cavity; and its whole inner ſurface is lined by a membranous expanſion, termed *peritoneum*, all theſe parts being covered by the integuments already ſpoken to. As additional or auxiliary parts, we might likewiſe add ſome portions of the ſacro-lumbares, longiſſimi dorſi, vertebrales, glutæi, &c.

The cavity of the abdomen is of an irregularly oval figure, but ſtill ſymmetrical. On the foreſide it is uniformly arched or oval, and its greateſt capacity is even with the navel and neareſt part of the hypogaſtrium. On the upper ſide it is bounded by a portion of a vault, very much inclined. On the backſide it is in a manner divided into two cavities by the jetting out of the vertebræ of the loins. On the lower ſide, it contracts gradually all the way to what I call the *little edge* of the pelvis; and from thence expands again a little as far as the os coccygis, and tubercles of the iſchium, terminating in the void ſpace between theſe three parts.

§ 1. *Peritonæum.*

HAVING carefully removed the muſcles of the abdomen, the firſt thing we diſcover is a very conſiderable membranous covering, which adheres immediately to the inner ſurface of the muſculi tranſverſi, and of all the other parts of this cavity; and involves and inveſts all the viſcera contained therein, as in a kind of bag. This membrane is named *peritonæum*, from a Greek word, which ſignifies to be ſpread around.

The peritonæum, in general, is a membrane of a pretty cloſe texture, and yet very limber and capable of a very great extenſion; after which it can recover itſelf, and be contracted to its ordinary ſize; as we ſee in pregnancy, dropſies, corpulency, and repletion.

It may be looked upon as a ſingle membrane, although it has been deſcribed by many anatomiſts as a duplicature of two diſtinct membranous laminæ. But, properly ſpeaking, the internal portion alone deſerves the name of a *membranous lamina*, as being the main body of the peritonæum. The external portion may properly enough be termed the *cellular ſubſtance of the peritonæum.*

The inner ſurface of the peritonæum is very ſmooth, and poliſhed on that ſide which is turned to the cavity and viſcera of the abdomen, and continually moiſtened by a ſerous fluid diſcharged through almoſt imperceptible pores.

Theſe pores may be ſeen by ſpreading a portion of the peritonæum on the end of the finger, and then pulling it very tight on all ſides; for then the pores are dilated

lated, and ſmall drops may be obſerved to run from them, even without a microſcope.

The ſources of this fluid are chiefly from the exhalent veſſels. The whitiſh corpuſcles found in diſeaſed ſubjects are no proof of the glands, which ſome anatomiſts place there in the natural ſtate.

The cellular ſubſtance, or external portion of the peritonæum, adheres very cloſely to the parts which form the inſides of the cavity of the abdomen; and it is not every where of an equal thickneſs. In ſome places it is in a very ſmall quantity, and ſcarcely any appears at the tendinous or aponeurotic portions of the muſculi transverſi, and on the lower ſide of the diaphragm.

In all other places it is thicker, and forms cells expanded into very fine laminæ, which, in diſeaſed ſubjects, become ſometimes ſo broad and thick, as to reſemble ſo many diſtinct membranes.

In ſome places, this ſubſtance is every way like a membrana adipoſa, being filled with fat, as round the kidneys, and along the fleſhy portions of the tranſverſe muſcles, to which it adheres. It entirely ſurrounds ſome parts, as the bladder, ureters, kidneys, ſpermatic veſſels, &c. and it is in theſe places improperly termed the *duplicature of the peritonæum.*

Beſides theſe differences in thickneſs, the cellular ſubſtance has ſeveral elongations, which have been called *productions of the peritonæum.* Two of theſe productions accompany and inveſt the ſpermatic ropes in males, and the vaſcular ropes, commonly called the *round ligaments*, in women. There are other two, which paſs under the ligamentum Fallopii, with the crural veſſels, which they involve; and they are gradually loſt in their courſe downward.

To theſe four productions of the cellular ſubſtance of the peritonæum we may add a fifth, which is ſpread on the neck of the bladder; and perhaps a ſixth, which accompanies the inteſtinum rectum. All theſe elongations paſs out of the cavity of the abdomen, and may be termed *external*, to diſtinguiſh them from others that remain in the abdomen, and are called *internal;* of which hereafter.

The great blood-veſſels, that is, the aorta and vena cava, are likewiſe involved in this cellular ſubſtance of the peritonæum. In a word, it involves immediately and ſeparately all the parts and organs which are commonly ſaid to lie in the duplicature of the peritonæum.

The true lamina, or membranous portion of the peritonæum, is connected by the intervention of the cellular ſubſtance to the inner ſurface of the cavity of the abdomen; but it does not naturally accompany the external elongations of that ſubſtance. It only covers the origin or baſis of theſe productions, without any alteration in its own ſurface at theſe places.

It has, nevertheleſs, productions of its own; but they are very different from thoſe of the cellular ſubſtance; for they run from without inward, that is, they advance from the convex ſide of the great bag of the peritonæum into the cavity of that bag, ſome more, ſome leſs, and alſo in different manners, as if the ſides of a large ball or bladder were thruſt inward into the cavity of the ball or bladder.

Of theſe internal elongations of the peritonæum, ſome are ſimply folded like a duplicature; ſome are expanded like inverted bags, or ſacculi, to contain ſome viſcus; ſome begin by a ſimple duplicature, and are afterwards expanded into a cavity which contains ſome organ; ſome are alternately extended in the form of ſimple duplicatures and of cavities; and, laſtly, ſome form only a ſmall eminence on the inner ſurface of the great cavity of the peritonæum.

Under the firſt ſpecies of theſe productions, we may bring the membranous ligaments of the abdomen, ſuch as thoſe of the liver, colon, &c. We ſee the ſecond ſpecies in the external membrane of the liver; the third in the meſentery; the fourth in the meſcolon; and the fifth at the kidneys and ureters.

Beſides

Befides the external productions of the cellular fubftance of the peritonæum, it has the fame number of internal elongations with the true lamina; which lie between all the duplicatures, and line the infides of all the cavities, or that fide next the vifcera contained in them.

The ufes of the peritonæum, in general, feem to be very evident from the defcription which I have given of it: and the chief of thefe ufes are, to line the cavity of the abdomen, to inveft the vifcera contained in that cavity as in a common bag, to fupply them with particular coats, to form productions, ligaments, connections, folds, vaginæ, &c. as we fhall fee hereafter.

The fine fluid which tranfudes through the whole internal furface of the peritonæum prevents the inconveniences which might arife from the continual frictions and motions, to which the vifcera of the abdomen are expofed, either naturally or by external impulfes.

I muft here obferve, that it is the common cuftom to demonftrate four ligamentary ropes, termed the *umbilical veffels*, before the peritonæum is opened, becaufe they adhere to the umbilicus; and three of them are really veffels in the fœtus, viz. two umbilical arteries and one vein. We are in a manner obliged to fubmit to this cuftom in public anatomical demonftrations, where we have but one fubject for the whole; but as I am here under no fuch neceffity, I refer the defcription of thefe ligaments to other more proper places of this work. The venal ligament fhall be defcribed in the hiftory of the liver; and the two arterial ligaments, together with the urachus, which is the fourth, in the hiftory of the bladder.

It is fufficient to obferve here in general, that three of thefe umbilical ropes or ligaments are involved feparately, and fuftained by a production or duplicature, which the peritonæum fends into the cavity of the abdomen in form of a falx.

§ 2. *Ventriculus.*

Situation and figure of the ſtomach. The ſtomach is a great bag or reſervoir, ſituated partly in the left hypochondrium, and partly in the epigaſtrium.

The figure of the ſtomach is like that of a bag-pipe; that is, it is oblong, incurvated, large, and capacious, at one end, and ſmall and contracted at the other. We ſee this figure moſt evidently when the ſtomach is moderately filled with air or with any other fluid.

The curvature of the ſtomach gives us occaſion to diſtinguiſh two arches in it; one large, which runs along the greateſt convexity; and one ſmall, directly oppoſite to the former. I name theſe arches the *great* and *ſmall* curvatures of the ſtomach; and by the ſides of the ſtomach, I underſtand the two lateral portions which lie between the two arches.

The ſtomach has two extremities; one large and one ſmall. It has two openings, called the *orifices of the ſtomach;* one between the great extremity and the ſmall curvature, the other at the end of the ſmall or contracted extremity. The firſt opening is a continuation of the œſophagus; the other joins the inteſtinal canal, and is called by the name of *pylorus*.

The ſtomach is not ſituated in the left hypochondrium and epigaſtric region, in the manner repreſented in moſt of the figures. It lies tranſverſely, obliquely, and almoſt laterally; in ſuch a manner as that the great extremity, and the orifice next it, are on the left hand; and the ſmall extremity, with its orifice, or the pylorus, on the right hand, and lower and more inclined than the former: Therefore we ought, with the ancient anatomiſts, to call one of theſe orifices *ſuperior*, the other *inferior*.

The great extremity of the ſtomach is in the left hypochondrium, and for the moſt part immediately under the diaphragm; yet the ſuperior orifice is not in the left hypo-

hypochondrium, but almoft oppofite to, and very near the middle of, the bodies of the loweft vertebræ of the back.

The fmall extremity of the ftomach does not reach to the right hypochondrium. It bends obliquely backward toward the upper orifice: fo that the pylorus lies about two fingers breadth from the body of the vertebræ immediately under the fmall portion of the liver; and confequently lower down, and more forward, than the other orifice by almoft the fame diftance. This extremity of the ftomach has fometimes a particular dilatation on the fide next the great curvature.

According to this natural fituation, the ftomach, efpecially when full, "is fituated with its great curvature forward and a little downward, and its fmall curvature backward and a little upward."

One of the lateral convex fides is turned upward, the other downward; and not forward and backward as they appear in dead bodies, where the inteftines do not fupport them in their natural fituation.

If we divide the ftomach along the two curvatures into two equal parts, we fhall fee that the two orifices do not both adhere to the fame half of this divifion, as we would be apt to imagine according to the common notion; but that the diaphragmatic orifice is entirely in the upper half, and the inteftinal orifice in the lower.

Therefore the body of the ftomach is fo far from lying in the fame plane with the œfophagus, as it is commonly reprefented in figures drawn from a ftomach taken out of the body and laid upon a table, that it forms an angle or fold immediately at the paffage of the œfophagus through the fmall mufcle of the diaphragm; and it is on account of this angle that the fuperior orifice is turned backward.

Structure of the ftomach. The ftomach is compofed of feveral parts; the chief of which are the different ftrata which form its fubftance, to which anatomifts give the name of *tunicæ* or *coats*. Thefe coats are commonly reckoned

reckoned to be four in number; the outer or common, the fleſhy or muſcular, the nervous or aponeurotic, and the villous or inner coat; and they are afterwards ſubdivided ſeveral ways.

The firſt or outermoſt coat is ſimply membranous, being one of the internal productions of the peritonæum. This appears evidently at the connection of the ſuperior orifice with the diaphragm, where the external membrane of the ſtomach is really continuous with the membrane, which lines the inferior ſurface of the diaphragm; and it is from this that it has been named the *common coat*.

The ſecond or muſcular coat is made up of ſeveral planes of fibres, which may all be reduced to two; one external, the other internal. The external coat is longitudinal, though in different reſpects following nearly the direction of the curvatures and convexities of the ſtomach; and the internal plane is tranſverſely circular.

The fibres of the external plane run ſlanting in ſeveral places; and are interſected by ſmall oblique whitiſh lines, which ſeem to be in ſome meaſure tendinous. This plane is ſtrengthened by a particular faſciculus which runs along the ſmall curvature, its fibres appearing to be leſs oblique than thoſe of the great plane.

The fibres of the inner or circular plane of this muſcular coat are ſtronger than thoſe of the outer plane. They are rather ſegments which unite at different diſtances, than entire circles; and they are likewiſe interſected by great numbers of ſmall white lines, in ſome meaſure tendinous and very oblique, which all together repreſent a kind of net-work, the areolæ or meſhes of which are very narrow.

As theſe circles or ſegments advance on the great extremity of the ſtomach, they diminiſh gradually, and form a kind of muſcular vortex; the centre of which is in the middle of that extremity.

Between the outer and inner planes, round the ſuperior orifice, there are two diſtinct planes about the breadth

breadth of a finger, and very oblique, which ſurround this orifice in oppoſite directions, and interſect each other where they meet on the two lateral ſides.

Along the middle of each lateral ſide of the ſmall extremity, there runs a tendinous or ligamentary flat portion, above a quarter of an inch in breadth, which terminates in the pylorus. Theſe two portions lie between the common and muſcular coats, and adhere very ſtrongly to the firſt.

Between the ſame two coats, there is a cellular ſubſtance which adheres very cloſely to the external coat, and inſinuates itſelf between the fleſhy fibres of the ſecond, all the way to the third, as may be perceived by blowing it up. Some make it a diſtinct coat, and call it *tunica celluloſa*; but it is no more than the cellular portion of the membranous coat, like the cellular portion of the peritonæum.

The third coat, called commonly *tunica nervoſa*, but properly *tunica celluloſa*, is compoſed of capillary veſſels and nerves, with a very large proportion of cellular ſubſtance. On the concave ſide it ſeems to be of a very looſe texture, and as it were ſpongy or filamentary, containing a number of ſmall glandular bodies, eſpecially near the ſmall curvature and ſmall extremity of the ſtomach.

This ſpongy texture reſembles fine cotton, as may be ſeen, by macerating it a little in clear water, which ſwells it conſiderably in a very ſhort ſpace of time. It is ſupported by a kind of ground-work of very fine ligamentary or aponeurotic filaments which interſect each other obliquely, much in the ſame manner as the third coat of the inteſtines, of which hereafter; and it adheres to the convex ſide of the villous coat.

The fourth coat of the ſtomach is termed *villoſa*, becauſe, when it ſwims in clear water, ſome have imaned they ſaw ſomething in it like the pile of velvet. The ancients called it *tunica fungoſa*; and perhaps this name agrees beſt with its true ſtructure. We obſerve

in

in it a great number of ſmall holes anſwering to the ſmall glands already mentioned.

Theſe two coats are of a larger extent than the two former, and they join in forming large rugæ on the concave ſurface of the ſtomach; the greateſt part of which is tranſverſe, though irregular and waving. There are likewiſe ſome longitudinal ones which interſect the others; but at the pylorus they all become longitudinal, and terminate there.

At the ſuperior orifice of the ſtomach, theſe rugæ are in a manner radiated, and ſeem to be a continuation of the plicæ or folds of the œſophagus; only they are thicker; and where theſe rugæ and plicæ meet, they form a ſort of crown, which diſtinguiſhes the ſuperior orifice of the ſtomach from the inferior extremity of the œſophagus.

In the interſtices of theſe rugæ, there is often found a ſort of ſlimy mucus, with which the whole cavity of the ſtomach ſeems likewiſe to be moiſtened. This mucus is much more fluid in living bodies, and is ſupplied by the glands of the ſtomach. It may be termed *ſuccus gaſtricus*, or *ſtomachicus*.

On the inner ſurface of the ſmall extremity of the ſtomach, at the place where it ends in the inteſtinal canal, we obſerve a broad, thin, circular border, with a roundiſh hole in the middle. This hole is the inferior orifice of the ſtomach, called by the Greeks *pylorus*, which ſignifies a porter.

This border is a fold or duplicature of the two inner coats of the ſtomach, the nervoſa and villoſa; and it is formed in part by a faſciculus of fleſhy fibres fixed in the duplicature of the tunica nervoſa, and diſtinguiſhed not only from the other fleſhy fibres of the extremity of the ſtomach, but alſo from thoſe of the inteſtines, by a thin, whitiſh circle, which appears even through the external or common coat, round the union of the ſtomach and inteſtines.

The figure of the pylorus is that of a ring, tranſverſe-

ly

ly flatted, the inner edge of which, or that next the centre, is turned obliquely toward the inteſtines. This inner edge runs naturally more or leſs into little plaits or gathers, like the mouth of a purſe almoſt ſhút; all which particulars are very different from what figures and dried preparations would make us believe. It is therefore a kind of ſphincter, which can contract the inferior orifice of the ſtomach, but ſeems not capable of ſhutting it quite cloſe.

Arteries of the ſtomach. The principal arteries of the ſtomach are the coronaria ventriculi, which runs along the ſmall curvature; and the two gaſtricæ, that is, the ſiniſtra or major, and dextra or minor, both which form one common artery, which runs along the great curvature. The coronaria ventriculi becomes united in the ſame manner with the pylorica, and both make one common veſſel.

Theſe two arterial arches ſend a great number of branches toward each other on both ſides of the ſtomach; and theſe branches are gradually ramified in different directions, by very different diviſions and ſubdiviſions, the greateſt part of which communicate with thoſe from the other artery.

From theſe frequent ramifications and communications of the arterial arches of the ſtomach; two different reticular textures ariſe, whereof one, which is the largeſt, lies between the common and muſcular coats in the cellular ſubſtance found there: the other, which is very fine, lies on the ſurface of the tunica nervoſa. This latter is a production of the firſt, being formed by means of a great number of very ſhort rami, which go out from the other, and paſs through the ſmall interſtices between the fibres of the muſcular coat.

By artificial injections we can ſhow a third extremely fine reticular texture of capillary veſſels, which run between the glandular bodies and papillæ of the tunica villoſa. Theſe do not ſeem in the natural ſtate to be pure-

ly

ly blood-veſſels, as inflammations and injections may incline us to think.

The arteries of the ſtomach come originally from the cæliaca, by means of the hepatica, ſplenica, and coronaria. The pylorica and meſenterica ſuperior likewiſe contribute to them by communications, more or leſs immediate. They communicate alſo with the mammariæ, internæ, and diaphragmaticæ, and, by means of the epigaſtrica ſiniſtra, with the meſenterica inferior.

Veins of the ſtomach. The veins of the ſtomach are ramifications of the vena portæ in general; and in particular, of the meſeraica major, ſplenica, and meſenterica inferior, the diſtribution of which may be ſeen in the deſcription of the veins. They accompany the arteries more or leſs, and form nearly the ſame kinds of arches and reticular textures; with this difference, that they are proportionably greater, their reticular areolæ larger, and their external communications more frequent.

Nerves of the ſtomach. Between the common and muſcular coats of the ſtomach, we find a great number of nerves of different ſizes. Many of them accompany each other, in form of a broad flat faſciculus, along the ſmall curvature of the ſtomach, from the ſuperior to the inferior orifice. The reſt are ſpread in different directions, on the ſides, extremities, and great curvature, forming at different diſtances a kind of reticular plexus, from which a great number of filaments are detached to the inner coats.

They ariſe chiefly from the nervi ſympathetici medii, or eighth pair, by means of the plexus coronarius ſtomachicus formed round the ſuperior orifice of the ſtomach, by the expanſion of the extremities of two large ropes, which run down upon the œſophagus, by the name of *nervi ſtomachici*. The great ſympathetic nerve, commonly called *intercoſtalis*, contributes likewiſe to them, by communicating filaments, which the plexus ſtoma-

ſtomachicus receives from the ſemilunar ganglions of the plexus hepaticus, and particularly from the plexus ſplenicus.

Uſes of the ſtomach. The ſtomach receives in general, whatever the mouth and tongue ſend thither, thro' the canal of the œſophagus: but its particular uſe is to receive the aliments; to contain them for a longer or ſhorter time, in proportion as they are more ſolid or fluid; and to digeſt them, that is, to put them in a condition to be turned into that nutritious fluid called *chyle*.

This operation, which goes by the general name of *digeſtion*, and by which chylification begins, is performed partly by the ſuccus gaſtricus, which flows continually from the tunica villoſa, and partly by the continual contraction and relaxation of the muſcular coat. Theſe motions in men are but very weak, and nowiſe ſufficient for digeſtion, without the aſſiſtance of the alternate motions of the diaphragm, and muſcles of the abdomen.

The pylorus, or fleſhy circle of the inferior orifice of the ſtomach, ſerves to retain the aliments in it, till they have acquired a ſufficient degree of fluidity, to paſs eaſily through that opening. I ſay eaſily; for by a particular irritation of the muſcular coat of the ſtomach, and ſtill more by a violent contraction of the diaphragm and muſcles of the abdomen, the contents of the ſtomach may be very ſoon forced towards the ſmall extremity, and puſhed through the pylorus.

The gentle and alternate motions of the orbicular fibres of the muſcular coat, may aſſiſt in ſending through the pylorus, in the natural way, the aliment that is ſufficiently digeſted. This was called the *periſtaltic* or *vermicular motion*, by thoſe who believed that it is ſucceſſively reiterated, like that of earth-worms when they creep.

Trituration might be a proper enough term for this operation, provided it be made to ſignify only a gentle agitation

agitation or action of the flefhy fibres in a fubftance continually moiftened by the gaftric liquor, and not a violent grinding of a dry fubftance.

The fituation of the ftomach, which is nearly tranfverfe, is likewife of ufe in making the aliment remain long enough in that cavity; and may ferve to make the length of this ftay, in fome meafure, arbitrary, by means of the different poftures of the body; for when we lie on the left fide, the aliment muft remain longer than when we lie on the right, &c.

The obliquity of the ftomach may ferve to clear up a difficulty that very much torments thofe who believe that both orifices of the ftomach lie on the fame level; which is, how any heavy fubftance, once got into the ftomach, can ever rife again to this level, to pafs into the inteftines.

§ 3. *The Inteftines in general, and Inteftinum Duodenum in particular.*

Situation, fize, and divifion of the inteftines. Between the pylorus and the very loweft part of the abdomen lies a long canal, bent in a great many different directions by numerous convolutions or turnings, called the *inteftines*.

This canal, thus folded and turned, forms a confiderable bulk, which fills the greateft part of the cavity of the abdomen; and it is connected through its whole extent to membranous productions or continuations of the peritonæum, principally to thofe called the *mefentery* and *mefocolon;* of which hereafter.

The incurvations of the inteftinal canal form two arches; a fmall one, by which it is connected to the mefentery and mefocolon; and a great one on the oppofite fide, which lies loofe. The whole canal is generally about fix or feven times as long as the fubject.

The inteftinal canal is neither of an equal fize nor thicknefs through its whole length; from whence anatomifts

tomifts have taken occafion to confider its different portions as fo many particular inteftines, and to divide them all into fmall and great.

And as they ftill found fome differences in each clafs taken altogether, they divided each into three portions, which they diftinguifhed by particular names. In the fmall inteftines, the three portions are named *duodenum*, *jejunum*, and *ileum*; aud in the great inteftines, *cæcum*, *colon*, and *rectum*.

Structure of the inteftines. The inteftines in general are compofed of feveral coats, much in the fame manner with the ftomach. The firft and outermoft is a continuation of the mefentery, or of fome other elongation or duplicature of the peritonæum.

This is commonly termed the *common coat*; and it has a cellular fubftance on its inner furface, like that of the ftomach, which M. Ruyfch thought fit to call a diftinct coat by the name of *tunica cellulofa*.

The fecond coat of the inteftines is flefhy or mufcular, and made up of two planes; one external, the other internal. The external plane is very thin, and its fibres longitudinal; the internal plane is thicker, and its fibres run tranfverfely round the circumference of the inteftinal cylinder.

I am not of opinion that thefe fibres are fpiral, nor that they are perfect circles or rings; but they feem rather to be fegments of circles, difpofed much in the fame manner as in the ftomach, and thus furrounding entirely the inteftinal canal.

Thefe two planes adhere clofely together, and are feparated with great difficulty. They adhere likewife to the common coat by the intervention of the cellular fubftance, which is in greater quantities on the fide next the mefentery than on the other.

The third coat is called *nervofa*, and is fomething like that of the ftomach. It has a particular plane, which ferves as a bafis to fuftain it, made up of very fine,

 ftrong,

ſtrong, oblique fibres, which ſeem to be of the ligamentary or tendinous kind.

To ſee this plane diſtinctly, a portion of the inteſtines muſt be inflated, the common coat removed, and the fleſhy fibres ſcraped off.

This coat ſuſtains two reticular ſubſtances, which are both vaſcular, one arterial, the other venal, accompanied by a great number of nervous filaments. Theſe veſſels and nerves are productions of the meſenteric veſſels and nerves; and as they ſurround the whole canal of the inteſtines, ſome anatomiſts have formed them into a diſtinct coat by the name of *tunica vaſculoſa*.

The nervous coat ſends off from its inner ſurface a great number of portions of ſepta, more or leſs circular, which contribute to the formation of what are called *valvulæ conniventes;* of which hereafter. It likewiſe ſeems to ſuſtain ſeveral different glandular bodies, which we diſcover in the cavity of the inteſtines.

The fourth or innermoſt coat is very ſoft, and is named *tunica villoſa*. It has the ſame extent with the third coat, which ſupports it; and it lines all the ſepta of that third coat; but it is not uniform through the whole canal, as we ſhall ſhow in the particular deſcription.

Inteſtina tenuia. The ſmall inteſtines form one continued uniform canal; and although three portions of it have three different names, yet we have no ſufficient marks whereby to diſtinguiſh them, to fix the preciſe extent or length of each portion, or to ſettle its juſt limits.

The firſt and ſmalleſt portion of the whole canal is called *duodenum;* the ſecond, which is much longer, *jejunum;* and the third, which is ſtill longer than the ſecond, *ileum.*

Situation and connection of the duodenum. The firſt portion of the ſmall inteſtines was called *dnodenum*, from the

the length aſcribed to it by the ancients, *viz.* the breadth of twelve fingers; and the moderns need not cavil much about this length, if it is meaſured with the ends of the fingers of the ſubject.

This inteſtine having ariſen from the pylorus, is immediately bent a little backward and obliquely downward; then it bends a ſecond time toward the right kidney, to which it is a little connected; and from thence paſſes before the renal artery and vein, aſcending inſenſibly from right to left, till it gets before the aorta and laſt vertebræ of the back. It continues its courſe obliquely forward by a gentle turn, which may be reckoned a third incurvation, and alſo the extremity of the duodenum.

Through this whole courſe the duodenum is firmly bound down by folds of the peritonæum, eſpecially by a tranſverſe duplicature which gives origin to the meſocolon. The two laminæ of this duplicature being at firſt ſeparate, and ſoon afterwards uniting, muſt leave a triangular ſpace between them, which is lined with a cellular ſubſtance.

It is in this ſpace that the duodenum adheres by means of the cellular ſubſtance to the parts already named; and the inteſtine is contained therein, as in a caſe; ſo that, without diſſection, we can ſee nothing but its two extremities; and even theſe are hid by the colon, and by the firſt convolutions of the jejunum.

Structure of the duodenum. The firſt coat of the duodenum is conſequently different from that of the other ſmall inteſtines, having this peculiar to it, that it does not inveſt the whole circumference of the inteſtine; becauſe, through the greateſt part of its length, it lies in the triangular ſpace already mentioned; and, for the ſame reaſon, there is a greater quantity of cellular ſubſtance belongs to the outer coat of the duodenum than to that of the other inteſtines.

The muſcular coat of the duodenum is thicker than in the jejunum and ileum.

The tunica nervofa and villofa form conjointly, on the infides of this inteftine, a great number of fmall duplicatures, which advance into the cavity more or lefs directly, like portions of circular planes, with one edge fixed to the inteftine, and the other loofe. Thefe are what anatomifts call *valvulæ conniventes.*

The loofe or floating edge of thefe valves is formed into fmall gathers or waves in the natural ftate. I fay defignedly, *in the natural ftate*, to rectify the falfe ideas which dry preparations of the inteftines are apt to beget. The whole furface of thefe duplicatures or valves is villous, as well as that of the inteftines between them.

The villi of this inteftine are thicker than in the ftomach; but the texture of them in man is not like hairs, as they are commonly reprefented in figures, but rather like that of a fungous, granulated fubftance, compofed of an infinite number of very fine papillæ of different figures; in which we fee, through a microfcope, a multitude of depreffed points or pores, by which their whole furface feems to pierced.

By the fame help we obferve, on different places of the inner furface of this inteftine, feveral round villous tubercles, rifing like fmall verrucæ at different diftances from each other.

This fubftance fuftains an infinite number of capillary veffels of different kinds; for befides the blood-veffels, we fometimes obferve a great number of white filaments which run thro' it, and end at its inner fuface like fo many capillary roots of the veffels called *venæ lacteæ.*

The fungous fubftance which binds thefe capillary filaments together, and furrounds them, is very tender; and the capillary extremities of the fmall blood-veffels diftributed through it, feem to be turned toward the pores of the papillæ. Through thefe pores a mucous fluid, more or lefs tranfparent, is difcharged, which continually moiftens the cavity of the inteftine.

Glands of the duodenum. The internal furface of the duode-

duodenum is furnifhed with a great number of fmall flat glandular tubercles, raifed on the fides, and deprefled in the middle by a kind of foffula; and they are more numerous near the beginning of this inteftine than any where elfe. About the pylorus they lie in a manner in heaps or clufters; and from thence the diftance between them increafes gradually all the way to the other extremity where they are fingle.

Thefe glands, when examined carefully, appear like little bladders, with the orifices turned toward the cavity of the inteftine, and the bodies fixed in the fpongy fubftance next the nervous coat. They furnifh a particular fluid, which is often found to be vifcid.

The biliary orifice of the duodenum. In the inner furface of the duodenum, almoft at the lower part of the firft incurvation, and on the fhorteft fide, there is a longitudinal eminence, in the point or apex of which lies a particular opening, which is the orifice of the ductus bilarius, within which the ductus pancreaticus likewife opens.

This inteftine is commonly the wideft, though the fhorteft, of the inteftina tenuia; and is invefted by more cellular fubftances, efpecially while within its triangular cafe, where it wants the outer coat which the others have; and confequently it is more eafily dilatable by the fubftances which might otherwife ftick within it.

§ 4. *Inteftinum Jejunum.*

Situation and fize of the jejunum. The jejunum, fo called, becaufe it is oftener found empty than the ileum, begins at the laft incurvation of the duodenum, and is there connected to the beginning of the mefocolon.

From thence it bends downward from left to right, and obliquely forward, or from the vertebræ, and makes feveral convolutions, which lie chiefly in the upper part of the umbilical region. Through all this courſe it is connected to the meſentery, in the manner that ſhall be explained hereafter.

It is a pretty difficult matter to fix the exact bounds between this inteſtine and the ileum. The external marks of a redder colour in the one than in the other, though pretty common, are not conſtant; and the internal marks fixed from the plurality of valvulæ conniventes are indeterminate, and oftentimes appear only from diſſection.

Theſe two inteſtines may be better diſtinguiſhed by their different ſituations, which are pretty regular; but as even this mark is not particular enough, the moſt eaſy way that I have been able to contrive, and which will in moſt caſes be found ſufficiently exact, is to divide both inteſtines into five parts; and to allow nearly two-fifths to the jejunum, and three-fifths and a little more to the ileum.

Structure of the jejunum. The coats of the jejunum are nearly of the ſame ſtructure with thoſe of the duodenum, but thinner. The common coat is a continuation of the meſentery; and the cellular ſubſtance is in leſs quantity than in the duodenum, and indeed ſeems to be altogether wanting along the great curvature of the convolutions, where the longitudinal fibres of the muſcular coat adhere very cloſely to the external membrane.

This muſcular coat is not ſo ſtrong as that of the duodenum. The longitudinal plane of fibres is very thin, and almoſt imperceptible, except along the great curvature, oppoſite to the connection of the meſentery, where we ſee, through the membranous coat, a kind of whitiſh ligamentary band, about the third part of an inch in breadth, which is continued along the great curvature of all the convolutions of this inteſtine, and of the ileum.

This ligamentary band is like thoſe which we obſerve on the ſides of the ſmall extremity of the ſtomach. It adheres perfectly to the membranous coat, and to the

the longitudinal fibres of the muſcular, which are here more viſible, and appear to be ſtronger than in any other place.

The tunica nervoſa, which I chooſe rather to call *reticularis*, and its proper cellular or lanuginous ſubſtance, have nothing peculiar to them more than has been already ſaid about the inteſtines in general. By blowing artfully into this ſubſtance, it may be made to ſwell ſo much, round the whole cavity of the inteſtines, as to deſtroy all the duplicatures or valvulæ conniventes.

Theſe valves in this inteſtine are very broad, very numerous, and very near each other. On the ſide of the great curvature, their circumference is continuous and uniform; but next the ſmall curvature, there are ſeveral breaks in them, the extremities of ſome advancing beyond the reſt, and terminating in points. Some of theſe valves go quite round, others only ſome part of the way; and ſome of them are very ſmall, which go obliquely between two large ones, forming a kind of communication.

The papillæ of the tunica villoſa are here more raiſed, more looſe and floating, than in the duodenum; and each of them ſeems to be divided into ſeveral others, by inciſures of a very ſingular kind. In other reſpects they agree pretty much with what was ſaid in the deſcription of the inteſtines in general. The obſervations and figures publiſhed by M. Helvetius, firſt phyſician to the French queen, in the Memoirs of the Royal Academy, expreſs theſe papillæ, and the whole tunica reticularis, very juſtly.

The glandular lacunæ of the jejunum are of the ſame ſtructure with the glandulæ Brunneri or duodenales; but they are diſpoſed in a different manner. They are partly ſingle, at different diſtances from each other; and partly in ſeveral cluſters, like flat oblong bunches of grapes, called *plexus glanduloſi Peyeri*. Theſe are in the largeſt quantity near the great curvature, and they crofs through feveral valvulæ conniventes at once.

The veffels, nerves, connections, &c. muft be referred till the mefentery has been defcribed.

§ 5. *Inteftinum Ileum.*

Situation of the ileum. The convolutions of the inteftinum furround thofe of the jejunum on the two lateral and lower fides, and it paffes in a winding courfe from the left fide, by the hypogaftrium, to the right fide, where it terminates a little below the right kidney, joining the inteftina craffa, in the manner that I fhall relate hereafter. The lateral convolutions are fupported by the offa ilium, fo called, not from this inteftine, but from the region of the abdomen, termed *ilia.*

Structure of the ileum. The ftructure of the ileum is much the fame with that of the jejunum; only the internal duplicatures or valvulæ conniventes decreafe gradually both in number and fize. Near the extremity of the ileum their direction is changed; and inftead of being tranfverfe or circular, they become longitudinal, and terminate in a kind of pylorus, which advances into the cavity of the great inteftines, as we fhall fee prefently.

We obferve likewife in this inteftine, as in the jejunum, fingle or folitary glands or lacunæ, and alfo reticular glands or glands in clufters; the laft of which, at the extremity of this inteftine, is oftentimes of a great extent: but the greateft part of thefe glands appear to be flatter here than in the jejunum. The cellular fubftance of the external coat is in lefs quantities than in the foregoing inteftines; and the ileum appears commonly more pale, or not fo red as the jejunum.

The veffels, nerves, connections, &c. muft be referred to the hiftory of the mefentery.

§ 6. The

§ 6. *The Inteſtina Craſſa in general, and Inteſtinum Cæcum in particular.*

THE great inteſtines are one continued canal, divided into three portions, like the ſmall ones. This canal begins by a kind of ſacculus or bag, which is reckoned the firſt of the three portions, and called *cæcum*. The ſecond portion, called *colon*, is the longeſt of the three; and is diſtinguiſhed from them by a great number of particular eminences or convexities, which appear on its outer ſurface through its whole length. The laſt portion is named *rectum*; being more uniform, narrower, thicker, and much ſhorter, than the colon.

The ſtructure of the great inteſtines is nearly the ſame with that of the ſmall ones, in regard both to the number and diſpoſition of their coats. They are ſhorter, and have fewer convolutions, but are much more capacious. The coats in general are ſtronger, but eſpecially the muſcular coat. The villi and mucilaginous glands are different; and there are ſeveral other things relating to them, which will come in better in the particular hiſtory.

Situation and ſtructure of the cæcum. The inteſtinum cæcum is only a round ſhort broad bag, the bottom of which is turned downward, and the mouth or opening upward. It lies under the right kidney, and is hid by the laſt convolution of the ileum. It is about three fingers breadth in length, and its diameter is more than double that of the ſmall inteſtines.

Appendicula vermiformis. On one ſide of the bottom of the cæcum lies an appendix, reſembling a ſmall inteſtine, nearly of the ſame length with the cæcum, but very ſlender. It is termed *appendicula vermiformis*, from its ſuppoſed reſemblance to an earth-worm. Its common diameter is not above a quarter of an inch. By one extremity it opens laterally and a little obliquely into

into the bottom of the cæcum; and the other extremity is clofed, being fometimes greater fometimes fmaller than the reft of the appendix.

It has fome contortions, like thofe of a worm when it is touched, from whence comes the epithet of *vermicularis* or *vermiformis*. Its ftructure refembles nearly that of the other inteftines.

The internal coat of this appendix is folliculous, like that of the duodenum; and it is likewife reticular, the mefhes being the glandular lacunæ, which continually difcharge a fluid into its cavity.

It has been often difputed whether this appendix, or the large portion, which is, as it were, the head of the colon, ought to be called the *cæcum;* but the general divifion of the inteftines into great and fmall, leaves no room to doubt of its being only an appendix in man, whatever reafon there may be for talking differently with refpect to brutes and birds.

Through the membranous or common coat of the cæcum, we fee three white ligamentary bands, which adhere very clofely both to the outer and mufcular coat. One of them is hid by the adhefion of the mefocolon; and all the three divide the cæcum longitudinally into three parts more or lefs equal.

They all unite on the appendicula vermiformis, and cover its whole outer fide immediately under the common coat. Though they appear exteriorly on the cæcum to be ligamentary, they are made up interiorly of flefhy fibres which accompany and ftrengthen the longitudinal fibres of the mufcular coat.

The villous fubftance of the inner coat of the cæcum is very fhort, and furnifhed in feveral places with glandular lacunæ or folitary glands, broader than thofe of the fmall inteftines.

Thefe glandular lacunæ or folliculi are flattened and depreffed in the middle like fmall-pox. When we blow through a pipe into thefe lacunæ without touching them, the

the folliculi are inflated, and reprefent little caps with a hole in the middle of their convex fide.

§ 7. *Inteftinum Colon.*

Situation and ftructure of the colon. The colon is the moft confiderable of all the inteftines. From the cæcum, of which it is a continuation, it reaches, in form of an arch, above the umbilical region, and to the lower part of the left hypochondrium. Its continuity is, however, a little interrupted by the ileum, which advances into the cavity of the colon, and, together with a certain fold of that inteftine, forms what is called *valvula coli.*

The whole convex fide of the colon is divided longitudinally into three parts, by three ligamentary bands, continued from thofe of the cæcum, and of the fame ftructure with thefe. Two of thefe bands run on each fide, along the great curvature of the colon; and the third along the fmall curvature.

The uppermoft band of the two that belong to the great curvature, is the broadeft of the three; that which belongs to the fmall curvature is the narroweft, and lay hid by the connection of the mefocolon, till it was brought to light by M. Morgagni.

Thefe three longitudinal bands do the office of longitudinal fræna, between which this inteftine is thro' its whole length alternately depreffed into tranfverfe folds, and raifed into confiderable eminences. All the folds are duplicatures, which form portions of valvulæ conniventes in the cavity of the inteftine; and the eminences form receptacles, called the *cells of the colon.*

All the coats of the colon concur equally to the formation of thefe duplicatures and cells, the depth of which decreafes gradually toward the extremity of the inteftine, and neither of them go any further than the ligamentary bands.

Thefe portions of the colon which are immediately

co-

covered by the ligamentary bands, are ſmooth and without rugæ; and therefore, if theſe bands alone are cut acroſs, the inteſtine is not elongated ſufficiently to deſtroy all the folds and cells.

The common coat on one ſide is a continuation of the meſocolon, and on the other ſide it contributes, by the ſame continuation, to form the omentum. The longitudinal fibres of the muſcular coat are very ſlender; and thoſe which anſwer to the annular or circular fibres of the ſmall inteſtines, are only ſegments ſtretched over the eminences and folds. The other coats are nearly as in the cæcum; only the glandular lacunæ or ſolitary glands are broader and more numerous.

The arch of the colon begins under the right kidney, near the haunch. It runs up on the foreſide of that kidney to which it is connected; paſſes under the veſicula fellis, which tinges it with a yellow colour at that place; and continues its courſe before the firſt incurvation of the duodenum, to which it adheres, and partly hides it. In this part of its courſe, therefore, there is a remarkable connection between the colon, duodenum, right kidney, and veſicula fellis.

From thence the arch of the colon runs before the great convexity of the ſtomach, and ſometimes a little lower; then turns backward under the ſpleen, in the left hypochondrium; runs down on the foreſide of the left kidney, to which it is connected; below this kidney, turns toward the vertebræ, and terminates there by a double incurvature, or by two oppoſite convolutions, which repreſent in ſome meaſure an inverted Roman S.

Theſe laſt convolutions of the colon are ſometimes multiplied, and even advance to the right ſide of the pelvis; and along the great arch, and the two laſt incurvations, there are a kind of fringes, called *appendices coli adipoſæ*, which I ſhall afterwards explain, as alſo the connections of the colon with the meſocolon and omentum.

Val-

Valvula coli. At the place where the cæcum joins the colon, one portion of the circumference of both is depreſſed, and forms a large fold on the inſide, which advances into the cavity of the inteſtine. It is a litte open in the middle, and its extremities are very thick, by reaſon of the mutual duplicature of the coats of the cæcum and colon.

The extremity of the ileum is as it were grafted in the opening of this fold, and ſtrongly united to its ſides by the adheſion of its tranſverſe fibres to the tranſverſe fibres of the cæcum and colon.

This union forms a pretty thick ring, which likewiſe advances into the common cavity of the cæcum and colon, where it is wrinkled or formed into gathers, almoſt like the lower extremity of the œſophagus, the pylorus, or inſide of the anus. Its circumference is more or leſs oval; and, by a kind of continuity with the common fold of the cæcum and colon, it forms two productions, which M. Morgagni calls the *fræna* of the valvula coli.

The membranous coat of the extremity of the ileum is continued on the cæcum and colon, without ſinking into any fold at the place where the ileum enters the colon. The longitudinal fibres of the muſcular coat ſeem here to be confounded with the neareſt circular fibres of the cæcum and colon.

The inner portion of the muſcular coat of the ileum runs in between the circular fibres of the ileum and colon, as into a common fold of theſe two inteſtines; from all which a pretty thick ſhort portion of a fleſhy tube is formed, which is the circular riſing already mentioned.

The tunica nervoſa and villoſa of the extremity of the ileum likewiſe enter the common cavity of the cæcum and colon, and on the edge of the circular riſing join the like coats of theſe two inteſtines; ſo that the circular riſing or ſhort muſcular tube is covered both on the outer and inner ſides by a nervous and villous coat;

that on the inſide being ſupplied by the ileum, and the other by the two great inteſtines.

The ſituation of this extremity of the ileum is moſt commonly tranſverſe, and is inſerted almoſt in the ſame direction in the common cavity of the two inteſtines already mentioned; but it is often a little more inclined toward the cæcum, than to the colon; and whereas in all other places the ileum is wide and eaſily dilatable, it is very narrow at its inſertion, and its ſides are more ſolid and firm.

It is chiefly in this ſtructure that the mechaniſm of the inſertion of the ileum in the cæcum and colon conſiſts; about which inſertion or opening, authors are very much divided, ſome reckoning it a valve, others only a ſphincter.

It is very evident, from what I have ſaid, that it is a double machine contrived to hinder the return of the excrements into the ileum, becauſe it can produce this effect partly as a valve, and partly as a kind of ſphincter. The dried preparations of this part give a very falſe idea of its ſtructure and conformation; and the ſame thing is to be ſaid of the opening of the appendicula vermiformis into the cæcum.

The capacious arch of the colon is connected by both extremities to the regio lumbaris, near the kidneys, by two particular ligaments, one on the right ſide, the other on the left, which are only ſmall duplicatures of the peritoneum, more or leſs tranſverſe.

The remaining portion, which forms the two convolutions in form of the Roman S, contracts below the left kidney, being narrower there than lower down. The coats of this portion become gradually thicker and ſtronger, and likewiſe the ligamentary bands, which approach each other by degrees, and ſeem to increaſe in breadth.

The veſſels, nerves, &c. will be found in the deſcription of the meſentery.

§ 8. *In-*

§ 8. *Inteſtinum rectum, and Anus.*

Situation, figure, and ſize of the rectum. The laſt of all the inteſtines is named *rectum*, or the *ſtraight gut*, from its ſituation; for, when viewed directly forward, it appears to run down in a ſtraight courſe from the laſt vertebra of the loins, on the foreſide of the os ſacrum, all the way to the os coccygis, where it ends in what is called the *anus*.

This inteſtine, properly ſpeaking, is a true continuation of the laſt convolution of the colon; and it is the repoſitory, ſink, and common ſewer of the whole inteſtinal canal. It has likewiſe a ſpecial relation to the bladder, and to the parts of generation in both ſexes.

The rectum having paſſed below the laſt vertebra of the loins, to the inſide of the os ſacrum, is bent backward, on that concave ſide, to which it is connected, in the manner that ſhall be afterwards explained; and having reached the os coccygis, it runs likewiſe in the direction of that bone, and bends a little forward, terminating beyond the extremity of the coccyx.

The figure of this inteſtine varies according as it is full or empty. When empty, it is irregularly cylindrical, and ſinks in by a kind of tranſverſe folds; and in that ſtate, it is about three fingers breadth in diameter more or leſs. When full, it is wider in proportion to the quantity of fæces, wind, or whatever elſe is contained in it; and it may be extended to the ſize of a large bladder, ſo as to repreſent a kind of ſtomach.

Structure of the rectum. The membranous coat often contains a great quantity of fat, ſpread between it and the muſcular coat, and forming round the inteſtine numerous eminences, in the room of the appendices adipoſæ of the colon, which ſhall be explained in the hiſtory of the omentum.

The muſcular or fleſhy coat is very thick; and the longitudinal fibres, which in the other inteſtines are very thin,

thin, are in this ſtronger than the circular fibres of the reſt. The ligamentary bands continue to increaſe in breadth, and to approach each other, as has been ſaid; and it is to the fleſhy fibres of theſe bands, that the thickneſs of the longitudinal fibres ſeems to be owing.

The nervous or filamentous and internal coats, are larger here than in the other inteſtines; and when the rectum is empty, they form a great number of waving rugæ in its cavity, which diſappear in proportion as that cavity is filled.

The innermoſt coat is very improperly termed *villoſa*, and ſcarce deſerves the name of *papillaris*, becauſe of the ſmallneſs of the little corpuſcles ſpread on its ſurface. It contains a great number of ſingle or ſolitary glands; and it is always moiſtened by a mucus of different conſiſtences, diſcharged by theſe glands or folliculi, and perhaps by the corpuſcles alſo.

Near the extremity of this inteſtine the rugæ or folds become in a manner longitudinal; and at laſt, towards the circumference of the inner margin of the anus, they form little bags or ſemilunar lacunæ, the openings of which are turned upward, toward the cavity of the inteſtine. Theſe lacunæ are ſomething like thoſe at the lower extremity of the œſophagus, or upper orifice of the ſtomach.

Muſcles of the anus. At length the extremity of the rectum contracts, and terminates by a narrow orifice called the *anus*, the ſides of which are diſpoſed in cloſe folds or gathers. This extremity of the inteſtine has ſeveral muſcles belonging to it, ſome of which ſurround it like ſphincters; the reſt are broad fleſhy planes inſerted in it, and which, being likewiſe fixed to other parts, ſuſtain it in its natural ſituation, and reſtore it to that ſituation after being diſturbed by the force neceſſary for the excluſion of the fæces. Theſe latter muſcles are termed *levatores ani*, the firſt go by the general name of *ſphincters*.

Theſe ſphincters are three in number, one inteſtinal or orbicular, and two cutaneous or oval; whereof one is large, ſuperior, and internal; the other ſmall, inferior, and external.

The inteſtinal or orbicular ſphincter of the anus, conſiſts merely in an augmentation of the inferior portion of the fleſhy fibres of the extremity of the rectum.

In the deſcription of the freſh bones, I omitted two ligaments, one called *ligamentum cutaneum oſſis coccygis*, the other *ligamentum pubis interoſſeum*. Theſe two ligaments muſt be here deſcribed, before I proceed to the cutaneous ſphincters.

The cutaneous ligament goes out anteriorly, from the extremity of the os coccygis. It is very ſlender, and divides into two portions at the orifice of the anus, which run into the membrana adipoſa, and are inſerted in the ſkin on each ſide of the anus, by a kind of expanſion, and, continuing to devaricate, they are loſt on the two ſides of the perinæum.

The interoſſeous ligament of the oſſa pubis is a very ſtrong triangular membrane, fixed by two of its edges in the inferior rami of theſe bones, all the way up to their common ſymphyſis. The third edge, which is the loweſt, is looſe; and this whole membrane, the middle of which is perforated by a particular hole, is ſtretched very tight between the two bones, and under their cartilaginous arch, to which it adheres very cloſely.

At the lower part of this interoſſeous ligament, along its whole lower or looſe edge, lies a digaſtric muſcle, fixed by its two extremities in the rami of the oſſa pubis, its middle tendon lying on the middle of the edge of the ligament. The deſcription of that muſcle does not belong to this place; and I mention it here only becauſe of the relation it bears to the cutaneous ſphincters of the anus. It is called by ſome, *muſculus tranſverſalis perinei;* by others, *muſculus triangularis.*

The cutaneous ſphincters have each an anterior and

po-

poſterior inſertion, ending both ways in a kind of point, and comprehending the orifice of the anus between their middle portions.

They are diſtinguiſhed from each other by their ſituation, by their ſize, and by a kind of white cellular line. The greateſt of the two appears to be double; and the ſmalleſt lies neareſt the ſkin, and adheres moſt cloſely to it.

They are inſerted backward, partly in the apex of the os coccygis, and partly in the contiguous portion of the cutaneous ligament of that bone. Forward their chief inſertion is in the middle tendon of the tranſverſalis urethræ; and they have likewiſe ſome connections to other muſcles of the urethra, of which hereafter.

The levatores ani are broad, thin, muſcular portions, fixed by one extremity of their fleſhy fibres round the concave ſide of the inferior portion of the pelvis, from the ſymphyſis of the oſſa pubis, beyond the ſpine of the iſchium. The other extremity of theſe fibres runs down on each ſide behind, and under the curvature of the end of the rectum, where they meet together, and unite from the baſis of the os coccygis all the way to the margin of the anus.

By their ſuperior inſertions, theſe portions are on each ſide of the pelvis divided into three claſſes, an anterior, middle, and poſterior claſs. The two anterior claſſes reach from about the middle of the ſymphyſis of the oſſa pubis, to the upper border of the foramina ovalia of the pelvis. The middle claſſes continue the ſame courſe immediately above the inſertion of the obturator internus, on the oſſa iſchium, and a little on the oſſa ilium. The poſterior claſſes are ſpread on the inner ſides of the oſſa iſchium to the ſpinal apophyſes of theſe bones, and even a little beyond theſe, on the ligamenta ſacroſciatica.

The anterior portions are in their paſſage connected to the proſtate glands, to the neck of the bladder, to the

the bulb of the urethra, as ſhall be ſhown in the deſcription of thoſe parts; and they ſometimes ſend fibres to the muſculus tranſverſalis urethræ abovementioned.

The fibres of all theſe portions having by their ſuperior inſertions formed this large and ample circumference, run down obliquely from before backward, contracting in breadth, and approaching each other in the manner of truncated radii; and behind, and under the extremity of the rectum, they form a digaſtric muſcle, ſomething like the mylo-hyoidæus; which terminates the bony pelvis below, and forms the bottom of the cavity of the abdomen, as the diaphragm forms the upper part.

Here we ought to remark, that the margin or edge of the anus is formed by the union of the ſkin and epidermis with the internal coat of the rectum; ſo that the moſt ſuperficial portion of that coat ſeems to be a continuation of the epidermis.

I refer the arteries, veins, nerves, connections, uſes, &c. to the place already mentioned in the deſcription of the other inteſtines.

§ 9. *Meſenterium et Meſocolon.*

Diviſion of the meſentery, &c. This great bundle of inteſtines is not left to move at random in the cavity of the abdomen; but artfully bound down by a membranous web, which prevents the inteſtinal convolutions from being intangled in each other, and from being twiſted or compreſſed in all their different ways of meeting; and yet allows them a gentle floating, but limited motion.

This web goes ſtill by the ancient Greek name of *meſentery*, as being in ſome meaſure in the middle of the inteſtines. It is diſtinguiſhed into two portions, one of which being very broad and very much plaited, connects the ſmall inteſtines; the other, which is long and incurvated, does the ſame office to the great inteſtines.

Theſe two portions are in reality only one and the ſame continuation of the membranous lamina of the peritonæum doubled back upon itſelf, and they are diſtinguiſhed only by their breadth. Taken both together, they form a kind of ſpiral roll, more or leſs plaited in its circumference. The firſt portion has retained the name of *meſentery*, the other is termed *meſocolon*.

Structure of the meſentery, &c. The meſentery begins at the laſt incurvation of the duodenum, and runs obliquely from left to right, along the vertebræ of the loins. In this ſpace, the membranous portion of the peritonæum is detached on both hands, produces a duplicature by two elongations or particular laminæ applied to each other, and thus forms the meſentery.

It is narrow at its upper and lower parts, but chiefly at the upper. The middle portion is very broad, and the edge of it next the inteſtines is every where very much plaited. Theſe plaits or folds are only waving inflexions, ſuch as may be obſerved in the edge of a piece of ſhamoy which has been often drawn through the fingers. They make this edge of the meſentery very long, and they run through about one third of its breadth.

The two laminæ are joined together by a cellular ſubſtance, which contains glands, veſſels, and nerves, that ſhall be deſcribed hereafter; and in ſome ſubjects it has a great quantity of fat, which keeps the two laminæ at a good diſtance from each other.

Along the whole circumference of the meſentery, the two laminæ are naturally ſeparated, and applied to the two ſides of the ſmall inteſtines which they inveſt by their union or rather reciprocal continuation on the great curvature of that canal, and carry it as in a ſcarf or ſling. This is what forms the external or membranous coat of the inteſtines.

The meſocolon is the continuation of the meſentery, which

which having reached the extremity of the ileum, contracts and changes its name. At this place, the particular lamina which is turned to the right ſide, forms a ſmall tranſverſe fold, called *ligamentum coli dextrum.*

Afterwards the meſocolon aſcends toward the right kidney, where it ſeems to be loſt by the immediate adheſion of the colon to that kidney, and to the firſt incurvation of the duodenum. Then it appears again, and increaſing in breadth, it continues its courſe almoſt tranſverſely under the liver, ſtomach, and ſpleen, where it begins to turn downward, under the left hypochondrium, toward the kidney on the ſame ſide.

Through this whole courſe the meſocolon extends in breadth, and forms nearly a tranſverſe ſemicircular plane, very little plaited at its great circumference. By this circumference or edge, it is connected to the colon, and hides that ligamentary band of this inteſtine, which runs along its ſmall curvature. By its ſhort or ſmall edge, it forms the triangular caſe of the duodenum; and, by its great edge, the external coat of the colon, in the ſame manner as the meſentery does that of the ſmall inteſtines. As it paſſes under the large extremity of the ſtomach, it adheres a little to the lower portion of that extremity, as the diaphragm does to the upper.

Having got below the left kidney, it contracts, and forms another tranſverſe fold, called *ligamentum coli ſiniſtrum.* Afterwards it expands again, but not ſo much as in the upper part; and runs down on the left pſoas muſcle, toward the laſt vertebræ of the loins. This deſcending portion is fixed to their convolutions of the colon, in the ſame manner as the ſuperior portion is to the arch of that inteſtine.

The inteſtinum rectum is likewiſe inveſted by a particular production of the peritonæum, called commonly by the barbarous name of *meſo-rectum.* This production is very narrow; and about the middle of the foreſide of the rectum, it forms a tranſverſe ſemicircular fold, which appears when the inteftine is empty, but is loft when it is filled.

Between the laminæ of the mefentery, a great number of glands lie fcattered through the cellular fubftance. In the natural ftate, thefe glands are fomething of the figure of lentils or little round beans, fome of them being orbicular, others oval, but all of them a little flatted, and in corpulent fubjects we find them furrounded with fat.

Thefe glands are of the number of thofe that anatomifts call *glandulæ conglobatæ*, the ftructure of which is not as yet fufficiently known. They feem to be of a cellular fubftance, furrounded by a very fine membrane or coat, on which, by the help of microfcopes, we difcover an intertexture, of particular filaments, which Malpighi believed to be flefhy fibres.

The niceft anatomical injections have not hitherto given us any fatisfaction about thefe particulars: for though they be made with all poffible care, they always fill the folliculous texture of thefe glands; and though by means of thefe injections we may difcover a great many veffels, which were before invifible, we are not a whit the nearer our purpofe, becaufe we cannot by this method diftinguifh the fecretory, excretory, and blood-veffels from each other.

Befides the blood-veffels, which are diftributed in a reticular manner in the mefenteric glands, and befides many nervous filaments fpread through them, we difcover an infinite number of fmall veffels of another kind, running from gland to gland.

Thefe veffels are extremely thin and tranfparent, and furnifhed on the infide with numerous valves, which appear on the outfide like little fmall knots very near each other. They go out from each gland by ramifications, as by fo many roots; and having formed a fmall trunk, they are again divided, and enter fome neighbouring gland by the fame kind of ramifications by which they went out from the former.

Lac

Lacteal vessels. These are termed *lymphatic vessels*, because for the most part they contain a very clear, limpid, though mucilaginous serum, called *lympha* by anatomists. But as they have likewise been observed to be filled with a white milky fluid, called *chyle*, they have been called *vasa chylifera*, or *venæ lacteæ*. They have the name of *veins*, because their valves are disposed as those of the ordinary blood-veins, and because the fluid which they contain runs from smaller into larger tubes: But the particular description of these will come in more properly in a latter part of the work.

§ 11. *The Blood-vessels and Nerves of the Intestines.*

Blood-vessels of the intestines. The duodenum has commonly a particular artery called *duodenalis* or *intestinalis*, which comes indifferently from the stomachica coronaria, pylorica, gastrica major, or hepatica. It has likewise several distinct ramifications from these trunks, and from the mesenterica superior and splenica, which ramifications communicate with each other.

The arteria duodenalis, and the other additional small arteries, form a vascular net-work round the muscular coat of the intestine, which sends out a great number of capillaries toward both the outer and inner sides, that make the whole intestine look of a red colour.

The veins of the duodenum are ramæ of the vena portæ, and the distribution and denomination thereof is pretty much the same with that of the arteries; only they communicate more with each other than the arteries, and also with the great hæmorrhoidal vein.

The venal ramifications form round the duodenum a net-work like that of the arteries; and the same kind of vascular texture is more or less to be found in all the other intestines.

The arteries of the jejunum come chiefly from the me-

mefenterica fuperior, and fome from the afcending branch of the mefenterica inferior. The veins are for the moft part branches of the great meferaica; and the reft come from the fplenica and fmall meferaica or hæmorrhoidalis interna.

The principal fubaltern trnnks of thefe arteries and veins accompany each other through the cellular fubftance between the laminæ of the mefentery; are diftributed by branches and rami; and form the mefhes, lozenges, and arches, mentioned in the defcription of the arteries and veins. The laft of thefe arches and lozenges, or thofe next to the inteftine, produce two fmall vafcular planes, which feparate from each other very diftinctly, and furround the inteftinal canal in a reticular manner.

The blood-veffels of the ileum come from the fame fources with thofe of the jejunum, as has been faid in the hiftory of the arteries and veins; and it ought to be obferved concerning both thefe veffels, and thofe of the jejunum, that in their whole courfe through the mefentery, they give ramifications to the glands, laminæ, and cellular fubftance of the mefentery; and alfo that there is a kind of communication between feveral fmall meferaic veins, and the capillary rami of the venæ lumbares and fpermaticæ.

The arteries of the cæcum and appendicula vermiformis, are ramifications of the laft branch from the convex fide of the mefenterica fuperior; and they have likewife fome fmall ones from the fecond and third branches, when both are found. The veins of thefe two parts are ramifications of the great meferaica, and one of thefe rami is by Riolan termed *vena cæcalis*.

The ftraight portion of the arch of the colon, or that which is an immediate continuation of the cæcum, is fupplied with arteries by the fecond branch that comes from the concave fide of the mefenterica fuperior, and likewife a little by the third, when there is a third.

The fuperior or middle portion of the arch of the colon,

lon, is furniſhed by the firſt branch from the ſame ſide of the meſenterica ſuperior, which by a bifurcation communicates on both hands with the other portions of the arch of the colon.

The left portion of this arch derives its arteries partly from the firſt branch of the ſame meſenterica, and partly from that of the meſenterica inferior; which two branches form the celebrated communication or common arch of the two meſentericæ.

By means of this communication or continuation, in caſe one artery ſhould be obſtructed or compreſſed, the other would furniſh blood to all the branches below the place of the obſtruction. The ſecond branch of the meſenterica inferior gives likewiſe ſmall arteries to the left extremity of the colon.

The deſcending convolutions of the colon, which repreſent a Roman S, are ſupplied by the other branches of the meſenterica inferior; the laſt of which forms the hæmorrhoidalis interna.

The veins of all theſe portions of the colon are branches and ramifications of the vena portæ ventralis, and principally of the ſubaltern trunks, the meſeraica major, and meſeraica minor or hæmorrhoidalis interna. The diſtribution of theſe branches and ramifications is in ſome meaſure the ſame with that of the arteries, as may be ſeen in the deſcription of the veins.

The arteries of the rectum are furniſhed by the hæmorrhoidalis interna, the laſt branch of the meſenterica inferior, which communicates with the hypogaſtrica, and particularly with the hæmorrhoidalis externa, a production of one of theſe arteries.

The veins of the rectum are ramifications of the laſt branches of the meſeraica minor or hæmorrhoidalis interna; and they communicate with the hæmorrhoidales externæ, which are rami of one of the hypogaſtricæ. They communicate likewiſe with the capillary ramifications of the other hypogaſtric veins, whhich go to the internal parts of generation of both ſexes.

It

It is here to be obferved in general, that there is a fucceffive continuation, more or lefs fimple or multiplied, between all the arteries of the inteftinal canal, and likewife between all the veins; and alfo that the veins are here thinner and more capacious than the arteries, in a greater proportion than in the other parts of the body.

Nerves of the inteftines. The nerves of the duodenum are the middle plexus of the femilunar ganglion, and fome filaments of the plexus ftomachicus and hepaticus.

The nerves of the jejunum, ileum, and mefenteric glands, are the plexus mefentericus fuperior, the pofterior mefenteric fafciculi, and the plexus mefentericus inferior.

The nerves of the cæcum are the pofterior mefenteric fafciculi or plexus, and the plexus mefentericus inferior.

The nerves of the arch of the colon are the fame fafciculi, and the two plexus mefenterici.

The nerves of the laft convolutions of the colon are the pofterior mefenteric fafciculi, and the plexus mefentericus inferior and fub mefentericus.

The nerves of the rectum are the plexus mefentericus inferior, plexus fub-mefentericus or hypogaftricus, and the two ganglions of that plexus.

The nerves of the anus, and of its mufcles, are the ganglions of the plexus fub-mefentericus, the inferior rope of both fympathetici maximi, and the common arch of the extremities of both ropes.

Before I proceed to the liver, it muft be remarked, that the omentum and appendices adipofæ have fo near a relation to the liver and fpleen, that it is impoffible to defcribe them without mentioning feveral things belonging to thefe two vifcera; and therefore I think it more proper to give the hiftory of thefe after that of the other two, and even of the pancreas, than to begin the hiftory of the parts contained in the cavity of the

the abdomen by that of the omentum, as is commonly done.

For the ſame reaſon, I ſhall not give the uſes of theſe parts till after they have been all explained; and together with theſe uſes, I ſhall ſpeak to thoſe of the inteſtinal canal, meſentery, vaſa lactea, meſenteric glands, muſcles of the anus, &c.

§ 12. *Hepar, and Veſicula Fellis.*

Situation, figure, and diviſion, of the liver. The liver is a large and pretty ſolid maſs, of a dark red colour, a little inclined to yellow, ſituated immediately under the arch of the diaphragm, partly in the right hypochondrium, which it fills almoſt entirely, and partly in the epigaſtrium, between the appendix enſiformis and ſpina dorſi, and terminating commonly in the left hypochondrium, into which it ſometimes runs a conſiderable way.

The figure of the liver is irregular, it being arched or convex on the upper part, unequally concave on the lower, and very thick on the right and back ſides. Towards the left and anterior ſides, its thickneſs decreaſes very much, and terminates there by a kind of edge; and it is broader from right to left than from before backwards.

The liver may be divided into two extremities, one great, the other ſmall; two edges, one anterior, and one poſterior; two ſides, one ſuperior and convex, which is ſmooth, poliſhed, and proportioned to the arch of the diaphragm, and one inferior, concave and uneven, with ſeveral eminences and depreſſions; of which hereafter.

It may likewiſe be divided into two lateral parts, called *lobes*; one of which is termed the *great* or *right lobe*, the other the *ſmall* or *left lobe*. Theſe two lobes are diſtinguiſhed above by a membranous ligament, and

and below, very plainly, by a confiderable sciffure, lying in the fame direction with the fuperior ligament.

The eminences on the concave fide of the liver belong to the great lobe. The principal eminence is a fort of triangular or pyramidal apophyfis, fituated backward near the great sciffure which diftinguifhes the two lobes.

This triangular eminence is termed *lobulus Spigelii*, or fimply the fmall lobe of the liver. One of its angles advances a confiderable way toward the middle of the lower fide of the great lobe, and is loft there. This angle I call the *root* of the lobulus. Toward the forefide there is another eminence lefs prominent, but broader; and to this eminence, and the former, the ancients gave the general name of *portæ*.

The depreffions on the concave or lower fide of the liver, which deferve our attention, are four in number. The firft is the fciffure that feparates the two lobes, which runs acrofs the concave fide, from the eminences already mentioned, to the anterior edge, where it terminates by a notch of different depths in different fubjects. This is termed the *great fciffure* of the liver; and in fome fubjects part of it is an entire tube. The fecond depreffion is fituated tranfverfely between the two eminences of the great lobe, and filled by the finus of the *vena portæ*, fo called by the ancients becaufe it lies between the eminences of the fame name. The third depreffion is backward between the great lobe and lobulus fpigelii, and the vena cava paffes through it. The fourth is a kind of fulcus between the lobulus and fmall lobe of the liver, which in the fœtus ferved to receive a venal canal loft in adults, in whom it appears only as a kind of ligament. This fulcus is in fome meafure a continuation of the great fciffure, and joins the vena cava by an acute angle.

Befides thefe four depreffions, there is one on the fore-part of the great lobe, in which the veficula fellis is lodged; and it fometimes runs as far as the edge, where

where it forms a ſmall notch. We may likewiſe reckon among theſe depreſſions a ſmall ſuperficial cavity in the poſterior and lateral part of the lower ſide of the of the great lobe, by which it reſts on the right kidney; and likewiſe a ſuperficial cavity in the left lobe, where it runs over the ſtomach.

Laſtly, on the poſterior edge of the liver, there is a great ſinus common to both lobes, which gives paſſage to the ſpina dorſi and œſophagus, near the place where the vena cava deſcends; and we ſometimes meet with ſciſſures on both ſides of the liver, which are not ordinary.

Ligaments of the liver. The convex ſide of the liver is commonly connected to the diaphragm by three ligaments, which are only continuations of the membranous lamina of the peritonæum: One lies near the edge of the extremity of each lobe, and one in the middle; and they are accordingly termed the *right*, *middle*, and *left ligaments*. There is a cellular ſubſtance in the duplicature of each, in which the blood-veſſels and lymphatics run, and which ſends off a kind of lamina into the ſubſtance of the liver.

The right ligament ſometimes connects the great lobe to the cartilages of the falſe ribs; and the left ligament, or that of the ſmall lobe, is often double, and advances toward the middle ligament. This middle ligament begins below in the great ſciſſure of the liver, near the eminences called *portæ*; and from thence paſſes through the anterior notch, and over the convex ſide of the liver at the union of the two lobes, and is fixed obliquely in the diaphragm.

It is likewiſe fixed along the upper and inner part of the vagina of the right muſculus rectus of the abdomen, in ſuch an oblique manner as to be nearer the linea alba below than above.

Beſides theſe ligaments, the great lobe of the liver is likewiſe connected to the right ala of the tendinous portion of the diaphragm, not by a ligament, but by

a

a broad and immediate adhesion, without the intervention of the membrane of the peritonæum, which is only folded quite round this adhesion, to form the external membrane of all the rest of the body of the liver.

This broad adhesion is commonly, though improperly, called *ligamentum coronarium:* but in the first place it is not a ligament, as has been already observed; and, secondly, it is not circular, but oval and very oblong.

It is not on the upper part of the convex side of the liver, but along the posterior part of the great lobe; the broad extremity of the adhesion lying nearer the notch, and the pointed extremity towards the right hypochondrium.

The middle ligament, called improperly *ligamentum hepatis suspensorium*, contains in its duplicature a thick white rope, like a round ligament, which was the umbilical vein in the fœtus. Thus the lower part represents a falx; the convex edge of which is sharp, and the other rounded.

All these ligaments serve to keep the liver in its proper situation, and to hinder it from inclining too much towards either side: but we must not imagine that any of them serve to suspend it; because it is sufficiently supported by the stomach and intestines, especially when they are filled.

When the stomach is empty, or when we fast longer than ordinary, it is a common expression to say the stomach pinches us. As the liver is not then sustained by the stomach and intestines, it descends by its own weight, and, chiefly by means of the middle ligament, pulls the diaphragm along with it. It is in that place, therefore, that we have this uneasy sensation; and not at the superior orifice of the stomach, as is commonly believed.

The right or great lobe of the liver, which lies in the right hypochondrium, rests on the right kidney by a small superficial depression above-mentioned; and it like-

likewiſe covers a portion of the arch of the colon and the pylorus. About two third parts of the ſmall or left lobe lie in the middle of the epigaſtrium, and the remaining third part advances over the ſtomach towards the left hypochondrium.

This ſmall lobe is ſituated almoſt horizontally; the great lobe is very much inclined, and its thick extremity runs down almoſt in a perpendicular direction to the right kidney on which it lies, in the manner already ſaid. This obſervation is of uſe to diſtinguiſh the different parts of the liver in wounds and chirurgical operations.

It may likewiſe ſerve to direct us in examining a liver taken out of the body; the ſituation of which may be otherwiſe very eaſily miſtaken, eſpecially that of the parts of the concave ſide. The paſſage of the vena cava, between the body of the great lobe and the lobulus Spigelii, may likewiſe ſerve for a rule in placing a detached liver in its true ſituation.

Structure of the liver. The liver is compoſed of ſeveral kinds of veſſels; the ramifications of which are multiplied in an aſtoniſhing manner, and form, by the intertexture of their capillary extremities, an innumerable collection of ſmall pulpy friable corpuſcles, which are looked upon to be ſo many organs deſigned to ſeparate from the maſs of blood a particular fluid, termed the *bile.*

The greateſt part of theſe veſſels, from one end to the other, is included in a membranous vagina, called *capſula venæ portæ*, or *capſula Gliſſoni*, from an Engliſh author who firſt deſcribed it particularly.

The veſſel which carries the blood to the liver is called *vena portæ*, for the reaſon already given. In the deſcription of the veins, I obſerved that the vena portæ might be conſidered as two large veins, the trunks of which are joined endwiſe, and ſend out branches and ramifications in oppoſite directions to each other; that one of theſe veins is ramified in the liver, the other lying

ing without the liver, and fending its branches and ramifications to the vifcera of the abdomen; and, laftly, that the firft of thefe large veins may be termed *vena portæ hepatica*, the other *vena portæ ventralis*.

Vena portæ hepatica. The particular trunk of the vena portæ hepatica is fituated tranfverfely between the broad anterior eminence of the great lobe of the liver and the root of the lobulus in a particular fciffure, and forms what is called the *finus of the vena portæ*. From this finus five principal branches go out, which are afterwards divided into millions of ramifications through the whole fubftance of the liver.

At this place the vena portæ lays down the common office of a vein, and becomes a kind of artery as it enters, and is again ramified in the liver. The extremities of all thefe ramifications of the trunk of the vena portæ hepatica end in the pulpy friable corpufcles, which feem to be thick villous folliculi when examined thro' a microfcope in clear water.

Pori bilarii et ductus hepaticus. It is in thefe folliculi that the bile is fecreted; and it is immediately collected in the fame number of extremities of another kind of veffels, which unite, by numerous ramifications, into one common trunk. Thefe ramifications are termed *pori bilarii*, and the trunk *ductus hepaticus*; and the ramifications of thefe two kinds of veffels are invefted together by the capfula of the vena portæ.

Hepatic veins. The blood deprived of this bilious fluid is reconveyed to the heart by a great number of venal ramifications, which afterwards unite into three principal branches, befides others that are lefs confiderable, that terminate in the vena cava, and are all called by the name of *vena hepatica*.

The capillary extremities of the ramifications of the vena cava, join thofe of the vena portæ, and accompany them through the liver; and yet the great branches of both veins interfect each other in feveral places.

When

When we cut the liver in ſlices, it is eaſy to diſtinguiſh in each ſlice the ramifications of the vena cava from thoſe of the vena portæ; the firſt being thinneſt and largeſt, and adhering cloſeſt to the ſubſtance of the liver; whereas thoſe of the vena portæ, which are inveſted by the cellular capſula, appear to be a little ruffled when empty; becauſe the cellular capſula ſubſides when it is cut, but the other veins remain uniformly open, their ſides adhering to the ſubſtance of the liver.

Hepatic artery and nerves. The liver receives from the arteria cæliaca a particular branch, termed *arteria hepatica;* which being very ſmall when compared with the bulk of that viſcus, ſeems deſigned only for the nouriſhment thereof, and not for the ſecretion of the bile. The plexus hepaticus, formed by the nervi ſympathetici maximi et medii, furniſhes a great number of nerves to the ſubſtance of the liver. The ramifications of the artery and nervous plexus are included in the cellular capſula, together with thoſe of the vena portæ and pori bilarii.

The pulſation of this artery has been by ſome anatomiſts taken for that of the capſula; and by this they have endeavoured to explain the arterial function of the vena portæ: but they have not conſidered, that the blood in this vein does not require to be pumped forward; becauſe ſo ſwift a motion would have been prejudicial to the ſecretion of the fine oil of the bile, for which a ſlow and almoſt inſenſible motion is neceſſary.

The liver is covered exteriorly by a particular membrane or coat, which is a continuation of the peritonæum. There is likewiſe a membranous or filamentary ſubſtance that runs through this whole viſcus, and connects the ramifications and extremities of all its veſſels to each other. This ſubſtance ſeems to be a complicated production of the capſula of the vena portæ, and of the external membrane of the liver.

The outer ſurface of this coat is very ſmooth, but its inner ſurface is uneven, being made up of a great number of thin membranous laminæ; between which we obſerve, very diſtinctly, numerous lymphatic veſſels, on both the convex and concave ſides of the liver; but it is more difficult to trace thoſe which accompany the filamentary ſubſtance through that viſcus.

I have already obſerved, that the ſubſtance of the liver is chiefly made up of an infinite number of pulpy friable corpuſcles; each of which is bounded, and in a manner ſurrounded, by a particular expanſion of the capſula Gliſſoni; and all theſe expanſions are connected by common ſepta, in ſome meaſure reſembling a bee-hive.

Theſe corpuſcles have ſeveral angles, eſpecially in the inner ſurface of the liver; but near the ſurface they are raiſed in the form of ſmall tubercles. Their pulpy texture appears like radiated villi, a ſmall void ſpace being left in the middle of each.

If we blow through a pipe into the vena portæ, vena cava, arteria hepatica, or trunk of the pori bilarii, but eſpecially through the two veins, we obſerve the liver to ſwell, and the corpuſcles near the ſurface are raiſed, and become more ſenſible. If we blow with much force, we burſt theſe corpuſcles; and the air getting between them and the external membrane, raiſes it from the ſubſtance of the liver in bliſters.

Ductus cholidochus. The ductus hepaticus, or trunk of the pori bilarii, having run a little way, joins another canal, called *ductus cyſticus* or *veſicularis;* becauſe it comes from the veſicula fellis, as we ſhall ſee in the deſcription of that organ. Theſe two united ducts form a common trunk, named *ductus cholidochus;* becauſe it conveys the bile. This duct having reached the incurvation of the duodenum, inſinuates itſelf thro' the coats of that inteſtine, and opens into the cavity thereof, not by a round papilla, but by an oblong orifice rounded at the upper part, and contracted at the lower like the ſpout of an ewer, or like a common tooth-picker.

The

The edges of this orifice are raiſed, broad, and plaited, as we may ſee by making this portion of the duodenum ſwim in clear water. At the entry of this orifice we ſee another ſmall opening diſtinct from it, which is the orifice of the ductus pancreaticus; of which hereafter.

Veſicula fellis. The gall-bladder is a kind of ſmall bag, ſhaped like a pear; that is, narrow at one end, and wide at the other. The wide extremity is termed the *fundus* or *bottom*, the narrow extremity the *neck*, and the middle portion the *body*. About one third of the body of the veſicula lies in a depreſſion on the concave ſide of the liver, from the trunk or ſinus of the vena portæ, where the neck is ſituated, to the anterior edge of the great lobe, a little toward the right ſide, where the bottom is placed; and in ſome ſubjects it advances beyond the edge.

Therefore when we ſtand, the veſicula fellis lies in a plane inclined a little from behind forward. When we lie upon the back, it is almoſt inverted. When we lie on the right ſide the bottom is turned downward, and it is turned upward when we lie on the left ſide; and theſe ſituations vary according to the different degrees of each poſture.

The gall-bladder is compoſed of ſeveral coats; the outermoſt of which is a continuation of that which inveſts the liver, and conſequently of the peritoneum.

The ſecond coat is ſaid by ſome to be fleſhy, and made up of two ſtrata; one longitudinal, the other tranſverſe, "like that of the ſtomach or inteſtines; but excepting in ſome very robuſt ſubjects, there are ſcarcely any muſcular fibres to be ſeen."

A whitiſh ſtratum is looked upon as the third coat of the gall-bladder, anſwering to the tunica nervoſa of the inteſtines.

The innermoſt, or fourth coat, has on the inſide a great number of reticular folds, filled with ſmall lacunæ, like perforated papillæ, eſpecially near the neck of the

 veſicula,

veſicula, where theſe folds are longitudinal, and afterwards form a kind of ſmall pylorus, with plaits of the ſame nature with thoſe in the great one. Theſe lacunæ are looked upon to be glands.

That ſide of the body of the veſicula which lies next the liver is connected to that viſcus by a vaſt number of filaments, which run a great way into the ſubſtance of the liver. "Among theſe fibres, in ſome animals," ducts have been obſerved a long time ago. They are moſt numerous near the neck of the veſicula; and they are named *ductus cyſto-hepatici*, or *hepatico-cyſtici*: "but no ſuch ducts can be demonſtrated in the human body."

The neck of the veſicula is formed by the contraction of the ſmall extremity; and this neck bending afterwards in a particular manner, produces a narrow canal, named *ductus cyſticus*. This incurvation repreſents, in ſome meaſure, the head of a bird, of which the cyſtic duct, by the gradual diminution of its diameter, expreſſes the beak. This cannot be ſeen when the liver is *extra ſitum*; and even *in ſitu* it is but very imperfectly ſeen, when, in order to view the concave ſide, the liver is raiſed and thruſt too much againſt the diaphragm; for by thus inverting the liver, the curvature is diſordered, and we ſee two in the place of one.

To ſee this curvature in its true natural ſituation, the liver is to be raiſed but very little, and the duodenum left untouched; then we muſt ſtoop and look under the liver, without diſordering any thing. This incurvation may be of uſe to hinder too precipitate a diſcharge of the bile contained in the veſicula, which ſome ſituations of the body might occaſion.

The neck of the veſicula is nearly of the ſame ſtructure with the other parts. It has on the inſide ſeveral reticular rugæ and ſome folds, which appear like fragments of valvulæ conniventes, ſituated very near each other, from the neck to the contraction of the cyſtic duct. The firſt of theſe folds is pretty broad and large, and

and almoſt circular; the next is more oblique and ſmaller in ſize, and the reſt diminiſh in the ſame manner. Taken all together, they form a kind of ſpiral flight, which may be ſeen through the neck on the outſide, where it ſometimes appears like a ſcrew, eſpecially when the neck is filled with any fluid. This obſervation is owing to M. Heiſter.

By ſlitting the neck and duct, we ſee all theſe folds very diſtinctly, eſpecially when we examine them in clear water. When they are viewed in any other manner, they eaſily deceive us, being miſtaken for true valves, becauſe of their tranſverſe ſituation. They may, however, in ſome meaſure, ſupply the place of valves, by hindering the bile from running too faſt into the duodenum, and the contents of the duodenum from entering this duct.

The internal ſurface of all theſe biliary ducts, that is, of the ductus hepaticus, cyſticus, and cholidochus, being examined through a microſcope in clear water, appears to be nearly of the ſame ſtructure through their whole extent.

The cyſtic and hepatic ducts do not, in their ordinary and natural ſituation, repreſent the capital Υ of the Greeks, where they form the ductus cholidochus. After the incurvation of the neck of the veſicula, theſe two ducts run very near each other, and they appear to be ſeparated only by raiſing up the liver to view them. The ſame diſorder happens in an inverted liver extra ſitum; for then the body of the liver ſubſides, and is flattened, and thereby ſeparates the ducts; whereas, in its true ſituation, it is very much incurvated, and the ducts very near each other.

The ductus cholidochus appears rather to be a continuation of the ductus cyſticus than the common trunk of that and of the ductus hepaticus: for I have obſerved, that this laſt duct runs for ſome ſpace within the ſides of the former, before it opens into the cavity; much in the ſame manner as the ductus cholidochus paſſes into the duodenum. I have likewiſe obſerved, at the opening of the hepatic into the cyſtic duct, a ſmall looſe valvular membrane, which may hinder the bile from returning out of the ductus cholidochus into the hepaticus.

The bile, which paſſes through the ductus hepaticus into the cholidochus, may be called *hepatic;* and that which is collected in the veſicula fellis, may be termed *cyſtic*. The hepatic bile flows continually through the ductus cholidochus into the duodenum; whereas the cyſtic bile flows only by reaſon of plenitude or by compreſſion.

Remarks on the veſſels, &c. of the liver. The trunk of the vena portæ ventralis terminates between the lobulus and the oppoſite part of the great lobe; and there joins the trunk of the vena portæ hepatica in the tranſverſe ſinus of the liver, between the right extremity and the middle of that ſinus.

The umbilical ligament, and conſequently the umbilical vein in the fœtus, joins the trunk of the vena portæ hepatica toward the left extremity of the tranſverſe ſinus of the liver. The canalis venoſus in man is not exactly oppoſite the vena umbilicalis, but a little to the right hand; and therefore theſe three veſſels lie in ſuch a direction as to form two oppoſite angles, reſembling thoſe of the handle of a wheel or of a ſpit.

In the fœtus, therefore, the blood which comes from the umbilical vein does not run directly through that contained in the vena portæ hepatica in the ſinus, and from thence into the canalis venoſus; but is obliged to turn from left to right, and ſo to mix with the blood in the vena portæ, before it enters that canal which opens into the trunk of one of the great hepatic veins of the vena cava near the diaphragm.

The hepatic vena portæ gives off commonly five large branches into the liver, viz. three from its right extremity into the great lobe, and two from its left extremity into the ſmall lobe; and from the interſtice between

tween theſe, a ſmall branch goes directly to the middle of the convex ſide of the liver.

The hepatic veins are commonly three large branches of the trunk of the vena cava inferior, which go out from it by one common opening, eſpecially two of them; and then ſeparating, they enter the ſubſtance of the liver, interſecting the branches of the hepatic vena portæ, and are ramified in all directions in the manner already explained. The inferior portion of the opening of theſe veins into the vena cava, forms a kind of ſemilunar valve.

Below theſe hepatic veins, the vena cava inferior ſends off, in its paſſage by the liver, ſeveral other ſmall hepatic veins immediately from the trunk, which ſeem to have the ſame relation to the hepatic artery as the great veins to the vena portæ.

The paſſage of the vena cava is through the right portion of the poſterior ſinus of the liver, and conſequently on the ſide of the great lobe, which is hollowed at this place ſufficiently to give paſſage to the vein, of which it ſurrounds about three fourths, ſometimes more, and ſometimes the whole.

This paſſage anſwers to the interſtice between the lobulus and the reſt of the great lobe; and its direction is, in the natural ſtate, from above downward, and a little from right to left: but when the liver is viewed extra ſitum, and inverted, it appears very oblique; but ſtill it ſerves as a guide to beginners, who are very apt to be miſtaken in examining an inverted liver, as I have already obſerved.

The trunk of the great vena portæ, the hepatic arteries, the ductus hepaticus, or trunk of the pori bilarii, and the nerves of the plexus hepaticus, form all together a large bundle before they enter the liver. The trunk of the hepatic vena portæ is in the middle of this bundle; the hepatic arteries lie on the right and left ſides of this trunk, the nerves ſurround it on all ſides, and they communicate with the plexus meſentericus ſuperior.

Afterwards the firſt branches of the arteries, nerves, and pori bilarii, leave the trunk of the great vein, and join in the ſame manner the trunk of the ſmall or hepatic vena portæ, and its ramifications in the capſula Gliſſoni explained above.

All theſe branches of the vena portæ, and of the arteries, nerves, and pori bilarii, accompany each other by ramifications through the whole ſubſtance of the liver, forming every where ſmall faſciculi, in the ſame manner as the large bundles formed by their trunks. Each ramus of the vena portæ, artery, nerve, and porus bilarius, has a proper vagina, and all the four have a common vagina diſtinguiſhed from the former cellular ſepta, which are only continuations of the vaginæ of both kinds.

The convex ſide of the common cellular vagina is connected quite round to the ſubſtance of the liver by numerous filaments which ariſe from it, and which form the cellular ſubſtance found between the glandular corpuſcles. The concave ſide produces the cellular ſepta above-mentioned.

In this common vagina, the veſſels, ducts, and nerves, are diſpoſed in ſuch a manner, as that the rami of the vena portæ chiefly fill the cavity of it, and is in a lateral ſituation: the arterial ramus and porus bilarius lie together on the ſide of the vein, and the nerve is divided into ſeveral filaments, which run in between the veſſels and ducts, and chiefly accompany the artery and porus bilarius; the vena portæ having by much the feweſt.

The uſes of the liver ſhall be explained after the deſcription of the pancreas, ſpleen, and omentum, all theſe viſcera having a great relation to the liver.

§ 13.

§ 13. *Pancreas.*

Figure, divifion, and fituation, of the pancreas. The pancreas is a long flat gland, of that kind which anatomifts call *conglomerate*, fituated under the ftomach, between the liver and the fpleen. Its figure refembles that of a dog's tongue; and it is divided into two fides, one fuperior, the other inferior; two edges, one anterior, the other pofterior; and two extremities, one large, which reprefents the bafis of a tongue, and one fmall and a little rounded like the point of a tongue.

The pancreas is fituated tranfverfely under the ftomach, in the duplicature of the pofterior portion of the mefocolon. The large extremity is connected to the firft incurvation of the duodenum, and from thence it paffes before the reft of that inteftine all the way to its laft incurvation; fo that a great part of the duodenum lies between the pancreas and the vertebræ of the back. The fmall extremity is fixed to the omentum near the fpleen.

Structure of the pancreas. The pancreas is compofed of a great number of foft glandular moleculæ, combined in fuch a manner, as to exhibit the appearance of one uniform mafs on the outfide, the furface of which is rendered uneven, only by numerous fmall convexities, more or lefs flatted. When thefe moleculæ are feparated a little from each other, we find, along the middle of the breadth of the pancreas, a particular duct, in which feveral fmaller ducts terminate laterally on each fide, like fmall rami in a ftem.

This canal, named *ductus pancreaticus* or *ductus Virfungi*, from the difcoverer of it in the human body, is very thin, white, and almoft tranfparent, and the extremity of the trunk opens commonly into the extremity of the ductus cholidochus. From thence it diminifhes gradually, and terminates in a point, next the fpleen. The fmall lateral branches are likewife pretty large

large near the trunk, and very ſmall toward the edges of the pancreas, all of them lying in the ſame plane like the branches of the common filix or fern.

The pancreatic duct is ſometimes double in man, one lying above the other. It is not always of an equal length, and ſometimes runs in a winding courſe, but always in the ſame plane; and it is nearer the lower than the upper ſide of the pancreas. It pierces the coats of the duodenum, and opens into the ductus cholidochus; commonly a little above the prominent point of the orifice of that canal; and ſometimes it opens immediately into the duodenum.

The ſmall pancreas. In man, I obſerved ſeveral years ago, that where the great extremity of the pancreas is connected to the curvature of the duodenum, it ſends down an elongation, which adheres very cloſely to the following portion of the inteſtine; and, upon a careful examination, I found a particular pancreatic duct ramified like the large one, which ran toward and interſected this great duct, into the extremity of which it opened, after having perforated the duodenum. This portion I term *pancreas minus;* and it ſometimes opens ſeparately into the duodenum, in which we likewiſe obſerve ſeveral ſmall holes round the ductus cholidochus, which anſwer to the pancreas.

Blood-veſſels and nerves of the pancreas. The arteries of the pancreas come from the pylorica, duodenalis, and chiefly from the ſplenica, which adheres very cloſely to the whole lower ſide of the pancreas near the poſterior edge, and it ſends off in its paſſage a great many rami named *arteriæ pancreaticæ*, which go off from each ſide, more or leſs tranſverſely. It receives alſo ſome ſmall ramifications from the gaſtrica major, and meſenterica ſuperior.

The pancreatic veins are rami of the ſplenica, one of the principal branches of the vena portæ major or ventralis. This vena ſplenica runs likewiſe along the lower ſide of the pancreas near the edge, in a ſhallow depreſ-

ſion

ſion formed in the ſubſtance of the gland. Theſe veins anſwer to the arteries of the ſame name; and there are likewiſe other ſmall veins correſponding to the ſmall arteries, which are productions of the great meſeraica, &c.

The nerves of the pancreas come partly from the plexus hepaticus, partly from the plexus ſplenicus, and partly from the plexus meſentericus ſuperior, and it likewiſe receives ſome from the flat ganglion or plexiform intertexture, mentioned in the deſcription of the nerves, by the name of the *tranſverſe rope.*

The pancreatic duct is not only double in ſome ſubjects, as has been ſaid, but the collateral branches have communications in form of iſlands in ſeveral places, within the body of the pancreas. The uſes of this viſcus ſhall be explained hereafter.

§ 14. *Lien.*

Situation, diviſion, and figure of the ſpleen. THE ſpleen is a bluiſh maſs, ſomething inclined to red, and of a long oval figure, being about ſeven or eight fingers breadth in length, and four or five in breadth. It is of a ſoftiſh ſubſtance, and is ſituated in the left hypochondrium, between the great extremity of the ſtomach, and the neighbouring falſe ribs, under the edge of the diaphragm, and above the left kidney.

It may be naturally divided into ſides, edges, and extremities, as I have always done in my ordinary courſes, for theſe many years paſt. It has two ſides, one external and gently convex, and one internal which is irregularly concave; two extremities, one poſterior which is pretty large, and one anterior which is ſmaller and more depreſſed; two edges, one ſuperior, and one inferior, on both which there are, in ſome ſubjects, ſeveral inequalities.

The inner or concave ſide is divided by a longitudinal

nal groove or sciffure, into two planes or half fides, one upper, the other lower; and, by this groove, the veffels and nerves enter in human fubjects The fuperior half fide is broader and more concave than the inferior, being proportioned to the convexity of the great extremity of the ftomach. The inferior half fide lies backward on the left kidney, and forward on the colon; and fometimes this fide of the fpleen appears to have two fuperficial cavities, one anfwering to the convexity of the ftomach, the other to that of the colon. The convex fide of the fpleen is turned to the left ribs.

It is connected to the ftomach by the veffels called *vafa brevia*; to the extremity of the pancreas, by ramifications of the fplenic artery and vein; and to the omentum, by ramifications which the fame artery and vein fend to the fpleen, and which run in the longitudinal groove.

It is connected to the edge of the diaphragm by a particular membranous ligament of different breadths in different fubjects, fixed in its convex fide, fometimes near the upper edge, and fometimes near the lower. This ligament is fituated tranfverfely with refpect to the whole body, and longitudinally with refpect to the fize of the fpleen. In fome fubjects, it is connected by other ligaments to the ftomach and colon; but in all this there are confiderable varieties.

The figure of the fpleen is not always regular, and is as various as the fize. Sometimes it has confiderable fciffures both in the fides and edges, and fometimes it has appendices. I have fometimes found a kind of fmall diftinct fpleens, more or lefs round, and connected feparately to the omentum, at fome diftance from the anterior extremity of the ordinary fpleen.

Structure of the fpleen. The ftructure of the fpleen is not eafy to be unfolded in man; and it is very different from that of the fpleens of brutes, from which both public and private demonftrations are commonly made.

Its

Its coverings adhere to it ſo cloſely in man, that it is difficult to diſtinguiſh the common from the proper coat; whereas in ſome brutes, ſuch as oxen, ſheep, &c. nothing is more eaſy; for in ſuch animals we find two coats ſeparated by a cellular ſubſtance. This covering ſeems to be no otherwiſe a continuation of the peritonæum than by the intervention of the omentum and meſocolon; and even in man the two coats may be diſtinguiſhed, where the veſſels enter by the longitudinal ſciſſure.

In man, the ſubſtance of the ſpleen is almoſt wholly vaſcular, that is, compoſed of the ramifications of all kinds of veſſels. In oxen, the ſubſtance of the ſpleen is chiefly reticular, and in ſheep it is cellular. In oxen and ſheep, there are no venal ramifications; but inſtead thereof, only open ſinuſes diſpoſed like branches, except a ſmall portion of a venal trunk perforated on all ſides, at the extremity of the ſpleen.

In the human ſpleen, we ſee ſomething like glandular corpuſcles, as in thoſe of other animals; and there are numerous venal ramifications through its whole extent. Between theſe ramifications we every where obſerve an appearance of extravaſated blood, lying in a kind of filamentary, tranſparent, and very delicate ſubſtance expanded through the whole ſpleen.

This filamentary ſubſtance having ſurrounded all the ramifications, terminates in almoſt imperceptible cells which communicate with each other; ſo that, if we blow through a ſmall hole made in the membranous covering, the whole ſpleen will immediately be inflated.

The ſurface of the ſpleen of oxen and calves is viſibly full of a great number of lymphatic veſſels, which may at any time be eaſily demonſtrated; but in man it is a very difficult matter either to diſcover or demonſtrate them.

Blood-veſſels and nerves of the ſpleen. The ſplenic artery, which is one of the principal branches of the cæliaca,

liaca, runs along the lower ſide of the pancreas, as has been already ſaid, and paſſes from thence in a winding courſe to the ſpleen. The ſplenic vein, which is larger than the artery, is but little inflected in this part of its courſe.

This artery and vein having got beyond the extremity of the pancreas, ſend out ſeveral rami together, which immediately afterwards divaricate in the ſame plane, run in the membranous duplicature of the neighbouring portion of the omentum, and, laſtly, interſect each other in their common plane, all the way to the ſciſſure of the inner or concave ſide of the ſpleen.

Theſe arterial and venal rami enter the ſubſtance of the ſpleen together by the ſame ſciſſure; being accompanied by the cellular ſubſtance belonging to the membranous duplicature of the omentum. We may likewiſe obſerve, that at this place the coat of the ſpleen ſends from its concave ſide a portion of the lamina, which is incurvated in the ſciſſure, and penetrates into the ſubſtance of the ſpleen.

The nerves of the ſpleen are very numerous, and come from the plexus ſplenicus already deſcribed. Theſe nerves ſend out, at different diſtances, round all the arterial ramifications of the ſubſtance of the ſpleen, a great number of filaments in form of an irregular net-work.

The arteries, veins, and nerves, having entered the ſpleen, are there divided and ſubdivided into a great number of ramifications, and accompany each other to the very laſt extremities of their diviſions. They are contained in a kind of common cellular capſula or vagina, which firſt ſurrounds all the three, and then ſends off particular ſepta between them. This capſula ſeems to be formed by a continuation of the cellular ſubſtance of the omentum, and of that particular lamina of the coat of the ſpleen which I mentioned above.

The capillary extremities of all theſe vaſcular ramifications,

fications, both arterial and venal, end in the filamentary cells already mentioned. Malpighi confidered them as diftinct capfulæ or folliculi, containing the fame number of fmall glands. They all communicate together; fo that, wherever we pierce the coat of the fpleen, we may, through that hole, inflate the whole vifcus.

In oxen and fheep, there are no venal ramifications, as I have faid. The vena fplenica having entered the great extremity of thefe fpleens, runs firft of all for about half an inch or an inch; and afterwards, inftead of an ordinary vein, we find a canal perforated on all fides. The beginning of this canal has ftill fome remains of the coats of a vein; but the form of it is foon loft, and then we find nothing but finufes or fulci in the reticular fubftance in oxen, and in the cellular fubftance in fheep.

The fplenic artery and nerves are there ramified in a particular vagina, as in men; and the extremities of thefe arterial ramifications feem to fwim or float in the cells, and to fill their filamentary fubftance with blood. At the ends of feveral of thefe capillaries, I have obferved fmall corpufcles difpofed like bunches of grapes; and I have feen two fmall tubes going out from each corpufcle, one long and open, the other fmall and fhort, which was loft in the fides of the fpleen.

I imagine that the long tube, the extremity of which I was not able to find, may be the origin of a lymphatic veffel, efpecially becaufe thefe veffels are fo very numerous and vifible in an ox's fpleen, as has been already faid. Thefe fmall corpufcles may eafily be difcovered in an ox's fpleen, when boiled by a particular adminiftration, of which I fhall fay more in another place. They are indeed much larger before than after boiling; but they are not fo folid, and fubfide more eafily when cut. The fame fort of corpufcles may be difcovered in the human fpleen, but they are fo extremely fmall as not to be vifible without a microfcope.

The

The uses of the spleen shall be explained after the description of the omentum.

§ 15. *Omentum and Appendices Epiploicæ.*

Situation, division, and connection of the omentum. The omentum is a large, thin, and fine membranous bag, surrounded on all sides by numerous portions of fat, which accompany and even invest the same number of arteries and veins adhering closely to each other.

The greatest part of it resembles a kind of flat purse, or a sportsman's empty pouch; and is spread more or less on all the small intestines from the stomach to the lower part of the regio umbilicalis. Sometimes it goes down to the lower part of the hypogastrium, and sometimes does not reach beyond the regio epigastrica. It is commonly plaited or folded in several places, especially between the bands of fat.

It is divided into a superior and inferior, an anterior and posterior, and a right and left portion. The superior portion is in a manner divided into two borders, one of which is fixed along the great curvature or convex side of the arch of the colon, and the other along the great curvature of the stomach. The commissure or union of these two borders on the right side, is fixed to the common ligament or adhesion of the duodenum and colon, and to the contiguous parts of these two intestines. That on the left side is fixed to the longitudinal scissure of the spleen, to the extremity of the pancreas, and to the convex side of the great extremity of the stomach. It is likewise fixed to the membranous ligament which sustains the ductus cholidochus, and connects it to the vena portæ ventralis.

Below these adhesions, the other portions, that is, the anterior, posterior, two lateral and inferior portions, which last is the bottom of the sacculus epiploicus, have ommonly no fixed connections, but lie loose between the fore-side of the cavity of the abdomen and the intestines.

ſtines. The anterior and poſterior portions are generally called the *laminæ* of the omentum; but as that term is ordinarily employed to expreſs the duplicature of ſome compound membrane, it would be more convenient to call them *folia*, *alæ*, or ſome ſuch name.

Structure of the omentum. The membrane of the omentum is, through its whole extent, made up of two extremely thin laminæ joined by a cellular ſubſtance; the quantity of which is very conſiderable along the blood-veſſels, which it every where accompanies in broad bands proportioned to the branches and ramification of theſe veſſels. Theſe cellular bands are more or leſs filled with fat, according to the corpulency of the ſubject; and for that reaſon I have called them *bands* or *portions of fat.*

Little omentum. Beſides this large membranous bag, which I name the *great omentum*, there is another much ſmaller, which differs from the large one, not only in ſize, but alſo in figure, ſituation, and connection; and this I name the *little omentum.* This ſmall bag is fixed by its whole circumference, partly to the ſmall curvature of the ſtomach, and partly to the concave ſide of the liver before the ſinus of the vena portæ, ſo as to ſurround and contain the prominent portion of the lobulus.

The little omentum is thinner and more tranſparent than the other, and its cavity diminiſhes gradually from the circumference to the bottom, which in ſome ſubjects terminates in ſeveral ſmall cavities or foſſulæ more or leſs pointed. Its ſtructure is pretty much the ſame with that of the great omentum, it being compoſed of two laminæ, with a mixture of the ſame portions of fat, which are conſiderably finer than in the other.

We ſee from this ſituation of the two omenta, that in the ſpace left between the lower ſide of the ſtomach and upper ſide of the meſocolon, they have a very broad communication with each other; ſo that if either of them contained in its cavity any fluid, that fluid might readily get between the ſtomach and meſocolon, and ſo paſs into the other bag; eſpecially when the ſtomach is empty, and conſequently its ſituation eaſily changed.

Therefore, by means of this interſtice between the ſtomach and meſocolon, the two omenta form one cavity, which opens into the cavity of the abdomen by one common orifice, ſituated near the commiſſure on the right ſide of the great omentum. This orifice is ſemilunar or ſemicircular, and formed by the union of two membranous ligaments, whereof one connects the beginning of the duodenum and neck of the veſicula fellis to the liver; the other connects the contiguous portion of the colòn to the ſame viſcus, and extends to the pancreas. From thence ariſes an incurvated border, which ſurrounds the root of the lobulus, leaving an opening wide enough to admit the end of the finger.

To diſcover this orifice of the omentum, we need only raiſe a little the great lobe of the liver, and find out the root of the lobulus, and apply to it a large pipe wrapped round with cotton, wool, or tow, to hinder the regreſs of the air. Then if we blow gradually, the air will inflate the ſides of the great omentum, and give it the appearance of a large bladder irregularly divided into ſeveral lobes or tubercles by the bands of fat, which appear in this ſtate, like ſo many fræna between the lobes.

To be ſure of ſucceeding in this experiment, the two omenta muſt be in their natural ſtate, and they muſt be handled very gently with the fingers firſt dipped in oil. It ſucceeds better in young, lean ſubjects, than in old or fat ſubjects.

When we touch theſe membranes with dry fingers, they ſtick to them ſo cloſely as hardly to be ſeparated without being torn, as we ſee by the reticular holes which appear in thoſe portions of membranes that have been thus handled. In that caſe it is to no purpoſe pofe to blow through the natural orifice already mentioned; and it is owing to thefe fmall holes that the membranes of the omentum have been fuppofed to be naturally reticular.

The membranous laminæ of the little omentum are continuous partly with the external membrane of the liver, partly with that of the ftomach, and a little with the membrane that lines the neighbouring portion of the diaphragm. Thofe of the great omentum are continued partly with the fame coat of the ftomach, and partly with the external covering of the colon, and confequently with the mefocolon; and they likewife communicate with the covering of the fpleen.

We may fatisfy ourfelves concerning thefe continuations, by making a fmall hole in one of the laminæ of the omentum near the ftomach, colon, &c. and by blowing into that hole, through a pipe well fitted to it; for the air will gradually infinuate itfelf under the common coats of thefe vifcera; but if the parts be dry, they muft be moiftened a little, before the experiment is made.

Appendices epiploicæ. The fatty appendices of the colon and rectum have always appeared to me to be a kind of fmall omenta or appendices epiploicæ. They are fituated at different diftances along thefe inteftines, being particular elongations of their common or external coat. They are of the fame ftructure with the great omenta; and there is a cellular fubftance contained in their duplicature, more or lefs filled with fat, according as the fubject is fat or lean.

Next the inteftine, each of them forms a broad, thin bafis; and they terminate by irregular papillæ, thicker than their bafes. Thefe bafes are at firft difpofed longitudinally; then obliquely; and laftly, more or lefs tranfverfely, efpecially near the rectum, and upon that inteftine.

Thefe appendices are for the moft part feparated from each other; but fome of thefe which have longitudinal

 bafes

bafes communicate together, the veftiges of thefe communications being very narrow, and not very prominent. By blowing through a fmall hole made in one of thefe appendices, it is inflated like a fmall irregular bladder, and the air paffes under the external coat of the colon or rectum.

Befides thefe appendices epiploicæ, we obferve at different diftances along the colon, between the ligamentary band, which lies hid, and one of the other two, that is, on both fides of the adhefion of the mefocolon, feveral adipofe ftrata, which may likewife be looked upon as appendices of the fame nature with the former, but thefe ftrata are very feldom obferved between the two apparent ligamentary bands of the colon.

Veffels of the omentum. The arteries and veins of the great omentum are branches of the gaftricæ, and for that reafon go by the name of *gaftro-epiploicæ dextræ* and *finiftræ*. The arteries on the right fide anfwer to the hepatic artery, and thofe on the left fide to the fplenic; and both communicate with the arteria ventriculi coronaria, and refpectively with the arteriæ mefentericæ. The gaftro-epiploic veins anfwer, in the fame manner of diftribution, to the vena portæ.

The veffels of the little omentum come chiefly from the coronariæ ventriculi, and thofe of the appendices and ftrata are ramifications from the reticular texture of the arteriæ and veins of the colon and rectum.

§ 26. *Ufes of the Abdominal Vifcera defcribed in the thirteen foregoing Paragraphs.*

THE inteftines in general finifh what the ftomach had begun. The alimentary pulp having been fufficiently prepared by the fuccus gaftricus, or lymph of the ftomach, undergoes a farther change by the inteftinal lymph, bile, and pancreatic juice, by which the milky liquor called *chyle* is produced, and this liquor render-

ed

ed fluid enough to enter the lacteal veſſels through the tunica villoſa of the ſmall inteſtines, while the groſſer portion of the aliment continues its courſe, and becoming gradually thicker as it advances toward the great inteſtines, is there collected by the name of *fæces*.

The dilatation of the inteſtines is bounded by their common coat. The undulating, ſucceſſive, and periodical contraction of the fleſhy fibres, eſpecially of the orbicular fibres of the muſcular coat, expreſſes the inteſtinal lymph, beats it up into an emulſion with the alimentary paſte, ſtrains that emulſion through the lacteal veſſels, and propels the reſiduum in the manner already ſaid.

The nervous coat ſerves to ſuſtain the tunica villoſa; and, by the oblique diſpoſition of its fibres, yields to the periodical motions of the muſcular coat, without compreſſing the chyliferous ducts which paſs through the meſhes of this coat in the ſmall inteſtines. The uſes of the villous or internal coat are ſufficiently apparent from the deſcription given of it.

The length of the ſmall inteſtines gives a great extent to what may be called the *ſtrainer of the chyle*, and this extent is very much enlarged by the numerous folds termed *valvulæ conniventes*. By means of this large extent, there is a great quantity of chyle ſtrained through theſe inteſtines, and the valves hinder the alimentary pulp from paſſing through them too faſt, that is, before all the milky juice has been expreſſed; and this may be obſerved chiefly in the beginning of the inteſtines, where theſe valves are moſt numerous and broadeſt, and the aliment moſt fluid.

The cavity of the great inteſtines ſerves to receive the fæces of the aliment, and to contain a conſiderable quantity thereof for a certain ſpace of time, without any inconvenience, and without being obliged to diſcharge them continually, which would be as great an inconvenience as any. The incurvation of the colon, its cells, and contraction of its laſt convolutions, contribute to this retention of the fæces; but the cæcum ſeems to be the firſt organ thereof, becauſe the fæces being firſt collected there, are obliged afterwards to move in a contrary direction as they aſcend into the colon.

The valve of the colon, which might more properly be termed the *ſphincter* or *pylorus* of the ileum, hinders the fæces from returning into the ſmall inteſtines: I ſay, the fæces or groſs matter, becauſe it is not certain that this valve entirely ſtops that paſſage, or that it always hinders any fluid matter forced downward by the colon from entering the ileum, even in a natural ſtate.

The glandular lacunæ of the great inteſtines furniſh continually a kind of mucilage, which not only defends the internal coat from the acrimony of the fæces, but ſerves alſo to lubricate theſe fæces in proportion to their different degrees of ſolidity.

The appendicula vermiformis is ſo very ſmall in adults, that its uſe cannot be determined with certainty. Perhaps the mucilaginous matter in its cavity, furniſhed by the numerous glandular lacunæ of its internal coat, which can only be evacuated by plenitude, may, during its ſtay there, contract an acrimony, which may vellicate or ſtimulate the cæcum, in order to throw its contents into the colon.

The inteſtinum rectum is the laſt reſervatory of the fæces. The great thickneſs of its muſcular coat, and the great number of longitudinal fibres by which this thickneſs is chiefly formed, enable it to yield to the collected fæces to ſo great a degree as to repreſent a large bladder or ſtomach. The muſculi levatores ani ſerve to ſuſpend the lower portion of this inteſtine, eſpecially when full; and it is partly by the contraction of theſe muſcles which overcome the ſphincter of the anus, that the fæces are diſcharged out of the body. Theſe ſphincters form the third pylorus of the whole alimentary canal.

The

The meſentery and meſocolon connect the inteſtines, in ſuch a manner, as that they cannot be twiſted or run into knots, without hindering them from ſliding and yielding to each other according to the different poſtures of the body, or according as they are more or leſs empty or full.

The adheſions of the meſentery form the convolutions of all the ſmall inteſtines into a large bundle, irregularly round, which fills a great part of the cavity of the abdomen. from the epigaſtrium downward.

The meſocolon, by its adheſion to the colon, forms a kind of ſeptum tranſverſum, between the ſmall inteſtines and the viſcera contained in the epigaſtrium; and this ſeptum ſupports the liver and ſtomach under the arch of the diaphragm, juſt as much as it is ſuſtained by the inteſtines. This natural ſituation of theſe viſcera is moſt commonly altered in dead bodies opened after the common method, and without the neceſſary precautions.

The breadth of the meſentery and meſocolon affords a large extent to the ramifications of the arteries, veins, and nerves, diſtributed through them by innumerable communications and anaſtomoſes, by means of which any portion of the inteſtines may be ſupplied, though the principal branch which leads to it ſhould happen to be compreſſed or obſtructed.

The cellular ſubſtance in the duplicature of the meſentery and meſocolon, ſerves not only for a ſoft bed to all theſe ramifications, but alſo to contain thoſe collections of fat, neceſſary for the formation of the bile, as I ſhall obſerve hereafter; and the cellular ſubſtance of the meſentery has likewiſe one uſe peculiar to it, which is to inveſt the lymphatic glands and lacteal veſſels, and upon this account it is thicker than that of the meſocolon.

The lacteal veſſels being firſt formed by a copious reticular texture round the circumference of the inteſtines, reſembling the vaſcular net-work of that canal,

 and

and afterwards uniting every where through the duplicature of the mesentery, with the arterial ramifications, which they likewise accompany in many places; it is easy to conceive that the pulsation of the mesenteric arteries must propel the chyle in the lacteal vessels from the intestines to the receptaculum chyli, that motion being suitable to the direction of their valves.

The liver is the principal organ for the secretion of the bile. The villi of that immense number of glandular cells of which it is composed, filtrate continually from the blood of the vena portæ small drops of bile, which afterwards insinuate themselves into the pori bilarii, and are in part lodged in the vesicula fellis, and in part run directly into the duodenum, in the manner already explained in describing the biliary ducts.

The spleen, omentum, appendices epiploicæ, adipose strata of the mesentery, and those of the great intestines, and even of the pancreas, with the whole series of glands in the intestinal canal, seem to contribute to the formation of the bile, as so many auxiliary, or rather preparatory organs; but each of them in a different way.

It appears, (1.) That the venal blood that returns from all the intestinal glands, and from the pancreas, has left a great portion of its serum. (2.) That the blood which returns from the spleen has undergone a certain change, by its course being mechanically retarded; and likewise that its texture is altered by the action of the numerous nerves sent thither by the plexus splenicus. (3.) That the blood which returns from the omenta, appendices epiploicæ, and from the strata and other collections of fat, is loaded with oil.

These three kinds of venal blood meet in the trunk of the vena portæ ventralis, where they are mixed together; and from thence they enter the transverse sinus or trunk of the vena portæ hepatica. In this sinus they are still more intimately mixed, as in a kind of lake, and become one uniform mass of blood; which being forced

forced into the branches of the vena portæ hepatica only by the ſupervening blood from the other vena portæ, and by the lateral pulſations of the ramifications of the hepatic artery, its courſe muſt be very ſlow. The ſecretion of the bile depends partly on this ſlow motion, and partly on theſe external impulſes, as I ſhall ſhow in another place.

The veſicular bile appears to be more exalted than that in the hepatic duct; and by meeting in the ductus cholidochus, they ſeem to compoſe a third kind of bile, which, without the cyſtic or veſicular bile, would perhaps be too mild, and too acrid without the hepatic. This bile mixes in the duodenum with the pancreatic juice, and with that of the inteſtinal glands; and from this mixture a fluid reſults, which is proper to ſeparate the chylous matter from the groſs and uſeleſs part of the alimentary pulp, as it comes from the ſtomach.

§ 17. *Renes et Ureteres.*

Situation, figure, and diviſion of the kidneys. The kidneys are two pretty ſolid glandular bodies, ſituated in the poſterior part of the cavity of the abdomen, on each ſide of the lumbar vertebræ, between the laſt falſe ribs and os ilium. The right kidney lies under the great lobe of the liver; and is conſequently lower than the left, which lies under the ſpleen.

The figure of the kidneys reſembles that of a large bean, their circumference being convex on one ſide, and concave on the other. The concave ſide is turned to the vertebræ, and the convex ſide the oppoſite way. Their length anſwers to the diſtance between the laſt falſe rib and os ilium; they are about half as broad as long, and half as thick as broad.

In each kidney we obſerve a fore and back ſide, an upper and lower extremity, a great and ſmall curvature, and a convexity and concavity.

The

The backſide is broader than the foreſide; and the upper extremity is a little broader and more incurvated than the lower. The depreſſion in the ſmall curvature is oblong and uneven, reſembling a ſinus, ſurrounded by ſeveral tubercles; and as it is turned a little toward the foreſide, this ſide is ſomething narrower than the other.

Blood-veſſels of the kidneys. The deſcending aorta and inferior vena cava lie between the kidneys, pretty cloſe to the bodies of the vertebræ and to each other; the artery being on the left hand, the vein on the right. Each of theſe large veſſels ſends out tranſverſely toward each ſide commonly one capital branch, which goes to the kidney, and enters the ſinus or depreſſion thereof, by ſeveral rami; of which hereafter.

Theſe veſſels were by the ancients termed the *emulgent arteries and veins*, but I chooſe rather to call them *arteriæ venæ renales*. Sometimes there are more than one of each kind, which is ofteneſt found in the arteries, ſometimes on one ſide only, and ſometimes in both.

The artery and vein are not of an equal length, and the difference depends on the ſituation of the aorta and vena cava: for the left renal artery is ſhorter than the right, becauſe the aorta lies neareſt the left kidney; and the left renal vein is longer than the right, becauſe the vena cava lies furtheſt from the left kidney.

Theſe veſſels are likewiſe diſpoſed in ſuch a manner, as that the veins lie more anteriorly than the arteries; becauſe the aorta lies cloſe to the ſpina dorſi; whereas the vena cava, which perforates the diaphragm at ſome diſtance from the vertebræ, does not join them till after it has given off the renal veins.

Nerves of the kidneys. Each artery is ſurrounded by a nervous net-work, called *plexus renalis;* which furniſhes a great number of filaments to the kidneys, that come partly from the ſemilunar ganglions of the two great ſympathetic nerves, and partly from the plexus he-

hepaticus and ſplenicus. This renal plexus ſends likewiſe ſome filaments round the renal veins.

Coats of the kidneys. The kidneys are ſurrounded by a very looſe membranous and cellular covering, called *membrana adipoſa;* becauſe, in fat perſons, the cells of this ſubſtance are filled with fat. This was for a long time impertinently taken for a duplicature of the peritonæum; the true membranous lamina of which covers only the foreſide of the kidneys; and conſequently they lie without the peritonæum, becauſe the portion of that membrane that covers them cannot be looked upon as an entire coat: ſo that the only common coat they have is the cellular ſubſtance, which likewiſe inveſts the renal arteries and veins in form of a vagina.

The proper coat or membrane of the kidneys is "ſtrong and denſe, and adheres very cloſely to their ſurface; for it penetrates every where by numerous elongations into their ſubſtance, from which it cannot be ſeparated without tearing theſe."

The external ſurface of this lamina is very ſmooth, poliſhed, and gliſtening; and it renders the whole ſurface of the kidney very even and uniform in adults. In children, this convex ſurface is in a manner divided into ſeveral lobes or tubercles, almoſt as in oxen and calves; and in grown perſons we ſometimes obſerve the ſame inequalities.

The blood-veſſels having entered the kidneys, are ramified every way; and theſe ramifications ſend out other capillary rami, which go all the way to the ſurface, where they appear like irregular ſtars, and furniſh the proper membrane of the kidneys. Sometimes theſe two ramifications penetrate to the membrana adipoſa, and communicate there with the arteriæ and venæ adipoſæ.

The proper membrane having ſurrounded the kidney all the way to the ſinus, joins the veſſels at that place, and accompanies all their ramifications through the body of the kidney in form of a vagina or capſule, and

and likewiſe contributes in part to form the pelvis and calices or infundibula; of which hereafter.

We ſometimes obſerve a conſiderable veſſel to go in or come out from the convex ſurface of the kidney; but this is not common: and in that caſe there is a depreſſion, by which the proper membrane enters, and communicates with that portion which goes in by the ſinus.

The tunica adipoſa, or common coat, which likewiſe inveſts the great veſſels to their entry into the kidneys, does not ſeem to accompany them any further, but terminates at the ſinus, in the interſtices between the ramifications.

Structure of the kidneys. We may diſtinguiſh three kinds of ſubſtances in the kidney; an exterior ſubſtance, which is thick, granulated, and in a manner cortical; a middle ſubſtance, which is medullary and radiated, called *ſtriata*, *ſulcata*, or *tubularis*, becauſe it ſeems to be made up of radiated tubes; and an inner ſubſtance, which is only a continuation of the ſecond, and terminates on the inſide by papillæ; for which reaſon I have given it the name of *papillaris*.

Theſe three ſubſtances may be ſeen diſtinctly in a kidney cut into two equal parts through the great curvature. The cortical ſubſtance may be obſerved round the whole circumference; and, by the microſcope, we perceive it to be of a ſpongy, granulated, and waving texture, all its parts adhering together in a radiated manner. Its colour is a bright whitiſh grey.

By fine anatomical injections and inflammations, we diſcover an infinity of ſmall capillary veſſels, which run in various directions between and round the different portions of this ſubſtance; and, by the help of a microſcope, we ſee likewiſe great numbers of ſmall red corpuſcles more or leſs round, and diſpoſed almoſt like bunches of currants. Theſe ſmall corpuſcles are perhaps only the extremities of the cut veſſels, filled either with blood or with a coloured injection.

The

The other two ſubſtances, that is, the medullary or ſtriated, and the papillary, are really but one and the ſame maſs, of a more reddiſh colour; the convex ſide of which riſes at ſeveral places into narrow tubercles, lodged in the ſame number of cavities or depreſſions. The radiated ſtriæ are afterwards continued to the papillary portion; and the papillæ form in ſome meaſure ſo many centres of theſe radii, oppoſite to the tubercles.

The medullary ſubſtance is likewiſe diſtinguiſhed from the cortical, by the arterial and venal arches, which ſend capillary ramifications on all hands; and its colour is more or leſs red.

The papillæ, which are only a continuation of the medullary ſubſtance, as has been ſaid, are often a little paler than that ſubſtance. They are ten or twelve in number, very diſtinct from each other, reſembling the ſame number of cones, with very broad baſes and obtuſe apices.

At the point of each papilla we ſee, even without a microſcope, in a ſmall depreſſion, ſeveral very ſmall holes, through which little drops may be perceived to run when the papillæ are compreſſed. Theſe are little drops of urine, which being filtered, partly in the cortical, partly in the medullary or tubular ſubſtance, do afterwards paſs through the ſubſtance of the papillæ, and are diſcharged by theſe orifices.

The pelvis of the kidneys. Each papilla lies in a kind of membranous calix or infundibulum, which opens into a common cavity, called the *pelvis*. This pelvis is membranous, being of the ſame ſtructure with the calices, of which it is a continuation; and its cavity in man is not uniform, but diſtinguiſhed into three portions, each of which contains a certain number of infundibula or calices, together with the papillæ which lie therein; and ſometimes we find two or three papillæ in the ſame infundibulum.

At the place where theſe infundibula ſurround the baſes of the papillæ, they ſend productions into the me-

medullary or radiated ſubſtance of the kidney, which accompany the blood-veſſels, and ſerve for capſules or vaginæ to all the vaſcular arches, both arterial and venal, and to their different ramifications, quite thro' the cortical ſubſtance, and as far as the ſurface of the kidney.

Ureters. After the infundibula have contracted in a conical form round the apices of the papillæ, each of them forms a ſmall ſhort tube or gullet, which uniting at different diſtances along the bottom of the ſinus of the kidney, form three large tubes which go out from the ſinus, in an oblique direction from above downwards, and immediately afterwards unite into one trunk.

This trunk becomes a very long canal, called the *ureter*. In men, the three tubes ſupply the place of what is called the *pelvis* in brutes, and might more properly be called the *roots* or *branches* of the ureters than the pelvis; which name would agree beſt to the trunk, as being larger than the reſt of the ureter. The ureters are commonly two in number, one for each kidney; but ſometimes there are more than two.

The ſituation of the trunk, and of the roots and branches of each ureter, with reſpect to the renal artery and vein, is in the following manner: The artery is in the upper part of the ſinus, and partly before the vein. The vein is about the middle, and between the artery and ureter. The ureter is in the lower part, a little behind the vein, and it is partly ſurrounded by one branch of the artery.

This diſpoſition appears plainer near the anterior than near the poſterior ſide of the kidney, becauſe this laſt is broader than the former; and we likewiſe ſee there the three branches of the ureter, of which the uppermoſt is the longeſt, and the loweſt is the ſhorteſt, becauſe of their oblique direction downward.

From this deſcription, we ſee, that in the human kidney there is no other common or uniform pelvis, but the trunk

trunk or head of the ureter, and the three great branches. To have a true idea of their diſpoſition, we muſt imagine that the ureter enters the kidney by the lower part of the oblong ſinus; that it increaſes gradually in breadth as it advances; and that it is divided into three branches, before it enters the ſubſtance of the kidney.

One of theſe branches may be reckoned a direct continuation of the ureter, and it is longer than the reſt, being extended from the lower to the upper part of the ſinus; and it may be found without much preparation. The other two branches are ſhorter, and cannot be well diſcovered without an artificial ſeparation. The angles between theſe branches at their baſes, or at the head of the ureter, are not pointed as thoſe of other ramifications, but formed by a round incurvation, which is generally ſurrounded by fat.

Theſe firſt branches of the ureters produce other ſmall branches at the bottom of the ſinus, which are diſpoſed in pairs. Theſe ſmall collateral branches extend in breadth, and form the infundibula or calices, in which the papillæ are lodged; the great circumference of which produces, in the ſubſtance of the kidney, the different vaginæ of the vaſcular arches and of their ramifications. The internal lamina of the kidney is continued round theſe vaginæ; and the external lamina is expanded round the firſt branches, round the trunk, and round all the reſt of the ureter.

If the trunk of the ureter be ſplit on that ſide which is next the vertebræ, and this ſection be continued to the extremity of the ſuperior branch, we may obſerve immediately above the trunk, two holes lying near each other, which are the orifices of the ſmall collateral branches and gullets of the infundibula. A little above theſe holes, there are other two very much like them, and ſo on all the way to the extremity of the ſuperior branch, which terminates likewiſe by theſe gullets

lets of the infundibula; and in each of thefe gullets we may obferve at leaft the apex of one papilla.

A fection begun on the convex furface of the kidney, and carried from thence to the trunk of the ureter, difcovers the extent of the papillæ very plainly, and likewife the infundibula, their gullets, &c.; but it will be difficult to give beginners a juft idea of the ftructure of thefe parts, without the other fection.

The ureters run down obliquely, and with a very fmall degree of inflexion, from the kidneys to the lateral parts of the inner or anterior fide of the os facrum; and paffing between the rectum and bladder they terminate in the laft of thefe vifcera, in the manner that fhall be explained hereafter.

They are compofed of three proper coats; the firft of which, that furrounds the reft, is of a whitifh colour, and of a very compact filamentary texture, being ftretched with difficulty, and appearing like a filamentary fubftance degenerated. The next coat is of a reddifh colour, ftronger than the firft, "and is compofed of mufcular fibres, although this has been doubted by fome authors."

The innermoft coat is in fome meafure ligamentary, and lined by a very fine membrane, which covers a very delicate reticular texture of veffels, and is moiftened all over by a mucilaginous liquor.

Befides thefe proper coats, the ureters are invefted by the cellular fubftance of the peritonæum; the membranous lamina of which covers likewife about two thirds of their circumference, fometimes more, fometimes lefs, but never furrounds them entirely: fo that when they are examined in their natural fituation, they appear like ropes lying behind the peritonæum, and jutting out more or lefs toward the cavity of the abdomen, together with that portion of the peritonæum which covers them.

All that has been faid about the ftructure of the ureters, pelvis, arches, ftriæ, foffulæ, and holes at the apex

apex of the papillæ, appears moſt diſtinctly when theſe parts are examined in clear water, as I have already often obſerved.

§ 18. *Glandulæ renales, vulgo Capſulæ atrabilariæ.*

Situation, figure, and ſize of the renal glands. Immediately above each kidney lies a glandular body, called by the ancients *capſulæ atrabilariæ;* by others, *capſulæ renales*, *renes ſuccenturiati*, and *glandulæ renales;* and they might be properly enough termed *glandulæ ſupra renales*. They are ſituated on the upper extremity of each kidney a little obliquely, that is, more toward the inner edge and ſinus of the kidney than toward the outer convex edge.

Each gland is an oblong body with three ſides, three edges, and two points, like an irregular creſcent with its great or convex edge ſharp, and the ſmall concave edge broad. Its length is about two thirds of the greateſt breadth of the kidney, and the breadth of its middle portion is about one-third of its extent between the two extremities, ſometimes more, ſometimes leſs. Its colour is a dark yellow.

It has one anterior, one poſterior, and one lower ſide, which laſt may be termed the *baſis;* and it has one upper, and two lower edges, whereof one is anterior, the other poſterior. The upper edge may be called the *criſta*, and the two lower edges the *labia*. One of its extremities is internal, or turned inward toward the ſinus of the kidney; the other is external, or turned outward toward the gibbous part of the kidney. The figure of this glandular body may likewiſe be compared to that of a ſingle cock's-comb, or to the top of an helmet.

Structure of the renal glands. The ſurface of theſe glands is uneven; the foreſide is the broadeſt, and the lower ſide or baſis the narroweſt. Along the middle of the anterior ſide, a ridge runs from the edge of the inner extremity a little above the bafis, to the point of the other extremity, and divides this fide into two equal parts, like the middle rib of the leaf of a tree, and on the lower fide under the bafis, there is a kind of raphe or future.

The blood-veffels of thefe glands come from the arteriæ, and venæ renales, and diaphragmaticæ, and likewife from the aorta and vena cava, from the arteria cæliaca, &c. Thefe veffels are termed the *capfular* arteries and veins; and as they enter the glands, they feem to be invefted by a vagina. They are not always derived from the fame fources, neither is their number the fame in all fubjects; and there is commonly a pretty large vein which runs along the ridge. The nerves on each fide are furnifhed by the neighbouring femilunar ganglion, and by the renal plexus which depends on it.

In the infide of thefe capfulæ, there is a narrow triangular cavity, the furface of which is full of fhort, ftrong villi of a yellowifh colour; but in children it is reddifh, and of a dark brown in aged people. The fides of this cavity are connected by a great number of filaments; and they appear to be wholly glandular, that is, to be filled with very fine fmall folliculous corpufcles. Along the top of the gland thefe fides touch each other immediately.

In opening this cavity, we find a granulated or follicular fubftance, which fills it almoft entirely; and the blood-veffels are diftributed on this fubftance, as well as on the fides of the cavity. If the fection be begun at the great extremity of the capfula, and be continued through the upper edge; and if the lateral portions be afterwards feparated, the glandular body appears like a kind of crifta, raifed from the middle of the bottom of the cavity.

This glandular body or nucleus adheres more clofely to the bottom or bafis of the cavity, than to the two fides, efpecially near the great extremity; but yet it may

may be ſeparated both from the baſis and ſides, being connected to them by a great number of ſmall filaments. It adheres leaſt to the baſis near the ſmall extremity.

The capſular vein, which comes ordinarily from the vena renalis, is much larger than the arteries; and it communicates with the inſide of the capſula much in the ſame manner as the vena ſplenica with the cells of the ſpleen, for it may be inflated by blowing into any part of the capſular cavity, and the air likewiſe paſſes into the vena renalis, &c.

This cavity contains an unctuous viſcid liquor, of a yellowiſh red colour, which, with age, changes gradually into a yellowiſh purple, a dark yellow, and a black yellow: ſometimes it is perfectly black; but even then, if it be ſpread thin on a large ſurface, it appears yellow. I have ſometimes found it not only reddiſh, but mixed with real blood.

The uſes of theſe renal glands have not as yet been diſcovered; and all that we know about the liquor contained in them is, that it has ſomewhat the appearance of the bile. They are very large in the fœtus, and diminiſh in adults. Theſe two phænomena deſerve our attention.

They lie ſometimes directly on the top of the kidneys, but I never found them on the gibbous part. The gland on the right ſide is partly connected to the diaphragm, under and very near the adheſion of the great lobe of the liver to that muſcle. That on the left ſide adheres to the diaphragm below the ſpleen; and both theſe connections are confined to the contiguous portions of the inferior muſcle of the diaphragm. They are involved, together with the kidneys, in the membrana adipoſa, of which a very thin portion inſinuates itſelf between the kidneys and glands, and alſo between them and the diaphragm; ſo that they adhere to both by the intervention of the cellular ſubſtance, which in ſome ſubjects contains a ſtratum of fat.

The renal ridge already mentioned, ſinks ſo deep into the foreſide in ſome ſubjects, that the upper part of this ſide appears to be ſeparated from the lower; but this is ſeen moſt diſtinctly when the capſula is examined in clear water.

When the capſular vein is opened lengthwiſe with the point of a lancet, we diſcover in it a great many ſmall holes, many of which are only the orifices of the rami of the vein, others are ſimple holes; and it is perhaps through theſe that the air paſſes into the gland, as already mentioned.

On the outer ſurface of theſe capſulæ we obſerve a very thin, diſtinct coat, ſeparate from the cellular ſubſtance that ſurrounds them. Sometimes this coat is raiſed by an uneven ſtratum of fat, which makes it appear granulated; and, for the ſame reaſon, the capſulæ are of a pale colour like a corpus adipoſum.

The liquor contained in them appears ſometimes, in the fœtus, and in young children, of a bluiſh colour inclined to red.

To be able to diſcover the uſes of theſe capſulæ, we muſt not only attend to the two circumſtances already mentioned, but alſo to their external conformation, which is commonly more regular in the fœtus and in children, than in adults and old people. We muſt likewiſe conſider the conſiſtence and ſolidity of their ſubſtance; which is greater before birth, and in childhood, than in an advanced old age; in which they are often very flaccid, and very much decayed; and this perhaps may be the reaſon, why the figures given of theſe glands taken out of their membrana adipoſa, are ſo very irregular and different from what I have demonſtrated for above 20 years paſt.

§ 19. *Veſica Urinaria.*

Situation, figure, and diviſion of the bladder. The bladder is a kind of membranous and fleſhy pouch or bottle,

bottle, capable of dilatation and contraction, fituated in the lower part of the abdomen immediately behind the fymphyfis of the offa pubis, and oppofite to the beginning of the inteftinum rectum. The figure of it is nearly that of a fhort oval. It is broader on the fore and back fides, than on the lateral parts; rounder above than below, when empty; and broader below than above, when full.

It is divided into the body, neck, and bottom; into an anterior, pofterior, and two lateral parts. The upper part is termed the *fundus*, or *bottom;* and the neck is a portion of the lower part, which is contracted like the gullet of fome veffels.

Structure of the bladder. The bladder is made up of feveral coats, almoft like the ftomach. That part of the external coat which covers the upper, pofterior, and lateral fides of the bladder, is the true lamina or membrane of the peritonæum; and the reft of it is furrounded by a cellular fubftance, by the intervention of which, the peritonæum is connected to the mufcular coat.

The proper coats are three in number; one mufcular, one cellular, and an internal fmooth one commonly called *villous coat.* The mufcular coat is compofed of feveral ftrata of flefhy fibres; the outermoft of which are moftly longitudinal; the next to thefe are more inclined toward each hand; and the innermoft, more and more oblique, and they become at length almoft tranfverfe. All thefe fibres interfect each other in various manners; and they are connected together by a fine cellular fubftance, and may be feparated by inflating that fubftance.

The cellular coat is nearly of the fame ftructure with what is called the *tunica nervofa* of the ftomach.

The internal coat is fomething grandulated and glandular; and a mucilaginous ferum is continually difcharged through it, which moiftens the inner furface of the bladder, and defends it againft the acrimony of the

 urine.

urine. It appears ſometimes altogether uneven on the inner ſide, being full of eminences and irregular rugæ when empty and in its natural ſtate of contraction. Theſe inequalities diſappear when the bladder is full, or when it is artificially diſtended by air, or by injecting any liquid.

Urachus. At the top of the bladder above the ſymphyſis of the oſſa pubis, we obſerve a ligamentary rope, which runs up between the peritonæum and the linea alba of the abdomen, all the way to the navel, diminiſhing gradually in thickneſs as it aſcends. This rope had a particular uſe in the fœtus, as ſhall be ſaid in another place. It is ſufficient to add here, that it is in part originally a production of the inner coats of the bladder, which production is termed *urachus.*

Arteriæ umbilicales. This rope is compoſed likewiſe of two other ligamentary elongations, which are the extremities of the umbilical arteries. Theſe arteries come from the hypogaſtricæ, run up by the ſides of the bladder, and remain hollow and filled with blood, even in adults, as high as the middle of the bladder, through all which ſpace they likewiſe ſend off ramifications. Afterwards they loſe their cavity, and become ligamentary as they aſcend. At the upper part of the bladder they approach each other; and joining the urachus, form that rope, which may be termed the *ſuperior ligament of the bladder.*

The external fibres of the muſcular coat are more numerous than the internal; and the moſt longitudinal anterior fibres form a kind of incurvation round the urachus at the top of the bladder, much like that of one of the fleſhy portions which ſurround the ſuperior orifice of the ſtomach and lower extremity of the œſophagus. This incurvation paſſes behind the urachus.

The portion of the peritonæum, which covers the poſterior convex ſide of the bladder, forms a very prominent tranſverſe fold, when the bladder is contracted, which

which diſappears when the bladder is extended. This fold ſurrounds the poſterior half of the bladder, and its two extremities are elongated toward each ſide; by which elongations a kind of lateral ligaments of the body of the bladder are formed, which are more conſiderable in children than in adults.

The lower part of the bladder, which deſerves the name of *fundus* much better than the upper part, is perforated by three openings, one anterior, and two poſterior. The anterior opening is formed by an elongation of all the proper coats, in form of a gullet, turned much in the ſame manner with the inner orifice of the roſtrum of the head of an alembic. This elongation is called the *neck of the bladder*, the deſcription of which belongs to that of the parts of generation in men.

The other two openings in the true fundus of the bladder, are formed by the ureters, which in their courſe downward, already deſcribed, run behind the ſpermatic veſſels, and then behind the lower part of the bladder, approaching each other. Each ureter lies between the umbilical artery and vas deferens of the ſame ſide; the artery lying on the outſide of the ureter, and the vas deferens on the inſide.

Afterwards they get between the vaſa deferentia and the bladder, croſſing theſe canals: and then, at about a finger's breadth from each other, they begin to pierce the coats of the bladder. They run a little way between the muſcular and nervous coats, and open into the bladder obliquely, ſomething nearer each other than when they firſt entered in coats.

The orifices of the ureters in the bladner are ſomething oval and narrower than the cavity of the ureters immediately above them. The edge of theſe orifices is very thin, and ſeems to be formed merely by the union of the internal coat of the bladder with that of the ureters.

Blood-veſſels and nerves of the bladder. The arteries of the bladder are furniſhed by the hypogaſtricæ or iliacæ internæ, being rami of the arteria ſciatica, epigaſtrica, and umbilicalis on each ſide. The veins come from thoſe of the ſame names with the arteries.

The nerves of the bladder come from the crurales, and alſo from the ſympathetici maximi, by means of their communication with the curales. It has likewiſe ſome nerves from the plexus meſentericus inferior.

Beſides the ligaments already mentioned, there are likewiſe two ſmall ones, by which the anterior part of the true fundus of the bladder is connected to the oſſa pubis, which ſhall be deſcribed with the neck and ſphincter, after the hiſtory of the parts of generation in both ſexes; and I refer to the ſame place, all that relates to the connection of the bladder with the other neighbouring parts.

§ 20. *The parts of Generation in Males.*

Situation in general, and diviſion of theſe parts. The parts of generation in males are of different kinds, ſome of them being wholly contained in the abdomen, and others lying without it. From this ſituation, they might properly enough be divided into external and internal parts; and all thoſe belonging to the firſt claſs might be deſcribed before thoſe of the ſecond.

But as it is ſtill more proper to have a regard to the œconomy of theſe parts, according to which, their functions begin in ſome internal parts, are continued in ſome external parts, return again to the internal, and are finiſhed in the external; I ſhall follow the ſame order in deſcribing them, and this is what I conſtantly obſerve in my public lectures.

The firſt of theſe four claſſes comprehends the ſpermatic veins and arteries; the ſecond, the teſtes, epidydimis, and ſcrotum; the third, the vaſa deferentia, veſiculæ ſeminales, and proſtates; and the fourth,

fourth, the corpora cavernofa, urethra, integuments, &c.

I formerly made a fifth clafs out of fome of thefe parts, which I looked upon as accompanying the reft; but I now think it better to include them all in the four claffes that I have mentioned.

The fpermatic veffels. The fpermatic arteries go out moft commonly from the anterior part of the inferior aorta, near each other, and about an inch lower than the arteriæ renales. Their origin oftentimes varies: for I have obferved them to arife from the renal artery; and fometimes they go out higher, lower, or more laterally than is common, and each artery has been feen to arife from different places.

They run down obliquely in the pofterior part of the abdomen within the cellular fubftance of the peritonæum, paffing infenfibly from behind, forward; and fo, parting gradually more and more from the aorta, they crofs over the forefide of the ureters, and run thro' the openings or rings of the abdominal mufcles along with the elongations or productions of the cellular portion of the peritonæum.

They are fmall at their origin; and, in their courfe downward they give off pretty confiderable lateral ramifications, to the membrana adipofa, peritonæum, and alfo the mefentery, where they feem to communicate with the mefenteric arteries.

They fometimes pafs through the areolæ or mefhes of the fpermatic veins; and before they go out of the abdomen, they are divided into very fine rami, which run in a more or lefs winding courfe, almoft parallel to each other.

Afterwards they enter the cellular productions of the peritonæum, which ferve them for vaginæ. They do not fluctuate indifferently from one fide to the other of thefe vaginæ; but are connected along their inner furface by thin membranous laminæ, which are like-

wife

wife continuations of the cellular fubftance of the peritonæum.

The arteries continue the fame winding courfe within thefe vaginæ, paffing before the vafa deferentia, which are likewife contained in them; and at length they terminate by ramifications in the epidydimis and teftes, in the manner that fhall be afterwards explained.

The fpermatic veins accompany the arteries, and have nearly the fame courfe. The right vein arifes commonly from the trunk of the vena cava, in the fame manner as the artery from the aorta; and I have fometimes obferved it to go out from the union of the right renal vein with the vena cava, and fometimes I have feen three veins on the right fide go out feparately from the trunk of the vena cava. The left fpermatic vein arifes moft commonly from the vena renalis finiftra.

In their courfe downward, they firft join the arteries, and, together with them, enter the cellular productions of the peritonæum, to which they are connected in the fame manner. From their origin to their paffage through the openings or rings of the abdominal mufcles, they fend off feveral rami to the membrana adipofa of the kidneys, peritonæum, and mefentery, where they feem to communicate with the venæ meferaicæ, and confequently with the vena portæ.

A little below the place where they crofs over the ureters, they fend out a confiderable branch, which is afterwards divided into two rami, one of which communicates with the vena capfularis, and the other oftentimes with the renalis; and lower down they give out the vein, which communicates with the vena meferaica, as already obferved.

They differ from the fpermatic arteries, not only in that they are larger, and their coats thinner, but alfo in being more divided and multiplied as they defcend to the rings of the abdominal mufcles; and as they gradually produce a large fafciculus of ramifications, the an-

ancients gave to them, and to the arteries, the name of *vaſa pyramidalia*.

Theſe ramifications often communicate with each other in this courſe, and form a great number of areolæ, contortions, and convolutions, ſo as to repreſent a kind of plexus, which is connected to the cellular vagina of each ſide by very fine laminæ; and the artery which accompanies the vein croſſes it in ſeveral places, and runs through the areolæ in different directions. Theſe frequent convolutions gave aiſe to the name of *vaſa pampiniformia*, formerly given to theſe veſſels; and their particular adheſions to each other at ſome places, made it believed that there were real anaſtomoſes between the artery and the vein.

Leal Lealis, an Italian anatomiſt, not attending to the lateral ramifications of the ſpermatic arteries and veins, believed himſelf able to eſtabliſh and demonſtrate theſe pretended anaſtomoſes. The experiments made by him on living animals prove nothing. His way was, to make a common ligature on both veſſels, a little above the teſticle, and another on the trunk of the vein, after he had emptied it. Then preſſing the aorta to force the blood into the ſpermatic artery, the vein which he had before emptied was found to be preſently filled.

From thence he concluded, that the courſe of the blood to and from the teſticle being obſtructed by the inferior ligature, there muſt be ſome anaſtomoſes between the two ligatures, through which the vein was ſupplied with blood. But it is very plain, that this effect was owing to the lateral ramifications of the ſpermatic artery and vein, and not to his pretended anaſtomoſes. Theſe fine lateral ramifications were well known to Euſtachius, but had eſcaped Leal Lealis.

Teſtes. The teſtes are two glandular bodies, ſituated near each other, without the abdomen, below the interſtice between the groins in an adult. The ancients named them *didymi* or *gemini*. Their ſize is nearly that of of a pigeon's egg, and they are of an oval figure, a little flatted at each fide. We may confider in each tefticle two extremities, two edges, and two fides. One extremity is fituated forward and a little upward, the other backward and a little downward; and their edges lie upward and downward.

At the upper edge they have each an appendix, called *epidydimis*, together with which it is involved in feveral coverings; and they are both fufpended in a common covering, called the *fcrotum*.

Each tefticle is a fpermatic gland formed by a vaft number of fine whitifh tubes, folded and twifted in different manners, and diftributed in different fafciculi, between membranous fepta; the whole being furrounded by a ftrong common covering, named *tunica albuginea*.

Thefe fepta are difpofed longitudinally, divaricating from each other on one fide, and approaching on the other. They approach each other along one edge of the tefticle, and terminate in a long narrow whitifh body, as in a kind of axis.

From thence they divaricate in a regular manner, and are fixed by their oppofite edges in the inner furface of the tunica albuginea, of which they appear to be a continuation. This white body may be termed the *nucleus* of the tefticle.

From this defcription we fee, that all thefe fepta are not of an equal breadth; that the interftices between them are in fome meafure triangular; and that the extent of the fmall tubes, which lie therein, muft be very confiderable. They have been reckoned to amount to many yards, by taking the fum of all their feveral portions; and they may be eafily unfolded by a long maceration, which deftroys the delicate fubftance by which all their folds and convolutions are connected and tied down.

All thefe fmall canals "are collected into bundles above twenty in number, divided by diftinct cells or partitions, which

which deſcend from the tunica albuginea, to conduct the arteries and veins. In each of theſe cells there is a ſeminiferous duct to convey the ſecreted humour from the teſticle. The ducts form a net-work, adhering to the ſurface of the albuginea, and forming inoſculations one with another. From the ſaid net, in the upper part of the teſticle, aſcend ten or twelve ducts; which being contorted together into folds, form as many vaſcular cones, that are joined together by an intermediate cellular ſubſtance; and, lying incumbent one upon another, there form the epidydimis, which goes round the outer and poſterior margin of the teſticle, to which it adheres by its thicker head, joined with a good deal of cellular ſubſtance: While in its lower, middle, and more ſlender part, it adheres in ſome meaſure, and is in part free; in ſuch a manner that it intercepts a ſort of impervious bag betwixt itſelf and the teſticle. The vaſcular cones, at the upper part of the epidydimis, by degrees uniting, form at length one duct; which grows larger as it deſcends, being largeſt at the bottom of the teſticle; from whence again aſcending along the poſterior face of the teſticle, in a direction contrary to itſelf, it by degrees ſpreads open its ſpiral convolutions, and comes out much larger, under the name of *vas deferens*."

Epidydimis. The epidydimus thus formed, may be reckoned a production of the teſticle, or a kind of teſtes acceſſorius; and it reſembles in ſome meaſure an arch ſupported by its centre or frame. It is more contracted at the middle than at the extremities, by which it is cloſely united to thoſe of the teſticle.

Between its extremities it does not immediately touch the teſticle; but is only looſely connected to it by the duplicature of a very fine and almoſt tranſparent membrane, as by a kind of ligament. This membrane is the continuation and duplicature of the tunica albuginea, or proper coat of the teſticle; which having ſupplied

plied the place of a ligament to the epidydimis, afterwards invests it.

The epidydimis is flat, a little concave on the under side or that next the testicle, irregularly convex on the upper side or that turned from the testicle: and these two sides are distinguished by two angular edges; by the innermost of which it is connected to the testicle in the manner already said, but the outer edge and flat side are loose and free.

The anterior extremity or head of the epidydimis arises from the testicle; and the posterior extremity or tail, which likewise adheres very closely to it, is incurvated from behind, forward and a little upward, and contracting by degrees forms a particular canal, termed *vas deferens;* which shall be described after the scrotum. By this description of the extremities and edges of the epidydimis, I demonstrated, many years ago, a method to discover whether a testicle, viewed extra situm, belongs to the right or left side.

Scrotum. The scrotum is the cutaneous covering of the testes. Outwardly, it is a bag common to both, formed by a continuation of the skin of the neighbouring parts, and commonly very uneven, having a great number of rugæ on its outer surface. Interiorly, it is fleshy, and forms a muscular capsula for each testicle, termed *dartos.*

The exterior or cutaneous portion of the scrotum is nearly of the same structure with the skin in general, of which it is a continuation; only it is something finer, and it is likewise plentifully stored with sebaceous glands and bulbs of roots of hairs.

Though it is a common covering for both testicles, it is nevertheless distinguished into two lateral parts by a superficial and uneven prominent line, which appears like a kind of suture, and from thence has been termed *raphe.*

This line is a continuation of that which divides, in the same manner, the cutaneous covering of the penis; and

and it is continued through the perinæum, which it divides likewiſe all the way to the anus. It is only ſuperficial, and does not appear on the inſide of the ſkin.

The inner ſurface of this cutaneous bag is lined by a very thin cellular membrane, through which the bulbs and glands appear very diſtinctly when we view its inſide. The rugæ of the ſcrotum are in the natural ſtate commonly a mark of health, and then its ſize is not very large. It increaſes in ſize, chiefly according to its length; and then the rugæ diſappear more or leſs, according to the degrees of the preternatural ſtate or indiſpoſition.

The dartos of the ſcrotum has been looked upon as a true cutaneous muſcle; " but is chiefly a cellular ſubſtance condenſed, with a great number of bloodveſſels entering into its compoſition, but without fat." This ſubſtance is thin; and by the diſpoſition of its fibres, forms a bag with two cavities, or two ſmall bags joined laterally to each other, and contained within the cutaneous portion.

The lateral parts of theſe two bags, which are turned from each other, are longer than thoſe which are joined together; and by this union a ſeptum is formed between the teſtes, which may be called *mediaſtinum ſcroti*.

The raphe or ſuture already mentioned, adheres to the edge of this ſeptum, and thereby braces down the middle of the cutaneous portion; which from thence appears to have in part two cavities; and this was perhaps what gave occaſion to make the French word for the ſcrotum to be in the plural number. The other edge of the ſeptum adheres to the urethra.

The " dartos has a ſtrict connection with the reſt of the cellular ſubſtance," eſpecially at the upper part below the groin, where its anterior and external lateral portions terminate by a kind of tendinous or ligamentary expanſion, which is ſtrongly united to the internal cellular membrane. I have often ſhown this as a particular

ticular faſcia lata, which gives inſertion to the portions of the dartos juſt mentioned, and as a broad frænum which keeps the ſame portions together.

The aponeurotic or ligamentary expanſion of the dartos is fixed in the ramus of the os pubis, between the muſculus triceps and the origin of the corpus cavernoſum of the ſame ſide, which ſhall be deſcribed hereafter, all the way to the lower part of the ſymphyſis of theſe bones. The internal portion of theſe muſcular bags, or that which forms the ſeptum ſcroti, is fixed to the urethra by means of a communication between the ſame ligamentary expanſion; and another, which ſhall be explained in its proper place.

Vaſa deferentia. The vaſa deferentia are two white ſolid flatted tubes; one lying on the right ſide, the other on the left. From the epidydimis, of which they are continuations, as has been already ſaid, each of them runs up in the cellular vagina of the ſpermatic veſſels, as high as the openings in the abdominal muſcles; the blood-veſſels lying forward, and the vas deferens behind them.

This faſciculus thus formed, by the blood-veſſels, vas deferens, and their common covering, is termed the *ſpermatic rope.* The covering is ſmoother on the outer than on the inner ſide; and for that reaſon it has been looked upon as a vagina; the internal ſubſtance of which is moſt cellular, and connects all the veſſels together, while the external forms a covering to inveſt them.

The vas deferens having reached the membranous lamina of the peritonæum, where that lamina runs over the orifice of the vagina, ſeparates from the blood-veſſels, and runs backward, in form of an arch, in the cellular ſubſtance of the peritonæum, as far as the neareſt ſide of the bladder.

It paſſes afterwards behind the body of the bladder, to which it adheres very cloſely, as alſo to the lamina of the peritonæum which covers it, and then continues its

its arched courſe towards the neck of the bladder, where both vaſa deferentia meet, and their arches terminate.

In this courſe, the vas deferens paſſes behind and croſſes the neighbouring umbilical artery; croſſes the extremity of the ureter of the ſame ſide, in its paſſage between that extremity and the bladder; and having got behind the bladder, it meets the vas deferens of the other ſide between the inſertions of the ureters, and they run down together to the neck of the bladder.

This canal, which at the origin of the epidydimis is pretty large and plaited, becomes immediately afterward ſmaller and ſmoother, and continues in that form till it gets behind the bladder, where it begins again to be larger and more uneven.

It ariſes from the angular portion or poſterior extremity of the epidydimis; and from thence runs forwards in a very oblique courſe, on the poſterior half of the epidydimis, where it is a little incurvated as it joins the back ſide of the ſpermatic veſſels.

The texture of the ſmooth portion of this canal is very ſolid, and in a manner cartilaginous, eſpecially near the ſurface of its cavity; which, though very narrow, is ſtill kept open by means of the ſolidity and thickneſs of its ſides.

The cavity of the vas deferens is cylindrical, though the whole tube is flat, and its external circumference oval, as may be ſeen by cutting it tranſverſely; and the cavity enlarges as it paſſes behind the bladder. The termination of theſe canals muſt be referred to the hiſtory of the urethra.

Coats of the teſtes. The particular coverings of the teſtes are commonly called *coats;* and they are reckoned to be three in number, the tunica muſculoſa named *cremaſter*, vaginalis, and albuginea. The firſt two are common to each teſticle, and to the ſpermatic rope that belongs to it; and the third is peculiar to the teſticle alone.

The tunica vaginalis is the moſt conſiderable of the three, and muſt be deſcribed firſt, in order to conceive the ſtructure and connection of the cremaſter, which is very improperly called a *coat*. The albuginea has been already deſcribed with the teſtes.

The tunica vaginalis is a continuation of the vagina of the ſpermatic rope, which, as it approaches the teſticle, is gradually dilated, and forms two capſulæ, one contained within the other, the external being the longeſt and broadeſt at bottom; ſo that there is a void ſpace there left between them, in which the teſticle is lodged.

This ſtructure may likewiſe be explained in the following manner. The vagina having reached as low as the teſticle, is divided into two laminæ; the innermoſt of which is the bottom of the vagina, and the outermoſt is expanded round the teſticle, and gives it a coat, called *vaginalis*, from the Latin word *vagina*. The ancients termed it likewiſe *elytroides*, from a Greek word that ſignifies the ſame thing.

The inner ſurface of this coat is lined by a fine membrane, which ſtrengthens the bottom of the vagina, and forms a kind of diaphragm; which prevents all communication between the vagina of the ſpermatic rope and the tunica vaginalis of the teſticle.

Cremaſter. The cremaſter, improperly termed *a coat*, is a thin muſcle or fleſhy plane, which runs down round the vagina of the ſpermatic rope, and terminates in the tunica vaginalis of the teſticle.

It ſurrounds almoſt the whole vagina; and afterwards expands itſelf on the upper and external part of the tunica vaginalis, in which it is inſerted and loſt.

It ariſes partly from the ligamentum Fallopii, but chiefly from the lower edge of the internal oblique muſcle of the abdomen.

It is covered by a very fine cellular membrane, detached from the outſide of the aponeuroſis of the obliquus externus, round the opening commonly called the

the *ring*. This membrane is loſt in the cellular ſubſtance of the inſide of the dartos.

From all this we ſee, that the cremaſter is rather a muſcle of the tunica vaginalis than a particular coat. Thoſe among the ancients who believed it to be a coat, called it *tunica erythroides*, from a Greek word which ſignifies *red;* but this muſcle is not always red, neither is that colour eſſentially neceſſary to a fleſhy ſubſtance.

Corpora cavernoſa. The corpora cavernoſa are two ligamentary and very limber tubes, united laterally to each other through the greateſt part of their length, and ſolid at their two extremities; two of which are connected together, and rounded like the end of a finger; the other two divaricate, like the branches of the Greek Υ; and, diminiſhing gradually in ſize after the divarication, terminate in an oblique point. Theſe divaricated and pointed extremities may be called the *roots*, and the round extremities the *heads*.

Theſe two bodies are almoſt cylindrical, being round, and of an equal diameter from the roots to the heads, where they are in ſome meaſure conical. The ligamentary ſubſtance of their ſides is elaſtic, and compoſed of fine cloſe fibres; which are partly tranſverſe, and partly more or leſs oblique.

The cavity of theſe ligamentary tubes is entirely filled by a ſtrong cellular or cavernous ſubſtance, which does not ſeem to be a continuation of the ſubſtance of the ſides. Theſe cells communicate with each other, and are always more or leſs full of blood, reſembling pretty much the cellular ſubſtance of the ſpleen, only with this difference, that the ſides of the cells are thicker in theſe cavernous bodies, and without any additional ſubſtance.

By the union of the two corpora cavernoſa, two external grooves are formed; one on the upper ſide, the other on the lower. The lower groove is ſomething broader than the upper; and it is filled through its whole length by a third tube, narrower than the corpora cavernofa, called the *urethra;* which fhall be prefently defcribed.

The roots of the corpora cavernofa are fixed, each, to the edge of the fmall ramus of the ifchium and os pubis. They meet at the fymphyfis of the offa pubis, where each of them becomes a cylindrical tube, and unites with the other in the manner already faid.

The heads or rounded extremities join the bafis of a diftinct body, called the *glans*, which is an expanfion of the urethra, and clofely united to it in the manner that fhall be explained hereafter.

By the union of the corpora cavernofa from their roots to their round extremities or heads, a particular feptum is formed by the tranfverfe fibres of both. Between the fibres of this feptum feveral fmall void fpaces are left, by which the corpora cavernofa communicate with each other; and therefore, by blowing into one of them, we prefently inflate the other. Toward the rounded extremities, the feptum diminifhes every way.

Urethra. The urethra is the third fpongy tube which compofes the penis; and it adheres to the corpora cavernofa, through the whole length of the inferior groove formed by their union. It differs from the other two, both as it is narrower, and as it forms a true hollow canal. Its fubftance is fpongy or cavernous, except a fmall portion next the bladder; and its inner and outer furfaces are membranous.

It is at firft no more than a membranous canal continued from the anterior opening of the bladder, at the place called the *neck* of the bladder, which is a name that would be more proper for this portion of the urethra.

About a finger's breadth and an half from its origin, it joins a cavernous fubftance like that of the two other tubes, only fmaller, which furrounds it through the whole extent of the inferior groove of the corpora cavernofa.

But before this fpongy fubftance begins to furround the

the urethra, it forms a diſtinct oblong body, like a pear or onion, which is connected only to the lower convex ſide of the canal; and afterwards being ſplit on each ſide, inveſts it quite round. This body is called the *bulb* of the urethra, being larger than any other part of that canal, and divided interiorly by a very fine membranous ſeptum into two lateral parts; and therefore, when it is inflated, it appears to be double, or with two heads.

Proſtatæ. The firſt portion of the urethra, or that which is not covered by the cavernous ſubſtance, and which from the bladder to the bulb is only a membranous canal, is ſuſtained by a large ſolid whitiſh maſs, of the figure of a cheſnut, and ſituated between the bladder and the bulb of the urethra; its baſis being toward the bladder, the apex or point toward the urethra, and the ſides lying upward and downward.

This body is termed the *proſtates*, from a Greek word that expreſſes its ſituation before the veſiculæ ſeminales, and implies a plurality, becauſe it appears to be divided into two lateral lobes by a hollow groove, which runs through its upper ſide from the baſis to the apex. The firſt portion of the urethra lies in this groove, adhering very cloſely to the proſtates which ſurround it.

The body of the proſtates lies on the inteſtinum rectum, and the apex is under the internal labium of the cartilaginous arch of the oſſa pubis. The inner ſubſtance is ſpongy, but very compact; and in each lobe there are ſeveral folliculi, which open into the firſt portion of the urethra, toward the bottom of the groove, as we ſhall ſee hereafter. The ſmall portion of the urethra, between the apex of the proſtates and the bulb, perforates the interoſſeous ligament of the oſſa pubis, formerly deſcribed. This portion is very ſhort, its length being no more than what is ſufficient to paſs through the hole in the ligament; the backſide of which conſequently touches the apex of the proſtates, and its forefide the bulb of the urethra. This portion might be called the *neck* of the urethra, and that which lies between the body of the bladder and the proftates might be called the *neck* of the bladder.

Glans. The fpongy fubftance of the urethra having reached the extremity of the corpora cavernofa, forms a large head called the *glans*, which crowns the three fpongy pillars; with this difference, however, that it is a continuation of the fpongy fubftance of the urethra, and only adheres to the extremity of the corpora cavernofa, without any direct communication.

It is for this reafon, that if we blow into the fpongy fubftance of the urethra, the glans is prefently inflated, and no air paffes into the corpora cavernofa: but when we blow into one of thefe bodies, the air paffes immediately into the other, the urethra and glans remaining as they were.

The figure of the glans is that of a rounded cone, a little flattened at the lower part, and with an oblique prominent bafis; the circumference of which is fomething greater than that of the corpora cavernofa.

The fpongy fubftance of the glans is thick and uniform next the corpora cavernofa; but next the urethra it is perforated by a continuation of that canal, and is there no thicker than the urethra before the formation of the glans.

Therefore the canal of the urethra does not lie in the middle of the glans; but continues its direct courfe through the lower flat fide of it, all the way to the extremity, where it terminates by an oblong orifice.

All the convex furface of the glans is covered by a fine villous fubftance, and that again by a fine membrane, refembling the red part of the lips. The circumference of the bafis of the glans has a double row of fmall papillæ, which may be reckoned febaceous glands, from which a thick matter is difcharged.

Caruncula. We have feveral things to take notice of in the cavity of the urethra. At the bottom of the cavity

vity of the firſt portion, or that which lies within the proſtates, there is a ſmall oblong oval eminence, pretty large on the back part, and terminating forward in a point, called *caruncula*, or *verumontanum*. The large portion of it is commonly perforated by two holes, ſometimes only by one, and very ſeldom by three; and theſe are the excretory orifices of the veſiculæ ſeminales; of which hereafter. Each orifice has a ſmall thin membranous border, which may ſerve for valves to the excretory ducts of the veſiculæ.

On each ſide of the large portion of the caruncula, there are five or ſix holes ranked in form of a creſcent round its lateral parts, which are the orifices of the excretory ducts of the proſtates that come from the folliculi already mentioned, and run in an oblique courſe to the orifices, in a kind of membranous duplicature.

Veſiculæ ſeminales. The veſiculæ ſeminales are ſoft whitiſh knotted bodies, about three or four fingers breadth in length, one in breadth, and about three times as broad as thick, ſituated obliquely between the rectum and lower part of the bladder, in ſuch a manner, as that their ſuperior extremities are at a diſtance from each other, and their lower extremities united between thoſe of the vaſa deferentia, of which they imitate both the obliquity and the incurvation.

They are irregularly round on the upper part, and their breadth decreaſes gradually from thence. By the union of their lower extremities they form a kind of fork, the branches of which are broad, and bent like rams horns. Theſe extremities are very narrow, and form a ſmall neck, which runs behind the bladder toward its orifice, and continues its courſe in the groove of the proſtates, through the ſubſtance of the contiguous portion of the urethra, till its extremities pierce the caruncula in the manner already ſaid.

The inner ſubſtance of the veſiculæ is plaited, and in a manner diſtinguiſhed into ſeveral capſulæ by contorted folds. Their external ſurface is covered by a fine membrane, which ſerves for a border and frænum to the folds, and is a true continuation of the cellular ſubſtance of the peritonæum. The veſiculæ may eaſily be unfolded, and all their contortions ſtraightened; and by this means they become much longer than in their natural ſtate.

Their inner ſurface is villous and glandular, and continually furniſhes a particular fluid, which exalts, refines, and perfects the ſemen, which they receive from the vaſa deferentia, and of which they are the reſervatories for a certain time.

The paſſage of the vaſa deferentia into the veſiculæ, is very particular. I have already obſerved, that theſe canals are incurvated behind the bladder, and that their contracted extremities unite at that place. They unite in an angle, and run between the contiguous extremities of the veſiculæ; and this union is ſo cloſe, that the adhering portions ſeem to form only one middle ſeptum, between two ſmall tubes; each of which is formed, partly by the extremity of one vas deferens, and partly by that of the neighbouring veſicula.

This lateral union of the extremities of the vas deferens, and veſicula ſeminalis on each ſide, forms likewiſe a kind of ſhort ſeptum, which terminates in a creſcent, like a ſmall ſemilunar valve; and the extremity of the vas deferens is narrower than that of the veſicula. By this mechaniſm, the fluid contained in each vas deferens has liberty to enter the contiguous veſicula; but that contained in the veſicula cannot return into the other canal.

If we blow into one of the vaſa deferentia, after having compreſſed the urethra, the air inflates the contiguous veſicula ſeminalis, and the bladder of urine, without paſſing into the veſicula or canal of the other ſide, except we blow with too great violence.

Afterwards the two ſmall tubes, formed each by the extremities of the vas deferens and veſicula, run in between the baſis of the proſtates and canal of the urethra; and

and perforating the ſides of that canal obliquely, they terminate in the caruncula in the manner already ſaid.

Lacunæ of the urethra. The inſide of the canal of the urethra is lined by a fine membrane, full of capillary blood-veſſels; and its ſurface is perforated by a great number of oblong holes, or ſmall lucunæ of different ſizes, the largeſt lying near the glands.

Theſe lacunæ or orifices of the excretory ducts of the ſame number of ſmall glands, are diſperſed through the ſubſtance of the urethra: which ducts run for ſome way in the ſpongy ſubſtance along the convex ſide of the internal membrane of the urethra, and open obliquely from behind forward into the great canal. The edges of the lacunæ are ſemilunar, or like a creſcent, becauſe of the obliquity of their opening.

Anti-proſtatæ. A little way from the beginning of the cellular ſubſtance of the urethra, we meet with two lacunæ more conſiderable than the reſt, and their ducts are very long. Theſe lacunæ and ducts lead to two glandular bodies, ſituated on the two convex ſides of the ſpongy ſubſtance of the urethra near the bulb. Each of them is about the ſize of a cherry-ſtone; but they are oblong and flat, and covered entirely by the muſcles called *acceleratores;* of which hereafter. Theſe two bodies are commonly called *proſtatæ inferiores;* but if their ſituation be carefully examined, they will be found to be higher than the true proſtates. There is a third body of the ſame kind ſituated more anteriorly.

Orifice of the urethra. The cavity of the urethra reſembles nearly that of a ſmall writing-pen. It is not every where round, and towards the glans becomes broader and flatter on each ſide, eſpecially in the glans itſelf, where there is a kind of oval or navicular foſſula.

This canal terminates at the extremity of the glans by a narrow oblong orifice or fiſſure, which is much leſs than the reſt of the cavity. The commiſſures of this ſmall fiſſure are turned. one toward the convex, the

the other toward the flat ſide of the glans; and the labia of the fiſſure are its lateral parts; and it ſeems to be ſurrounded by fleſhy fibres.

The common integuments. The integuments which cover all theſe parts are three or four in number. The firſt is the ſkin with the cuticula; the ſecond is the common cellular membrane, which in this place ſeldom contains any fat; the third is termed *nervous;* and the fourth is a particular cellular membrane, which is not always to be found.

Præputium. The firſt of theſe integuments, the ſkin, is a continuation of that of the pubes and ſcrotum; and it adheres to the ſecond all the way to the baſis of the gland, where that ſecond integument ends. The reſt of the cutaneous integument covers the glans without adheſion, and terminates by an opening. This portion is named *præputium;* and along the whole lower or back ſide, both of the whole integument in general, and of the præputium in particular, there runs a fine ſuture, which is a continuation of the raphe of the perinæum and ſcrotum.

The inner ſurface of the præputium is lined with a fine membrane from the opening all the way behind the baſis of the glans, and the ſame membrane is folded from behind, forward, round the glans, forming the proper integument thereof, and covering very cloſely its whole villous ſurface, as far as the orifice of the urethra, where it joins the membrane which lines the inſide of that canal.

This proper membrane of the glands, and internal membrane of the præputium, form conjointly along the flat part of the glans, from its baſis to the orifice of the urethra, a membranous duplicature, which like a ſeptum or mediaſtinum divides this part into two lateral portions, and limits the motions of the præputium; for which reaſon it is called *frænum præputii.*

The ſurface of the internal membrane of the præputium diſcharges a fluid which prevents it from adhering to to the glans, and perhaps ſerves likewiſe to dilute that which is collected at the baſis of the glans, from the glandulæ ſebaceæ, already mentioned.

The ſecond common integument of theſe parts, is nearly the ſame with what is every where found under the ſkin, except that it is not filled with fat, and that it is more fibrous than cellular, and a little looſe. It accompanies the ſkin to the baſis of the glans, as has been already obſerved.

Ligamentum ſuſpenſorium. The third common integument, improperly called *tunica nervoſa*, is of a firm, elaſtic, ligamentary ſubſtance, and its fibres are ſometimes of a yellowiſh colour. It inveſts the corpora cavernoſa and urethra from the glans to the ſymphyſis of the oſſa pubis; and at ſome diſtance from theſe bones, it forms on the ſuperior groove of the corpora caver-noſa a cloſe duplicature; and by this duplicature, a flat broad ligament which runs directly upward, and is inſerted in the forementioned ſymphyſis, as far as the tendinous baſis of the muſculi pyramidales of the abdomen.

This ligament has been called *ligamentum elaſticum*, becauſe it yields and recovers itſelf; and *ſuſpenſorium*, becauſe it ſuſpends theſe parts, by means of its inſertion in the ſymphyſis. It ſends off a detachment or ala toward each ſide, one edge of which is fixed between the muſculus triceps and the corpus cavernoſum, and forms the ligamentary expanſion in which the dartos is inſerted, as has been already ſaid. It ſeems likewiſe to ſend down another elongation directly to the perinæum and anus.

The fourth integument of theſe parts is the tunica celluloſa of M. Ruyſch, which immediately ſurrounds the corpora cavernoſa and urethra, lying between theſe and the third integument, from which it ſeems to be diſtinguiſhed only by the cloſeneſs and fineneſs of its texture; and it is ſometimes hardly perceivable.

The muſcles. Several muſcles are inſerted in the parts

parts which we have juſt deſcribed. They may be reckoned to be ſix in number, two for the corpora cavernoſa, two for the urethra, and two common muſcles called *tranſverſales*.

The firſt two muſcles are commonly termed *erectores*, but might be more properly named *iſchio-cavernoſi*. The next two are called *acceleratores*, but the name of *bulbo-cavernoſi* would better agree to them. It may be obſerved, that the names taken from the ſuppoſed uſes are very equivocal.

The muſculi iſchio-cavernoſi lie along the roots of the corpora cavernoſa; each of them being fixed by one extremity very obliquely, in the internal labium of the ramus of the os iſchium, from the tuberoſity upward. From thence it accompanies the root of the corpus cavernoſum, all the way to the ſymphyſis of the oſſa pubis; and is fixed, by its other extremity, in the corpora cavernoſa, near their union; where the fibres of both muſcles meet, and are reciprocally expanded over both corpora. They lie a little lower and more interiorly than the roots of theſe cavernous bodies.

I have ſhown two other muſculi acceſſorii, which I looked upon as lateral acceleratores, or as acceleratores acceſſorii; fixed lower and more interiorly in the os iſchium than the former, which they accompany all the way to the corpora cavernoſa, and then leaving them they are inſerted chiefly in the urethra near the bifurcation of the muſculus bulbo-cavernoſus.

Theſe bulbo-cavernoſi, commonly termed *acceleratores*, form firſt of all a penniform muſcle, by means of a middle tendon, fixed in the lower part of the interoſſeous ligament of the oſſa pubis, and to the union of the muſculi tranſverſales with the ſphincters of the anus. From which they paſs in an expanded form over the bulb of the urethra, covering that bulb and the urethra itſelf, and adhering in ſome meaſure to both, as as high as the origin of the ligamentum ſuſpenſorium, the middle tendon anſwering to the ſeptum of the bulb.

Afterwards the two fleſhy planes ſeparate, and run obliquely to the right and left hands, from behind forward, and from below upward; ſurrounding the corpora cavernoſa, in the outer ſides of which they are inſerted. The middle tendon adheres very ſtrongly to the lower part of the ſeptum of the bulb, in which, and in the urethra itſelf, ſeveral of the fibres of theſe muſcles are fixed.

The muſculi tranſverſi, called alſo *triangulares*, are two long, narrow, fleſhy faſciculi, inſerted, each, by one extremity, in the root or beginning of the ramus of the os iſchium; from whence they run tranſverſely along the edge of the interoſſeous ligament of the oſſa pubis, as far as the apex of the proſtates, where their other extremities meet, and form commonly a kind of digaſtric muſcle, the middle of which gives inſertion to the muſcles of the urethra, and to the cutaneous ſphincters of the anus.

Blood-veſſels. The arteries of theſe parts come chiefly from the iliacæ internæ or hypogaſtricæ, and the reſt from the iliacæ externæ or crurales. The principal arteries are termed *pudicæ*, of which one is external, the other internal.

The pudica externa ſends a branch to each ſide, which having paſſed out of the pelvis by the ſide of the os ſacrum, runs on the inſide of the tuberculum iſchii, to the roots of the corpora cavernoſa, along the inſide of the muſculi iſchio-cavernoſi or erectores. It ſends ramifications to the bulbous head of the urethra and to the corpora cavernoſa; and together with the gluteæ, with which it communicates in its paſſage, it likewiſe ſupplies the ſcrotum.

The pudica interna having furniſhed the inteſtinum rectum, bladder, veſiculæ ſeminales, and proſtates, communicates with the hæmorrhoidales, paſſes under the

the arch of the oſſa pubis, and partly enters the corpora cavernoſa, and partly runs along their upper ſide, ſending off ſmall lateral branches, which ſurround theſe bodies, like irregular half arches, and penetrate them by numerous ramifications.

The crural arteries ſend each likewiſe a branch, which, running behind the contiguous crural vein, is diſtributed to the integuments of the penis, by the name of *pudica externa*, and communicates, by lateral ramifications, with thoſe of the pudica interna. Theſe communications are not only between the internal and external pudicæ of the ſame ſide, but alſo between thoſe of both ſides, which reciprocally communicate with each other.

The diſtribution of the veins follows nearly that of the arteries; but they have more ramifications and communications, as in other places. The principal vein is that which paſſes directly under the ſymphyſis of the oſſa pubis between the two arteries, and runs along the whole ſuperior groove formed by the union of the corpora cavernoſa. It is very large, often double, and very ſeldom triple, but the trunks do not ſeparate while in the groove; and it has a great number of valves.

This great middle vein is formed by the union of the hypogaſtric branches, which, after paſſing on the two inner ſides of the pelvis, meet about the middle of the arch of the oſſa pubis. At this place we obſerve a venal plexus, which covers the upper convex ſide of the firſt portion of the urethra, before it is ſurrounded by the ſpongy ſubſtance.

The ſpermatic veſſels, of which I have already deſcribed the origin and courſe all the way to where they go out of the abdomen, having reached on each ſide near the teſticle, are divided into two principal faſciculi, one of which is larger than the other. The largeſt is the anterior, and is diſtributed through the teſticle, by a prodigious number of very fine capillary ramifications, which

which accompany all the convolutions and folds of the ſmall canals.

The other faſciculus is poſterior, and is diſtributed to the epidydimis in the ſame manner.

The ſpermatic artery is accompanied by a ramus of the epigaſtric artery, which runs down on the ſide of it as far as the teſticle, where they communicate reciprocally with each other. There is ſometimes a ſmall ramus of the hypogaſtric artery, which accompanies the vas deferens to the epidydimis, and there communicates with the arteria ſpermatica.

Nerves. The nerves of theſe organs come from the lumbares and ſacri; and they communicate with the ſympatheticus maximus, and plexus meſenterici. Near the arch of the os pubis, they form together, on each ſide, a particular rope, which paſſes under that arch along the upper ſide of the neighbouring corpus cavernoſum, near the artery already mentioned.

In their paſſage over the corpora cavernoſa, they ſend off a great many rami, which ſurround theſe bodies on all ſides, between the ſkin and ligamentary integument; being ſo diſpoſed, as that the arteries lie between them and the middle vein. They muſt be examined preſently after the ſkin has been raiſed, becauſe when the ramifications are dried by the air, they diſappear.

There are two nerves which accompany the ſpermatic rope; whereof one comes from the nervi lumbares, near the anterior ſpine of the os ilium, which is incurvated in its paſſage out of the abdomen through the muſcles, and ſerves to diſtinguiſh the cremaſter; the other nerve comes from the plexus renalis.

There is likewiſe one nerve on each ſide; which being produced from the union of the ſecond, third, and fourth pairs of the nervi ſacri, eſpecially from the third, goes out of the abdomen above the ligamentum iſchioſacrum, paſſes by the inſide of the tuberoſity and ſmall branch of the os iſchium, and is diſtributed to the cor-

pora

pora cavernoſa, to the muſcles belonging to them, and to the neighbouring parts.

§ 21. *The Parts of Generation in Females.*

The parts of generation in females are ſeveral in number, ſome of them external and ſome internal; and they are all ſubordinate to one principal internal part, called the *uterus*. The other internal parts are the tubæ Fallopianæ, ovaria, vaſa ſpermatica, ligamenta lata, the ropes or bands called *ligamenta rotunda*, and the canal of the uterus. The external parts are the pubes, the alæ, nymphæ, clitoris, orifice of the urethra, and orifice of the canal of the uterus.

Uterus. The uterus lies between the bladder and the inteſtinum rectum. It is a body inwardly hollow, outwardly of a whitiſh colour, of a pretty ſolid ſubſtance, and, except in time of pregnancy, of the figure of a flat flaſk, being in adults about three fingers breadth in length, one in thickneſs, and two in breadth at one end, and ſcarcely one at the other. This ſize varies, according to the age of the ſubject.

The broadeſt portion is termed the *fundus*, and the narroweſt the *neck*. Its ſituation is oblique, the fundus being turned backward and upward, and the neck forward and downward; the broad ſides lie next the rectum and bladder, and the narrow ſides are lateral.

The cavity of the uterus is flat; and reſembles an oblong triangle, the ſhorteſt ſide of which anſwers exactly to the fundus; and the two longeſt ſides lie one on the right hand, the other on the left; and they are all bent inward, or toward the cavity formed by them.

Of the three angles of this cavity, the two which terminate the fundus are perforated each by a narrow duct, which with difficulty admits a hog's briſtle. The third angle forms a flat duct wider than the former, which

which perforates the neck of the uterus lengthwife, and terminates at the extremity of that neck, by a tranfverfe opening.

This opening is termed *the internal orifice of the uterus;* and in the natural ftate is narrower than the duct of the colum uteri, fo that only a fmall ftilet can be paffed through it. At the edge of this orifice are feveral fmall holes, anfwering to the fame number of glandular corpufcles, which difcharge a vifcid lympha.

The inner furface of the cavity of the uterus, is lined by a very fine membrane, which at the fundus or broad portion is fmooth and even, but in the narrow portion which leads to the orifice, it is wrinkled in a particular manner.

The portion of this membrane, which covers the bottom of the cavity, is perforated by a great number of confiderable holes, through which fmall drops of blood may be obferved to pafs, when the whole uterus is compreffed; and fometimes it appears to have very fmall hairs or villi. Both thefe villi and holes are obferved to be more or lefs tinged with blood, in thofe women who die in the time of their menfes.

In the narrow part, which anfwers to the colum, each fide is divided into two lateral parts by a kind of prominent longitudinal line, which is larger in the upper or anterior fide, than in the lower or pofterior.

On each fide of thefe two longitudinal lines, there are lines or rugæ obliquely tranfverfe, and difpofed like branches, the longitudinal lines reprefenting trunks. Between and round thefe rugæ, there are fmall lacunæ, through which a mucilaginous fluid is difcharged that clofes the orifice of the uterus. We obferve likewife in the interftices between the rugæ, feveral tranfparent globular corpufcles, which a modern author took for a kind of ova.

Structure of the uterus. The fubftance of the body of the uterus is fpongy and compact, with a copious in-

intertexture of veſſels. Its thickneſs is nearly equal and uniform in the ſides and edges; but the fundus is thicker toward the middle than toward the two angles, where the thickneſs decreaſes gradually. The edges are likewiſe much thinner near theſe angles, than near the extremity of the neck.

The uterus is covered by a portion of the peritonæum, which ſerves it for a coat, and is the continuation of that which covers the bladder and inteſtinum rectum, running up from the lower and poſterior part of the bladder, over the anterior part of the uterus, and from thence over the fundus, and down the backſide, and afterwards going to the rectum.

On each lateral part or edge of the uterus this portion of the peritonæum forms a broad duplicature, which is extended on each ſide, more or leſs directly to the neighbouring lateral parts of the pelvis, forming a kind of membranous ſeptum, between the anterior and poſterior halves of the cavity of the pelvis; and it is afterwards continued in a looſe manner, with the peritonæum, on the ſides of the pelvis.

Broad ligaments of the uterus. Theſe two broad duplicatures have the name of *ligamenta lata*, and *veſpertilionum alæ*. The upper edge of each is partly double, or folded, forming two ſmall diſtinct duplicatures, which I term the *pinions of the broad ligaments*. The anterior pinion is more raiſed than the poſterior, and they are both very looſe.

The laminæ of all theſe duplicatures are connected by a cellular ſubſtance, in the ſame manner as the other duplicatures of the peritonæum; and they contain the Fallopian tubes, the ovaria, a part of the ſpermatic veſſels, and of thoſe that go to the body of the uterus; the ropes called the *round ligaments*, the nerves, *&c.*

Ovaria. The ovaria are two whitiſh oval, flat, oblong bodies, ſituated on the ſides of the fundus uteri, to to which they are fixed by a kind of ſhort round ligament, and incloſed, together with it, in the duplicature of the poſterior pinion of the ligamenta lata.

They are compoſed of a compact ſpongy ſubſtance, and of ſeveral little balls, or tranſparent veſiculæ, which are called *ova*. The ſpongy ſubſtance ſurrounds each of theſe veſiculæ very cloſely, and ſeems likewiſe to furniſh them with diſtinct ſpongy coverings or calices. Theſe veſiculæ are to be carefully diſtinguiſhed from other preternatural ones, termed *hydatides*.

The ligaments of the ovaria lie in the edges of the poſterior pinions of the ligamenta lata, much in the ſame manner as the umbilical vein, in the anterior or umbilical ligament of the liver. They are round ropes of a filamentary texture, fixed by one extremity to the corner of the fundus uteri, a little above and behind the level of that fundus. They were formerly believed to be hollow, and looked upon as vaſa deferentia.

Tubæ Fallopianæ. The Fallopian tubes are two flaccid, conical, and vermiform canals, ſituated more or leſs tranſverſely on each ſide of the uterus, between the fundus and the lateral parts of the pelvis, and included in the anterior duplicatures or pinions of the ligamenta lata.

Each of them is fixed by its narrow extremities in the corner of the fundus uteri, into which it opens, tho' by ſo narrow a duct, as hardly to admit a large briſtle. From thence their diameter augments by degrees all the way to the other extremity, where it is about one-third part of an inch. The body of the tubæ goes in a winding courſe, and their large extremity is bent toward the ovaria.

Theſe large extremities are irregularly round, and terminate by a narrow orifice, a little plaited and turned toward the ovarium, where it preſently expands in form of a membranous fringe, full of plaits and inciſures.

Thefe fringes are called the *broad ends of the Fallopian tubes.*

The breadth of the fringe is not equal in all parts. Its circumference is in a manner oval, and the longeft fegment of the fringe reaches to, and is fixed in the ovarium. The folds are difpofed like laminæ on the concave fide.

Thefe tubes are compofed of flefhy fibres, whereof fome are longitudinal, and fome obliquely circular, with an intertexture of another very fine fubftance.

The anterior pinions of the ligamentum latum ferve for a common or external coat to both tubæ, and alfo to connect them, in the fame manner as the mefentery connects the inteftines. From thence the tubæ, and efpecially their fringes, come to be loofe, and their direction to be very imperfectly determined in the greateft part of the figures.

Their cavity is lined by a foft glandular membrane, which is plaited longitudinally, almoft like the inner furface of the afpera arteria; and thefe folds are ftronger and broader near the great extremities, than any where elfe. Their fubftance feems to be fpongy, and the interftices between them are moiftened more or lefs by a fluid, which is continually difcharged there.

Blood-veffels. The blood-veffels of thefe parts are of different kinds, viz. the hypogaftric arteries and veins, the ramifications of which belong chiefly to the body of the uterus; the fpermatic veffels, and the two vafcular ropes, called *ligamenta rotunda*, which might be more properly termed the *vafcular ropes of the uterus* or of the *ligamenta lata.*

The hypogaftric branches are arterial and venal ramifications, arifing from the artery and vein of the fame name, which having reached the lateral edges of the uterus, are diftributed to all the parts thereof, both internal-ternal and external, forming a great number of incurvations and particular intertextures.

The arteries of one ſide communicate both upon the uterus, and through its whole ſubſtance, with thoſe of the other ſide, and the arterial ramifications of each ſide form numerous anaſtomoſes with each other. The veins communicate together on each ſide in the ſame manner; and all theſe blood-veſſels communicate likewiſe with the ſpermatic veſſels, with the vaſcular ropes of the ligamenta lata, and with the hæmorrhoidales.

Theſe frequent anaſtomoſes may be demonſtrated by injecting or blowing into the hypogaſtric veſſels, having firſt made proper ligatures to prevent the liquor or air from running into other parts. The extremities of theſe arteries terminate and open into the cavity of the uterus, as has been already ſaid; and there is this peculiar to the veins, that they communicate with the hæmorrhoidales, and conſequently with the vena portæ.

The ſpermatic veſſels have nearly the ſame origin in females as in males, and likewiſe the ſame courſe and intertextures; but they never paſs out of the abdomen, being wholly diſtributed to the ovaria and tubes; and they communicate with the hypogaſtrics, and with the vaſcular ropes of the ligamenta lata. The veins are very large in proportion to the arteries; and theſe veſſels ſend out lateral ramifications, which ſeem to communicate with the meſaraicæ and vena portæ.

The vaſcular ropes, commonly called the *round ligaments*, are two long ſmall faſciculi of arteries and veins, interwoven and connected together by a fine cellular ſubſtance; and they run in the great duplicature of the ligamenta lata, from each corner of the fundus uteri, as far as the annular openings of the abdominal muſcles.

In this courſe, each rope thruſts outward or raiſes the anterior lamina of the duplicature, which conſequently gives a kind of coat to theſe vaſcular faſciculi,

 and

and makes them appear like diſtinct ropes connected to this foreſide of the duplicatures.

They ſeem to ariſe from the communication between the vaſa ſpermatica and hypogaſtrica, and might be reckoned a particular continuation of the ſpermatic veſſels. The diſpoſition of their adheſions to the angles of the fundus uteri, with reſpect to that of the tubes and ligaments of the ovaria, which lie all near each other, is this: The tubes lie higheſt, the ligaments of the ovaria moſt backward, and the vaſcular ropes forward; and a little lower than the ligaments of the ovaria.

Afterwards they run in a courſe, nearly reſembling that of the ſpermatic veſſels in males, paſs out of the abdomen, through the openings of the abdominal muſcles, and are loſt in the fat of the upper and middle parts of the groins. It may be conjectured, that theſe veſſels furniſh the lacunæ; of which hereafter. As they paſs out of the abdomen, they are accompanied by a production of the cellular portion of the peritonæum, as the ſpermatic rope in men, and by a faſciculus of fleſhy fibres, repreſenting a kind of cremaſter.

Nerves, *lymphatics*, *&c.* Beſides all the veſſels hitherto mentioned, we obſerve nerves and lymphatics, to which we may add the lactiferous ducts that are ſeen in an advanced pregnancy. The nerves come from the lumbares, ſacri, and ſympathetici maximi, in the ſame manner as in males. The lymphatic veſſels run chiefly in the coats continued from the peritonæum. I ſhall in another place explain the lactiferous ducts, and alſo the particular fibres which ſeem to be interwoven in the ſubſtance of the uterus in a pregnant woman, the innermoſt of which being diſpoſed in a vortical or turbinated manner, gave occaſion to M. Ruyſch to deſcribe them particularly by the name of *muſculus uteri orbicularis*.

Pubis. The pubis is that broad eminence at the lower part of the hypogaſtricum, between the two inguina, on which the hairs grow at a certain age, called in Latin by by the ſame name, and almoſt of the ſame kind with thoſe found under the axillæ. This eminence is owing to a particular thickneſs of the membrana adipoſa which covers the forepart of the oſſa pubis, and ſome ſmall portions of the neighbouring muſcles.

Sinus and alæ. The longitudinal cavity which reaches from the middle and lower part of the pubes, within an inch of the anus, was by the ancients termed *ſinus;* and they called the lateral parts of the cavity *alæ*, which is a more proper name than that of *labia*, commonly given to them. The places where the alæ are joined above and below, are termed *commiſſures;* and may likewiſe be called *the extremities* or *angles of the ſinus.*

The alæ are more prominent, and thicker above than below, and lie nearer each other below than above. They are chiefly compoſed of the ſkin, cellular ſubſtance, and fat. The exterior ſkin is a continuation of that of the pubes and inguina. It is more or leſs even, and furniſhed with a great number of glandular corpuſcles, from which a whitiſh ceruminous matter may be expreſſed; and after a certain age it is likewiſe covered in the ſame manner with the pubes.

The inner ſide of the alæ is ſomething like the red portion of the lips of the mouth; and it is diſtinguiſhed every where from the external ſide by a kind of line, in the ſame manner as the red portion of the lips from the reſt of the ſkin; being likewiſe thinner and ſmoother than the outward ſkin. A great number of pores are obſervable in it, and alſo numerous glandular corpuſcles, which furniſh a liquor more or leſs ſebaceous; and theſe corpuſcles are larger near the edges than in the other parts.

Lacunæ. Near the inner edge of the inner ſurfaces of the alæ, on each ſide of the orifice of the canal of the uterus, we find a ſmall hole more viſible than the reſt. Theſe two holes are termed *lacunæ;* and they communicate by two ſmall ducts with the ſame number of follicular bodies lying in the ſubſtance of the alæ,

 and

and which may be looked upon as ſmall proſtates anſwering to the glandulæ proſtaticæ in males. When compreſſed, they diſcharge a viſcid liquor.

Above the ſuperior commiſſure, a thin flat ligament runs down from each ſmall branch of the oſſa pubis, which penetrates the fat in the ſubſtance of each ala, and is loſt therein inſenſibly near the edge. Theſe may be looked upon as the ligamenta ſuſpenſoria of the alæ. The inferior commiſſure of the alæ is very thin, or like a membranous ligament; and, together with the neighbouring parts of the inner ſide, it forms a foſſula, termed *navicularis*, or *ſcaphoides*. The ſpace between the inferior commiſſure and anus, termed *perinæum*, is about a large finger's breadth in length.

The other external parts are ſituated in the ſinus, and hid by the alæ. Directly under the ſuperior commiſſure, lies the clitoris, with its cover, called *præputium*. A little lower is the orifice of the urethra; and below that is the orifice of the great canal of the uterus. The circumference of this orifice is bordered, either by a membranous circle, called *hymen*, or by fleſhy portions, termed *carunculæ myrtiformes*. On each ſide of the clitoris begins a very prominent fold, like a criſta, which runs down obliquely on each ſide of the orifice of the urethra. Theſe folds are termed *nymphæ*, and they might likewiſe be named *criſta clytoridis*. On each ſide of the great orifice lies the ſmall proſtatic hole already deſcribed.

Clitoris. The clitoris appears at firſt ſight like a ſmall imperforated glans. Its upper and lateral ſides are covered by a kind of præputium, formed by a particular fold of a portion of the inner ſide of the alæ; which appears to be glandular, and to diſcharge a certain moiſture; and its inſide is granulated.

By diſſection, we diſcover in the clitoris a trunk and two branches, as in the penis, made up of a ſpongy ſubſtance, and of very elaſtic coats, but without any urethra. This ſubſtance may be inflated either by air

or

or anatomical injections into the artery, &c. The trunk is divided into two lateral parts by a middle ſeptum, from the bifurcation to the glans, where it is inſenſibly loſt.

The bifurcation of the trunk is on the edge of the cartilaginous arch of the oſſa pubis; and the branches, which reſemble the roots of the corpora cavernoſa, are inſerted in the inferior rami of theſe bones, and in thoſe of the oſſa iſchium, where they terminate by degrees; but there is ſometimes a membranous tube on each ſide, which reaches to the tuberoſity of the iſchium.

The trunk of the clitoris is ſuſtained by a ligamentum ſuſpenſorium fixed in the ſymphyſis of the oſſa pubis, and containing this trunk in its duplicature, nearly as in the other ſex.

Four muſcles or faſciculi of fleſhy fibres are inſerted in the trunk of the clitoris, two on each ſide. One of them runs down on the foreſide of the neighbouring corpus cavernoſum, and is inſerted by a tendinous or aponeurotic portion, partly in the extremity of the corpus cavernoſum, and partly in the tuberoſity of the iſchium. Theſe two muſcles are called *erectores;* but the name of *iſchio-cavernoſi* would be more proper.

The other muſcle on each ſide lies under the former, and runs down on the ſide of the urethra and great orifice of the uterus all the way to the anus; increaſing gradually in breadth in its paſſage, and terminating partly like that which is called *accelerator* in males.

Theſe two muſcles ſurround very cloſely the lateral parts of the urethra and of the great orifice. They expand very much as they deſcend, and are ſpread on the lower and lateral parts of the great orifice; for which reaſon ſeveral anatomiſts have looked upon them as muſcular ſphincters. All theſe four muſcles, and eſpecially the two latter, are oftentimes almoſt covered with fat.

The blood-veſſels of the clitoris come chiefly from the hypogaſtricæ, and the nerves from the ſecond and third

third pairs of the nervi ſacri; by means of which they communicate with the inferior meſenteric plexus, and with the great ſympathetici.

Nymphæ. The nymphæ, criſtæ clitoridis, or, as they may likewiſe be termed, *alæ minores ſive internæ*, are two prominent folds of the inner ſkin of the great or external alæ, reaching from the præputium of the clitoris to the two ſides of the great orifice of the uterus. They begin very narrow; and having increaſed in breadth in their courſe downward, they are again contracted at their lower extremity.

They are of a ſpongy ſubſtance, intermixed with glands; ſeveral of which may be perceived by the naked eye. Their ſituation is oblique, their upper extremities lying near each other, and the lower at a much greater diſtance. In married women they are more or leſs flaccid and decayed.

Urethra. By the urethra in females, we mean the urinary duct; the orifice of which is between the nymphæ below the glans of the clitoris. The ſides of this orifice are a little prominent and wrinkled, and perforated by ſmall lacunæ, from which a viſcid or mucilaginous liquor may be ſqueezed. In time of pregnancy, this orifice is ſometimes drawn a little inward.

The body of the urethra is a ſpongy duct of the ſame ſtructure as in males, but much more ſhorter, ſituated directly under the trunk of the clitoris, and above the great canal of the uterus, adhering to each of theſe canals between which it lies by membranous filaments. It paſſes under the cartilaginous arch of the oſſa pubis, and terminates by an oblique opening at the neck of the bladder, being bent a little downwards between its two extremities.

The internal membrane of the urethra is a little plaited, and perhaps by ſmall holes, which communicate with folluculi, lying hid in its ſubſtance, as in males. If we blow into one of theſe holes, we obſerve a ſmall canal to be inflated, which runs from without inwards, and

and terminates in ſome places by a kind of ſacculus, by compreſſing which a viſcid liquor is diſcharged.

The continuation of this membrane, which lines the neck of the bladder, forms likewiſe ſeveral rugæ, more or leſs equal; but that which lines the cavity of the bladder is wrinkled in an irregular manner when the bladder is empty.

The canal of the uterus. The great canal, formerly called the *neck* of the uterus, is ſituated below the urethra, and above the extremity of the inteſtinum rectum, a little obliquely, being more raiſed on the inner and back part than on the outer and fore part.

Its inner or poſterior extremity joins the extremity of the body of the uterus, and ſurrounds its orifice much in the ſame manner as the duodenum ſurrounds the pylorus, or as the ileum is ſurrounded by the cæcum and colon.

The anterior extremity forms the great orifice, which lies under that of the urethra, and above the foſſula of the inferior commiſſure of the alæ.

The body of the canal is chiefly made up of a ſpongy ſubſtance, interwoven with numerous blood-veſſels; and it is commonly longer and narrower in virgins than in married women.

Its inner or concave ſurface has ſeveral tranſverſe rugæ, and is covered by a particular membrane. The rugæ are formed by oblong narrow eminences, incurvated like portions of arches, placed very near each other, and diſpoſed in ſuch a manner as to divide the cavity of the canal into an upper and lower ſide.

By the union of the extremities of the upper and lower rugæ, a kind of raphe or ſuture is formed on the right and left ſides; and both arches are ſometimes interſected in the middle, and ſo form two half arches; but in this there is ſome variety.

In general, theſe arches are very conſiderable in young perſons; become gradually more ſuperficial in married women, and are quite loſt in time of delivery.

The

The inner or poſterior extremity of this great canal ſurrounds the orifice of the uterus a little obliquely, in ſuch a manner as that the upper ſide of the canal lies very near the orifice, and the lower ſide at a greater diſtance from it; and this makes the extremity of the uterus appear to advance more into the canal on the lower than on the upper part.

Circulus membranoſus. The exterior or anterior extremity of the great canal in virgins, and eſpecially before the firſt eruption of the menſes, is commonly bordered by circular membranous fold of different breadths, more or leſs ſmooth, and ſometimes ſemilunar; which in ſome ſubjects leaves but a very ſmall opening, in others a larger opening; and in all renders the external orifice narrower than the reſt of the cavity. This fold, called *hymen*, is formed by the union of the internal membrane of the great canal with that on the inſide of the alæ, and repreſents a membranous circle of different breadths, and ſometimes uneven.

Carunculæ. This membranous circle is commonly ruptured after the conſummation of marriage; is quite loſt in delivery, and afterwards only ſome irregular portions of it remain; which, from their ſuppoſed reſemblance to myrtle-leaves, have been termed *carunculæ myrtiformes*. This circle may likewiſe ſuffer ſome diſorder by too great a flux of the menſes, by imprudence, levity, and other particular accidents.

Plexus retiformis. Each ſide of the anterior portion of the great canal is covered exteriorly by a thin, broad, cavernous, and vaſcular plexus, called the *plexus retiformis* of that canal. Theſe two planes run down on each ſide of the clitoris behind the nymphæ, and likewiſe cover the urethra like a collar, before they are ſpread on the great canal.

This plexus is ſtrictly united to the muſcular portions, commonly taken for accelerators or conſtrictors, lying between theſe portions and the lateral parts of the urethra and of the great canal.

This

This plexus may be inflated by air like a flaccid ſpleen, or like the ſpongy ſubſtance of the clitoris, with which it ſeems to have ſome communication; and on this account the lateral portions of this reticular plexus have been named the *internal* crura of the clitoris. It is a kind of rete-mirabile, compoſed of veſſels which come chiefly from the hypogaſtricæ.

It ſtill remains to be obſerved, that on each ſide of the bottom of the pelvis, in both ſexes, oppoſite to the lower part of the bladder, there is an aponeurotic or tendinous ligament, which runs over the inner ſurface of the muſculus obturator internus from before backward. The anterior extremity of this ligament is fixed on one ſide of the middle portion of the ſymphyſis of the oſſa pubis, and the poſterior extremity to the middle part of the ligamentum ſacro-ſciaticum, formerly deſcribed.

A little above the elongation called the *neck* of the bladder, there is another ligamentary expanſion on each ſide of the bladder; the forepart of which is narrow, and fixed to the anterior extremity of the ligament already mentioned; and the broad poſterior part to the ſide of the bladder. Theſe two lateral expanſions may be looked upon as proper ligaments of the bladder, by which it is connected to the inner ſide of both oſſa pubis.

To the anterior portion of each of theſe ligaments of the bladder is fixed a particular faſciculus of fleſhy fibres, which run up obliquely on the foreſide of the bladder; on which thoſe of each ſide meeting together, form a kind of muſcular intertexture, and unite with the moſt tranſverſe fibres of the bladder.

Theſe two muſcular faſciculi form a part, and perhaps the principal part, of what is called the *ſphincter* of the bladder: but to have a true idea of them, they muſt be examined *in ſitu*, without deſtroying any of their natural connections. When the bladder is removed out of its place, as is done in the common method of of diſſection, theſe faſciculi are cut; and thereby their direction being loſt, they appear tranſverſe, and are taken, by thoſe who know no better, for portions of an orbicular ſphincter.

In males, theſe two faſciculi are partly fixed in the proſtates; but in females they are very broad, and appear ſometimes to be double on each ſide, one plane lying above the other. They are to be looked upon as true muſcles, fixed by ſmall tendons on the ſides of the ſymphyſis of the oſſa pubis.

§ 22. *Of the Gravid Uterus.*

Art. I. Of Conception.

The theory of conception is as intricate and obſcure as the cauſe of the periodical evacuation of the catamenia: and many circumſtances relating to generation will, perhaps, ever remain a myſtery. The different hypotheſes ſuggeſted on the ſubject may, however, be referred to the following.

I. To thoſe who think that the rudiments of the fœtus are contained in the mother.

II. To thoſe who are of opinion that they exiſt in the male.

III. To thoſe who imagine the fœtus reſults from an union of both.

That each of theſe ſyſtems has had its ſeveral ſupporters and antagoniſts will not be ſurpriſing, when we conſider the obſcurity of the ſubject, as well as the extent of learning and brilliancy of imagination which have diſtinguiſhed the ſeveral combatants. Harvey, our illuſtrious countryman, belongs to the firſt claſs; the acute Leeuwhenhoek, who perceived living animals, or bodies which reſembled them, in the ſemen maſculinum, has added luſtre to the ſecond; and the Count de Buffon, whoſe ingenuity and acuteneſs are diſtin-

diſtinguiſhable even in an enlightened nation, is the chief ſupporter of the third opinion.

But a particular conſideration of this ſubject is foreign to the deſign of the preſent work. It may ſuffice to obſerve, that the pride of ſcience, and brilliancy of imagination, have been equally unſucceſsful. To elude difficulties which they cannot conquer, modern philoſophers have endeavoured to transfer the queſtion; and by ſuppoſing the animal already to exiſt complete in its ſeveral parts, but of an aſtoniſhing minuteneſs, have rather laboured to ſhow by what means it is animated, and by what aſſiſtances evolved.

This view, when extended to ſucceſſive generations, at firſt ſtartles the modeſt inquirer by its apparent abſurdity, and perplexes the moderate calculator. It, however, is not more contradictory than many phyſiological poſitions which have never been controverted; and it is ſome addition to its credit, that it is ſupported by Bonnet and Haller. On this foundation, which is ſupported alſo by the authority of Harvey, the principle of animation muſt be the ſemen maſculinum; and it is not entirely without reaſon, that Bonnet conſiders it as the firſt and chief ſupport of the fœtus: but an extenſive period is required to evolve the ſeveral very intricate organs of which the human frame conſiſts. The embryo is, at firſt, almoſt entirely vegetative: it adheres to the fundus uteri, and extracts the fluids of its mother without any exertions that are peculiarly its own. But it ſoon ſhows ſome marks of animation. Its heart is obſerved to beat: it ſeems to prepare fluids for its own purpoſes, and to ſeparate thoſe which are no longer beneficial: in ſhort, it acquires a diſtinct ſyſtem; from part of which it is ſupplied with the original portion of its fluid; and which it, in its turn, ſupplies with the ſame fluids more highly elaborated, and more carefully prepared. But this rather belongs to the hiſtory of the ovum, which we ſhall next conſider.

ART.

Art. II. Structure of the Ovum in early Gestation.

When the germ is conveyed into the uterus, impregnation is ſaid to take place. The ovum, ſoon after its introduction, adheres to ſome part of the internal ſurface of the uterus: at firſt it appears like a ſmall veſicle, ſlightly attached; and gradually increaſes in bulk, till it apparently comes in contact with the whole cavity of the fundus.

The embryo, or unformed fœtus, with placenta, umbilical cord, membranes, and waters, in early geſtation, conſtitute the ovum; which then appears like a thickened fleſhy maſs, the more external lamellæ and other parts, which are afterwards ſeparate and diſtinct, being blended and jumbled in ſuch a manner that they cannot be readily diſtinguiſhed or traced.

In the progreſs of geſtation, the external lamellæ, or membranous ſurface, by ſtretching, grows thinner; the cavity which contains the rudiments of the fœtus becomes more apparent; and then a thick vaſcular part on the outſide of the chorion, called *placenta*, can be readily diſtinguiſhed from the membranous portion of the ovum.

The external membranous part of the ovum (or bag which contains in its cavity the embryo, funis, and watery fluid in which the embryo floats) is originally compoſed of three coats: the internal lamella, or that next the fœtus, is called *amnios;* the next is the *true chorion;* and the external is called the *falſe* or *ſpongy chorion.* But it is ſuppoſed to derive an extraordinary lamella immediately from the uterus, which conſtitutes the external covering of the ovum. This production, which is ſuppoſed to be entirely formed by a continuation of the internal membrane of the uterus, is at firſt looſely ſpread over the ovum, and afterwards comes in contact with the falſe chorion. Theſe two lamellæ, which

which form the external vafcular furface of the ovum, are much thicker than the internal membranes of the true chorion and amnios; and the proportion which they bear to the other parts is fo great, that, in early conception, the mafs of the ovum is chiefly compofed of them. Dr Ruyfch called this exterior coat the *tunica filamentofa*; more modern authors, the *falfe* or *fpongy chorion*. But Dr Hunter has found the fpongy chorion to confift of two diftinct layers: that which lines the uterus he ftyles *membrana caduca* or *decidua*, becaufe it is caft off after delivery; the portion which covers the ovum, *decidua reflexa*, becaufe it is reflected from the uterus upon the ovum, forming the connecting medium between them. The portion which covers the ovum is a complete membrane, like the true chorion and amnios: but that which immediately lines the uterus is imperfect or deficient, being perforated with three foramina, viz. two fmall ones, correfponding with the infertion of the tubes at the fundus uteri; and a larger ragged perforation oppofite to the orificium uteri.

Thus, according to Dr Hunter, the embryo, on its firft formation in the ovum, and the fœtus during the whole time of geftation, is inclofed in four membranes, viz. the double, falfe, or fpongy chorion, called *membrana decidua*, and *decidua reflexa*; the true chorion, and the amnios, which include a fluid called the *liquor amnii*, in which the embryo floats.

The true chorion and the amnios are decidedly organized membranes, containing veffels, and compofed of regular layers of fibres. The decidua, and decidua reflexa, differ in appearance, and feem to refemble thofe inorganic fubftances which connect inflamed vifcera. If they be original membranes, and only vifible from their evolution and increafe, it is not eafy to conceive how the ovum gets behind them, fince the Fallopian tubes are not covered by them. We are therefore inclined to adopt an opinion fuggefted firft by Mr Crookfhanks, and

and rendered probable by the experiments of Signor Scarpa, "That they are entirely compofed of an infpiffated coagulable lymph."

Between the amnion and chorion, a quantity of gelatinous fluid is contained in the early months; and a fmall bag, or white fpeck, is then obferved on the amnion, near the infertion of the umbilical cord. It is filled with a white liquor, of a thick milky confiftence; and is called *veficula umbilicalis*, *veficula alba* or *lactea*: it communicates with the umbilical cord by a fmall funis, which is made up of an artery and vein. This veficle, and duct or tube leading from it, are only confpicuous in the early months; and afterwards become tranfparent, and of confequence invifible. Their ufe is not yet underftood.

Though the bag, or external parts of the conception, at firft form a large proportion of the ovum in comparifon of the embryo or fœtus, in advanced geftation the proportions are reverfed. Thus an ovum between the eighth and ninth week after conception, is nearly about the fize of a hen's egg, while the embryo fcarcely exceeds the weight of a fcruple: at three months, the former increafes beyond the magnitude of a goofe's egg, the weight above eight ounces; but the fœtus does not then amount to three ounces: at fix months, the fœtus weighs twelve or thirteen ounces, and the placenta and membranes only feven or eight: at eight months, the fœtus weighs between fix and feven pounds, the fecundines little more than one pound: at birth, the fœtus weighs from ten to fourteen pounds, or more; but the placenta feldom increafes much in bulk from between the feventh and eighth month.

Having defcribed the ovum in early geftation, we fhall next take a view of the germ; trace the progrefs of the embryo and fœtus; then refume the fubject of the ovum, to explain the ftructure of the membranes, placenta, &c. in advanced geftation, and point out the moft

re-

remarkable changes which the uterus ſuffers during impregnation.

Art. III. Evolution of the Foetus.

There can be little doubt that all the parts of an animal exiſt completely in the germ, though their extreme minuteneſs and fluidity for ſome time conceal them from our ſight. In a ſtate of progreſſion, ſome of them are much earlier conſpicuous than others.

The embryo, in its original ſtate, is probably entirely fibrous and nervous; and theſe primary parts ſeem to contain, in a ſmall ſcale, all the others which are afterwards to be progreſſively evolved. Of the former, the heart and liver, of the latter, the brain and ſpinal medulla, firſt become conſpicuous: for the ſpine or carina of the embryo is formed ſome time before any veſtige of extremities begin to ſprout. The encephalon, or head, and its appendages, firſt appear; then the thoracic viſcera; next, the abdominal: at length the extremities gradually ſhoot out; the ſuperior firſt, then the inferior: and, by ſlow and inſenſible gradation, the beautiful and admirable ſtructure of the whole complicated ſyſtem is evolved.

As ſoon as the embryo has acquired ſufficient conſiſtence to be the ſubject of any obſervation, a little moving point, which is the heart, diſcovers itſelf. Nothing, however, but general circumſtances relating to the particular order and progreſs of the ſucceſſive germination or evolution of the viſcera, extremities, vaſcular ſyſtem, and other parts of the human fœtus, can be aſcertained, as it is beyond the power of anatomical inveſtigation.

It is alſo exceedingly difficult to determine the age or proportional growth of the fœtus. The judgment we form will be liable to conſiderable variation: 1ſt, From the uncertainty of fixing the period of pregnancy; 2dly, From the difference of a fœtus of the ſame age in different women, and in the fame woman in different pregnancies; and, laftly, Becaufe the fœtus is often retained *in utero* for fome time after the extinction of its life.

The progrefs of the fœtus appears to be much quicker in the early than latter months: but the proportional increafe is attended with difficulty in the calculation; for this, among other reafons, that we have not an opportunity of knowing the magnitude or weight of the fame fœtus in different months. It will alfo, probably, be materially influenced by the health, conftitution, and mode of life, of the parent.

A fœtus of four weeks, is near the fize of a common fly; it is foft, mucilaginous, feems to hang by its belly, and its bowels are only covered by a tranfparent membrane. At fix weeks, the confiftence is ftill gelatinous, the fize about that of a fmall bee, the head larger than the reft of the body, and the extremities then begin to fhoot out. At twelve weeks, it is near three inches long, and its formation pretty diftinct. At four months, the fœtus meafures above five inches; at five months, between fix and feven inches; at fix months, the fœtus is perfect in all its external parts, and commonly in length about eight, or between eight and nine inches; at feven months, it is between eleven and twelve inches; at eight months about fourteen or fifteen inches; and at full time, from eighteen to twenty-two and twenty-three inches. But thefe calculations, for the above reafons, muft be very uncertain.

Art. IV. Contents of the Gravid Uterus in advanced Gestation.

These confift of the fœtus, umbilical cord, placenta, membranes, and contained fluid. We have already traced the progrefs of the fœtus; and fhall proceed to defcribe the other parts of the ovum in advanced geftation, as juft now enumerated.

Um-

Umbilical cord. The fœtus is connected to the placenta by the umbilical cord, or navel-ſtring; which may be defined, " a long vaſcular rope, compoſed of two arteries and a vein, covered with coats derived from the membranes, and diſtended with a quantity of viſcid gelatinous ſubſtance, to which the bulk of the cord is chiefly owing."

The cord always ariſes from the centre of the child's belly, but its point of inſertion in the cake is variable. Its ſhape is ſeldom quite cylindrical; and its veſſels are ſometimes twiſted or coiled, ſometimes formed into longitudinal ſulci. Its diameter is commonly about the thickneſs of an ordinary finger, and its length ſufficient to admit the birth of the child with ſafety, though the placenta ſhould adhere at the fundus uteri. In length and thickneſs, however, it is liable to conſiderable variation. The extremity next the fœtus is generally ſtrongeſt; and is ſomewhat weaker and more ſlender next the placenta, according to its place of inſertion; which, though commonly not far from the centre, is ſometimes towards the very edge. This ſuggeſts an important advice to practitioners, to be cautious of pulling the rope to extract the placenta when they feel the ſenſation of its ſplitting as it were into two diviſions, which will proportionally weaken its reſiſtance, and render it liable to be ruptured with a very ſlight degree of force in pulling. The uſe of the cord is to connect the fœtus to the cake, to convey the nutritious fluid from the mother to the child, and to return what is not employed.

Placenta. The placenta, cake, or after-birth, is a thick, ſoft, vaſcular maſs, connected to the fœtus by the funis umbilicalis, and to the uterus by means of the ſpongy chorion, as already explained: It differs in ſhape and ſize; it is thickeſt at the centre, and gradually becomes thinner towards the edges, where the membranes go off all round, making a complete bag or involucrum to furround the waters, funis, and child.

Its fubftance is chiefly vafcular, and probably in fome degree glandular. The ramifications of the veffels are very minute, which are unravelled by maceration, and, when injected, exhibit a moft beautiful appearance refembling the bufhy tops of a tree. It has an external convex, and an internal concave, furface. The former is divided into a number of fmall lobes and fiffures, by means of which its adhefion to the uterus is more firmly fecured. This lobulated appearance is moft remarkable when the cake has been rafhly feparated from the uterus; for the membrana decidua, or connecting membrane between it and the uterus, being then torn, the moft violent and alarming hæmorrhagies frequently enfue.

The internal concave furface of the placenta is loofely covered with the amnion, and by the chorion more immediately and intimately. From this internal furface arife innumerable ramifications of veins and arteries, which inofculate and anaftomofe with one another; and at laft the different branches unite, and form the funis umbilicalis.

The after-birth adheres to every part of the internal furface of the uterus, as at the pofterior and anterior fuperior parts, laterally; and fometimes, though more rarely, part of the cake extends over the orificium uteri; from whence, when the orifice begins to dilate, the moft frightful and dangerous floodings arife. But the moft common place of attachment of the cake is from the fuperior part of the cervix to the fundus.

Twins, triplets, &c. have their placenta, fometimes feparate, and fometimes adhering together. When the placentæ adhere, they have generally the chorion in common; but each fœtus has its diftinct omnion. They are commonly joined together, either by an intervening membrane, or by the furfaces being contiguous to one another; and fometimes the veffels of the one cake anaftomofe with thofe of the other.

The

The human placenta, according to Dr Hunter, is ſimilar in ſtructure to that of quadrupeds; and ſeems to be compoſed of two diſtinct ſyſtems of parts, a ſpongy or cellular, and a vaſcular ſubſtance. It has of conſequence two diſtinct ſets of veſſels. The ſpongy or cellular part, formed by the decidua, is derived from the mother; and, if filled with injection, will increaſe the placenta to nearly twice its ordinary thickneſs; the more internal vaſcular part belongs entirely to the fœtus, and can only be injected from the cord, as the ſpongy part by filling the veſſels of the uterus. This will be better underſtood when the mode of circulation between the parent and child is explained.

Membranes. Theſe conſiſt, externally, of two layers of the ſpongy chorion, called *decidua*, and *decidua reflexa;* internally, of the true chorion and the amnion. They form a pretty ſtrong bag, commencing at the edge of the cake, going round the whole circumference, and lining the internal ſurface of the womb. When ſeparated from the uterus, this membranous bag is ſlender and yielding, and its texture readily deſtroyed by the impulſe of the contained fluid, the preſſure of the child, or of the finger in touching; but in its natural ſtate, while it lines the womb, and is in cloſe contact with its ſurface, the membranous bag is ſo tough and ſtrong as to give a conſiderable degree of reſiſtance. It is alſo ſtrengthened in proportion to the different layers of which it is compoſed, whoſe ſtructure we ſhall proceed to explain more particularly.

1. The *membrana decidua*, or that lamella of the ſpongy falſe chorion which is in immediate contact with the uterus, is originally very thick and ſpongy, and exceedingly vaſcular, particularly where it approaches the placenta. At firſt it is looſely, as it were, ſpread over the ovum; and the intervening ſpace is filled with a quantity of gelatinous ſubſtance. It gradually becomes more and more attenuated by ſtretching, and approaches nearer to the interior lamella of the decidua, called *de-*

cidua reflexa ; and about the fifth month the two layers come in contact, and adhere ſo as to become apparently one membrane.

2. *Decidua reflexa*. In its ſtructure and appearance it is ſimilar to the former, being rough, fleecy, and vaſcular, on its external ſurface ; internally, ſmoother, and perforated with a number of ſmall foramina, which are the orifices of veſſels that open into this internal ſurface. In advanced geſtation, it adheres intimately to the former membrane, and is with difficulty ſeparated when the double decidua comes off entire ; but the outer lamella more commonly adheres to the uterus after the placenta and other membranes are expelled, and is afterwards caſt off with the cleanſings.

The decidua reflexa becomes thicker and more vaſcular as it approaches the placenta, and is then blended with its ſubſtance, conſtituting the cellular or maternal part of the cake, as it is termed by Dr Hunter. The other or more internal part belongs to the fœtus, and is ſtyled the *fœtal* part of the placenta.

The double decidua is opaque in compariſon of the other membrane ; the blood-veſſels are derived from the uterus, and can be readily traced into it. Dr Hunter ſuppoſes that the double decidua lines the uterus nearly in the ſame manner as the peritonæum does the cavity of the abdomen, and that the ovum is incloſed within its duplicature as within a double night-cap. On this ſuppoſition the ovum muſt be placed on the outſide of this membrane, which is not very readily to be comprehended ; unleſs we adopt Signior Scarpa's opinion already mentioned, and ſuppoſe it to be originally entirely compoſed of " an inſpiſſated coagulable lymph."

3. The *true chorion*, or that connected with the amnion, is the firmeſt, ſmootheſt, and moſt tranſparent of all the membranes, except the amnios ; and, when ſeparated from it, has a conſiderable degree of tranſparency. It adheres pretty cloſely to the internal ſurface

face of the cake, which it covers immediately under the amnios, and gives alſo a coat to the umbilical cord. It is connected to the amnion by means of a gelatinous ſubſtance, and is eaſily ſeparated from it.

4. The *amnion*, or internal membrane, forms the external coat of the umbilical cord. This internal lamella of the membranous bag is by much the moſt thin, attenuated, and tranſparent of the whole; and its veſſels are ſo delicate, that they can hardly be diſcovered; their diameters are ſo ſmall, as to be incapable in their natural ſtate of admitting globules of red blood. It is, however, firmer and ſtronger than the chorion, and gives the greateſt reſiſtance in the breaking of the membranes.

The ſmall bag, called *veſicula umbilicalis*, formerly deſcribed, and only conſpicuous in the early months from its ſituation, is placed between the amnion and chorion, near the attachment of the cord; and, from the colour of its contents, has been miſtaken for the urachus: but there is no allantois in the human ſubject.

The allantois in quadrupeds is an oblong membranous ſac, or pouch, placed between the chorion and amnion. This membrane communicates with the urachus, which in brutes is open, and tranſmits the urine from the bladder to the allantois.

5. The *waters* are contained within the amnion, and are called the *liquor amnii*. They are pureſt, cleareſt, and moſt limpid in the firſt months; acquiring a colour, and becoming ſomewhat ropy, towards the latter end. They vary in different ſubjects, both in regard to conſiſtence and quantity; and, after a certain period, they proportionally diminiſh as the woman advances in her pregnancy. This liquor does not, in any reſpect, reſemble the white of an egg; it is generally ſaltiſh, and therefore unfit for the nutrition of the child; ſome of it may perhaps be abſorbed by the fœtus, but the child is chiefly nouriſhed by the navel-

ſtring.

ſtring. In the early months, the organs are not fit for ſwallowing; and monſters are ſometimes born alive, where ſuch organs are altogether wanting.

Water is ſometimes collected between the chorion and amnion, or between the lamellæ of the chorion. This is called the *falſe water*. It is generally in much ſmaller quantity than the true water; and, without detriment to the woman, may flow at any time of pregnancy.

Having deſcribed the contents of the gravid uterus, let us conſider the changes which that organ ſuffers during the progreſs of geſtation, and explain the manner of circulation between the parent and fœtus, and within the body of the fœtus; after which we ſhall enumerate the moſt remarkable peculiarities of the *non-natus*.

Art. V. Changes of the Uterine System from Impregnation.

Though the uterus gradually increaſes in ſize from the moment of conception till full time, and although its diſtention is proportioned to that of the ovum, with regard to its contents, it is, ſtrictly ſpeaking, never completely diſtended; for in early geſtation, they are entirely confined to the fundus; and, at full time, the finger can be paſſed for ſome way within the orificium uteri without touching any part of the membranes. Again, though the capacity of the uterus increaſes, yet it is not mechanically ſtretched, for the thickneſs of its ſides does not diminiſh. The increaſed ſize ſeems, therefore, to depend on a proportionable quantity of fluids ſent to that part, nearly in the ſame way the ſkin of a child, though it ſuffers ſo great diſtention, does not become thinner, but preſerves its uſual thickneſs.

This is proved from ſeveral inſtances of extra-uterine fœtuſes, where the uterus, though there were no contents, was nearly of the ſame ſize, from the additional quan-

quantity of fluids tranſmitted, as if the ovum had been contained within its cavity. Boehmerus relates the ſame circumſtance, without attempting to explain it, in the hiſtory of a caſe of extra-uterine conception in the fifth month. The uterus is painted of a conſiderable ſize, though the fœtus was contained in the ovarium.

The gravid uterus is of different ſize in different women; and will vary according to the bulk of the fœtus and involucra. The ſituation alſo varies according to the increaſe of its contents, and the poſition of the body. For the firſt two or three months, the cavity of the fundus is triangular as before impregnation; but as the uterus ſtretches, it gradually acquires a more rounded form. In general, the uterus never riſes directly upwards, but inclines a little obliquely; moſt commonly to the right ſide: its poſition is never, however, ſo oblique as to prove the ſole cauſe either of preventing or retarding delivery.

Though conſiderable changes are occaſioned by the gradual diſtention of the uterus, it is difficult to judge of pregnancy from appearances in the early months. For the firſt three months, the os tincæ feels ſmooth and even, and its orifice is nearly as ſmall as in the virgin ſtate. When any difference can be perceived, it will conſiſt in the increaſed length of the projecting tubercle of the uterus, and the ſhortening of the vagina from the deſcent of the fundus uteri through the pelvis. This change in the poſition of the uterus, by which the projecting tubercle appears to be lengthened, and the vagina proportionally ſhortened, chiefly happens from the third to the fifth month. From this period the cervix begins to ſtretch and be diſtended, firſt at the upper part; and then the os tincæ begins alſo to ſuffer conſiderable changes in its figure and appearance. The tubercle ſhortens, and the orifice expands: but during the whole term of geſtation, the mouth of the uterus is ſtrongly cemented with a ropy mucus, which lines it and the cervix, and begins to be diſcharged on the approach

proach of labour. In the laſt weeks, when the cervix uteri is completely diſtended, the uterine orifice begins to form an elliptical tube, inſtead of a fiſſure; and ſometimes, eſpecially when the parietes of the abdomen are relaxed by repeated pregnancy, diſappears entirely, and is without the reach of the finger in touching. Hence the os uteri is not placed in the direction of the axis of the womb, as has generally been ſuppoſed.

The progreſſive increaſe of the abdominal tumour, from the ſtretching of the fundus, affords a more deciſive mark of the exiſtence and period of pregnancy than any others; and the progreſs is nearly as follows.

About the fourth, or between the fourth and fifth month, the fundus uteri begins to riſe above the pubes or brim of the pelvis, and the cervix to be ſomewhat diſtended. In the fifth month, the belly ſwells like a ball with the ſkin tenſe, the fundus extends about half way between the pubes and navel, and the neck is ſenſibly ſhortened. In the ſeventh month, the fundus, or ſuperior part of the uterine tumour, advances as far as the umbilicus; and the cervix is then nearly three-fourths diſtended. In the eighth, it reaches mid-way between the navel and ſcrobiculus cordis; and in the ninth, to the ſcrobiculus itſelf, the neck then being entirely diſtended; which, with the os tincæ, become the weakeſt parts of the uterus. Thus at full time the uterus occupies all the umbilical and hypogaſtric regions: its ſhape is almoſt pyriform, that is, more rounded above than below, and having a ſtricture on that part which is ſurrounded by the brim of the pelvis.

During the progreſs of diſtention, the ſubſtance of the uterus becomes much looſer, of a ſofter texture, and more vaſcular, than before conception; and the diameter of its vein is ſo much enlarged, that they have acquired the name of *ſinuſes*. They obſerve a more direct courſe than the arteries, which run in a ſerpentine manner through its whole ſubſtance, and anaſtomoſe with

with one another, particularly at that part where the placenta is attached: It is in this part alſo that the vaſcular ſtructure is moſt conſpicuous.

The arteries paſs from the uterus through the decidua, and open into the ſubſtance of the placenta in an oblique direction. The veins alſo open into the placenta; and by injecting theſe veins from the uterus with wax, the whole ſpongy or maternal part of the placenta will be filled.

The muſcular ſtructure of the gravid uterus is extremely difficult to be traced with any exactneſs. In the wombs of women who die in labour, or ſoon after delivery, fibres running in various directions are obſervable more or leſs circular. Theſe ſeem to ariſe from three diſtinct origins, viz. from the place where the placenta adheres, and from the aperture or orifice of each of the tubes: but it is almoſt impoſſible to demonſtrate regular plans of fibres continued any length without interruption.

The appendages of the uterus ſuffer alſo conſiderable changes; for the tubes, ovaries, and ligaments, gradually go off below the fundus as it ſtretches, and at full time are almoſt entirely obliterated. At full time, eſpecially in a firſt pregnancy, when the womb riſes higher than in ſubſequent impregnations, the ligamenta rotunda are conſiderably ſtretched; and to this cauſe thoſe pains are probably owing which ſtrike from the belly downwards in the direction of theſe vaſcular ropes, which are often very painful and diſtreſſing towards the latter end of geſtation. Again, as the uterus, which is chiefly enlarged towards the fundus, at full time ſtretches into the cavity of the abdomen without any ſupport, leaving the broad ligaments below the moſt bulky part, we can readily ſee, that by pulling at the umbilical cord to deliver the placenta, before the uterus is ſufficiently contracted, the fundus may be pulled down through the mouth of the womb, even though no great violence be employed. This is ſtyled the *in-*

verſion

verſion of the uterus; and is a very dreadful, and generally fatal, accident. It is the conſequence only of ignorance or temerity; and can ſcarcely happen but from violence, or from an officious intruſion on the work of nature, by pulling at the rope while the woman is faint or languid, and the uterus in a ſtate of atony.

In ſome rare inſtances, the force of labour which propels the child where the cord is ſhort naturally, or rendered ſo by circumvolutions round the body of the child, may, when the placenta adheres to the fundus uteri, bring it down ſo near the os tincæ, that little force would afterwards be ſufficient to complete the inverſion. This ſuggeſts a precaution, that in the above circumſtances, if ſtrong labour-pains ſhould continue, or a conſtant bearing down enſue, after the delivery of the child, the practice of pulling by the cord ſhould be carefully avoided, and the hand of the operator be prudently conducted within the uterus, to ſeparate the adheſion of the cake, and guard againſt the hazard of inverſion.

The ovaria alſo ſuffer ſome change from pregnancy. A roundiſh figure of a yellow colour appears in one of them, called by anatomiſts the *corpus luteum;* and in caſes of twins, a corpus luteum often appears in each ovarium. It was imagined to be the calyx ovi; and is obſerved to be a gland from whence the female fluid or germ is ejected. In early geſtation, this cicatrix is moſt conſpicuous, when a cavity is obvious, which afterwards collapſes.

If the ovarium be injected in the latter months, the corpus luteum will appear to be compoſed chiefly of veſſels. A portion of it, however, in the centre, will not be filled; from which it is, with ſome reaſon, ſuſpected that it is a cavity, or that it contains a ſubſtance not yet organized.

ART.

Art. VI. Manner of Circulation between the Mother and Foetus.

After many diſputes on this ſubject, it is now generally allowed, that the communication between the parent and child is carried on entirely by means of the placenta, whoſe ſpongy ſurface adheres to the internal ſurface of the womb, and receives the finer part of the arterial blood of the mother by abſorption. No anaſtomoſes of blood-veſſels between them have yet been clearly ſhown by the experiments of any phyſiologiſt; nor has any coloured injection been puſhed from the uterus into the anterior vaſcular part of the cake, nor from the fœtus or umbilical veſſels into the cellular part, except by the force of extravaſation. This cellular part of the placenta is probably derived from the decidua; and is not a ſpongy inorganic ſubſtance, merely intended for the attachment of the cake, but probably a regularly conſtructed and organized part belonging to the mother. The cells, therefore, cannot be filled by injection from the umbilical veſſels, though an injection will readily paſs from the veſſels of the uterus.

We find the ſame ſtructure obtain in cows, where the cellular can be eaſily ſeparated from the vaſcular part, and the diſtinct property of each aſcertained.

As the ſtructure of the cellular part of the placenta is ſomewhat ſimilar to that of the more ſimple glands, it may be reaſonably inferred, that it is intended for other purpoſes beſides merely abſorbing blood, and conveying it to the umbilical veſſels of the child. It ſeems probable, therefore, that an operation ſimilar to ſecretion is carried on in the placenta; that the veins and arteries of the fœtus, in the vaſcular part of the cake, are continuous; and that abſorbents ariſe in the follicles, which ſoon terminate in veins. From this view it appears, that the placenta is not only the connecting me-

medium between the mother and child, intended for conveying and returning the nutritious fluid from the one to the other, but alſo changes and prepares it, in a particular manner, for circulating through the minute veſſels of the delicate fœtus.

This mode of circulation is admirably well contrived for the preſervation of the child from diſeaſes which would otherwiſe be communicated from the mother. If the mutual communication were kept up by continuous veſſels, the fœtus would conſtantly be in danger of ſuffering when the mother's circulation was accelerated or otherwiſe diſturbed.

Art. VII. Circulation in the Foetus.

The finer part of the arterial blood of the mother, tranſmitted, in the manner juſt now mentioned, from the uterus to the placenta, and conveyed along the umbilical cord to the fœtus for its ſupport and increaſe, circulates in the ſyſtem of the non-natus in the following manner.

The blood paſſes directly from the placenta into the umbilical vein; which, running along the funis, perforates the belly of the fœtus, and enters under the liver, where it divides into two branches, nearly at half a right angle. One of theſe branches, called the *ductus venoſus*, carries part of this liquor immediately to the lower vena cava. The other carries the reſt to the vena portarum; where, after circulating through the liver, it alſo gets into the vena cava, and ſo to the heart: but the circulation here is carried on without any neceſſity for the lungs being dilated. For fœtuſes have an oval hole open between the two auricles of the heart, and a large communicating canal, called *canalis arterioſus*, going between the pulmonary artery and aorta; which two paſſages allow the reſt of this circulating fluid, that returns by the cava ſuperior, to be tranſmitted to the aorta, without paſſing through the lungs.

The

The blood is returned from the fœtus by the *arteriæ umbilicales*, which take their riſe ſometimes from the trunk of the aorta, and ſometimes from the iliac arteries of the fœtus; and, running by the external ſides of the bladder, aſcend to go out at the navel.

Thus there are three circulations belonging to the fœtus, *viz.* one between the uterus and placenta, by abſorption; one between the placenta and fœtus, by a continuation of veſſels through the cord; and one within the fœtus itſelf.

Art. VIII. Position of the Foetus in Utero.

The fœtus is commodiouſly adapted to the cavity of the uterus, and deſcribes an oblong or oval figure; its ſeveral parts being collected together in ſuch a manner as to occupy the leaſt poſſible ſpace. The ſpine is rounded, the head reclines forward towards the knees, which are drawn up to the belly, while the heels are drawn backwards towards the breech, and the hands and arms are folded round the knees and legs. The head of the child is generally downwards. This does does not proceed, as was commonly alleged, from the funis not being exactly in the middle of the child's body, for it is not ſuſpended by the funis: the reaſon is, becauſe the ſuperior parts are much larger and heavier in proportion than the inferior. When other parts preſent, it ſeems owing to the motion of the child altering its figure when the waters are much diminiſhed in quantity, or to circumvolutions of the cord: when the poſition is once altered, it becomes confined or locked in the uterus, and cannot eaſily reſume its original poſture.

As the figure of the fœtus is oval, and the head naturally falls to the moſt depending part of the uterus, the vertex generally points to the os tincæ, with the ears diagonally in the pelvis between the pubes and ſacrum. The fœtus is mechanically diſpoſed to aſſume

 this

this poſition from its peculiar figure and conſtruction, particularly by the bulk of the head and articulation with the neck, by the action of its muſcles, and by the ſhape and conſtruction of the cavity in which it is contained.

Art. IX. Peculiarities of the Foetus.

The fœtus, both in external figure and internal ſtructure, differs materially, in many ſtriking circumſtances, from the adult. It is ſufficient for our preſent purpoſe to mention a few particulars.

The head is very large in proportion to the reſt of the body: the cranial bones are ſoft and yielding, and the ſutures not yet united, ſo that the bulk of the head may be diminiſhed in every direction, and its paſſage conſequently be rendered more commodious. The bones of the trunk and extremities, and all the articulations, are alſo remarkibly flexible. All the apophyſes are epiphyſes; even the heads and condyles and brims of cavities, inſtead of bone, are of a ſoft cartilaginous conſiſtence.

The brain, ſpinal marrow, and whole glandular as well as nervous and ſanguiferous ſyſtems, are conſiderably larger in proportion in the fœtus than in the adult. It has a gland ſituated in the forepart of the cheſt between the laminæ of the mediaſtinum, called the *thymus*. The liver and kidneys are much larger in proportion; and the latter are divided into a number of ſmall lobes, as in the brute.

The fœtus alſo differs in ſeveral circumſtances from a child who has breathed.

The cavity of the thorax is leſs in proportion than after reſpiration. The lungs are ſmaller, more compact, of a red colour like the liver, and will ſink in water; but putrefaction, and a particular emphyſema, as in diſeaſes of cattle, and blowing into them, will make them ſwim: which ſhould prevent us from haſtily determining,

ning, from this circumſtance, whether a child has breathed or not; which we are often called on to do. Neither does their ſinking prove that the child never breathed; for a child may die, or be ſtrangled in the birth, or immediately after, before the lungs are fully inflated.

The arterial and venous ſyſtems are alſo different from that of the child. Hence the difference in the manner of circulation already taken notice of.

Explanation of TAB. IX.

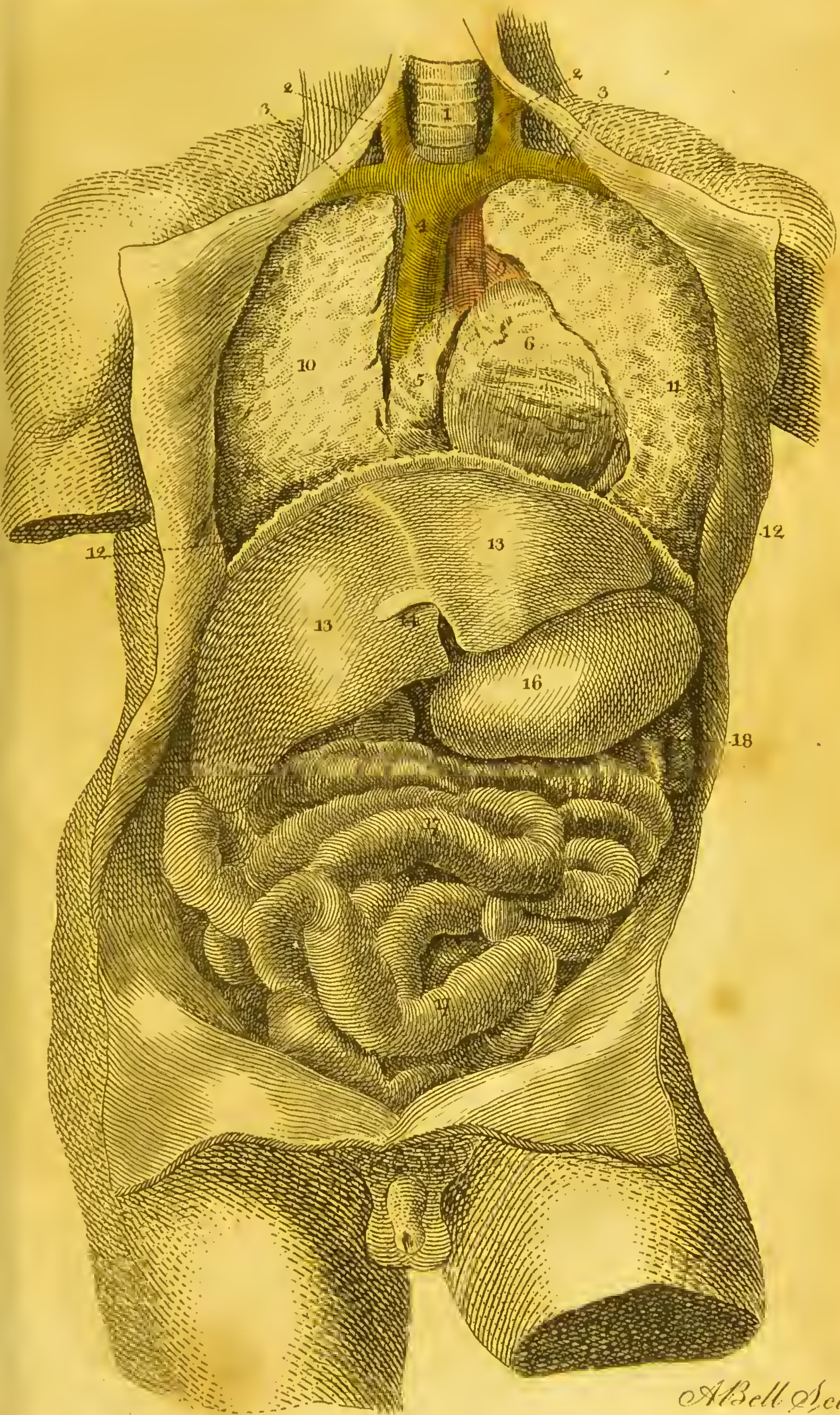
1. Trachea.
2. The internal jugular vein.
3. The ſubclavian vein.
4. Vena cava deſcendens.
5. The right auricle of the heart.
6. The right ventricle, the pericardium being removed.
7. Part of the left ventricle.
8. Aorta aſcendens.
9. Arteria pulmonalis.
10. The right lobe of the lungs, part of which is cut off to ſhow the great blood-veſſels.
11. The left lobe of the lungs.
12. The diaphragm.
13. The liver.
14. The ligamentum rotundum.
15. The bottom of the gall-bladder projecting beyond the anterior edge of the great lobe of the liver.
16. The ſtomach, preſſed by the liver toward the left-ſide.
17. The ſmall guts.
18. The ſpleen.

EXPLANATION of TAB. X.

1. The under ſide of the liver.
2. Ligamentum rotundum.
3. The gall-bladder.
4. The pancreas.
5. The ſpleen.
6. The kidney.
7. Aorta deſcendens.
8. Vena cava aſcendens.
9. The emulgent vein.
10. A probe under the ſpermatic veſſels and the arteria meſenterica inferior, and over the ureters.
11. The ureter.
12. The iliac veſſels.
13. The rectum inteſtinum.
14. The bladder of urine.

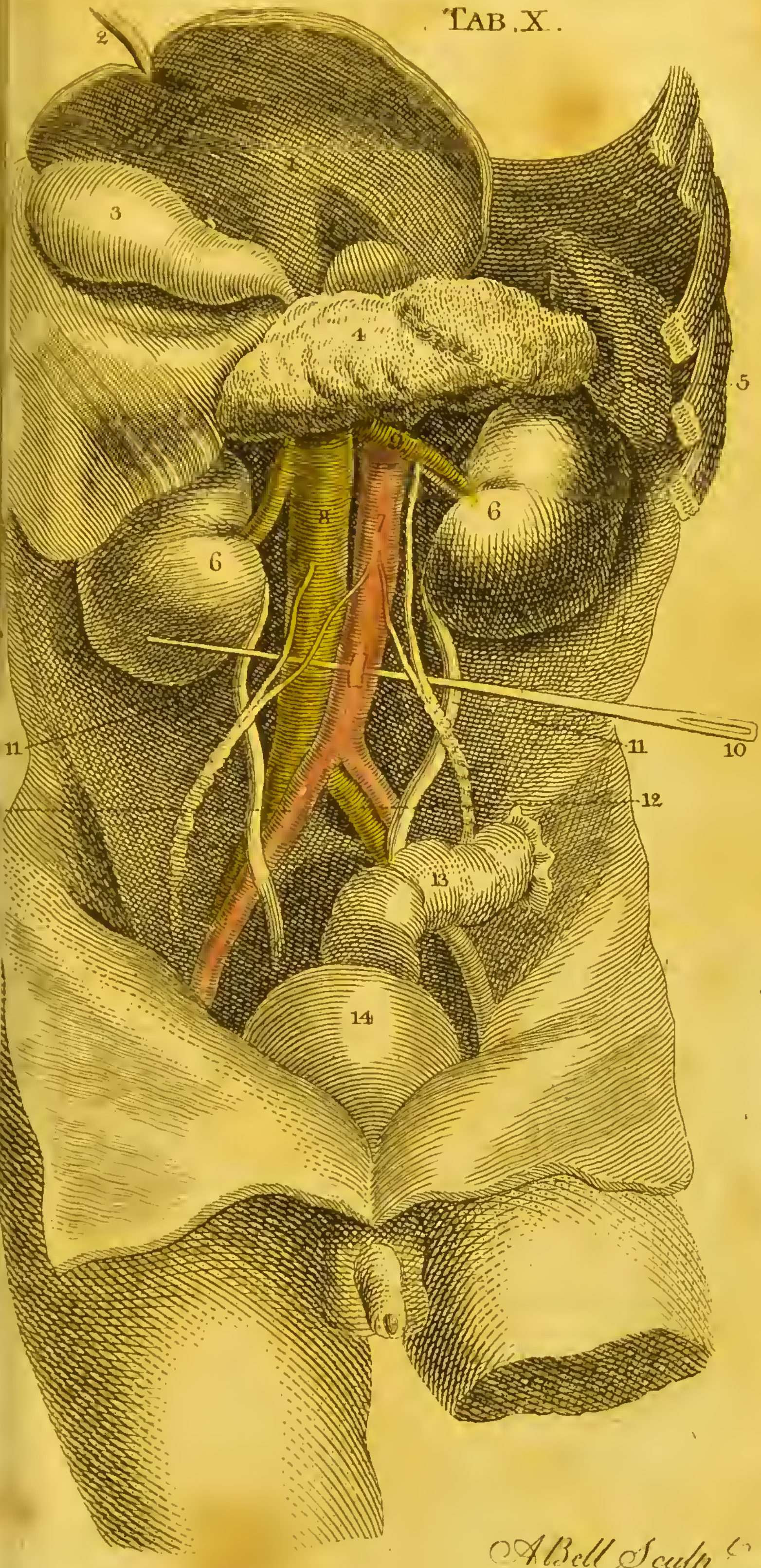
A

TAB. IX.



A Bell Sculp.

TAB. X.



A Bell Sculp.

A

SYSTEM OF ANATOMY.

PART VII.

OF THE VESSELS.

CHAP. I.

Of the ARTERIES *.

Introduction. THE heart throws the blood into two great arteries; one of which is named *aorta*, the other *arteria pulmonalis*.

The aorta diſtributes the blood to all the parts of the body, for the nouriſhment of the parts, and for the ſecretion of different fluids.

The arteria pulmonalis carries the venal blood thro' all the capillary veſſels of the lungs.

Both theſe great or general arteries are ſubdivided into ſeveral branches, and into a great number of ramifications.

The pulmonary artery. " The pulmonary artery goes

 out

* From WINSLOW, with Improvements.

out from the right ventricle of the heart; and its trunk having run almoſt directly upward as high as the curvature of the aorta, is divided into two lateral branches, one going to the right ſide, called the *right pulmonary artery*, the other to the left ſide, termed the *left pulmonary artery*. The right artery paſſes under the curvature of the aorta, and is conſequently longer than the left. They both run to the lungs, and are diſperſed through their whole ſubſtance by ramifications nearly like thoſe of the bronchia, and lying in the ſame directions. From the pulmonary arteries the blood is returned by the veins, which, contrary to the courſe of the arteries, begin by very minute canals; and gradually become larger, forming at length four large trunks called *pulmonary veins*, which terminate in the left auricle by one common opening, from whence the blood paſſes into the left ventricle." From this the aorta goes out in a direct courſe, nearly over-againſt the fourth vertebra of the back. Its courſe, I ſay, is direct with reſpect to the heart; but with reſpect to all the reſt of the body, it aſcends obliquely from the left to the right hand, and from before, backward.

Soon after this, it bends obliquely from the right hand to the left, and from before, backward, reaching as high as the ſecond vertebra of the back; from whence it runs down again in the ſame direction, forming an oblique arch. The middle of this arch is almoſt oppoſite to the right ſide or edge of the ſuperior portion of the ſternum, between the cartilaginous extremities or ſternal articulations of the firſt two ribs.

From thence the aorta deſcends in a direct courſe along the anterior part of the vertebræ, all the way to the os ſacrum, lying a little toward the left hand; and there it terminates in two ſubordinate or collateral trunks, called *arteriæ iliacæ*.

General diviſion of the aorta. The aorta is by anatomiſts generally divided into the aorta aſcendens and aorta deſcendens, though both are but one and the ſame trunk.

trunk. It is termed *aſcendens*, from where it leaves the heart to the extremity of the great curvature or arch. The remaining part of this trunk from the arch to the os ſacrum or bifurcation already mentioned, is named *deſcendens*.

The aorta deſcendens is further divided into the ſuperior and inferior portions; the firſt taking in all that lies above the diaphragm; the other, all that lies between the diaphragm and the bifurcation.

The aorta aſcendens is chiefly diſtributed to part of the thorax, to the head and upper extremities. The ſuperior portion of the aorta deſcendens furniſhes the reſt of the thorax; the inferior portion furniſhes the abdomen and lower extremities.

The great trunk of the aorta, through its whole length, ſends off immediately ſeveral branches, which are afterwards differently ramified; and theſe arterial branches may be looked upon as ſo many trunks with reſpect to the other ramifications, which again may be conſidered as ſmall trunks with regard to the ramifications that they ſend off.

The branches which go out immediately from the trunk of the aorta, may be termed *original* or *capital branches;* and of theſe ſome are large, and others very ſmall.

The large capital branches of the aorta are theſe: two arteriæ ſubclaviæ; two carotides, one cæliaca, one meſenterica ſuperior, two renales, formerly termed *emulgentes*, one meſenterica inferior, and two iliacæ.

The ſmall capital branches are chiefly the arteriæ coronariæ cordis, bronchiales, œſophagææ, intercoſtales, diaphragmaticæ inferiores, ſpermaticæ, lumbares, and ſarcæ.

Theſe capital branches or arteries are for the moſt part diſpoſed in pairs; there being none in odd numbers but the cæliaca, the two menſentericæ, ſome of the œſophagææ, the bronchialis, and ſometimes the ſacræ.

The ramifications of each capital branch are in uneven numbers with reſpect to their particular trunks; but with reſpect to the ramifications of the like capital trunks on the other ſide, they are diſpoſed in pairs. Among the branches there are in odd numbers, none but the arteria ſacra when it is ſingle, and the œſophagææ, the ramifications of which are ſometimes found in pairs.

Before I enter upon the detail of each of theſe particular arteries, many of which have proper names; it will be convenient to give a ſhort view of the diſpoſition and diſtribution of the principal arterial branches, as a general plan to which all the particularities of each diſtribution may afterwards be referred: for I have found by experience, that the common method of deſcribing the courſe of all the ramifications of theſe veſſels, without having firſt given a general idea of the principal branches, is very troubleſome to beginners.

General diſtribution of the branches of the aorta. The aorta gives riſe to two ſmall arteries, called *coronariæ cordis*, which go to the heart and its auricles; one of which is ſituated anteriorly, the other poſteriorly, and ſometimes they are three in number.

From the upper part of the arch or curvature, the aorta ſends out commonly three, ſometimes four, large capital branches, their origins being very near each other. When there are four, the two middle branches are termed *arteriæ carotides;* the other two, *ſubclaviæ;* and both are diſtinguiſhed into right and left.

When there are but three branches, which is ofteneſt the caſe, the firſt is a ſhort trunk, common to the right ſubclavian and carotid; the ſecond is the left ſubclavian; and the third the left carotid. Sometimes, tho' very rarely, theſe four arteries unite in two trunks.

The origin of the left ſubclavian terminates the aorta aſcendens; but I have ſometimes obſerved four branches, the firſt three of which were thoſe already mentioned, and the fourth a diſtinct trunk of the left vertebral artery.

It

It muſt be obſerved, that theſe large branches which ariſe from the curvature of the aorta, are ſituated obliquely; the firſt, or that which is moſt on the right hand, lying more forward than the reſt, and the laſt, which is moſt on the left hand, more backward. The firſt and ſecond, or middle branches, are generally in the middle of the arch, and the third lower down. Sometimes the firſt alone is in the middle; all which varieties depend on the obliquity of the arch.

The carotid arteries run up directly to the head, each of them being firſt divided into two, one external, the other internal. The external artery goes chiefly to the outer parts of the head and dura mater, or firſt covering of the brain. The internal enters the cranium through the bony canal of the os petroſum; and is diſtributed through the brain by a great number of ramifications.

The ſubclavian arteries ſeparate laterally and almoſt tranſverſely, each toward that ſide on which it lies, behind and under the claviculæ, from whence they have their name. The left ſeems to be ſhorter, and runs more obliquely than the right.

The ſubclavian on each ſide terminates at the upper edge of the firſt rib, between the lower inſertions of the firſt ſcalenus muſcle; and there, as it goes out of the thorax, takes the name of *arteria axillaris*.

During this courſe of the ſubclavian artery, taking in the common trunk of the right ſubclavian, ſeveral arteries ariſe from it, *viz.* the mammaria interna, mediaſtina, pericardia, diaphragmatica minor ſive ſuperior, thymica, and trachealis.

The thymica and trachealis on each ſide are in ſome ſubjects only branches of one ſmall trunk which ſprings from the common trunk of the right ſubclavian and carotid.

They are generally ſmall arteries, which run ſometimes ſeparate, and ſometimes partly ſeparate and partly joined.

The

The ſubclavian ſends off likewiſe the mammaria interna, vertebrales, cervicales, and ſometimes ſeveral of the upper intercoſtales.

The axillary artery, which is only a continuation of the ſubclavian, from where it goes out of the thorax to the axilla, detaches chiefly the mammaria externa or thoracica ſuperior, thoracica inferior, ſcapulares externæ, ſcapularis interna, humeralis or muſcularis, &c. Afterwards it is continued, by different ramifications and under different names, over the whole arm, all the way to the ends of the fingers.

The ſuperior portion of the aorta deſcendens gives off the arteriæ bronchiales, which ariſe ſometimes by a ſmall common trunk, ſometimes ſeparate, and ſometimes do not come immediately from the aorta. It next ſends off the œſophagææ, which may be looked upon as mediaſtinæ poſteriores; and then the intercoſtales from its poſterior part, which in ſome ſubjects come all from this portion of the aorta, in others only the loweſt eight or nine.

The ſmall anterior arteries here mentioned are generally, at their origins, ſingle and in uneven numbers, but they divide ſoon after toward the right and left.

The inferior portion of the deſcending aorta, as it paſſes through the diaphragm, gives off the diaphragmaticæ inferiores or phrenicæ, which however do not always come immediately from the aorta. Afterwards it ſends off ſeveral branches anteriorly, poſteriorly, and laterally.

The anterior branches are cæliaca, which ſupply the ſtomach, liver, ſpleen, pancreas, &c.; the meſenterica ſuperior, which goes chiefly to the meſentery, to the ſmall inteſtines, and to that part of the great inteſtines which lies on the right ſide of the abdomen; the meſenterica inferior, which goes to the great inteſtines on the left ſide, and produces the hæmorrhoidalis interna; and laſtly, the right and left arteriæ ſpermaticæ.

The poſterior branches are the arteriæ lumbares, of which

which there are ſeveral pairs, and the ſacræ, which do which not always come from the trunk of the aorta.

The lateral branches are the capſulares and adipoſæ, the origin of which often varies; the renales, formerly termed *emulgentes*, and the iliacæ, which terminate the aorta by the bifurcation already mentioned.

The iliac artery on each ſide is commonly divided into the external or anterior, and internal or poſterior.

The internal iliaca is likewiſe named *arteria hypogaſtrica;* and its ramifications are diſtributed to the viſcera contained in the pelvis, and to the neighbouring parts, both internal and external.

The iliaca externa, which is the true continuation of the iliac trunk, and alone deſerves that name, goes on to the inguen, and then out of the abdomen, under the ligamentum Fallopii; having firſt detached the epigaſtrica, which goes to the muſculi abdominis recti. Having quitted the abdomen, it commences arteria cruralis, which runs down upon the thigh, and is diſtributed by many branches and ramifications to all the lower extremity.

I ſhall now go on to examine particularly all the capital or original branches of the aorta, from their origin to the entry of them, and of their ramifications into all the parts of the body, and all the different viſcera and organs.

Arteriæ cardiacæ ſive coronariæ cordis. The cardiac or coronary arteries of the heart, ariſe from the aorta immediately on its leaving the heart. They are two in number; and, according to the natural ſituation of the heart, one is rather ſuperior than anterior, the other rather inferior than poſterior.

They go out near the two ſides of the pulmonary artery; which having firſt ſurrounded, they afterwards run upon the baſis of the heart in form of a kind of crown or garland, from whence they are called *coronariæ;* and then purſue the ſuperficial traces of the union of of the two ventricles, from the bafis of the heart to the apex.

They fend communicating branches to each other, which are afterward loft in the fubftance of the heart, as fhall be fhown more particularly in defcribing that organ.

We fometimes meet with a third coronary artery, which arifes from the aorta more backward, and is fpent on the pofterior or lower fide of the heart.

The arteriæ carotides in general. The carotid arteries are commonly demonftrated after the fubclavian; but I choofe to defcribe them firft, that I may afterwards be able to purfue the arteries of the thorax, arifing partly from the fubclaviæ, and partly from the aorta defcendens, without interruption.

Thefe arteries are two in number, one called the *right carotid*, the other the *left*. They arife near each other, from the curvature or arch of the aorta; the left immediately, the right moft commonly, from the trunk of the fubclavia on the fame fide, as has been already obferved.

They run upon each fide of the trachea arteria, between it and the internal jugular vein, as high as the larynx, without any ramification. During this courfe, therefore, they may be named *carotid trunks*, or general, common, and original carotids. Each of thefe trunks is afterwards ramified in the following manner.

The trunk having reached as high as the larynx, is divided into two large branches or particular carotids; one named *external*, the other *internal;* becaufe the firft goes chiefly to the external parts of the head, the fecond enters the cranium, and is diftributed to the brain.

The external carotid is anterior, the internal pofterior; and the external is even fituated more inward and nearer the larynx than the other; but the common names

names may ſtill be retained, as being taken, not from their ſituation, but from their diſtribution.

Arteria carotis externa. The external carotid is the ſmalleſt, and yet appears by its direction to be a continuation of the common trunk. It runs inſenſibly outward, between the external angle of the lower jaw and the parotid gland, which it ſupplies as it paſſes. Afterwards it aſcends on the foreſide of the ear, and ends in the temples.

In this courſe it ſends off ſeveral branches, which may well enough be divided into anterior or internal, and poſterior or external; and the principal branches of each kind are theſe.

The firſt anterior or internal branch goes out from the very origin of the carotid on the inſide; and having preſently afterward taken a little turn, and ſent off branches to the jugular glands near it to the fat and ſkin, it runs tranſverſely, and is diſtributed to the glandulæ thyroidææ, and to the muſcles and other parts of the larynx; for which reaſon I name it *laryngææ*, or *gutturalis ſuperior.* It likewiſe ſends ſome branches to the pharynx and muſcles of the os hyoides.

The ſecond anterior branch paſſes over the neareſt cornu of the os hyoides to the muſcles of that bone and of the tongue; and to the glandulæ ſublinguales; afterwards paſſing before the cornu of the os hyoides, it loſes itſelf in the tongue; from whence it has been called *arteria ſublingualis;* and it is the ſame artery which others have named *ranina.*

The third branch, or arteria maxillaris inferior, goes to the maxillary gland, to the ſtyloide and maſtoide muſcles, to the parotid and ſublingual glands, to the muſcles of the pharynx, and to the ſmall flexors of the head.

The fourth branch, which I name *arteria maxillaris externa*, paſſes anteriorly on the maſſeter muſcle, and middle of the lower jaw near the chin; from whence it has a denomination, in ſome languages, which cannot

not be expreſſed in Engliſh. Afterwards it runs under the muſculus depreſſa angulioris, which it ſupplies, as well as the buccinator and the depreſſor labii inferioris.

It ſends off a particular branch, very much contorted, which divides at the angular commiſſure of the lips, and running in the ſame manner along the ſuperior and inferior portions of the muſculus orbicularis, it communicates on both ſides with its fellow, and thereby forms a kind of arteria coronaria labiorum.

Afterwards it aſcends toward the nares, and is diſtributed to the muſcles, cartilages, and other parts of the noſe, ſending down ſome twigs which communicate with the coronary artery of the lips. Laſtly, it reaches the great angle of the eye, and is ramified and loſt on the muſculus orbicularis palpebrarum, ſuperciliaris, and frontalis. Through all this courſe it is named *arteria angularis*.

The fifth branch ariſes over-againſt the condyle of the lower jaw; and as it is very conſiderable, I call it *maxillaris interna*. It paſſes behind the condyle; and having given off a twig among the muſculi pterygoidæi, it is divided into three principal branches.

The firſt branch goes through the inferior orbitary or ſpheno-maxillary fiſſure to the orbit, after having ſupplied the muſcles about the uvula, and the glandulous membrane of the poſterior nares, through the foramen ſpheno-palatinum. I name this branch *ſpheno-maxillaris*.

It ſends ſome very ſmall branches inferiorly and laterally to the parts contained in the orbit, and detaches a ſmall ſubaltern branch through the extremity of the ſuperior orbitary or ſphenoidal fiſſure, which enters the cranium, and is ſpent upon the dura mater, communicating there with the other artery of the dura mater, which enters by the foramen ſpinale of the ſphenoidal bone.

It ſends off likewiſe another ſubaltern branch, which paſſes

paſſes through the poſterior opening of the orbitary canal; and having furniſhed the maxillary ſinus and the teeth, goes out by the inferior orbitary hole, and on the cheek communicates with the angular artery.

The ſecond of the three branches runs through the canal of the lower jaw; and being diſtributed to the alveoli and teeth, goes out at the hole near the chin, and loſes itſelf in the neighbouring muſcles, communicating with the rami of the arteria maxillaris externa.

The third branch of the maxillaris interna runs up between the internal and external carotids, paſſes thro' the foramen ſpinale of the ſphenoidal bone, and is diſtributed to the dura mater by ſeveral ramifications, which run forward, upward, and backward; the uppermoſt communicating with thoſe on the other ſide above the longitudinal ſinus of the dura mater.

This artery of the dura mater, which may be termed *ſpheno-ſpinalis*, to diſtinguiſh it from thoſe that go to the ſame part by another courſe, ariſes ſometimes from the trunk of the external carotid, behind the origin of the laryngæa or gutturalis ſuperior, and ſometimes from the firſt ramus of the maxillaris interna, juſt before it enters the ſpheno-maxillary fiſſure.

The ſixth anterior or internal branch, which is very ſmall, is ſpent on the muſculus maſſeter.

The firſt external or poſterior branch is named *arteria occipitalis*. It paſſes obliquely before the internal jugular vein, and having given twigs to the muſculus ſtylo-hyoidæus, ſtylo-gloſſus, and digaſtricus, it runs between the ſtyloide and maſtoide apophyſes, along the maſtoide groove, and goes to the muſcles and integuments which cover the os occipitis, turning ſeveral times in an undulating manner as it aſcends backwards.

It communicates by a deſcending branch with the vertebral and cervical arteries, as has been already ſaid, near the top of the head; it communicates likewiſe with the poſterior branches of the temporal artery,

tery, and it ſends a branch to the foramen maſtoidæum.

The ſecond external branch ſpreads itſelf on the outward ear, by a great many ſmall twigs on each ſide, ſeveral of which run inward, and furniſh the cartilages, meatus auditorius, ſkin of the tympanum, and internal ear.

The trunk of the external carotid aſcends afterward above the zygoma, paſſing between the angle of the lower jaw and parotid gland, and forms the temporal artery, which divides into an anterior, middle, and poſterior branch.

The anterior branch of the temporal artery goes to the muſculus frontalis, communicates with the arteria angularis, and ſometimes gives off a very ſmall artery, which pierces the internal apophyſis of the os malæ all the way to the orbit. The middle branch goes partly to the muſculus frontalis, partly to the occipitalis. The poſterior branch goes to the occiput, and communicates with the arteria occipitalis. All theſe branches likewiſe furniſh the integuments.

Arteria carotis interna. The internal carotid artery leaving the general trunk, is at firſt a little incurvated, appearing as if either it were the only branch of that trunk, or a branch of the trunk of the external carotid. Sometimes the curvature is turned a little outward, and then more or leſs inward, paſſing behind the neighbouring external carotid.

It is ſituated a little more backward than the carotis externa, and generally runs up without any ramification, as high as the lower orifice of the great canal of the apophyſis petroſa of the os temporis. It enters this orifice directly from below upward, and afterward makes an angle according to the direction of the canal, the reſt of which it paſſes horizontally, being covered by a production of the dura mater.

At the end of this canal it is again incurvated from below upward, and enters the cranium through a notch

 of

of the ſphenoidal bone. Then it bends from behind, forward, and makes a third angle on the ſide of the ſella ſphenoidalis; and again a fourth, under the clinoide apophyſis of that ſella.

As it leaves the bony canal to enter the cranium, it ſends off a ſmall branch through the ſphenoidal fiſſure to the orbit and eye; and ſoon afterward a conſiderable branch, through the foramen opticum, to ſupply the contents of the orbit. The continuation of this paſſes out through the foramen ſupra orbitarius, to be diſtributed to the forehead. At the inner angle of the eye it communicates with the angular artery.

Afterwards the internal carotid runs under the baſis of the brain to the ſide of the infundibulum, where it is at a ſmall diſtance from the internal carotid of the other ſide, and there it commonly divides into two principal branches, one anterior, and one poſterior.

The anterior branch runs forward under the brain, firſt ſeparating from that on the other ſide, then coming nearer again, it unites with it by an anaſtomoſis or communication in the interſtice between the olfactory nerves. Afterwards, having ſent off ſmall arteries, which accompany theſe nerves, it leaves its fellow, and divides into two or three branches.

The firſt of theſe branches goes to the anterior lobe of the brain; the ſecond, which is ſometimes double, is inſerted on the corpus calloſum, to which it gives ſome ramifications, as alſo to the falx of the dura mater and middle lobe of the brain. The third, which in ſome ſubjects is a diſtinct branch, in others only a diviſion of the ſecond, goes to the poſterior lobe of the brain. This might be looked upon as a third principal branch, lying between the other two.

The poſterior branch communicates firſt of all with the vertebral artery of the ſame ſide, and after running between the anterior and lateral lobes of the brain, divides into ſeveral rami, which run between its ſuperficial circumvolutions; and are ramified in many different directions on and between these circumvolutions, all the way to the bottom of the sulci.

All these ramifications are covered by the pia mater, in the duplicature of which they are distributed, and form capillary reticular textures in great numbers; and afterwards they are lost in the inner substance of the brain. The anterior and middle branches produce the same kind of ramifications, and the anterior, in particular, sends a twig to the corpus callosum.

Arteria subclavia. The subclavian arteries are named from their situation near the claviculæ, in the transverse direction of which they run. They are two in number, one right, the other left; and they arise from the arch of the aorta, on each side of the left carotid, which commonly lies in the middle between them; but when both carotids go out separately, they both lie between the subclaviæ. These arteries terminate, or rather change their name, above the middle of the two first ribs, between the anterior insertions of the musculi scaleni.

The right subclavian is larger at the beginning than the left, when it produces the right carotid; its origin is likewise more anterior and higher, because of the obliquity of the arch of the aorta; for which reason also the left is shorter than the right, and runs more obliquely. Both of them are distributed much in the same manner; and therefore the description of one may likewise be applied to the other.

The right subclavian, the longest of the two, gives off, first of all, small arteries to the mediastinum, thymus, pericardium, aspera arteria, &c. which are named *mediastinæ, thymicæ, pericardiæ, and tracheales.* These small arteries sometimes go out from the subclavian itself, either separately or by small common trunks; sometimes they are branches of the mammaria interna, especially the mediastina.

Afterward this right subclavian, at about a finger's breadth from its origin, often produces the common ca-

carotid of the ſame ſide; and at a ſmall finger's breadth from the carotid, it gives off commonly three conſiderable branches, viz. the mammaria interna, cervicalis, and vertebralis, and ſometimes an intercoſtal artery, which goes to the firſt ribs called *intercoſtalis ſuperior.*

Arteria thymica. The arteria thymica communicates with the mammaria interna, and ſometimes ariſes from the anterior middle part of the common trunk of the ſubclavian and carotid. The thymus receives likewiſe ſome rami from the mammaria interna and intercoſtalis ſuperior. The ſame obſervation may be applied to the mediaſtina and pericardia.

Arteria pericardia. The pericardia ariſes much in the ſame manner with the thymica, and runs down upon the pericardium all the way to the diaphragm, to which it ſends ſome ſmall ramifications.

Arteria mediaſtina. The mediaſtina ariſes ſometimes immediately after the thymica, and is diſtributed principally to the mediaſtinum.

Arteria trachealis. The trachealis, which may likewiſe be named *gutturalis inferior*, runs up from the ſubclavia, in a winding courſe, along the aſpera arteria, to the glandulæ thyroidææ and larynx, detaching ſmall arteries to both ſides, one of which runs to the upper part of the ſcapula.

Arteria mammaria interna. The internal mammary artery comes from the anterior and lower ſide of the ſubclavia, near the middle of the clavicula, and runs down for about one finger's breadth, behind the cartilages of the true ribs, an inch diſtant from the ſternum.

In its paſſage it ſends rami to the thymus, mediaſtinum, pericardium, pleura, and intercoſtal muſcles. It likewiſe detaches other branches, through theſe muſcles and between the cartilages of the ribs, to the pectoralis major, and other neighbouring muſcular portions, to the mammæ, membrana adipoſa, and ſkin.

Several of theſe rami communicate, by anaſtomoſes, with the mammaria externa, and other arteries of the thorax, eſpecially in the ſubſtance of the pectoralis major, and likewiſe with the intercoſtals. Afterwards it goes out of the thorax on one ſide of the appendix enſiformis, and is loſt in the muſculus abdominis rectus, a little below its upper part; communicating, at this place, by ſeveral ſmall ramifications with the arteria epigaſtrica; and, in its courſe, it gives branches to the peritonæum, and to the anterior part of the oblique and tranſverſe muſcles of the abdomen.

Arteria cervicalis. The cervical artery ariſes from the upper ſide of the ſubclavian, and is preſently afterwards divided into two, which come out ſometimes ſeparately, ſometimes by a ſmall common trunk. The largeſt of theſe two arteries is anterior, the other poſterior.

The anterior cervicalis, running behind the carotid of the ſame ſide, is diſtributed to the muſculus coraco-hyoidæus, maſtoidæus, cutaneus, ſterno-hyoidæus, and ſterno-thyroidæus, to the jugular glands, the aſpera arteria, the muſcles of the pharynx, bronchia, œſophagus, and to the anterior muſcles which move the neck and head. This artery has been obſerved to ſend out the intercoſtalis ſuperior.

The poſterior cervicalis ariſes ſometimes a little after the vertebralis, and ſometimes from that artery. It paſſes under the tranſverſe apophyſis of the laſt vertebra of the neck; and ſometimes through a particular hole in that apophyſis; and from thence runs up backward in a winding courſe, on the vertebral muſcles of the neck, and then returns in the ſame manner.

It communicates with a deſcending branch of the occipital artery, and with another of the vertebral artery above the ſecond vertebra. It is diſtributed to the muſculi ſcaleni, angularis ſcapulæ, and trapezius, and to the jugular glands and integuments.

Ar-

Arteria vertebralis. The vertebral artery goes out from the poſterior and upper ſide of the ſubclavian, almoſt oppoſite to the mammaria interna and cervicalis. It runs up through all the holes in the tranſverſe apophyſis of the vertebræ of the neck, and in its paſſage ſends off little twigs through the lateral notches of theſe vertebræ, to the medulla ſpinalis and its coverings. It alſo gives arteries to the vertebral muſcles, and to other muſcles near them.

As it paſſes through the tranſverſe hole of the ſecond vertebra, it is generally incurvated, to accommodate itſelf to the particular obliquity of this foramen, mentioned in the deſcription of the ſkeleton. And between this hole and that in the firſt vertebra, it takes another larger turn in a contrary direction to the former. Having paſſed the tranſverſe hole of the firſt vertebra, it is conſiderably incurvated a third time, from before backwards, as it goes through the ſuperior and poſterior notch in this vertebra.

At this third curvature, it ſends off a ſmall branch, which is ramified on the outer and poſterior parts of the occiput, and communicates with the cervical and occipital arteries. Having afterwards reached the great foramen of the os occipitis, it enters the cranium, and pierces the dura mater; and on theſe accounts it may be named *arteria occipitalis poſterior*, to diſtinguiſh it from the other, which is lateral.

As ſoon as it enters the cranium, it ſends ſeveral ſmall ramifications to the back-part of the medulla oblongata, and to the corpora olivaria and pyramidalia, which are likewiſe ſpread on the backſides of the fourth ventricle of the brain, and form the plexus choroides of the cerebellum.

Afterwards it advances on the apophyſis baſilaris of the os occipitis, inclining by ſmall degrees toward the vertebral artery of the other ſide, all the way to the extremity of that apophyſis, where they both join in one common trunk, which may be named *arteria basilaris*.

Arteria basilaris. The arteria basilaris runs forward under the great transverse protuberance of the medulla oblongata, to which it gives ramifications, as well as to the neighbouring parts of the medulla. Sometimes this artery divides again near the extremity of the apophysis basilaris into two lateral branches, which communicate with the posterior branches of the two internal carotides, and are lost in the posterior lobe of the brain.

Arteriæ spinalis. The spinal arteries are two in number, one anterior, and one posterior; both produced by both vertebrales, each of which, as soon as it enters the cranium, sends out a small branch, by the union of which the posterior spinalis is formed. Afterwards the vertebrales advancing on the apophysis basilaris, or production of the occipital bone, detach backward two other small branches, which likewise meet, and by their union form the spinalis anterior. These spinal arteries run down on the fore and back sides of the medulla spinalis, and, by small transverse ramifications, communicate with those which the intercostal and lumbar arteries send to the same part.

Arteria auditoria interna. The internal auditory artery goes off from each side of the arteria basilaris to the organ of hearing, accompanying the auditory nerve, having first furnished several small twigs to the membrana arachnoides.

Arteria meningæa posterior. The posterior meningæa arises from the same trunk with the auditoria interna, and goes to the back-part of the dura mater, on the occipital and temporal bones, and likewise supplies the neighbouring lobes of the brain.

Arteria intercostalis superior. When the superior intercostal artery does not go out from the trunk of the aorta descendens, it commonly arises from the lower side of the subclavian, and runs down on the inside of the

the two, three, or four, uppermoſt true ribs, near their heads, and ſends off under each rib a branch which runs along the lower edge, and ſupplies the intercoſtal muſcles and neighbouring parts of the pleura.

Theſe branches or particular intercoſtal arteries communicate with each other at different diſtances by ſmall rami, which run upward and downward from one to the other, on the intercoſtal muſcles.

They likewiſe give branches to the muſculi ſterno-hyoidæi, ſubclavius, vertebrales, and bodies of the vertebræ; and alſo to the pectoralis major and minor, piercing the intercoſtal notch; and laſtly, they ſend branches through the muſcles of the firſt four vertebræ to the medulla ſpinalis and its coverings.

Sometimes the ſuperior common intercoſtal artery comes from the cervicalis, and not immediately from the ſubclavia. Sometimes it ariſes from the aorta deſcendens, either by ſmall ſeparate arteries, or by a common trunk, which divides as it runs obliquely up upon the ribs. Laſtly, it ſometimes ariſes from the neareſt bronchialis, or from ſeveral bronchiales together.

Ductus arterioſus in ligamentum verſus. The ductus arterioſus, which is found only in the fœtus and in very young children, ariſes from the aorta deſcendens, immediately below the left ſubclavian artery. In adults, this duct is ſhrunk up and cloſed, and approaches only like a ſhort ligament, adhering by one end to the aorta, and by the other to the pulmonary artery; ſo that in reality it deſerves no other name than that of *ligamentum arterioſum.*

Arteria bronchialis. The bronchial arteries go commonly from the foreſide of the ſuperior deſcending aorta, but ſometimes from the firſt intercoſtal, and ſometimes from the arteria œſophagæa. Sometimes they ariſe ſeparately from each ſide, to go to each lung, and ſometimes by a ſmall common trunk, which afterwards ſeparates towards the right and left hand, at the bifurcation of the afpera arteria, and accompany the ramifications of the bronchia.

The bronchial artery on the left fide often comes from the aorta, while the other arifes from the fuperior intercoftal on the fame fide; which variety is owing to the fituation of the aorta. Sometimes there is another bronchial artery which goes out from the aorta pofteriorly, near the fuperior intercoftal, above the bronchialis anterior.

"Sometimes there are free communications obferved between the branches of the bronchial artery and thofe of the pulmonary artery: thefe have been miftaken for direct communications between the bronchial artery and pulmonary vein, vena azygos, &c."

The bronchialis gives a fmall branch to the neighbouring auricle of the heart, which communicates with the arteria coronaria.

Arteriæ œfophagææ. The œfophagææ are generally two or three in number, fometimes but one. They arife anteriorly from the aorta defcendens, and are diftributed to the œfophagus, &c. Sometimes the uppermoft œfophagæa produces a bronchial artery.

Arteriæ intercoftales inferiores. The inferior intercoftals are commonly feven or eight on each fide, and fometimes ten, when the fuperior intercoftals arife likewife from the aorta defcendens; in which cafe thefe run obliquely upward, as has been already faid.

They arife along the backfide of the defcending aorta in pairs, all the way to the diaphragm, and run tranfverfely towards each fide, on the bodies of the vertebræ. Thofe on the right fide pafs behind the vena azygos; and afterwards they all run to the intercoftal mufcles, along the lower edge of the ribs, all the way to the fternum, or near it.

They fend branches to the pleura, to the vertebral mufcles, to thofe mufcles which lie on the outfides of the ribs, and to the upper portions of the mufcles of the abdo-

abdomen; and they communicate with the arteriæ epigaſtricæ and lumbares.

Sometimes, inſtead of going out from the aorta in pairs, they ariſe by ſmall common trunks, which afterwards divide, and ſend an artery to each neighbouring rib.

Before they take their courſe along the ribs, each of them detaches one branch between the tranſverſe apophyſes on both ſides, to the vertebral muſcles, and another which enters the great canal of the ſpina dorſi. Each of theſe latter branches divides at leaſt into two ſmall arteries, one of which runs tranſverſely on the anterior ſide of the canal, the other on the poſterior ſide. Both of them communicate with the like arteries from the other ſide of the ſpine, in ſuch a manner as to form a kind of arterial rings, which likewiſe communicate with each other by other ſmall ramifications. The ſame is to be obſerved in the arteriæ lumbares.

Afterwards each intercoſtal artery having reached the middle of the rib, or a little more, divides into two principal branches, one internal, the other external. Soon after this diviſion, the arteries that run upon the falſe ribs ſeparate a little from them, being gradually bent downward one after another, and are ſpread upon the abdominal muſcles. They are likewiſe diſtributed to other neighbouring muſcles, and particularly to thoſe of the diaphragm, almoſt in the ſame manner with the arteriæ phrænicæ; they alſo communicate with the lumbares, and ſometimes with branches of the hypogaſtricæ.

Arteriæ axillares. The ſubclavian artery having left the thorax immediately above the firſt rib, in the interſtice left between the portions of the ſcalenus, there receives the name of *axillaris*, becauſe it paſſes under the axilla.

In this courſe it gives off from its inſide, a ſmall branch to the inſide of the firſt rib; and afterwards four

four or five principal branches, viz. the thoracica ſuperior or mammaria externa, thoracica inferior, muſcularis or ſcapularis externa, ſcapularis interna, and humeralis.

Arteria thoracica ſuperior. The ſuperior thoracica or external mammary artery, runs down in a winding courſe on the lateral parts of the thorax, and croſſes the ribs. It gives branches to the two pectoral muſcles, to the mamma, muſculus ſubclavius, ſerratus major, latiſſimus dorſi, and to the upper portions of the coraco-brachialis and biceps.

Theſe branches are ſometimes ſeparate for ſome ſpace; and one of them, in particular, runs down between the deltoides and pectoralis major, together with the vena cephalica, to which it adheres very cloſely, the extremity of it piercing the coat of that vein, as if there were an anaſtomoſis between them. Another ſometimes runs between the muſculus brachiæus and anconæus internus, which communicates with a branch of the radial artery.

Arteria thoracica inferior. The inferior thoracic artery runs along the inferior coſta of the ſcapula, to the muſculus ſubſcapularis, teres major and minor, infra-ſpinatus, latiſſimus dorſi, ſerratus major, and the neighbouring intercoſtal muſcles, communicating with the arteriæ ſcapulares.

Arteriæ ſcapulares. The external ſcapulary artery paſſes through the notch in the ſuperior coſta of the ſcapula, to the muſculus ſupra-ſpinatus and infra-ſpinatus, teres major and minor, and to the articulation of the ſcapula with the os humeri.

The internal ſcapularis ariſes from the axillary artery near the axilla, and runs backward, to be diſtributed to the ſubſcapularis, giving branches to the ſerratus major, to the axillary glands, and to the teres major, upon which it is ramified in different manners. It likewiſe ſends rami to the infra-ſpinatus and upper portion of the anconæi.

Ar-

Arteria articularis. The articular artery ariſes from the lower and fore part of the axillaris, and runs backward between the head of the os humeri and teres major, ſurrounding the articulation till it reaches the poſterior part of the deltoides, to which it is diſtributed.

During this courſe, it gives ſeveral branches to the ſuperior portions of the anconæi, to the capſular ligament of the joint of the ſhoulder, and to the os humeri itſelf through ſeveral holes immediately below the great tuberoſity of the head of that bone. It likewiſe communicates with the ſcapulary artery.

Oppoſite to the origin of this articular artery, the axillaris ſends off another ſmall branch, which runs in a contrary direction between the head of the os humeri and the common upper part of the biceps and coraco-brachialis; and having given branches to the vagina and channel of the biceps, and to the perioſteum, afterwards joins the principal humeralis.

Arteria brachialis. The axillary artery having given off theſe branches, paſſes immediately behind the tendon of the pectoralis major, where it changes its former name for that of *arteria brachialis.* It runs down on the inſide of the arm over the muſculus coraco-brachialis and anconæus internus, and along the inner edge of the biceps behind the vena baſilica, giving ſmall branches on both ſides to the neighbouring muſcles, to the perioſteum, and to the bone.

Between the axilla and middle of the arm, it is covered only by the ſkin and fat; but afterwards it is hid under the biceps, and runs obliquely forward as it deſcends; being at ſome diſtance from the internal condyle, but it does not reach the middle of the fold of the arm.

Between the axilla and this place, it ſends off many branches to the infra-ſpinatus, teres major and minor, ſubſcapularis, latiſſimus dorſi, ſerratus major, and other neighbouring muſcles, to the common integuments, and even

even to the nerves. Below the fold of the arm, it divides into two principal branches, one called *arteria cubitalis*, the other *radialis*.

From its upper and inner part, it ſends off a particular branch, which runs obliquely downward and backward over the anconæi, and then turns forward again near the external condyle, where it communicates with a branch of the arteria radialis.

Immediately below the inſertion of the teres major, it gives off another branch, which runs from within outwards, and from behind forward, round the os humeri; and deſcends obliquely forward, between the muſculus brachiæus, and anconæus externus, to both which it is diſtributed in its paſſage. Having afterwards reached the external condyle, it unites with the branch laſt mentioned, and likewiſe communicates with a branch of the arteries of the fore-arm, ſo that there is here a triple anaſtomoſes.

About the breadth of a finger below this ſecond branch, the brachial artery ſends off a third, which runs down toward the internal condyle, and communicates with other branches of the arteries of the fore-arm, as we ſhall ſee hereafter.

About the middle of the arm, or a little lower, much about the place where the brachial artery begins to be covered by the biceps, it ſends off a branch, which is diſtributed to the perioſteum, and penetrates the bone, between the muſculus brachiæus and anconæus internus.

About an inch lower, it gives off another branch, which having furniſhed ramifications to the anconæus internus, runs over the inner condyle, and likewiſe communicates with branches of the arteries of the fore-arm.

Having got below the middle of the arm, the brachial artery detaches another branch, which runs behind the inner condyle in company with a conſiderable nerve; and having paſſed over the muſcles inſerted in this

this condyle, it communicates with that branch of the cubital artery which encompaſſes the fold of the arm.

A little lower it ſometimes ſends out another branch, which paſſes on the foreſide of the inner condyle, and then communicates with a branch which runs up from the cubital artery. Theſe three communicating branches are termed *collateral arteries.*

The common trunk of the brachial artery having reached the fold of the arm, runs, together with a vein and a nerve, immediately under the aponeuroſis of the biceps, and paſſes under the vena mediana, detaching branches on each ſide to the neighbouring muſcles.

About a large finger's breadth beyond the fold of the arm, this artery divides into two principal branches; one inner or poſterior, named *cubitalis;* the other outer or anterior, named *radialis*, as has been already ſaid.

From this bifurcation, the brachial artery ſends branches on each ſide, to the ſupinator longus, pronator teres, fat, and ſkin. It ſometimes, though very rarely, happens, that this artery is divided from its origin into two large branches, which run down on the arm, and afterwards on the fore-arm, where they have the names of *cubitalis* and *radialis.*

Arteria cubitalis. The cubital, or ulnar artery, ſinks in between the ulna and the upper parts of the pronator teres, perforatus ulnaris gracilis, and radialis internus; then leaving the bone, it runs down between the perforatus and ulnaris internus, all the way to the carpus and great tranſverſe ligament. In this courſe it winds and turns ſeveral ways, and ſends out ſeveral branches.

The firſt is a ſmall artery, which runs inward to the inner condyle, and then turns upward like a kind of recurrent, to communicate by ſeveral branches with the collateral arteries of the arm already mentioned, and particularly with the third. A little lower down, another ſmall branch goes off; which having run upward a little way, and almoſt ſurrounded the articulation,

com-

communicates with the fecond collateral artery of the arm, between the olecranum and inner condyle.

Afterwards, the cubital artery having, in its courfe between the heads of the ulna and radius, reached the interoffeous ligament, fends off two principal branches, one internal, the other external; which I call the *interoffeous arteries* of the fore-arm.

The external artery pierces the ligament about three fingers breadth below the articulation; and prefently afterwards gives off a branch, which runs up like a recurrent toward the external condyle of the os humeri, under the ulnaris externus, and anconæus minimus, to which it is diftributed, as alfo to the fupinator brevis; and it communicates with the collateral arteries of the arm on the fame fide.

Afterward this external interoffeous artery runs down on the outfide of the ligament, and is diftributed to the ulnarus externus, extenfor digitorum communis, and to the extenfores pollicis indicis and minimi digiti; communicating with fome branches of the internal interoffeous artery.

Having reached the lower extremity of the ulna, it unites with a branch of the internal interoffeous artery, which at this place runs from within outward, and is diftributed together with it on the convex fide of the carpus and back of the hand, communicating with the arteria radialis, and with a branch of the cubitalis; which will be mentioned hereafter.

By thefe communications, this artery forms a fort of irregular arch, from whence branches are detached to the external interoffeous mufcles, and to the external lateral parts of the fingers.

The internal interoffeous artery runs down very clofe to the ligament, till it reaches below the pronator teres; between which and the pronator quadratus, it perforates the ligament, and goes to the convex fide of the carpus and back of the hand, where it communicates

cates with the external interoſſeous artery, with the radialis and internal branches of the cubitalis.

From the origin of the two interoſſææ, the cubital artery runs down between the perforatus, perforans, and ulnarius internus, along the ulna, ſending branches to the neighbouring parts. Below the internal interoſſea, it ſometimes ſends off a branch which runs down between the flexor pollicis, radialis internus, and perforatus; to which it is diſtributed all the way to the carpus, where it runs under the internal annular ligament, and communicates on the hand with branches of the arteria radialis.

Afterward the cubital artery paſſes over the internal tranſverſe ligament of the carpus, by the ſide of the os piſiforme; and having furniſhed the ſkin, palmaris brevis, and metacarpius, it ſlips under the aponeuroſis palmaris, giving off one branch to the hypothenar minimi digiti, and another which runs towards the thumb between the tendons of the flexors of the fingers and the baſes of the metacarpal bones.

It likewiſe ſends off a branch, which, running between the third and fourth bones of the metacarpus, reaches to the back of the hand, where it communicates with the external interoſſeous artery. Afterwards, having ſupplied the interoſſeous muſcles, it communicates with the radialis; and they both form an arterial arch in the hollow of the hand, in the following manner.

The cubitalis having got about two fingers breadth beyond the internal annular ligament of the carpus, forms an arch; the convex ſide of which is turned to the fingers, and commonly ſends off three or four branches. The firſt goes to the inner and back part of the little finger; and is ſometimes a continuation or production of that branch which goes to the muſcles on the foreſide of the little finger.

The other three branches run in the interſtices of the four metacarpal bones; near the heads of which each

each of them is divided into two branches, which paſs along the two internal lateral parts of each finger, from the foreſide of the little finger to the poſterior ſide of the index incluſively; and at the ends of the fingers theſe digital arteries communicate and unite with each other.

Sometimes the arch of the cubital artery terminates by a particular branch in the middle finger; and in that caſe it communicates with the radial artery, which makes up what the other wants.

This arch ſends likewiſe from its concave ſide, towards the ſecond phalanx of the thumb, a branch for the lateral internal part thereof; and then ends near the head of the firſt metacarpal bone, by a communication with the radialis, having firſt given a branch to the foreſide of the index, and another to the ſide of the thumb next the former. Theſe communicate at the ends of the fingers with the neighbouring branches as in the other fingers.

This arch ſends likewiſe ſmall twigs to the interoſſeous muſcles, to the lumbricales, palmaris, and to other neighbouring parts; and, laſtly, to the integuments.

Arteria radialis. The radial artery begins by detaching a ſmall branch, which runs upwards like a recurrent, toward the fold of the arm, and turns backward round the external condyle, communicating with the neighbouring branches from the trunk of the brachial artery, eſpecially with the firſt collateral branch on that ſide.

It runs down along the inſide of the radius, between the ſupinator longus, pronator teres, and the integuments, giving branches to theſe muſcles, and likewiſe to the perforatus, perforans, and ſupinator brevis. From thence it runs in a winding courſe toward the extremity of the radius, ſupplying the flexors of the thumb and pronator quadratus.

Having reached the extremity of the radius, it runs nearer the ſkin, eſpecially toward the anterior edge of the bone, being the artery which we there feel when we examine the pulſe.

At the end of the radius, it gives off a branch to the abductor pollicis; and after having communicated with the arch of the cubital artery in the palm of the hand, and ſent off ſome cutaneous branches at that place, it detaches one along the whole internal lateral part of the thumb.

Afterwards it runs between the firſt phalanx and tendons of the thumb, to the interſtice between the baſis of this firſt phalanx and of the firſt metacarpal bone, where it turns toward the hollow of the hand.

At this turning, it ſends off a branch to the external lateral part of the thumb, which, having reached the end thereof, communicates by a ſmall arch with the branch which goes to the internal lateral part.

It likewiſe ſends branches outward, which run more or leſs tranſverſely between the firſt two bones of the metacarpus and the two tendons of the radialis externus; and it communicates with an oppoſite branch of the cubitalis; together with which it furniſhes the external interoſſeous muſcles and integuments of the back of the hand and convex ſide of the carpus.

Laſtly, the radial artery terminates, in its paſſage over the ſemi-interoſſeous muſcle of the index, near the baſis of the firſt metacarpal bone, and as it runs under the tendons of the flexor muſcles of the fingers, where it is joined to the arch of the cubitalis.

It ſends off another branch, which runs along the forepart of the firſt bone of the metacarpus to the convex ſide of the index, where it is loſt in the integuments.

It gives likewiſe a branch to the internal lateral part of the index; which, at the end of that finger, joins an oppoſite branch which comes from the arch of the cubitalis. It alſo ſends off a ſmall branch croſs the internal interoſſeous muſcles, where it forms a kind of ſmall irregular arch, which communicates with the great arch by ſeveral ſmall arterial rami.

When the arch of the cubitalis ends at the middle

 finger,

finger, the radialis runs along the inner or concave part of the firſt metacarpal bone; at the head of which it terminates by two branches.

One of theſe branches runs along the inner and anterior lateral part of the index; the other paſſes between the flexor tendons of this finger and the metacarpal bone; and having communicated with the cubital branch of the middle finger, it advances on the poſterior lateral part of the index all the way to the end of that finger, where it unites again with the firſt branch.

Arteria diaphragmatica. The left diaphragmatic artery goes out commonly from the aorta deſcendens as it paſſes between the crura of the ſmall muſcle of the diaphragm. The right diaphragmatic comes ſometimes from the neareſt lumbar artery, but moſt commonly from the cæliaca. Sometimes both theſe arteries ariſe by a ſmall common trunk immediately from the aorta. They likewiſe have the name of *arteriæ phrenicæ.*

They appear almoſt always in ſeveral ramifications on the concave or lower ſide of the diaphragm, and ſeldom on the upper or convex ſide. They give ſmall branches to the glandulæ renales, or capſulæ atrabilariæ, which ſometimes communicate with the other arteries that go to the ſame part.

They ſend likewiſe ſmall branches to the fat which lies upon the kidneys, called the *membrana adipoſa*, from whence they have the name of *arteriæ adipoſæ;* and they ſometimes come immediately from the trunk of the aorta on one ſide of the meſenterica ſuperior.

Beſides theſe capital diaphragmatic arteries, there are others of a ſubordinate claſs, which come from the intercoſtales, mammariæ internæ, mediaſtinæ, pericardiæ, and cæliaca, as is obſerved in the deſcription of each of theſe arteries.

Arteria cœliaca. The cæliac artery riſes anteriorly and a little to the left hand, from the aorta deſcendens, immediately after its paſſage through the ſmall muſcle of the diaphragm, nearly oppoſite to the cartilage between

tween the laſt vertebra of the back and firſt of the loins. The trunk of this artery is very ſhort; and near its origin it ſends off from the right ſide two ſmall diaphragmaticæ, though ſometimes there is only one, which goes to the right-hand, and is afterwards diſtributed both ways; communicating with the other arteries of the ſame name which come from the intercoſtales and mammariæ. The left branch ſends rami to the ſuperior orifice of the ſtomach and to the glandula renalis on the ſame ſide; the right furniſhes the pylorus and the renal gland on the right ſide.

Immediately after this, the celiaca gives off a conſiderable branch, named *arteria ventriculi coronaria*, and *gaſtrica*, or *gaſtrica ſuperior;* and then it preſently divides into two large branches; one toward the right hand, named *arteria hepatica;* the other to the left, called *ſplenica*, which is larger than the former.

Sometimes this artery is divided into theſe three branches at the ſame place, very near its origin; the trunk going out from the aorta almoſt in a ſtraight line, and the branches from the trunk almoſt at right angles; like radii from an axis; whence this trunk has been called *axis arteriæ cœliacæ*.

Arteria ventriculi coronaria. The coronary artery of the ſtomach goes firſt to the left ſide of that organ, a little beyond the ſuperior orifice; round which orifice it throws branches, and alſo to every part of the ſtomach near it: and theſe branches communicate with thoſe which run along the bottom of the ſtomach to the pylorus.

Afterwards it runs on the right ſide of the ſuperior orifice, along the ſmall curvature of the ſtomach, almoſt to the pylorus, where it communicates with the arteria pylorica; and turning towards the ſmall lobe of the liver, it gives off ſome branches to it.

Then it advances, under the ductus venoſus, to the left lobe of the liver, in which it loſes itſelf near the beginning of the juſt-mentioned duct, having firſt given off ſome ſmall branches to the neighbouring parts of the diaphragm and omentum.

Arteria hepatica. As ſoon as the hepatic artery leaves the cæliaca, it runs to the upper and inner part of the pylorus, in company with the vena portæ, ſending off two branches; a ſmall one called *arteria pylorica*, and a large one named *gaſtrica dextra*, or *gaſtrica major*.

The pylorica is ramified on the pylorus, from whence it has its name; and having diſtributed branches to the neighbouring parts of the ſtomach, which communicate with thoſe of the right gaſtrica, it terminates on the pylorus, by an anaſtomoſis, with the coronary artery of the ſtomach.

The right gaſtric artery having paſſed behind and beyond the pylorus, ſends out a conſiderable branch, named *arteria duodenalis*, or *inteſtinalis;* which ſometimes comes from the trunk of the hepatica, as we ſhall ſee hereafter. Afterwards this gaſtric artery runs along the right ſide of the great curvature of the ſtomach; to the neighbouring parts of which, on both ſides, it diſtributes branches.

Theſe branches communicate with thoſe of the arteria pylorica, and of the coronoria ventriculi, and with the right gaſtro-epiploicæ, which furniſh the neareſt parts of the omentum, and communicate with the meſenterica ſuperior. After this, the right gaſtric artery ends in the left, which is a branch of the ſplenica.

The duodenal or inteſtinal artery runs along the duodenum on the ſide next the pancreas; to both which it furniſhes branches, and alſo to the neighbouring part of the ſtomach. Sometimes this artery goes out from the meſenterica ſuperior, and ſometimes it is double.

The hepatic artery having ſent out the pylorica and right gaſtrica, advances behind the ductus hepaticus, toward the veſicula fellis, to which it gives two principal branches, called *arteriæ cyſticæ;* and another named

med *bilaria*, which is loſt in the great lobe of the liver.

Afterwards this artery enters the fiſſure of the liver, and joins the vena portæ, with which it runs within a membranous vagina, called *capſula gliſſoni*; and accompanies it through the whole ſubſtance of the liver by numerous ramifications, which may be termed *arteriæ hepaticæ propriæ*.

Before it enters the liver, it gives ſmall branches to the external membrane of this viſcus, and to the capſula gliſſoni. The gaſtric and proper hepatic arteries, come ſometimes from the meſenterica ſuperior, when the ordinary ramifications are wanting.

Arteria ſplenica. Immediately after the origin of the ſplenic artery from the cæliaca, it runs toward the left hand, under the ſtomach and pancreas, to the ſpleen. It adheres cloſely to the poſterior part of the lower ſide of the pancreas, to which it gives ſeveral branches, named *arteriæ pancreaticæ*.

Near the extremity of the pancreas, under the left portion of the ſtomach, the ſplenic artery gives off a principal branch, called *gaſtrica ſiniſtra* or *minor*, which runs from left to right along the left portion of the great curvature of the ſtomach, giving branches to both ſides of this portion, which communicate with thoſe of the coronaria ventriculi.

This gaſtric artery ſends likewiſe another branch at leaſt to the extremity of the pancreas, which communicates with the other pancreatic arteries. It alſo ſupplies the omentum with branches, termed *gaſtro-epiploicæ ſiniſtræ*; and then it communicates with the right gaſtrica; and from this union the gaſtro-epiploicæ mediæ are produced.

From this detail we learn, that the arteria coronaria ventriculi pylorica, inteſtinalis, both gaſtricæ, gaſtro-epiploicæ, and conſequently the hepatica, ſplenica, and meſenterica, communicate all together.

Afterwards the ſplenic artery advances towards the

 ſpleen,

ſpleen, in a courſe more or leſs contorted; but before it arrives at that viſcus, it gives two or three branches to the large extremity of the ſtomach, commonly called *vaſa brevia;* and one to the omentum, named *epiploica.*

At the ſpleen, this artery divides into four or five branches, which enters that viſcus, after having given ſome ſmall twigs to the neighbouring parts of the ſtomach and omentum.

Arteria meſenterica ſuperior. The ſuperior meſenteric artery ariſes anteriorly from the lower portion of the deſcending aorta, a very little way below the cæliaca, going out a little towards the right-hand, but bending immediately afterwards to the left.

Near its origin, it gives off a ſmall branch, which dividing into two, goes to the lower ſide of the head of the pancreas, and neighbouring part of the duodenum, communicating with the inteſtinalis by ſmall arches, and areolæ or maſhes.

Afterwards it paſſes over the duodenum, between this inteſtine and the meſeraic vein, between the two laminæ of the meſentery; and then bending in an oblique direction from left to right, and from above downward, by very ſmall degrees, it advances toward the extremity of the ilium. By this incurvation, it forms a kind of long arch, from the convex ſide of which a great many branches go out.

Theſe branches are ſixteen or eighteen in number, or thereabouts; and almoſt all of them are beſtowed on the ſmall inteſtines, from the lower third part of the duodenum to the cæcum and colon. The firſt branches are very ſhort; and from thence they increaſe gradually in length all the way to the middle of the arch; the reſt diminiſhing again by ſmall degrees.

As they approach the inteſtines, all theſe branches communicate, firſt by reciprocal arches, then by areolæ and maſhes of all kinds of figures; from which is detached an infinite number of ſmall ramifications, which

ſurfurround the inteftinal canal, like an annular piece of net-work.

Thefe arches and mafhes increafe in number proportionably to the length of the branches; and their fize diminifhes gradually as they approach the inteftines.

The firft branches from the convex fide of the mefenteric arch, which are very fhort, fupply the pancreas and mefocolon, and communicate with the duodenal artery. The laft branches go to the appendicula vermiformis, and fend a portion of an arch to the beginning of the colon.

The confiderable branches from the concave fide of the mefenteric arch are feldom above two or three in number; but before they arife, a fmall ramus goes out to the duodenum, and gives fome very fmall arteries to the pancreas.

The firft confiderable branch from the concave fide of the arch goes into the mefocolon towards the right portion of the colon, being firft divided into two rami; the firft of which runs along the whole fuperior part of the colon, where it forms the famous communication with the mefenterica inferior, and might be named *arteria colica fuperior*. The other ramus of this branch runs down on the right portion of the colon.

The fecond principal branch having run for fome fpace through the mefentery, divides into three rami; the firft of which goes to the lower part of the right portion of the colon, where it communicates with the fecond ramus of the firft branch; the fecond goes to the beginning of the colon, where it communicates with the firft and to the inteftinum cæcum.

The third ramus of this fecond branch having communicated with the fecond, gives fmall twigs to the cæcum, appendicula vermiformis, and extremity of the ileum. Afterwards it communicates with the extremity of the arch, or curve trunk of the fuperior mefenteric.

All thefe communications are by arches and mafhes, as in thofe branches that come from the convex fide of the arch; and it is to be obſerved in general, that all the branches of the meſenterica ſuperior are diſpoſed according to the folds of the meſentery and circumvolutions of the inteſtines; giving off branches, through their whole courſe, to the laminæ of the meſentery, its cellular ſubſtance, and to the meſenteric glands.

Arteria meſenterica inferior. The lower meſenteric artery goes out anteriorly from the aorta deſcendens inferior, about a finger's breadth or more above the bifurcation, and below the ſpermatic arteries; and having run about the length of an inch, or ſomething more, it is divided into three or four branches, which gradually ſeparate from each other.

The firſt or ſuperior branch, about an inch from its origin, divides into two rami; the firſt of which runs along the left portion of the colon, and forms the communication of the two meſenteric arteries already mentioned. It may be named *arteria colica ſiniſtra.* The ſecond ramus having communicated with the firſt, runs down upon the ſame portion of the colon.

The middle branch having run the ſame length with the firſt, divides into two rami; one of which paſſes upward on the extremity of the colon, communicating by arches with the ſecond ramus of the ſuperior branch; the other runs down on the extremity of the ſame inteſtine.

When there is another middle branch, it goes to the firſt part of the double curvature of the colon by a like diſtribution and communication from above downward.

The lower branch goes to the ſecond portion of the colon, or to both, when the ſecond middle branch is wanting, and ſends up a ramus, which communicates with the foregoing.

It ſends another conſiderable branch downward, called *arteria hæmorrhoidalis interna*, which runs down behind the inteſtinum rectum, to which it is diſtributed by by ſeveral ramifications; and it communicates with the arteriæ hypogaſtricæ.

Arteriæ renales. The renal arteries, called commonly *emulgents*, are ordinarily two in number, and go out laterally from the inferior deſcending aorta, immediately under the meſenterica ſuperior; one to the right hand, the other to the left. The right is ſituated more backward, and is longer than the left, becauſe of the vena cava, which lies on the right ſide between the aorta and the kidney.

They run commonly without diviſion, and almoſt horizontally to the kidneys, into the depreſſions of which they enter by ſeveral branches, which form arches in the inner ſubſtance of theſe viſcera.

From theſe arches, numerous ſmall rami go out toward the circumference or outer ſurface of the kidneys. Sometimes there is more than one artery on each ſide; ſometimes this augmentation is only on one ſide, and theſe ſupernumerary arteries come ſometimes immediately from the aorta, and enter at the upper or lower part of the kidneys.

Ordinarily, the right renal artery paſſes behind the vena cava and renal vein on the other ſide; and the left artery, firſt behind and then before the vein. Sometimes they ſend branches to the glandulæ renales, membrana adipoſa of the kidneys, and even to the diaphragm.

Arteriæ capſulares. The arteries of the renal glands, which may be termed *arteriæ capſulares*, ariſe ſometimes from the aorta above the arteria renalis, and give out the arteriæ adipoſæ, which go to the fat of the kidneys. Sometimes they come from the trunk of the cæliaca. The right capſular artery comes moſt commonly from the arteria renalis of the ſame ſide, near its origin; the left from the aorta above the renalis.

Arteriæ ſpermaticæ. The ſpermatic arteries are commonly two in number, ſometimes more. They are very ſmall; and go out anteriorly from the aorta deſcendens

ſcendens inferior, near each other, about a finger's breadth below the arteriæ renales, more or leſs, between the two meſentericæ, or between the renales and meſentericæ inferiores. Sometimes one is higher, or placed more laterally than the other.

They ſend off to the common membrane of the kidneys ſmall branches named *arteriæ adipoſæ;* and afterwards they run down upon the pſoas muſcles, on the foreſide of the ureters, between the two laminæ of the peritonæum.

They give ſeveral conſiderable branches to the peritonæum, chiefly to thoſe parts of it which are next the meſentery, and they communicate both with the meſentericæ and adipoſæ. They likewiſe ſend ſmall arteries to the ureters.

Afterwards they paſs, in men, through the tendinous openings of the abdominal muſcles in the vagina of the peritonæum, and are diſtributed to the teſticles and epidydimis, where they communicate with a branch of the iliaca externa.

In women, they do not go out of the abdomen, but are diſtributed to the ovaria and uterus, and communicate with branches of the hypogaſtrica, at the jagged extremities of the tubæ Fallopianæ.

Arteriæ lumbares. The lumbar arteries go out poſteriorly from the inferior deſcending aorta, in five or ſix pairs, or more, much in the ſame manner with the intercoſtals.

They may be divided into ſuperior and inferior. The ſuperior ſend ſmall branches to the neighbouring parts of the diaphragm and intercoſtal muſcles, and ſupply the place of ſemi-intercoſtal arteries. Sometimes thoſe pairs go out by a ſmall common trunk, and not ſeparately.

They are diſtributed on each ſide to the pſoas muſcles, to the quadrati lumborum, and to the oblique and tranſverſe muſcles of the abdomen; and by perforating the oblique muſcles, they become external hypogaſtric ar-

arteries. They go likewife to the vertebral mufcles, and to the bodies of the vertebræ, and enter the fpinal canal through the lateral notches, to go to the membranes, &c. forming rings much in the fame manner with the intercoftals; and they likewife give fmall twigs to the nerves.

Arteriæ facræ. The atteria facra media goes out commonly from the-back part of the inferior defcending aorta, at the bifurcation. Sometimes it arifes higher from the lumbares, and fometimes lower from the iliacæ. Sometimes there are two, three, or four, in number. The branches of this artery are ramified on the os facrum, and on the neighbouring parts of the peritonæum, inteftinum rectum, fat, &c.; and enter the canal of that bone through the anterior holes, being there diftributed toward each fide. They likewife fend fmall arteries to the large fafciculi of nerves which go out through the holes of the os facrum, and they penetrate the inner fubftance of that bone. "The os facrum has alfo branches fpread out upon its furface, and fome running through its anterior holes from the hypogaftric artery."

Arteriæ iliacæ. The inferior defcending aorta ends at the laft vertebra of the loins, and fometimes higher, in two large lateral branches, one on the right hand, the other on the left, called *arteriæ iliacæ;* each of which is a common trunk to two other arteries of the fame name. This bifurcation lies on the anterior and left fide of that of the vena cava.

The primitive iliac arteries divaricate gradually as they defcend, advancing obliquely toward the anterior and lower part of the offa ilium, without any confiderable ramification, for about the breadth of three fingers, except a few very fmall arteries that go to the os facrum; fome of which enter by the upper holes, and are diftributed like the arteriæ facræ, while others emerge again through the pofterior holes, and go to the neighbouring mufcles, &c. They likewife give fmall

arte-

arteries to the peritonæum, to the coats of the veins, and to the fat and ureters, behind which the iliac trunks paſs.

The right iliac trunk paſſes firſt on the foreſide of the origin of the left iliac vein, and runs down on the foreſide of the right vein, almoſt to the place where it goes out of the abdomen, its courſe being there directed more inwardly. The left trunk goes down likewiſe before the left vein, but lies a little toward the inſide as it leaves the abdomen.

About three fingers breadth from their origin, each iliac trunk is divided into two ſecondary arteries, one external, the other internal. The external artery has no particular name; the internal is termed *hypogaſtrica*, which often appears to be no more than a branch of the other, in adults; but in young children, and eſpecially in the fœtus, the hypogaſtric artery looks like the trunk, and the other like a branch.

The external iliacs on each ſide runs down on the iliac muſcle to the ligamentum Fallopii, under which it goes out of the abdomen. In this courſe, it gives off only a few ſmall arteries, to the peritonæum and other parts near it; but as it paſſes out of the abdomen under the ligament, it detaches two conſiderable branches, one internal, the other external.

The internal branch is named *arteria epigaſtrica*, and goes out anteriorly from the external iliaca. From thence it runs obliquely upward on the tendon of the tranſverſe muſcle toward the poſterior part of the rectus, which it reaches about two or three fingers breadth above the os pubis.

Afterwards the epigaſtric artery runs up along the poſterior or inner ſide of this muſcle, ſending ramifications to the tendons of the neighbouring muſcles, &c.; and then loſes itſelf by a true anaſtomoſis of ſeveral ramifications, with the mammaria interna. It likewiſe communicates with the inferior intercoſtals, which are ſpread on the abdomen.

It

It ſometimes gives out two particular branches, one of which, accompanied by a nerve, goes through the foramen ovale of the pelvis to the triceps muſcles, &c.; the other runs down to the teſticles along with the ſpermatic artery, and there communicates with it.

The external branch of the outer iliac goes off laterally from the outſide of that artery under the ligamentum Fallopii, and from thence to the internal labium of the os ilium, where it divides into two, and is ramified on the oblique and tranſverſe muſcles of the abdomen, communicating with the arteria lumbaris.

Beſides theſe two branches, the external iliaca gives off a ſmall ramus internally under the ligament, which runs to the vagina of the ſpermatic rope; and ſometimes another ſmall twig goes from the outſide to the os ilium.

The internal iliaca or hypogaſtrica, having run a little more than a finger's breadth inward and backward, bends by ſmall degrees obliquely forward, and toward the outſide; and, afterwards contracting in its dimenſions, it ends in the umbilical artery, which ought to be looked upon as a true continuation of the trunk of the hypogaſtrica.

This arteria umbilicalis aſcends on the ſide of the bladder, and having detached ſmall rami to that viſcus and to the neighbouring parts of the peritonæum, &c. it contracts, and in adults is quite cloſed up, above the middle of the bladder. It likewiſe gives branches to the uterus, and to the neighbouring parts in both ſexes. Afterwards it aſcends in form of a ligament to the umbilicus, where it joins the umbilical artery on the other ſide; its name being taken from its uſe in the fœtus.

From the convex ſide of the curvature of the hypogaſtric artery, four or five principal branches commonly go out very near each other. Sometimes they all ariſe ſeparately, ſometimes by ſmall common trunks, and what

what is the firſt branch in ſome ſubjects, is only a ramus of another principal branch in others; ſo much does the number, diſpoſition, origin, and diſtribution of theſe branches vary in different ſubjects. For this reaſon I think it proper to diſtinguiſh them by the following proper names: *iliaca minor*, *glutæa*, *ſciatica*, *pudica communis ſive pudica hypogaſtrica*, and *obturatrix*.

The iliaca minor, the moſt poſterior of theſe branches, and which is often no more than a ramus of the glutæa, paſſes between the laſt two lumbar nerves, and divides into two rami, one of which enters the canal of the os ſacrum through the loweſt large anterior holes; the other paſſes behind the muſculus pſoas, to which it gives twigs, and behind the crural nerve; being afterwards diſtributed to the iliac muſcle, and to the middle part of the inſide of the os ilium, penetrating into the ſubſtance of the bone, ſometimes by one hole, ſometimes by more.

The arteria glutæa is commonly very conſiderable, and ſometimes the largeſt of all the hypogaſtric branches. Near its beginning it ſometimes ſends out the iliaca minor, and ſometimes the ſmall ramus that goes from that artery to the os ſacrum and other parts fixed to that bone. Afterwards this artery goes out of the pelvis in company with the ſciatic nerve, through the upper part of the great ſinus of the os innominatum, below the muſculus pyriformis, and is diſtributed in a radiated manner to the glutæus maximus and medius.

In its paſſage, it gives ſome branches to the os ſacrum, os coccygis, muſculus pyriformis, the muſcles of the anus, and to the neighbouring parts of the inteſtinum rectum, forming a particular hæmorrhoidalis interna. It likewiſe ſends twigs to the bladder and parts near it; and detaches a pretty long branch which runs down with the ſciatic nerve.

The arteria ſciatica gives firſt of all, ſome branches to to the mufculus pyriformis, the quadrigemini, the os facrum, &c. and even to the inner fide of the os ifchium. It likewife detaches a branch which runs under the mufculus quadratus, to the articulation of the os femoris.

It paffes obliquely over the fciatic nerve; and as they both go through the great pofterior finus of the os ilium, it detaches fmall arteries, which are diftributed to the inner fubftance of that nerve. Afterwards it runs up in a radiated manner on the outfide of the os ilium, and is diftributed to the inner fubftance of that bone, and to the mufculi glutæi, efpecially to the medius and minimus.

The pudica communis, called commonly *pudica interna*, arifes fometimes by a trunk common to it and to the glutæa, and gives out two principal branches; the firft of which paffes through the great finus of the os ilium in company with the glutæa and fciatica, and then divides into two rami.

The firft ramus goes behind the fpine of the ifchium, between the two ligaments which lie between that bone and the os facrum; and runs on the infide of the tuberculum ifchii, all the way to the origin of the corpus cavernofum penis. There it divides into feveral arteries, one of which goes to the fphincter ani, under the name of *hæmorrhoidalis externa*.

The reft are diftributed to the neighbouring integuments, to the bulb of the urethra, and to the corpus cavernofum penis; but the laft of thefe arteries, or rather the extremity of this firft ramus, runs from behind forward, over the neck of the os femoris, and communicates with a branch of the artetia cruralis.

The fecond principal ramus, called commonly *arteria pudica externa*, runs between the bladder and inteftinum rectum, and is diftributed, in men, to the veficulæ feminales, neck of the bladder, proftate gland, and neighbouring parts of the rectum.

Afterwards it runs under the os pubis on the fide of a confiderable vein, which lies directly under the fymphyfis; and it runs along the penis between this vein and a nerve, being diftributed in its paffage to the corpus cavernofum, and communicating with the pudica minor, which comes from the cruralis.

This fecond branch of the pudica major goes off fometimes feparately from the hypogaftrica, efpecially in women; being diftributed to the lateral parts of the uterus, where it communicates with the fpermatic artery, near the jagged extremity of the tuba Fallopiana; and to the neighbouring parts of the vagina, &c.

The arteria obturatrix perforates the obturator mufcles, from whence it has its name, and goes out of the pelvis at the upper part of the ligament of the foramen ovale, having firft fent a fmall branch over the fymphyfis of the os ilium and os pubis, to the inguinal glands and integuments.

As it paffes by the mufcles, it divides and is diftributed to the pectineus and triceps. It likewife fends out another branch, which communicates with that branch of the fciatica that goes to the articulation of the os femoris, and gives fmall arteries to the holes of the neck of that bone.

Afterwards the hypogaftric artery ends in the umbilicalis, as has been already faid.

Arteriæ crurales. The iliac artery goes out of the abdomen between the ligamentum Fallopii and tendon of the pfoas, at the union of the os ilium and os pubis; and there it takes the name of *arteria cruralis.*

It fends off, firft of all, three fmall branches; one of which, called *pudica externa*, goes over the crural vein to the fkin and ligament of the penis, and to the inguinal glands, communicating with the pudica interna. The fecond goes to the mufculus pectineus; and the third to the upper part of the fartorius. All thefe branches furnifh likewife the neighbouring anterior integuments.

Afterwards the crural artery runs down on the head of the os femoris; and by taking a particular turn, gets on the inſide of the crural vein, about three fingers breadth from where it goes out of the abdomen. From its origin to this place, it is covered only by the ſkin and fat, and lies on the pectineus and triceps primus.

In changing its ſituation it ſends out three conſiderable branches, one external, one middle, and one internal. They all go out more or leſs poſteriorly, ſometimes by a ſhort common trunk, ſometimes by two, &c.

The external branch runs on the upper ſide of the thigh to the crureus, vaſtus externus, rectus anterior, muſculus faſciæ latæ, and glutæus medius; ſending up a ramus to the apex of the great trochanter, which communicates with the firſt principal ramus of the pudica major and ſciatica, as has been already ſaid.

The middle branch runs down on the inſide of the thigh between the triceps muſcles; to which it gives ſeveral rami, one whereof perforates the ſecond muſcle, and is diſtributed to the glutæus maximus, ſemi-nervoſus, ſemi-membranoſus, biceps, and to the neighbouring integuments.

The internal branch runs backward on the quadrigemini, towards the great trochanter; and having detached a ramus which goes into the joint of the os femoris, it runs downward, and gives rami to all the muſcles that lie on the backſide of that bone, one of which enters the bone itſelf on one ſide of the linea aſpera.

Having ſent off all theſe three branches, the arteria cruralis runs down between the ſartorius, vaſtus internus, and triceps, giving branches to all the parts near it. It is covered by the ſartorius all the way to the lower part of the thigh, where it is inflected backward over the triceps tertius, a little above the internal condyle of the os femoris. Afterwards continuing its courſe through the hollow of the ham, it is called *arteria poplitea*, being accompanied by the vein of the ſame name.

The poplitea, while in the ham, is covered only by the integument, ſending off branches toward each ſide, which run up upon the condyles, and communicate with the lower ramifications of the arteria cruralis.

It ſends rami to the joint of the knee, one of which at leaſt paſſes between the crucial ligaments. As it runs down, it ſends branches to the gaſtrocnemii and popliteus; and having reached the backſide of the head of the tibia, it gives off two branches, one to each ſide.

The firſt or internal branch ſurrounds the forepart of the head of the tibia, paſſing between the bone and internal lateral ligament; and, beſides ſeveral other ramifications, ſends up a ſmall branch which communicates with the arteries that lie round the condyles of the os femoris.

The ſecond or external branch runs over the head of the fibula, and between the head of the tibia and external lateral ligament of the knee, ſurrounding the articulation all the way to the ligaments of the patella, and communicating with the branches which lie round the condyles of the os femoris, together with a branch of the firſt or internal ramus.

Immediately after the origin of theſe two rami, and before the poplitea ends, it ſends a ſmall artery down on the backſide of the interoſſeous ligament, very near the tibia, into which it enters by a particular hole a little above the middle portion of the bone.

As the poplitea ends, it divides into two principal branches, one of which runs between the heads of the tibia and fibula, paſſing from behind forwards on the interoſſeous ligament, where it takes the name of *arteria tibialis anterior*. The ſecond branch divides into two others;

others; one internal and largeſt, called *arteria tibialis poſterior;* the other poſterior and ſmalleſt, named *arteria peronæa poſterior.*

The tibialis anterior having paſſed between the heads of the tibia and fibula, ſends ſmall branches upward and laterally. The ſuperior branches communicate with thoſe rami of the popliteus which lie round the articulation; and the lateral branches go to the neighbouring parts. Afterwards this tibial artery runs down on the foreſide of the interoſſeous ligament, toward the outſide of the tibia, between the muſculus tibialis anticus and extenſor pollicis.

Having run laterally on the tibia for about two-thirds of the length of that bone, it paſſes on the foreſide under the common annular ligament and extenſor pollicis, to the articulation of the foot; giving off ſeveral rami both to the right and left hand, which communicate laterally with the tibialis poſterior and peronæa poſterior, ſo that theſe two bones are in a manner ſurrounded by arteries.

At the joint of the foot, it ſends out branches which run between the aſtragalus and os calcis, being diſtributed to the articulation and to the bones of the tarſus. The communications are here very numerous on all ſides.

Having paſſed the fold of the foot, it ſends off toward both ſides other rami, which communicate with the poſterior tibialis and peronæa; all theſe branches making a kind of circles round the tarſus.

Afterwards the anterior tibial artery advances on the convex ſide of the foot, as far as the interſtice between the firſt and ſecond metatarſal bones; between the heads of which it ſends a large branch, which perforates the ſuperior interoſſeous muſcles, and, joining the tibialis poſterior, forms an arch on the ſide of the foot.

It likewiſe ſends two or three conſiderable branches over the other metatarſal bones, which go to the reſt of the interoſſeous muſcles, integuments, &c. and communicate with each other.

Laſtly, this artery terminates by two principal branches, one of which goes to the thenar and inſide of the great toe; the other is ſpent upon the outſide of the great toe, and the inſide of the ſecond toe.

The tibialis poſterior, called likewiſe *ſuralis*, runs down between the ſolei, tibialis poſticus, flexor digitorum communis, and flexor pollicis; giving branches to theſe muſcles, to the tibia, and to the marrow of that bone, through a particular canal in its poſterior and upper part.

Afterwards it runs behind the inner ankle, communicating with the tibialis anterior, and ſurrounded by the neighbouring veins; and paſſes to the ſole of the foot between the concave ſide of the os calcis and thenar muſcle, where it divides into two branches, one large or external, the other ſmall or internal.

The great branch, or arteria plantaris externa, paſſes on the concave ſide of the os calcis obliquely under the ſole of the foot, to the baſis of the fifth metatarſal bone, and from thence runs in a kind of arch toward the great toe, communicating there with the tibialis anterior, which perforates the interoſſeous muſcles in the manner already ſaid.

The convex ſide of this arch ſupplies both ſides of the laſt three toes, and the outſide of the ſecond toe, forming ſmall communicating arches at the end, and ſometimes at the middle of each toe, as in the hand. The concave ſide of the arch furniſhes the neighbouring parts.

The ſmall branch, or arteria plantaris interna, having reached beyond the middle of the ſole of the foot, is divided into two; one of which goes to the great toe, communicating with the ramus of the tibialis anterior; the other is diſtributed to the firſt phalanges of the other

toes,

toes, communicating with the ramifications from the arch already mentioned.

The arteria peronæa runs down on the backſide of the fibula, between the ſoleus and flexor pollicis, to which and to the neighbouring parts it gives rami in its paſſage.

Having reached to the lower third part of the fibula, it ſends off a conſiderable branch, which runs in between the tibia and that bone, paſſing between their extremities from behind forward, below the interoſſeous ligament, and is diſtributed to the integuments of the tarſus.

Laſtly, the peronæa continuing its courſe downward, on the backſide of the fibula, as far as the os calcis, forms an arch with the tibialis poſterior, between the aſtragalus and the tendo achillis.

From thence it runs outward, and a little above the outer ankle communicates with the tibialis anterior by an arch, which ſends ſeveral ſmall ramifications to the neighbouring parts.

In this deſcription of the arteries, I have ſaid nothing of the cutaneous anaſtomoſes, which are exceedingly beautiful in the fœtus; nor of the frequent and conſiſiderable communications of ſmall arteries upon the perioſteum, which form a delicate kind of net-work, or rete mirabile.

CHAP. II.

Of the VEINS *.

Introduction. THE blood diſtributed to all parts of the body by two kinds of arteries, the aorta and arteria pulmonaris, returns by three kinds of veins, called by anatomiſts *vena cava*, *vena portæ*, and *vena pulmonaris*.

The vena cava carries back to the right auricle of the heart, the blood conveyed by the aorta to all the parts of the body, except what goes by the arteriæ coronariæ cordis. It receives all this blood from the arterial ramifications in part directly, and in part indirectly.

The vena portæ receives the blood carried to the floating viſcera of the abdomen by the arteria cæliaca and the two meſentericæ; and conveys it to the vena hepatica, and from thence to the vena cava.

The vena pulmonaris conveys to the pulmonary ſinus, or left auricle of the heart, the blood carried to the lungs by the arteria pulmonaris.

To theſe three veins two others might be added, viz. thoſe which belong particularly to the heart, and to its auricles, and the ſinuſes of the dura mater.

In deſcribing the general courſe of the veins, we may either begin by their extremities in all the parts of the body,

* From WINSLOW, with Improvements.

body, and end by the trunks carried all the way to the heart, according to the courfe of the blood; or we may begin by the great trunks, and end by the ramifications and capillary extremities, according to their feveral divifions and fubdivifions.

"This laft method has been chofen by Winflow; and may be conveniently followed with regard to the great trunks. But in purfuing the rami and ramifications, the other method feems to be the moft natural, and is that to which the preference is given by the profeffor of anatomy in this univerfity. We fhall, therefore, in defcribing the branches, adopt the firft method, and, reverfing Winflow, trace them, according to the courfe of the blood, from their extremities to the trunks and heart."

General divifion of the vena cava. We commonly talk of the vena cava in general, as if it were but one vein at its origin, or had but one common trunk; whereas it goes out from the right auricle of the heart by two large feparate trunks, in a direction almoft perpendicularly oppofite to each other, one running upward, called *vena cava fuperior;* the other downward, called *vena cava inferior.*

It may, however, be faid, that thefe two veins have a fort of continuity, or a fmall portion of a common trunk, fixed to the edges of the right auricle; as if three quarters of the circumference of a large ftraight tube were cut off, and the edges of a fmall bladder applied to the edges of the opening thus made in the tube.

The right auricle may alfo be looked upon as a mufcular trunk common to thefe two large veins, and may be called the *finus* of the vena cava; but in this refpect, the name of *finus pulmonaris* agrees ftill better to the left auricle.

The vena cava fuperior is diftributed chiefly to the thorax, head, and upper extremities, and but very little to the parts below the diaphragm.

The vena cava inferior is diſtributed chiefly to the abdomen and lower extremities, and but very little to the parts above the diaphragm.

The ancients called the ſuperior vena cava, *aſcendens;* and the inferior, *deſcendens;* having regard only to the great tubes, and to their diviſion into trunks and branches. Several moderns have retained theſe names, but in a contrary ſignification, to accommodate them to the motion of the blood, which deſcends by the cava ſuperior, and aſcends by the cava inferior.

But, to ſhun the miſtakes that may happen in reports made of wounds or other diſeaſes, and of what is obſerved in opening dead bodies, and in other caſes of theſe kinds, it is beſt to retain the diſtinction of the vena cava ſuperior and inferior.

The trunk of each of theſe two veins ſends off, much in the ſame manner with the arteries, a certain number of principal or capital branches, which are afterward ramified in different manners. Each trunk terminates afterwards by a bifurcation or a diviſion into two ſubordinate trunks, each of which gives off other principal branches, ending in a great number of ſmall trunks, rami, and ramifications.

They have likewiſe this common to them with the arteries, that the greateſt part of the capital branches are in pairs; as well as the ſubordinate trunks. The ramifications of each ſubaltern trunk, taken by itſelf, are in uneven numbers; but they make even numbers, with thoſe of the other like trunk. The vena azygos and ſome other ſmall veins, of which hereafter, are exceptions from this rule.

Before I go on to the particular deſcription of each of theſe veins, many of which have proper names, I ſhall give a general idea of their diſtribution, and an enumeration of their principal ramifications, in the ſame manner as I did in the deſcription of the arteries, and for the ſame reaſon. But I ſhall ſay nothing of the venæ coronariæ cordis, becauſe they are not immediately joined

joined to any other vein, as we ſhall ſee in deſcribing the parts of the thorax. I begin by the vena cava ſuperior.

Vena cava ſuperior. The ſuperior vena cava runs up from the right auricle of the heart, almoſt in a direct courſe, for about two fingers breadth, lying within the pericardium, in the right ſide of the trunk of the aorta, but a little more anteriorly.

As it goes out of the pericardium, it is inclined a little to the left hand, and then runs up about an inch, that is, as high as the cartilage of the firſt true rib, and a little higher than the curvature of the aorta. At this place it terminates by a bifurcation or diviſion into two large branches or ſubordinate trunks, one of which runs toward the left hand, the other toward the right.

Theſe two branches are named *ſubclaviæ*, as lying behind, and, in ſome meaſure, under the claviculæ, both in the ſame manner. They are of unequal lengths, becauſe the trunk of the vena cava does not lie in the middle of the thorax, but toward the right ſide, where the left ſubclavian ariſes as well as the right, and is conſequently longeſt.

The trunk of the ſuperior cava, from where it leaves the pericardium to the bifurcation, ſends out anteriorly ſeveral ſmall branches, which ſometimes ariſe ſeparately, and ſometimes by ſmall common trunks. Theſe branches are the vena mediaſtina, pericardia, diaphragmatica ſuperior, thymica, mammaria interna, and trachealis; the laſt of which go out ſometimes behind the bifurcation.

All theſe ſmall branches from the trunk of the cava ſuperior are termed *dextræ;* and their fellows on the other ſide, called *ſiniſtræ*, do not ariſe from the trunk, becauſe of its lateral ſituation, but from the left ſubclavia.

Poſteriorly, a little above the pericardium, the trunk of the ſuperior cava ſends out a capital branch, called *vena azygos*, or *vena ſine pari*, which runs down on the right

right ſide of the bodies of the vertebræ dorſi, almoſt to the diaphragm; giving off the greateſt part of the venæ intercoſtales and lumbares ſuperioris.

The two ſubclaviæ run laterally or toward each ſide; and terminate, as they go out of the thorax, between the firſt rib and clavicula, immediately before the anterior inſertion of the muſculus ſcalenus.

The right ſubclavian, which is the ſhorteſt of the two, commonly ſends out four capital branches; the jugularis externa, jugularis interna, vertebralis, and axillaris; which laſt is rather a continuation than a branch of the ſubclavia.

The left ſubclavian being longer than the right, for the reaſon already given, gives off, firſt of all, the ſmall veins on the left ſide, anſwering thoſe on the right ſide that come from the trunk of the ſuperior cava, viz. the mediaſtina, pericardia diaphragmatica ſuperior, thymica, mammaria interna, and trachealis.

Next to theſe ſmall veins called *ſiniſtræ*, it detaches another ſmall branch called *intercoſtalis ſuperior ſiniſtra;* and then four large branches like thoſe from the right ſubclavian, viz. the jugularis externa, jugularis interna, vertebralis, and axillaris; which are all termed *ſiniſtræ*.

The external jugular veins are diſtributed chiefly to the outer parts of the throat, neck, and head; and ſend a ſmall vein to the arm, named *cephalica*, which aſſiſts in forming a large one of the ſame name.

The internal jugular veins go to the internal parts of the neck and head, communicating with the ſinuſes of the dura mater, and in ſeveral places with the external jugular veins.

The vertebral veins paſs through the holes in the tranſverſe apophyſes of the vertebræ of the neck, ſending branches to the neck and occiput. They form the ſinus venales of theſe vertebræ, and communicate with the ſinuſes of the dura mater.

The axillary veins are continuations of the ſubclaviæ, from

from where theſe leave the thorax to the axillæ. They produce the mammariæ internæ, thoracicæ, ſcapulares or humerales, and a branch to each arm; which, together with that from the external jugularis, forms the vena cephalica.

Afterwards the axillary vein terminates in the principal vein of the arm, called *baſilica*; which, together with the cephalica, is diſtributed by numerous ramifications to all the parts of the arm, fore-arm, and hand.

Vena cava inferior. The portion of the inferior vena cava, contained in the pericardium, is very ſmall, being ſcarcely the twelfth part of an inch on the fore-part, and not above a quarter of an inch on the back-part. From thence it immediately perforates the diaphragm, to which it gives the venæ diaphragmaticæ inferiores or phrenicæ.

It paſſes next behind the liver, through the great ſinus of that viſcus, to which it furniſhes ſeveral branches termed *venæ hepaticæ*.

In this courſe it inclines a little toward the ſpina dorſi and aorta inferior; the trunk and ramifications of which it afterwards accompanies in the abdomen, all the way to the os ſacrum; the arteria cæliaca and the two meſentericæ only excepted.

Thus the inferior cava ſends out on each ſide, in the ſame manner with the aorta, the venæ adipoſæ, renales, ſpermaticæ, lumbares, and ſacræ. Having reached to the os ſacrum, it loſes the name of cava; and terminating by a bifurcation, like that of the deſcending aorta, it forms the two venæ iliacæ.

Theſe iliac veins having given off the hypogaſtricæ, with all their ramifications, to the viſcera of the pelvis, and to ſome other external and internal neighbouring parts, go out of the abdomen, under the ligamentum Fallopii, and there take the name of *venæ crurales*.

Each crural vein ſends off numerous ramifications to all the lower extremity; beſides the vena ſaphena, which goes out near the origin of the cruralis, and, running

running along this whole extremity, detaches many ramifications all the way to the foot, as we ſhall ſee more particularly hereafter.

We ſhall now trace the veins in the courſe the blood takes to the heart.

§ 1. *Veins of the Head and Neck.*

Venæ jugulares externæ. Theſe are ſometimes double to their very terminations; and when they are ſingle, each of them is formed of two branches; one anterior, and the other poſterior or rather ſuperior. The anterior vein comes from the throat and face, running down toward the angle of the lower jaw, and the poſterior comes from the temples and occiput.

Each terminates at laſt into the ſubclavian on the ſame ſide, ſometimes into the axillaris, and ſometimes into the union of theſe two veins. The right and left do not always end in the ſame manner; for ſometimes the right goes into the ſubclavian, and the left into the internal jugular on the ſame ſide.

Vena jugularis externa anterior. This often terminates in the jugularis interna, and ſometimes in the communications of the two jugulares, in ſuch a manner as that it cannot be ſaid to belong more to the one than to the other. Sometimes, but very rarely, it runs into the vena axillaris.

They run down between the muſculus platyſma myoides and ſterno-maſtoidæus, being covered by the former, and croſſing over the latter.

The firſt branch comes along the muſculus corrugator ſupercilii and the upper part of the orbicularis, from the ſmall or external angle of the eye, after communicating with the vena temporalis, and with that vein which runs along the lower part of the orbicular muſcle, with which it forms a kind of circle.

The ſecond branch comes from the orbit in a winding courſe, on one ſide of the cartilaginous pulley, communicating with the vein of the eye.

The

The third branch is formed of branches from each fide, and runs down upon the forehead, by the name of *vena frontalis*, anciently *præparata*, communicating with its fellow, when any fuch vein is found.

The fourth comes from the root of the nofe; and communicating with its fellow from the other fide, receives feveral fmall veins from the holes of the offa nafi.

At the great or inner angle of the eye, thefe branches unite to form a trunk, called *vena angularis;* which, running down near the fide of the nofe, receives a branch from the internal nares, and another which afcends in a winding courfe from the upper-lip.

Afterwards the vena angularis runs down upon the face in a winding manner, receiving branches on each fide from the mufcles and integuments. It paffes next over the lower jaw near the angle of that bone, and forms the anterior external jugular vein.

While this vein lies upon the face, the branches running into it communicate with each other, efpecially one which paffes under the zygoma, behind the os malæ, from the inferior orbitary or fpheno-maxillary fiffure; and another fmall branch, which runs along the inferior portion of the orbitary mufcle, from the fmall or external angle of the eye, where it communicates with the rami temporales and frontales.

It runs down from the lateral part of the lower jaw, between the angle and the chin, like a vena maxillaris; and receives feveral branches forwards, backwards, and inwards.

Interiorly, at the fame place, it receives a large branch, which comes from the glandulæ fublinguales, runs up toward the cornua of the os hyoides, to communicate with fome branches of the jugularis interna, and receives feveral rami from the tongue, called *venæ raninæ.* It receives likewife a fmall branch from the mufculus depreffor anguli oris, the commiffure of the lips, and the neighbouring parts.

The fame branch which receives the venæ raninæ takes

takes in another from the lateral parts of the ſeptum palati, the amygdalæ, and the uvula, and receives rami forward from the membrane which lines the arch of the palate. Another branch comes into it from the pterygoidæus internus, and muſcles about the palatum molle.

It is here to be obſerved, that, under the angle of the lower jaw, there is a great variety of communications between the external and internal jugular veins, and alſo a great variety in the diſtribution of theſe veins.

Almoſt all the ramifications, which at this place go into the external jugular vein, from the upper part of the throat and face in ſome ſubjects, terminate in other ſubjects in the internal jugular; and ſometimes, one part of them goes to the external jugular, the reſt into the internal.

The trunk of the vein, after receiving theſe branches, admits another large branch anteriorly from the ſymphyſis of the lower jaw, from the maxillary glands, the digaſtric muſcle, the chin and under-lip.

Oppoſite to the cartilago thyroides, it receives a tranſverſe branch, which runs on the anterior or lower part of the muſculi ſterno-maſtoidæi, and communicates with the jugularis of the other ſide, though not always by a vein of the ſame kind.

The ſuperior and inferior tranſverſe branches communicate on each ſide by branches more or leſs perpendicular, and receive a ſmall branch from the muſculus depreſſor labii inferioris and platyſma myoides, and integuments.

Anteriorly, it receives ſeveral branches from the muſcles of the larynx, ſterno-hyoidæi, thyro-hyoidæi, and from the integuments; and below the larynx it receives communicating branches from the jugularis externa anterior of the other ſide.

Poſteriorly, it receives, 1. A large branch on the ſide of the upper part of the larynx, which communicates with the jugularis interna; and likewiſe with a large

large ſhort branch of the jugularis externa poſterior; of which below. 2. A ſmall branch, which has the ſame communication, but which is not always to be found. 3. Another ſmall branch a little below the lower jaw, which communicates with the jugularis externa poſterior.

Vena jugularis externa poſterior, ſive ſuperior. The poſterior or ſuperior external jugular vein runs down from the ſide of the head, &c. receiving conſiderable branches from neighbouring parts.

This vein is at firſt formed by a branch called *vena temporalis*, which receives the blood from the temples and lateral parts of the head, likewiſe from ſome part of the occiput and forehead. Sometimes the temporal vein has two inſertions, whereof one is into the jugularis interna.

The temporal vein of one ſide communicates above, with its fellow on the other ſide; before, with the vena frontalis; and behind, with the vena occipitalis. Oppoſite to the ear, it receives a large branch; one ramus of which runs under the lower edge of the zygoma, and then returning, communicates with another ramus from the ſame jugularis, a little below the condyle of the lower jaw, forming a kind of areola of a roundiſh form.

Behind this condyle, it receives branches from the temporal muſcle, from the neighbouring parts of the upper jaw, and from the inſide of the lower jaw, almoſt in the ſame manner as the arteries are ſent out.

Only one of theſe branches comes from the muſculus temporalis and pterygoidæi; communicating with a branch from the maſſeter, in its paſſage.

Having reached as far as the parotid gland, it paſſes through it, receiving a large branch, which communicates with another branch common to the internal and anterior external jugular veins; it forms communications with the anterior external jugular under the angle of the lower jaw.

Sometimes there are ſeveral branches; which having run

run a very little way, unite together, and repreſent the ſhort large branch, forming areolæ or meſhes, through which the nerves paſs.

Backward it receives the vena occipitalis, which comes from the different parts of the occiput, and ſometimes runs into the vena vertebralis or axillaris, &c. It likewiſe receives a ſmall vein, which comes out of the cranium by the poſterior maſtoide hole from one of the lateral ſinuſes. This branch goes ſometimes into another vein.

At the lower part of the neck it receives the vena cervicalis, which comes from the vertebral muſcles of the neck. This vein communicates with the humeralis by ſeveral areolæ, or venal meſhes; and they are both ramified in different manners.

Theſe ramifications and communications are in part covered by the muſculus trapezius, and communicate likewiſe with ſome branches of the vena occipitalis, and with a branch of the ſuperior intercoſtal vein, which perforates the firſt intercoſtal muſcle.

At its termination, it receives, poſteriorly, a principal branch from the muſcles which cover the ſcapula and joint of the humerus, commonly called *vena muſcularis*, and which might be named *ſuperhumeralis*.

Vena jugularis interna. The internal jugular vein is the largeſt of all thoſe that come from the head; tho' not ſo large as it ſeems to be when injected.

It is a continuation of the lateral ſinus, which, after getting through the foramen lacerum of the baſis crani, bends a little, and forms a ſort of varix, which fills a thimble-like cavity in the temporal bone. From this it runs along the ſides of the vertebræ of the neck, by the edges of the longus colli, and paſſes behind the ſterno maſtoidæus and omo-hyoidæus, which it croſſes, and ends in the ſubclavian vein. At the top of the neck it receives ſmall twigs from the pharynx and neighbouring muſcles.

Farther down it receives another branch backward, which comes from the occiput. This branch communicates with another of the vertebralis, and, through the poſterior maſtoide hole, with the lateral ſinus of the dura mater. This communication is ſometimes by an anaſtomoſis with a branch of the external jugular, or of the cervicalis.

Nearly oppoſite to the os hyoides, the internal jugular receives another branch, which comes from the parotid gland and angle of the lower jaw, where it communicates by other branches with the two external jugulars. This firſt branch receives others from the muſcles of the os hyoides and neighbouring parts.

About two fingers breadth lower than the former, it receives a middle-ſized branch, which comes laterally from the larynx, and may be named *vena gutturalis*.

This guttural vein is formed chiefly of three branches; the loweſt of which comes from the thyroide gland and neighbouring muſcles; the middle branch from the larynx, muſculi thyroidæi, &c; and the third comes downward from the great communication between the two jugulares already mentioned. In this, however, there is ſome variety; and I have ſeen the left guttural vein go into the axillaris.

The laſt branches which it receives are ſmall, and come from the thyroide glands.

Vena vertebralis. The vertebral vein accompanies the artery of the ſame name, ſometimes in one trunk, ſometimes in ſeveral ſtems, through all the holes of the tranſverſe apophyſes of the vertebræ colli, all the way from the great foramen occipitale, communicating with the occipital veins and ſmall occipital ſinuſes of the dura mater.

At the top of the neck it receives a branch, which comes through the poſterior condyloide hole of the os occipitis from the lateral ſinus of the dura mater; but it is not always to be met with.

As this vein runs through the holes in the tranſverſe apophyſes, it receives branches forward from the anterior muſcles of the neck, and from the ſmall anterior muſcles of the head.

Other branches come likewiſe from the muſculi tranſverſales and vertebralis colli at the back part of the neck.

It receives alſo the veins from the vertebral ſinuſes, which are pretty numerous, and placed one above another all the way to the occiput, communicating freely with each other and with thoſe on the oppoſite ſide; and at the great foramen of the os occipitis there is a communication between them and the occipital ſinuſes of the dura mater.

About the third or fourth vertebra of the neck, the vertebral vein ſends off a branch, which paſſes out between the vertebræ, and carries down part of the blood from the neck: this communicates again with the trunk of the vertebral vein, or with the ſubclavian.

The trunk of the vein afterwards runs down through the holes in the tranſverſe proceſſes of the vertebræ colli, receiving branches in its paſſage from the neighbouring muſcles. At the under part of the neck it leaves the vertebræ, and ends in the upper and back part of the ſubclavian vein.

§ 2. *Veins of the Superior Extremities.*

The veins of the extremities run in two ſets, one following the arteries, the other running immediately under the ſkin; we ſhall trace them from their origins to their terminations in the ſubclavian vein.

In general, the external or ſuperficial veins of the fore-arm are larger than the internal; but they are accompanied only by ſmall arteries, whereas the deep veins accompany large arteries.

Vena baſilica. This vein takes its origin by ſeveral branches which come from the convex ſide of the carpus; one of which, named by the ancients *ſalvatella*, comes

comes from the ſide of the little finger next the ring-finger, having firſt communicated with the cephalica, by means of the venal areolæ conſpicuous on the back of the hand. In the other fingers this vein follows nearly the ſame courſe with the artery.

After receiving theſe branches, it runs along the ulna, between the integuments and muſcles, a little towards the outſide, by the name of *cubitalis externa*, communicating with the veins called *profunda*, *ſatellites*, and *cephalica*. Near the inner condyle, it receives a branch which runs up along the inſide of the fore-arm, near the ulna, communicating with the mediana major. Having reached the inner condyle, it receives a vein called *mediana baſilica*, which opens into it obliquely.

Afterwards the baſilica runs up along the inſide of the os humeri, between the muſcles and integuments, forming many communications with the vena profunda, ſatellites, and cephalica, and ſupplying the muſcles and integuments.

Below the neck of the os humeri, near the hollow of the axilla, the baſilica receives two or three conſiderable veins which come up from the ſides of the brachial artery.

Theſe veins, which often terminate in the profunda ſuperior, communicate with the baſilica and cephalica. They follow the courſe of the trunks of the arteries, and have the ſame names. At that part of the elbow where the artery divides they unite, but afterwards ſeparate and reunite ſeveral times, ſurrounding the trunk of the brachial artery at different diſtances, and communicating freely with each other. Theſe veins might be called *venæ ſatellites arteriæ brachialis*.

Behind the tendon of the pectoralis major, the baſilica receives a conſiderable branch, which runs up in company with the trunk of the brachial artery from the neighbouring muſcles on both ſides. This vein is named *profunda brachii*, or *profunda ſuperior*.

It receives at laſt, under the head of the os humeri, a pretty large branch, which paffes almoft tranfverfely round the neck of that bone, from behind inward, and from within foreward, coming from the mufcles on the outfide of the fcapula, particularly the deltoides, and communicates with the venæ fcapularis externæ. This branch may be named *vena fub-humeralis*, or *articularis*, as the artery which lies in the fame place; they both having much the fame courfe.

This articular vein receives two principal branches; one of which runs along the infide of the bone, from which, and from the periofteum, it gets fmall veins. The other lies at the middle of the arm, between the bone and the biceps, and communicates with the cephalica.

The bafilic vein having reached the fide of the head of the os humeri, terminates in the trunk of the vena axillaris, which may be confidered as a continuation of it.

The ancients termed the bafilic vein of the right arm the *vein of the liver*, or *vena hepatica brachii*; and that of the left arm, the *vein of the fpleen*, or *vena fplenica brachii*. It has fometimes a double termination, by a branch of communication with the trunk of the axillaris.

Vena cephalica. The vena cephalica receives, at the extremity of the radius, branches which correfpond with thofe of the radial artery. Thefe branches form numerous areolæ, which communicate freely with each other.

A particular branch comes into it, which runs more or lefs fuperficially between the thumb and metacarpus, by the name of *cephalica pollicis*. The areolæ receive branches from the interoffeous mufcles and integuments, and communicate with the vena falvatella.

From the under part of the fore-arm the trunk of the vein runs along the radius between the mufcles and integuments, receiving branches from both fides, which communicate with other branches of the fame vein, and

and with ſome of the baſilica, forming areolæ much in the ſame manner as we ſhall afterwards find the ſaphena does in the lower extremity. That part of the vein which lies on the fore-arm may be looked upon as a radialis externa.

Having reached a little above the fold of the arm, it receives a large branch, which may be called *mediana cephalica*. This comes up obliquely from the middle of the fold of the arm, under the integuments, and over the tendon of the biceps, where it joins the mediana baſilica. Theſe two medianæ are ſent off in an angle, the apex of which is turned downward. The mediana cephalica ſometimes receives a long branch called *radialis interna*, which lies almoſt parallel to the radialis externa.

The two median veins are ſent off from a trunk which may be called *mediana major*, or *longa*, to diſtinguiſh it from the other two. This trunk runs up from the fore-arm between the cephalic and baſilic veins, communicating with both in its paſſage by many branches. At the part where it ſplits into the two branches already named, a branch opens into it called *vena cubiti profunda*. This comes from the neigbouring muſcles, after having communicated with the other veins of the fore-arm.

A little below the external condyle of the os humeri, it receives a branch from behind, which comes down between the muſculus brachialis and the upper portion of the ſupinator longus, after bending between the os humeri and anconæus externus, and communicating with ſome branches of the baſilica.

The cephalica runs next up along the outer edge of the external portion of the biceps; communicating ſeveral times with the vena baſilica, and receiving ſmall rami on each ſide, from the neighbouring muſcles, fat, and ſkin. Some branches go into its upper part, which lower down were ſent off from its trunk.

It runs afterwards between the deltoid and large pectoral mufcles, communicating in its paffage with a branch called *fmall cephalic*, and terminates in the vena axillaris.

Vena axillaris. This vein, formed by all the veins from the arm, receives, above the axilla, the venæ thoracicæ; one of which is fuperior, called alfo *mammaria externa;* and the other inferior. It likewife receives rami from the mufculus fubfcapularis, teres major, teres minor, fupra-fpinatus, latiffimus dorfi, ferratus major, pectoralis minor, pectoralis major, and from the glands of the axilla; and fometimes communicates by a fmall branch with the vena bafilica.

The axillary vein, having received the branches already defcribed, paffes before the anterior portion of the mufculus fcalenus, and between the firft rib and the clavicle, where it gets the name of *fubclaviana.* This receives the branches already defcribed, from the head, neck, and upper part of the thorax; and at laft meets with its fellow on the oppofite fide, to form the vena cava fuperior.

The laft veins which it receives are the mufculares, which come from the middle portion of the mufculus trapezius, from the angularis, infra-fpinatus, and fubfcapularis; and as fome of thefe branches come from the fhoulder exteriorly, others interiorly, the venæ fcapulares are diftinguifhed into external and internal.

§ 3. *Veins of the Thorax.*

Venæ pectorales internæ. The pectorales internæ, are fmall veins difpofed in pairs toward the right and left fide, behind the fternum and parts near it, including the diaphragmaticæ fuperiores, or pericardia diaphragmaticæ, mediaftinæ, mammariæ internæ, thymicæ, pericardiæ, and gutturales or tracheales.

All thefe fmall veins are divided into right and left; and thefe are both diftributed much in the fame manner; but they differ in their terminations, be-

becauſe of the inequality in the bifurcation of the cava ſuperior.

The right vena mediaſtina opens anteriorly into the trunk of the ſuperior cava, a little above the termination of the azygos; the left goes into the ſubclavian.

The right ſuperior diaphragmatica, or pericardio-diaphragmatica, goes anteriorly to the union of the two ſubclavian veins, or beginning of the ſuperior cava; and is formed by ſeveral branches from the upper, fore, and back parts of the pericardium, communicating with thoſe of the left diaphragmatica, and accompanying the nerve of the ſame name. The left ſuperior diaphragmatica goes into the left ſubclavian a little below the termination of the mammaria.

The right internal mammaria ariſes from the lower and fore part of the thorax, behind the upper end of the recti muſcles of the abdomen; here it communicates with the epigaſtric vein by ſeveral ſmall branches. It paſſes afterwards into the thorax under the cartilage of the laſt true rib, and receives ſmall branches from the mediaſtinum, while others come from the teguments through between the ribs. At the upper ſurface of the diaphragm it receives a branch which communicates with the diaphragmatic veins. The trunk thus formed, runs up within the thorax, behind the cartilages of the ribs near the edge of the ſternum, and in company with the artery of the ſame name; and terminates at laſt in the beginning of the vena cava ſuperior, but frequently in the ſubclavian vein.

The left internal mammaria terminates anteriorly in the left ſubclavian, oppoſite to the cartilage or anterior extremity of the firſt true rib.

The right vena thymica, when it terminates ſeparately, goes into the union of the two ſubclaviæ; and when it is wanting, the thymus, from whence it takes its name, ſends branches to the gutturalis or ſome other neighbouring vein. The left vein of the ſame name goes to the left ſubclavian, almoſt oppoſite to the ſternum.

The right pericardia ſeems to go rather into the termination of the right ſubclavian, than to the trunk of the ſuperior cava; but in this there are many varieties. It comes from the upper ſide of the pericardium, and other neighbouring parts. The left pericardia comes ſometimes into the left ſubclavian, before the mammaria; and ſometimes into the mammaria or diaphragmatica ſuperior on the ſame ſide.

The right gutturalis or trachealis goes into the upper part of the union of the ſubclaviæ, above the mammaria of the ſame ſide, ſometimes more backward, and ſometimes into the ſubclavia. It comes from the glandulæ thyroidææ, trachea arteria, muſculi ſterno-hyoidæi, thymus, and glandulæ bronchiales. It communicates by lateral branches, more or leſs contorted, with the internal jugular vein; and ſometimes, by another branch, with a ſmall vein, which the internal jugular receives from the glandula thyroides. The left gutturalis goes into the upper or poſterior part of the left ſubclavian near its termination.

The ſmalleſt internal pectoral veins do not always terminate ſeparately, but have ſometimes a ſmall common trunk, eſpecially on the right ſide; and of all theſe ſmall veins, the mammaria interna is the moſt conſiderable.

Vena azygos, and venæ intercoſtales. The vena azygos, or ſine pari, is very conſiderable, and ariſes from the lower and left ſide of the thorax internally.

For at the back part of the diaphragm, it communicates, by a very ſenſible anaſtomoſis, ſometimes with the vena renalis, ſometimes with a neighbouring lumbar vein, ſometimes immediately with the trunk of the cava inferior, and ſometimes otherwiſe.

I have ſeen this vein extremely large, reſembling the trunk of the inferior cava, from the diaphragm to the origin of the renales; the true cava being through all this

this ſpace very narrow, or of the ſize of an ordinary azygos.

From thence it runs acroſs the ſpine, and afterwards aſcends on the right ſide of the vertebræ dorſi and aorta, and before the intercoſtal arteries.

At the top of the thorax it is bent forward over the origin of the right lung; forming an arch which ſurrounds the great pulmonary veſſels on that ſide, as the arch of the aorta does thoſe of the left ſide, with this difference only, that the curvature of the azygos is almoſt directly forward, whereas that of the aorta is oblique. It opens poſteriorly, a little above the pericardium into the top of the ſuperior cava.

The azygos is formed at firſt of the left intercoſtal veins, but ſeldom the whole number; for the ſuperior veins go often into the left ſubclavian, by a vein ſomewhat ſimilar to the azygos, but much ſmaller. The inferior intercoſtal veins, to the number of ſix or ſeven, ſometimes more, ſometimes fewer, go commonly into the trunk of the azygos, which runs between the aorta and vertebræ, from the ſubſtance of which, and from the œſogus, it receives capillary twigs, as it paſſes to the right ſide of the thorax.

The trunk of the azygos is in ſome ſubjects bifurcated upward and downward, as it receives the left intercoſtals; and in others there are two ſmall trunks.

There is ſometimes an entire azygos on the left ſide, which, after being diſtributed in the ſame manner, opens into the ordinary azygos.

The azygos at the under part of the thorax receives a large branch, which perforates the muſcles of the abdomen, after having been ramified between their different planes, and communicating with the like ramifications of the laſt or laſt two intercoſtal veins.

Sometimes it takes in the vena diaphragmatica inferior, and alſo a branch formed by the firſt venæ lumbares dextræ.

Theſe communications between the laſt intercoſtal and

and firft lumbar veins are very irregular, being fometimes by a feries of oppofite angles, fometimes by areolæ, fometimes by a reticular texture, &c. Sometimes the extremity of the vena azygos communicates either mediately or immediately with the vena adipofa, and even with the vena fpermatica.

As the azygos runs up in the right fide of the thorax, it receives the inferior intercoftal veins on that fide, one coming from each feries of intercoftal mufcles. Thefe veins run along the lower edges of the ribs, after having perforated the mufcles by branches which come from the pofterior and external part of the thorax.

They communicate with the venæ thoracicæ, and moft commonly with the mammaria interna; and laftly, more or lefs with each other, by perpendicular branches, near the pofterior extremities of the ribs.

Afterwards the azygos admits into the extremity of the arch which it forms before it terminates, a trunk common to two or three fmall veins, called *intercoftales fuperiores dextræ*, which bring back the blood from the firft three feries of intercoftal mufcles, and from the neighbouring part of the pleura.

Thefe intercoftal veins communicate with other branches which come through the intercoftal mufcles from the ferratus fuperior pofticus, ferratus major, &c. and they run along the interftices between the ribs, communicating with the venæ mammariæ.

They likewife take in branches from the vertebral mufcles and canal of the fpine, where they communicate with the venal circles or finufes, which bring back the blood from the medulla fpinalis.

Laftly, the vena azygos receives two or three fmall veins into the top of the arch, one of which comes from the afpera arteria; the others partly from the afpera arteria, and partly from the bronchia, by the name of *venæ bronchiales*, accompanying the ramifications of the bronchial

chial artery. It opens at laſt into the back part of the ſuperior cava, a little above the pericardium.

Vena ſubclaviana. The ſubclavian vein is formed chiefly by veins from the head, neck, and arms. It paſſes over the inſertion of the anterior ſcalenus muſcle, between the clavicle and firſt rib.

The right ſubclavian, which is the ſhorteſt of the two, commonly receives four capital branches, viz. the jugularis externa, jugularis interna, vertebralis, and axillaris, of which laſt the ſubclavian may be looked upon as a continuation.

The left ſubclavian being longer than the right, becauſe the vena cava, into which both open, lies in the right ſide of the thorax, receives firſt the four capital branches, correſponding with thoſe already mentioned, as going into the right ſubclavian. Next to theſe, it receives a vein, ſomewhat ſimilar to the vena azygos, called *intercoſtalis ſuperior*, which is formed of branches coming ſometimes from five or ſix of the ſuperior intercoſtal muſcles, &c. theſe communicate with the other intercoſtals. The intercoſtalis ſuperior receives the left bronchial vein. It receives alſo the ſmall veins correſponding with thoſe of the right ſide, going into the trunk of the ſuperior cava, viz. the mediaſtina, pericardia, diaphragmatica ſuperior, thymica, mammaria interna, and trachealis. And beſides all theſe, it receives the termination of the thoracic duct, to be afterwards deſcribed.

After admitting the branches mentioned above, the two venæ ſubclavianæ unite at the upper end of the thorax, near the cartilage of the firſt rib, and form the vena cava ſuperior, which runs down about an inch, ſomewhat inclining to the right ſide; at this part it enters the pericardium, and deſcends about two fingers breadth in an ordinary ſized perſon, being ſituated on the right ſide of the aorta, but a little more anteriorly. It opens at laſt in the upper part of the right auricle.

§ 4. *Veins*

§ 4. *Veins of the Chylopoietic and aſſiſtant Chylopoietic Viſcera.*

Vena meſaraica minor, or hæmorrhoidalis interna. The blood ſent out by the cæliac and two meſenteric arteries is returned by veins, which, as in other parts of the body, are much larger than the arteries.

A branch runs up from the rectum and left portion of the colon. The beginning of this branch communicates with other hæmorrhoidal veins at the end of the rectum. The beginning of this vein, like the ends of the arteries, forms numerous ramifications which ſurround the inteſtines. The left ſpermatic vein ſeems to communicate with ſome of the branches which form the trunk.

This vein has been named *hæmorrhoidalis*, from the tumours called *hæmorrhoides*, which are often found at its beginning next the anus. The word *interna* is added to diſtinguiſh this vein from the hæmorrhoidalis externa, which comes from the vena hypogaſtrica, and with which this vein communicates by capillary ramifications. The name of *meſaraica minor* agrees to it very well, becauſe of its ſituation with reſpect to the inferior meſenteric artery, which is alſo leſs than the ſuperior.

After returning the blood from the parts already mentioned, it unites with a branch coming down from the left part of the arch of the colon, where, after many ramifications, it communicates with a branch of the great meſaraica, with the ramifications of the gaſtro-epiploica ſiniſtra, and with thoſe of the neighbouring epiploica.

At a ſmall diſtance from its termination, it receives from the duodenum a vena duodenalis, which is ſometimes more conſiderable than one which comes from the great trunk of the vena portæ.

The internal hæmorrhoidal vein is one of the three great branches of the vena portæ, opening ordinarily into

into the termination of the vena ſplenica, and ſometimes into the beginning of the great trunk of the vena portæ.

Vena ſplenica. The ſplenic vein is one of the three great branches of the vena portæ, and may be ſaid in ſome meaſure to be a ſubordinate trunk of that vein. It runs tranſverſely from the left to the right ſide, firſt along the lower ſide of the pancreas, near the poſterior edge, and then under the duodenum.

In this courſe it receives ſeveral veins, viz. the vena coronaria ventriculi, pancreaticæ, gaſtrica, or gaſtro-epiploica ſiniſtra, and epiploica ſiniſtra. It likewiſe often receives the hæmorrhoidalis interna, the third capital branch of the vena portæ.

The vena ſplenica begins by branches which run in a winding courſe, after having run through the whole length of the ſpleen, almoſt in the ſame manner as the ſplenic artery. It is into the moſt poſterior of theſe branches that the veins are received from the great extremity of the ſtomach, formerly known by the name of *vaſa brevia*, which communicate with the coronaria ventriculi and gaſtrica ſiniſtra.

In its paſſage it receives, at the ſmall extremity of the pancreas, a vein called *epiploica ſiniſtra*, becauſe it comes from the left ſide of the omentum, where it communicates with the hæmorrhoidalis interna. When this vein is wanting, the branch of the left gaſtrica, to be afterwards mentioned, ſupplies its place. It ſometimes goes to the moſt anterior branch, which the ſplenica receives from the ſpleen.

The left gaſtric or gaſtro-epiploic vein, coming from the convex ſide of the great extremity of the ſtomach, goes into the ſplenica at the left extremity of the pancreas.

In its paſſage, it receives ſeveral branches from both ſides of the ſtomach, which are diſtributed by numerous ramifications, form many areolæ, and communicate

municate with the branches of the coronaria ventriculi.

The venæ pancreaticæ are ſeveral ſmall branches ſent into the ſplenica from the under edge of the pancreas. There are other ſmall pancreatic veins which do not open into the ſplenica, as will be found in the deſcription of the gaſtro-colica, one of the branches of the great meſaraic trunk.

The coronaria ventriculi, ſo called becauſe it ſurrounds more or leſs the upper orifice of the ſtomach, runs along the ſmall arch of that viſcus from the pylorus, where it joins and becomes continuous with the vena pylorica. In its paſſage, it receives ſeveral rami from the ſides of the ſtomach, which there form numerous areolæ, and communicate with the veins of the great arch.

It terminates pretty often in the beginning of the ſplenica, and ſometimes in the left ſide of the beginning of the great trunk of the vena portæ, behind the hepatic artery; and in that caſe it is the moſt conſiderable of all the ſmall veins that go into the great trunk.

Vena meſaraica major. The blood is returned from moſt of the branches of the ſuperior meſenteric artery by a vein called *meſaraica* or *meſaraica major*. Into the concave ſide of the meſaraic vein, a branch paſſes called by Riolan *vena cæcalis*, which runs from the beginning of the colon, croſſing one of the branches of the ſuperior meſenteric artery.

This cæcal vein is formed by two arches, the uppermoſt of which communicates with the lower branch of the vena gaſtro-colica; the other receives ramifications from the inteſtinum cæcum and appendicula vermiformis, and communicates below with other branches of the great meſaraic vein.

Afterwards the trunk of the meſaraica paſſes over the ſuperior meſenteric artery, to which it adheres very cloſely, and into the convex ſide of its arch receives ſeveral branches almoſt in the ſame manner with the artery; but with this difference, that frequently the branches do not end immediately in the vein in ſo great numbers; and each of them is formed by many more ramifications.

The trunk of the great meſaraic vein receives ſometimes oppoſite to the gaſtrica, a particular branch from the omentum, called *epiploica dextra*. But almoſt immediately before it deſcends over the meſenteric artery, it gets the addition of two large branches very near each other, which paſs behind and under the artery, coming from the jejunum and part of the ilium by numerous ramifications, which form arches and areolæ like thoſe of the artery.

The trunk of the great meſaraic vein running farther, receives a vein which may be called *gaſtro-colica*; this is formed of two branches, one ſuperior, the other inferior.

The ſuperior branch of the vena gaſtro-colica receives the gaſtrica, or gaſtro-epiploica dextra, which comes from the great curvature of the ſtomach, communicating with the gaſtrica ſiniſtra. It alſo admits ſmall veins from the head of the pancreas. In it's paſſage it gets likewiſe branches from the ſtomach and omentum, and communicates with the pylorica, coronaria ventriculi, &c. and ſometimes it forms the pylorica.

The inferior branch of the vena gaſtro-colica, which may be called *colica dextra*, comes from the upper part of the colon, and then from the right portion of that inteſtine, where it is divided archwiſe, and communicates with the great branch of the colica anterior, and with a branch of the vena cæcalis, as we ſhall ſee hereafter.

The laſt particular branch running into this trunk is called by Riolan *vena colica*. It opens into the anterior part of the trunk, before it joins the artery, and comes directly from the middle of the colon; and here it is formed

formed of branches from the right and left, which communicate with others by arches. On the left hand, it communicates with the ſuperior or deſcending branch of the hæmorrhoidalis; and on the right, with the former branch of the meſaraica.

The vein, after having been diſtributed like the artery, comes from the ſmall inteſtines, the cæcum and right portion of the colon, and runs through thoſe parts of the meſentery and meſocolon which belong to theſe inteſtines; it runs next down over the trunk of the arteries, receiving in its paſſage the ſplenic vein, and terminates at laſt in the vena portæ.

The vena portæ inferior appears to be a continuation of the trunk of the vena meſaraica major. The ſplenica is a capital branch of that trunk; and the hæmorrhoidalis interna has ſometimes a common termination with the ſplenica, and ſometimes is no more than a branch of that vein. In ſome ſubjects the meſaraica major and ſplenica appear to end by an equal union in the trunk of the inferior vena portæ, and in others the the hæmorrhoidalis ends in the very angle of that union.

Vena portæ. The inferior vena portæ, after being formed of the ſplenic and meſenteric veins, receives into its trunk ſeveral ſmall rami, which are commonly the venæ cyſticæ, hepatica minor, pylorica, duodenalis, and ſometimes the gaſtrica dextra, and coronaria ventriculi.

All theſe ſmall veins ſometimes end ſeparately; and in other ſubjects, ſome of them go into it by ſmall common trunks. It ſometimes happens that ſeveral of them do not go immediately into the trunk of the vena portæ, but into one of its great branches.

The trunk formed by the two meſenterics and ſplenic veins paſſing on receives the vena gaſtrica, or gaſtro-epiploica dextra, and the coronaria ventriculi, but theſe go ſometimes into the trunk of the vena portæ.

The duodenal vein, commonly called *vena inteſtina-*

lis, goes into the great trunk near the cyſticæ, and ſometimes into the ſmall common trunk of theſe veins. It comes chiefly from the inteſtinum duodenum, and receives likewiſe ſome rami from the pancreas. There is another vein called alſo *duodenalis*, which is a branch of the gaſtrica of the ſame ſide.

The vena pylorica terminates in the great trunk, almoſt oppoſite to the end of the cyſticæ, and ſometimes goes into the right gaſtrica. It paſſes over the pylorus from the ſhort arch of the ſtomach, where it is joined by anaſtomoſis with the coronaria ventriculi.

The cyſtic veins run along the veſicula fellis from its bottom to its neck; and as they are commonly no more than two in number, they are called *cyſticæ gemellæ*, a name given likewiſe to the arteries which accompany them. They go into the right ſide of the great trunk near its end, ſometimes ſeparately, ſometimes by a ſmall and very ſhort common trunk.

The ſmall hepatic vein is commonly a branch of one of the cyſticæ, or of their common trunk.

The large trunk of the vena portæ inferior or ventralis, is ſituated under the lower or concave ſide of the liver, and joined by an anaſtomoſis to the ſinus of the vena portæ hepatica, between the middle and right extremity of that ſinus, and conſequently at a good diſtance from the left extremity. From thence it runs down a little obliquely from right to left, behind or under the trunk of the arteria hepatica, bending behind the beginning of the duodenum, and under the head of the pancreas; its length being about five fingers breadth.

At the head of the pancreas, this trunk may be ſaid to begin by the three branches already deſcribed.

The laſt portion of this vein may be termed *vena portæ hepatica*, ſuperior or minor, the trunk of which is commonly known by the name of *ſinus venæ portarum*. The other portion may be called *vena portæ ventralis*, inferior or major; and this is what I have deſcribed, referring the diſtribution of the other to the hiſtory of the liver.

The vena portæ running toward the under and back part of the liver divides into two principal branches, which enter the cavity called *porta;* and each of theſe branches divides into many others, which follow the branches of the hepatic artery throughout the whole ſubſtance of the liver.

The vena portæ may be conſidered as made up of two large veins, joined almoſt endwiſe by their trunks, from each of which the branches and ramifications go out in contrary or oppoſite directions. One of theſe parts comes from the ſtomach and inteſtines, with the ſpleen and pancreas; the other goes to the liver.

§ 5. *Veins of the Inferior Extremities.*

THE blood is returned from the inferior extremities by a ſuperficial and deep ſet of veins ſomewhat in a ſimilar manner to what we have deſcribed in the ſuperior extremities. Of the ſuperficial veins we find one, firſt running up immediately under the ſkin and getting the name of

Vena ſaphena. This begins at the great toe, then runs between the firſt two metatarſal bones irregularly under the ſkin towards the inner ankle.

At the great toe it receives a kind of tranſverſe arch over the metatarſus, which communicates by ſeveral branches with an arch which lies on the joint of the tarſus, and gets others from the toes. This arch receives likewiſe another branch, which runs down behind the outer ankle, having communicated with the vena tibialis externa.

Under the inner ankle, it receives a branch inward and forward, which runs under, and in ſome meaſure accompanies, the anterior tibial artery. Interiorly, it receives another branch at the ſame place, which paſſes up from the ſole of the foot, communicating with the ex-

external tibial vein by irregular arches. This in its paſſage receives branches from the toes.

At the lower part of the tibia, the ſaphena receives a conſiderable branch, which runs obliquely from the outer ankle, being formed of ſeveral rami, which communicate with each other and with the trunk of the ſaphena.

A little higher, it likewiſe receives from the fore-part of the tibia ſome branches coming from the perioſteum and bone, and communicating with other branches to be deſcribed.

Afterwards the trunk of the great ſaphena runs up on the inſide of the tibia, lying always near the ſkin; at the middle of the tibia, a vein forms an arch which communicates at both ends with the trunk of the large vein. A branch running up from from the outer ankle along the integuments of the tibia, and communicating with the ſaphena, paſſes into this arch. At the upper part of the bone, it receives branches forward, outward, and backward.

The anterior branches come from the integuments on the upper part of the leg; the poſterior, from thoſe which cover the gaſtrocnemii, and communicate with the little ſaphena; and the external branches come from the fat and integuments.

From the leg the ſaphena paſſes along the inſide of knee, and afterwards along the thigh, as far as the middle of the ſartorius muſcle; and here it receives from the ſame ſide ſeveral branches, which in their paſſage communicate with each other.

The vena ſaphena paſſes afterward to the forepart of the thigh, having been covered in all its paſſage by ſkin and fat only. At the groin it receives branches from the inguinal glands and neighbouring parts: theſe form free communications with each other. It opens at laſt into the top of the femoral vein.

Vena ſaphena minor. The vena ſaphena minor returns the blood from the outer ſide of the foot by many ſmall branches, which communicate freely with each other. From this part it runs up at the outſide of the tendo Achillis; and, next, between the gaſtrocnemius externus and ſkin.

Immediately above and below the ham, this vein receives other branches, which likewiſe communicate with each other, and with the ſaphena major.

At the ham, a branch forms a communication between it and the crural vein, receiving ſmall anaſtomoſing branches in its aſcent. It terminates at laſt a little above the ham in the trunk of the crural vein.

Vena tibialis anterior. From the extremities of the anterior tibial artery, the correſponding vein returns, firſt by a number of origins: but theſe, at the bottom of the leg, unites into one trunk; which, however, ſoon ſplits again into two or three branches, that ſurround the artery at different diſtances by ſmall communicating circles. A particular branch, which communicates with the vena tibialis poſterior, perforates the interoſſeous ligament from behind forward, and opens into the trunk of the vein at the bottom of the leg.

At the upper end of the leg the vein receives ſmall ſuperficial branches from the head of the tibia and fibula, which come from the joint of the knee, communicating theſe with lateral branches of the vena poplitea. It there perforates the head of the intoroſſeous ligament, and terminates in the vena poplitea.

Vena tibialis poſterior. From the ſole of the foot the venæ plantares return after being formed of ſeveral tranſverſe arches, which communicate with each other and with the ſaphena, and receive ramifications from the toes, nearly in the ſame manner as the arteria plantaris. The deep veins run along with the arteries, and have the ſame names.

The venæ plantares form a trunk, which paſſes on the inſide of the os calcis, and then behind the inner ankle as high as the ham. At the lower part of the leg, it communicates with a tranſverſe branch of the ſaphena, and

and with the anterior tibial vein, in the manner already ſaid; then receives branches from the muſculus tibialis poſticus and the long flexors of the toes.

Afterward the poſterior tibial vein runs up between the ſoleus and tibialis poſticus, receiving branches from each of them. It is formed, ſomewhat in the ſame manner as the tibialis anterior, of two or three branches, which, as they run, ſurround the correſponding artery, by ſmall communicating circles formed at different diſtances.

It receives near its termination a branch, called *ſuralis*, from the gaſtrocnemii and ſoleus; and opens at laſt into the vena poplitæa, a little lower than the tibialis anterior.

Vena peronæa. The vena peronæa is likewiſe double, and ſometimes triple. It runs up on the inſide of the fibula, almoſt in the ſame direction with the arteria peronæa, which it likewiſe ſurrounds at different diſtances, by communicating branches, after the manner of the tibialis poſterior, and like it ends in the vena poplitea.

It runs up from the foot to near the joint of the knee, communicating ſeveral times with the tibialis poſterior, and receiving ramifications from the neighbouring portions of the muſculi peronæi and long flexors of the toes.

The firſt of theſe communications makes the venæ plantares, in ſome ſubjects, to appear rather to go into this vein, than into the tibialis poſterior, where they commonly terminate.

Vena poplitea. The vena poplitea, formed of the three large veins laſt deſcribed, but appearing to be a continuation of the tibialis poſterior, runs up immediately behind the muſcle of the ſame name; at the lower part of which it receives ſeveral ramifications from each ſide, which divide and unite again in different ways and degrees before they terminate.

Near the internal condyle of the os femoris, the poplitea receives ſome lateral branches from the extremities of the neighbouring muſcles, eſpecially thoſe of the ſemi-nervoſus, ſemi-membranoſus, &c. A branch which comes off from the trunk a little way below, and runs along the peronæus longus, likewiſe goes into it.

It likewiſe receives ſeveral other branches; one of which comes laterally between the outer condyle and the biceps, having been ramified in the ſame manner with the artery. Another branch runs up on the backſide of the gaſtrocnemii muſcles from the tendo Achillis; then it goes forward, receiving ramifications from the beginning of theſe muſcles. Then running up betwixt the two condyles, it receives branches from the flexor muſcles of the leg, from the lower and poſterior parts of both vaſti, and from the fat which lies above the interſtice of the two condyles. A little above the ham, it gets the name of *crural vein*.

§ 6. *Veins of the Pelvis.*

Vena iliaca externa. After the crural vein gets from under the ligamentum Fallopii, it is called *vena iliaca externa;* this receives ſeveral ſmall rami from the neighbouring lymphatic glands.

To the inſide, after it gets into the abdomen, it receives the vena epigaſtrica; which runs down along the inſide of the muſculi recti, from which it chiefly comes; but receives alſo branches from the broad muſcles of the abdomen, which penetrate from without inwards: near its termination, it gets ſmall branches from the conglobate glands.

The beginning of the vena epigaſtrica runs downward, from the ramifications of the mammaria, with which it communicates, accompanying the epigaſtric artery. At the inſide of the epigaſtric vein, a branch is ſometimes received from the muſculus obturator internus, where a communication is alſo made with the vena obturatrix.

Near

Near the end of the former vein, it receives a branch which comes down along the inſide of the criſta of the os ilium; and admits others on each ſide, from the lateral and poſterior lower portions of the muſculi abdominis, from the muſculus iliacus, &c. So that the external iliac vein, lying on the pſoas and iliac muſcles, receives almoſt the ſame branches with the artery of the ſame name, and follows the ſame courſe.

After admitting the branches already mentioned, the trunk of the vein joins a large vein from the cavity of the pelvis called *vena iliac interna.*

Vena iliaca interna. The hypogaſtric or internal iliac vein, runs behind the artery of the ſame name, making the ſame kind of arch, into which the following branches open.

Of the branches which form the hypogaſtric vein, we find firſt a large branch running from the lower part of the os ſacrum, and two or more which come upward through the notch of the os ilium from the buttocks, anus, neighbouring portion of the muſculus pectineus, and from the external parts of generation, nearly in the ſame manner with the artery which accompanies them.

The veins that come from the anus, are termed *hæmorrhoidales externæ;* and thoſe that come from the parts of generation, *pudicæ internæ.* The external hæmorrhoidales communicate with the internal veins of the ſame name, which go to the ſmall vena meſariaca, one of the branches of the vena portæ.

The hypogaſtric vein receives branches which come into the pelvis, above the ligament which lies between the inferior lateral part of the os ſacrum and ſpine of the iſchium; and before they come in, they are ramified chiefly upward and downward.

Within the pelvis it receives a large branch called *vena obturatrix,* which comes through the foramen thyroideum from the obturator muſcles, adductores femoris, and neighbouring parts.

The vena obturatrix, after it perforates the mufcles, receives branches exteriorly from the mufculus iliacus, the fuperior part of the obturator internus, and from the os ilium, near its fymphyfis with the os ifchium.

Interiorly, the fame obturator vein receives another branch, which comes from the ureters, bladder, and internal parts of generation in both fexes. It communicates with the fpermatic veins, and is more confiderable in women than in men.

Into the pofterior or convex part of the arch, the iliac vein receives a branch from the fuperior lateral part of the os facrum, which comes from the mufculus facer or tranfverfo-fpinalis lumborum, and other mufcles thereabouts, and from the cavity of the bone, paffing through the firft great hole.

A little lower, on the fame fide, it receives another, which comes much in the fame manner with the former, through the fecond hole.

Into the external lateral part of the fame arch, a little anteriorly, it receives a large branch, which runs behind the great fciatic finus, and comes from the mufculi glutæi, pyriformis, and gemelli. After receiving thefe different branches, it joins the external iliac vein.

Vena iliaca communis. The hypogaftric vein, running up in the pelvis, joins the external iliac to form the common iliac vein, in the fame manner that the iliac arteries are connected with the aorta; but the union is about a finger's breadth lower than the bifurcation of the aorta.

One of thefe trunks is named *vena iliaca externa*, or *anterior*; the other *interna*, or *pofterior*. The external vein is likewife named fimply *iliaca*; and the internal, *hypogaftrica*. The external vein feems to be in a line with the common iliac, and the hypogaftrica only a branch. I here fpeak of adult bodies, becaufe in the fœtus there is a confiderable variation.

Thefe veins follow nearly the courfe and diftribution of the iliac arteries, except that the hypogaftric vein

doe

does not ſend off the vena umbilicalis. The external iliac veins lie more or leſs on the inſide of the arteries, in the manner already ſaid; but the hypogaſtric veins, in the bottom of the pelvis, lie almoſt behind the arteries on the ſame ſide.

To the common trunk of the iliac veins, and ſometimes to the origin of the iliaca externa, a particular branch comes in from the muſculus pſoas, iliacus, and quadratus lumborum; ſome of which communicate with the laſt lumbar vein.

§ 7. *Veins on the Back-part of the Abdomen and Loins.*

The two common iliac veins unite to form the vena cava. Into this union, and often into the end of the left iliaca, the vena ſacra goes in, having accompanied the artery of the ſame name in its diſtribution to the os ſacrum, to the nerves which lie there, and to the membranes which cover both ſides of that bone.

The extremity of the trunk of the vena cava, lies in ſome ſubjects behind the origin of the right iliac artery; in others, it is the left iliac vein which paſſes there, and conſequently croſſes the right iliac artery. The cava paſſes up through the abdomen on the forepart of the lumbar vertebræ, and on the right ſide of the aorta.

It receives poſteriorly the venæ lumbares; which commonly end in pairs, in the ſame manner as the arteries of the ſame name go out from the aorta. Theſe may be divided into ſuperior and inferior veins.

Their terminations vary in different manners. Sometimes the cava receives a branch from each ſide below the firſt vertebra of the loins, which, like a common trunk, receives the lumbar veins. This branch communicates with the azygos.

Sometimes a conſiderable branch comes into the lower extremity of the cava, near the union chiefly on the

the right ſide; which, having run down between the bodies and tranſverſe apophyſes of the vertebræ, receives the venæ lumbares, and communicates with the azygos.

Sometimes a like branch goes to the beginning of the left vena iliaca; and having run down on that ſide in the ſame manner, admits the lumbares. This branch likewiſe communicates with the azygos, and with the ſuperior or deſcending ramus lumbaris.

The venæ lumbares on one ſide, communicate by tranſverſe branches with thoſe of the other ſide, and likewiſe with each other by branches more or leſs longitudinal. The firſt and ſecond often go to the azygos, and thereby they communicate with the intercoſtal veins.

The lumbar veins receive capillaries, in their paſſage, from the ſubſtance of the bodies of the vertebræ; and they come from the muſcles of the abdomen, quadratus lumborum, pſoas, iliacus, &c. They get branches foreward from the neighbouring vertebral muſcles, and from the canal of the ſpine, and communicate with the venal ſinuſes in the ſame manner as the intercoſtals.

Having got as high as the arteriæ renales, the vena cava receives the veins of the ſame name, termed formerly *venæ emulgentes*, and which are the largeſt of all the veins that go to the cava inferior, from the beginning to the part where it runs behind the liver.

The right renal vein is the ſhorteſt, and runs up a little obliquely becauſe of the ſituation of the kidney. The left vein, which is the longeſt, croſſes on the foreſide of the trunk of the aorta, immediately above the ſuperior meſenteric artery, and both veins accompany the renal arteries.

They receive the venæ capſulares which come from the glandulæ renales, and branches from the venæ adi-

neys;

posæ which come from the fatty covering of the kidneys; and ordinarily the left renal vein receives the left spermatic vein.

A little below the renal veins, the trunk of the cava receives anteriorly the right vena spermatica. The left spermatic vein goes commonly, though not always, to the left renales. Both veins accompany the corresponding arteries.

In their passage, they receive several small branches on each side, from the peritonæum and mesentery; where they seem to be joined by anastomoses with the venæ mesaraicæ, and consequently with the vena portæ.

They sometimes bring a considerable branch over the iliac muscle, which is formed of two others; one ramus runs down from the membrana adiposa of the kidneys, the other runs up on the last mentioned muscle.

About the same height with the spermatic vein, the inferior cava receives posteriorly, in some subjects, a branch which runs downward, communicating with the vena azygos. Sometimes this branch goes into one or other of the renales, and appears to be a true continuation of the extremity of the azygos.

Behind the liver the vena cava receives the venæ diaphragmaticæ or phrenicæ; which come from the diaphragm, and appear chiefly on its lower side, one towards the right hand, and one towards the left. The right vein is more backward and lower than the left. The left comes partly from the pericardium, and partly from the diaphragm; and sometimes they receive rami from the capsulæ renales, much in the same manner as the arteriæ phrenicæ.

The inferior cava passes next thro' the posterior part of the great fissure of the liver, penetrating a little into the substance of that viscus, between the great lobe and the lobulus Spigelii; being, however, covered, but

but very little, on the backſide, by the ſubſtance of the liver, after it reaches the lobulus.

In its paſſage, it receives commonly three large branches, called *venæ hepaticæ*, which are ramified in the liver. Sometimes there are only two, and ſometimes four.

Beſides theſe large branches, it receives ſome other ſmall ones, either before or immediately after it enters the liver; which, according to ſome anatomiſts, anſwer to the branches of the hepatic artery, as the large branches do to thoſe of the vena portæ.

In the fœtus, as the vena cava paſſes by the liver, it receives the ductus venoſus, which communicates with the ſinus of the vena portæ, and in adults is changed to a flat ligament.

The vena cava having received theſe branches, perforates the tendinous portion of the diaphragm and the pericardium; and upon running a quarter of an inch or ſo within the pericardium, opens into the under part of the right auricle.

Explanation of TABLES XI. and XII.

Tab. XI. *Repreſents the Heart and Blood-veſſels.*

A, The heart.

B, The aorta aſcendens.

C, A trunk from which the right ſubclavian and right carotid arteries are ſent off. (Thoſe on the left ſide come off ſeparately.) The ſubclavian artery paſſes over to the arm behind the ſubclavian vein. The carotid artery runs up to the head, partly covered by the internal jugular vein.

D, The facial artery, which ſends off the coronary arteries of the lips.

E, The

E, The deep temporal artery.
F, The defcending aorta.
G, The right common iliac artery, which divides into the external and internal iliacs.
H, The femoral artery, which is a continuation of the external iliac artery.
I, The anterior tibial artery, fending branches to the forepart of the leg and upper part of the foot.
1, The frontal vein running down to form
2, The facial vein.
3, Deep temporal vein.
4, Occipital vein.
5, The external jugular vein.
6, The internal jugular vein, lying on the outer and fore part of the common carotid artery.
7, An arch on the palm of the hand, which runs partly to
8, The radial vein, and partly to
9, The ulnar vein. The two laft veins run clofe by the fides of their correfponding arteries.
10, The cephalic vein.
11, The bafilic vein cut. On the left fide it is entire.
12, Branches running up to form
13, The humeral vein.
14, The external thoracic veins running along with their arteries. [N. B. In many parts, the veffels are fo fmall, that one trunk muft reprefent both artery and vein.]
15, The axillary vein.
16, The fubclavian vein, receiving the jugular and other veins from the head and neck.
17, The vena cava fuperior.
18, Veins from the upper part of the foot, forming
19, The anterior tibial vein, which lies clofe by the fide of the correfponding artery.
20, The venæ profundæ femoris.
21, The upper part of the vena faphena.
22, The femoral vein.

23, The

23, The common iliac veins, formed of the external and internal iliacs.
24, Vena cava inferior.
25, The renal veins covering the arteries.
26, The diaphragmatic veins.

TAB. XII. *Exhibits a Back-view of ebt Blood-veſſels.*

A, The occipital veſſels.
B, The deep temporalveſſels.
C, The cervical veſſels.
D, The ſcapulary veſſels.
E, *F*, Deep humeral branches communicating with others at the elbow.
G, The poſterior interoſſeous veſſels.
H, Intercoſtal veſſels.
I, Arteriæ and venæ gluteæ.
K, Sciatic veſſels.
L, Arteria et vena poplitea.
M, Poſterior tibial veſſels.
N, Fibular veſſels.

N. B. The veſſels being ſo ſmall, both vein and artery are repreſented by one trunk.

CHAP.

B. XI.

TAB. XII.

D Lizars Sculpt

CHAP. III.

Of the ABSORBENT SYSTEM.

FOR the difcovery of the principal parts of this fyftem, we are chiefly indebted to Afellius, Pecquet, Rudbeck, Jolyffe, and Bartholine. Some of the veffels of which it confifts had been indeed feen and mentioned by their predeceffors, but it was in too curfory a manner to give them any title to the difcovery. Thus the lacteals had been feen in kids by Erafiftratus, who calls them *arteries*, as we are informed by Galen: And the thoracic duct had been feen by Euftachius, who fpeaks of it as a vein of a particular kind; (fee Euftachius *de Vena fine Pari.*)

In 1622, Afellius difcovered thofe veffels on the mefentery, which, from their carrying a milk-like fluid, he denominated *lacteals*. This difcovery being made by opening a living dog, anatomifts were thence encouraged to make experiments on living animals; and Pecquet, on opening a dog in the year 1651, found a white fluid mixed with the blood in the right auricle of the heart. Sufpecting this fluid to be chyle, he endeavoured to determine how it got from the lacteals into the heart: this he found was by means of the ductus

ductus thoracicus, which he traced from the lacteals to the fubclavian vein ; and thus he clearly proved the exiftence of that duct which we now confider as the trunk of the fyftem. Juft before his time the lacteals had been fuppofed to terminate in the liver; conformably to the idea which the phyfiologifts of that period had adopted about the ufe of this organ, which, from the authority of the older anatomifts, they believed was the vifcus hæmatopoeticum, or received the chyle from the inteftines to convert it into blood.

In the years 1651 and 1652, Rudbeck, Jolyffe, and Bartholin, difcovered the other parts of this fyftem, which, from their carrying a tranfparent and colourlefs fluid, are called the *lymphatic veffels.* Thus there was proved to exift in an animal body a fyftem of fmall veffels containing fluids very different from the flood, and opening into the fanguiferous veffels at the union of the left fubclavian vein.

After this period, Nuck added to our knowledge of this fyftem, by his injections of the lymphatic glands ; Ruyfch, by his defcription of the valves of the lymphatic veffels ; and Dr Meckel, by his accurate account of the whole fyftem, and by tracing thofe veffels in many parts where they had not before been defcribed.

Befides thefe authors, Drs Hunter and Monro have called the attention of the public to this part of anatomy, in their controverfy concerning the difcovery of the office of the lymphatics.

When the lymphatic veffels were firft feen and traced into the thoracic duct, it was natural for anatomifts to fufpect, that as the lacteals abforbed from the cavity of the inteftines, the lymphatics, which are fimilar in figure and ftructure, might poffibly do the fame office with refpect to other parts of the body: and accordingly, Dr Gliffon, who wrote in 1654, fuppofes thefe veffels arofe from cavities, and that their ufe was to to abſorb; and Frederic Hoffman has very explicitly laid down the doctrine of the lymphatic veſſels being a ſyſtem of abſorbents. But anatomiſts in general have been of a contrary opinion; for from experiments, particularly ſuch as were made by injections, they have been perſuaded, that the lymphatic veſſels did not ariſe from cavities, and did not abſorb, but were merely continuations from ſmall arteries. The doctrine, therefore, that the lymphatics, like the lacteals, were abſorbents, as had been ſuggeſted by Gliſſon and by Hoffman, has been revived by Dr Hunter and Dr Monro, who have controverted the experiments of their predeceſſors in anatomy, and have endeavoured to prove that the lymphatic veſſels are not continued from arteries, but are abſorbents.

To this doctrine, however, ſeveral objections have been ſtarted, particularly by Haller, (Elem. Phyſ. l. 24. § 2, 3.); and it has been found, that before the doctrine of the lymphatics being a ſyſtem of abſorbents can be eſtabliſhed, it muſt firſt be determined, whether this ſyſtem is to be found in other animals, beſides man and quadrupeds. Mr Hewſon claims the merit of having proved the affirmative of this queſtion, by diſcovering the lymphatic ſyſtem in birds, fiſh, and amphibious animals. See Phil. Tranſ. vol. 58. and 59.

Section I. *Of the Abſorbent Syſtem in general.*

The abſorbent ſyſtem conſiſts of the lacteals, the lymphatic veſſels, their common trunk, the thoracic duct, and the glands called *conglobate*.

The lacteals begin from the inteſtinal tube, and can for the moſt part be ſeen in a dog or other large quadruped that is killed two or three hours after eating, when they appear filled with a white chyle: but they do not always convey a fluid of this colour; for, even in a dog, if opened long after a meal, they are found diſtended with a liquor that is tranſparent and colourleſs like the lymph; and in birds the chyle is never found white, but always tranſparent, theſe veſſels, therefore, might, with as much propriety, be called the *lymphatics of the inteſtines*.

The lymphatic veſſels are ſmall pellucid tubes that have now been diſcovered in moſt parts of the human body: the fluid they contain is generally as colourleſs as water; a circumſtance which procured them at firſt the name of *ductus aquoſi*, and afterwards that of *vaſa lymphatica.* The courſe of the lymph, like that of the chyle, is from the extreme parts of the body towards the centre, and the lymphatic veſſels commonly lie cloſe to the large blood-veſſels. If therefore a ligature be thrown round the large blood-veſſels of the extremities of a living animal, or of one juſt dead, that ligature, by embracing the lymphatics, will ſtop the courſe of the lymph, which by diſtending the veſſels will make them viſible below the ligature.

All the lacteals, and moſt of the lymphatic veſſels, open into the thoracic duct, which lies upon the ſpine, and runs up towards the neck of the animal, where it commonly opens into the angle between the internal jugular and ſubclavian veins of the left ſide; and thus both the chyle and lymph are mixed with the blood. If therefore a ligature be thrown round the thoracic duct immediately after killing an animal, not only the lacteal, but alſo the lymphatic veſſels, in the abdomen and lower extremities, become diſtended with their natural fluids; the courſe of thoſe fluids being ſtopped by the ligature.

The lacteals, the lymphatics, and the thoracic duct, all agree in having their coats thinner and more pellucid than thoſe of the blood-veſſels. But although their coats are ſo thin, they are very ſtrong, as we daily ſee on injecting them with mercury, ſince they reſiſt a column of that fluid, whoſe weight would make it burſt through blood-veſſels, the coats of which are many times thicker than thoſe of the lymphatic ſyſtem.

The

The thinneſs of the coats prevents our dividing them from one another, and thereby aſcertaining their number as we do thoſe of the blood-veſſels. But as the blood-veſſels have a denſe internal coat to prevent tranſudation, we have reaſon to believe the lymphatics have the ſame. And as the blood-veſſels have a muſcular coat, which aſſiſts in the circulation; ſo may the lymphatics. This is rendered probable from what Dr Haller ſays of his having found them irritable in his experiments, and alſo from what is obſerved on ſeeing them in living animals diſtended with their lymph, in which caſe they appear of a conſiderable ſize; but upon emptying them of their contents, they contract ſo much as not to be eaſily diſtinguiſhed. This experiment, Mr Hewſon informs us, he frequently made in the trunk of the lacteals in a gooſe, and on the lymphatic veſſels on its neck; both of which, when diſtended with their natural fluids, are as large as a crow-quill; but, upon emptying them in the living animal, he has ſeen them contract ſo much that it was with the greateſt difficulty he could diſtinguiſh them from the fibres.

The coats of lymphatic veſſels have, in common with all other parts of the body, arteries, and veins, for their nouriſhment. This is rendered probable by their being ſuſceptible of inflammation; for they are frequently found in the form of a cord, painful to the touch, and extending from an ulcer to the next lymphatic gland. Theſe painful ſwellings of lymphatic veſſels likewiſe ſhow that their coats have ſenſibility, and therefore that they have nerves as well as arteries and veins. Beſides, we can clearly trace in different parts of the body blood-veſſels running along their ſurfaces.

The lymphatic ſyſtem in moſt animals, but particularly in man and quadrupeds, is full of valves. Theſe valves have been painted by the celebrated Nuck, Ruyſch, and others, and are much more frequent than in the common veins, and thence theſe lymphatics have ſometimes been diſtinguiſhed by the name of *valvular* *lymphatic vessels.* Those valves are generally two in number, are of a semilunar shape, and the one is sometimes much larger than the other. In most parts of the body these valves are so numerous, that there are three or four pair in an inch of space, but sometimes there is no more than one pair. They are less numerous in the thoracic duct than in the branches of the system; thence it might be supposed, that in proportion as we go from the trunk to the branches, we should find them thicker set: but this is not always true, for Mr Hewson observed them more numerous in the lymphatic vessels of the thigh, than on those of the leg. When the vessels are distended with lymph, they appear larger where the valves are; which sometimes gives a lymphatic vessel an appearance of being made of a chain of vesicles: as such they are represented by some authors; but it is an appearance that very seldom occurs.

Lastly, the lymphatic system, in different parts of its course, has the glands called *conglobate* or *lymphatic.* These glands are so placed, that the vessels come in on one side, and pass out on the other, in their way to the thoracic duct. Before the discovery of the lymphatic vessels in birds, fish, and turtle, some anatomists have considered these glands as so essentially necessary to the lymphatic system, that they have generally set about discovering the vessels by first looking for those glands: and wherever they found glands, they pronounced that there must be vessels; and when no glands could be seen, they thought it as certain a proof of there being no vessels. But that they are wanting in some animals, is now generally known.

Section II. *A particular Description of the Absorbent System in the Human Body.*

The absorbent system, besides the glands, is divided into three parts, viz The lacteals, the lymphatic vessels, and the thoracic duct. The lacteals belong to the in-

inteſtinal tube ; the lymphatics, to all the other parts of the body ; and the thoracic duct is the common trunk which receives both the lacteals and the lymphatics. We ſhall give a particular deſcription of theſe, chiefly from the late ingenious Mr Hewſon, by whom this part of anatomy, both human and comparative, has been ſo greatly illuſtrated, beginning with the lymphatics of the lower extremities.

§ 1. *Lymphatic Veſſels of the Lower Extremities.*

These may be divided into two ſets, viz. a ſuperficial, and a deep-ſeated.

The ſuperficial ſet of lymphatics conſiſts of a conſiderable number of veſſels that lie between the ſkin and the muſcles, and belong to the ſurface of the body or the ſkin, and to the cellular membrane which lies immediately under it. Of theſe there are two large branches that can be readily enough diſcovered in the limbs of dropſical ſubjects. One of theſe runs upon the top of the foot, as is repreſented Plate XIII. fig. i. (10) another is generally to be found juſt under the inner ankle; pipes have been introduced into both of them, whereby they have been filled the whole length of the lower extremity, as is ſeen in this figure.

The lymphatic (10) which belongs to the toes, runs up on the outſide of the tendon of the tibialis anticus (9), till it has got above the ankle; and it divides at (11) and again at (12, 12, 12) forming a plexus, which runs over the ſhin-bone (8), and aſcends in the cellular membrane immediately under the ſhin between that bone and the internal belly of the gaſtrocnemius (7) to the inſide of the knee (6), where in this figure it diſappears, but may be ſeen in fig. ii. This plexus, having paſſed the inſide of the knee, appears upon the thigh immediately under the ſkin, and over all the muſcles, as is ſeen in fig. i. (14), from which it paſſes to the groin, where theſe veſſels enter the lymphatic glands.

The lymphatic glands of the groin are ſix, ſeven, or eight in number; of theſe, ſome lie in the very angle between the thigh and the abdomen, and others lie a few inches down on the fore-part of the thigh. The lymphatic veſſels, above deſcribed, enter the lowermoſt of theſe glands, which in the ſubject of this figure, are four in number, viz. (15 15, 16 16. One branch, however, avoids theſe glands, as at (17); which afterwards bends over at (18) to the gland (19); from which go veſſels to the other lymphatic glands (20, 20) that lie in the angle between the thigh and the abdomen. It is into theſe upper glands alone that the lymphatic veſſels of the genitals enter, ſo that the venereal bubo which ariſes in conſequence of an abſorption of matter from theſe organs, is always ſeated in thoſe upper glands, and the lower glands (15 15, 16 16) are never affected, except by the regurgitation of the matter, or from their vicinity to the glands firſt diſeaſed, which very ſeldom happens. And, as it is the upper glands that are affected by the abſorption of matter from the genitals, ſo it is the lower which are commonly firſt affected from the abſorption of the acrid matter of an ulcer, diſeaſed joint, or carious bone, (in the parts below theſe glands); a circumſtance that may aſſiſt us in the diagnoſis of thoſe two kinds of buboes; Remembering, however, that this rule may be liable to an exception from one of the lymphatic veſſels paſſing the lower glands, and only entering the upper, as is ſeen at (17) in the ſame figure.

The lymphatic veſſels of the genitals having joined thoſe of the thigh, a network is formed, which enters the abdomen under the edge of the tendon of the external oblique muſcle, called *Poupart's ligament:* one of theſe veſſels is ſeen in Tab. XIV. (26). This plexus on the inſide of Poupart's ligament conſiſts of many branches; ſome of which embrace the iliac artery, of which one is ſeen in (27) *ibid.* but the greateſt number of them paſs up in the inſide of the artery, as is ſeen at (21, 22) Tab. XIII. fig. i. and at (27) Tab. XIV.

Theſe

Theſe ſuperficial lymphatics, ſmall as they are, * probably are the trunks of thoſe veſſels which abſorb from the ſkin and the cellular membrane immediately under it; and as no conſiderable branches can be diſtinguiſhed on the outſide of the leg or thigh, it is probable that all the lymphatic veſſels of thoſe parts bend towards the inſide, and open into the trunks that are here repreſented.

Upon theſe veſſels, from the foot to the groin, there is commonly not one lymphatic gland. But this rule has likewiſe ſome exceptions: for, even at the lower part of the leg, there is a very ſmall one in the ſubject from which this plate was taken, as repreſented at (13), Tab. XIII. fig. i. and in another ſubject our author ſaw a ſmall lymphatic gland near (14); from which it may be concluded, that the lymphatic glands, even in the human body, are in number and ſituation a little different in different ſubjects.

Beſides theſe ſuperficial lymphatic veſſels which lie above all the muſcles, or in the cellular membrane under the ſkin, there is a ſet deeper ſeated that lie amongſt the muſcles, and accompany the crural artery. Of theſe the principal trunk can be diſcovered by cutting down to the poſterior tibial artery, near the inner ankle. By introducing a pipe into it at this part, it may be injected; as has been done in ſeveral ſubjects, one of which is repreſented Tab. XIII. fig. ii.

From the inner ankle at (13) *ibid.* this veſſel paſſes up along with the poſterior tibial artery, being hid amongſt the muſcles on the back part of the tibia. About the middle of the leg it enters a ſmall gland at (15), which there is reaſon to believe will be found in moſt ſubjects. Having paſſed through this gland, the lymphatic runs up to the back part of the ham, ſtill lying cloſe

* Here it is neceſſary to obſerve, that as the artiſt could not expreſs the lymphatic veſſels to the ſame ſcale with that of the limb; ſo all of them appear larger than they ought to be in proportion to the magnitude of the part to which they belong.

to the artery, and in the ham it paſſes through three glands, viz. (18, 19, 20) But Mr Hewſon having ſeen a ſubject in which he could find only two glands, it is probable that the number varies. Hitherto this lymphatic has been a ſingle trunk; but after it has paſſed theſe glands, it commonly divides into two or three branches, which ſtill accompany the crural artery, and paſs with it through the perforation in the triceps muſcle. This muſcle is divided in the preparation from which this figure was taken, in order to give a better view of the lymphatics ; and the cut ends of the muſcle appear at (6, 6) though not very diſtinctly, from their being ſhrunk by drying. The lymphatic veſſels having perforated the triceps, paſs up with the artery, as is ſeen at (22, 23) and enter a gland (24), which is deeper ſeated than thoſe which appear in the groin: from this gland they paſs into the ſuperficial glands, repreſented at (15 15, 16 16) where the lymph of the deep-ſeated and of the ſuperficial lymphatics is mixed, and is conveyed into the body by the veſſels ſeen juſt above in the ſame figure. At this part likewiſe the lymph from the genitals is mixed with that brought by the two ſets of lymphatics from the lower extremities ; and the whole enters the abdomen by the plexus of veſſels repreſented fig. i. at (21), and a part of it at Tab. XIV. (27).

Tab. XIII. fig. i repreſents the lower extremity, with its more ſuperficial lymphatic veſſels. N (1) is the ſpine of the os ilium, (2) the os pubis, (3) the iliac artery, (4) the knee. The other references have been explained in the courſe of the deſcription.

Fig. ii. gives a back view of the lower extremity, diſſected ſo as to ſhow the deeper ſeated lymphatic veſſels which accompany the arteries. (1) The os pubis. (2) The tuberoſity of the iſchium. (3) That part of the os ilium which was articulated with the os ſacrum. (4) The extremity of the iliac artery appearing above the groin. (5) The knee. (6,6) The two cut ſurfaces of the

the triceps muſcle, which was divided to ſhow the lymphatic veſſels that paſs through its perforation along with the crural artery. (7) The edge of the muſculus gracilis. (8) The gaſtrocnemius and ſoleus, much ſhrunk by being dried, and by the ſoleus being ſeparated from the tibia to expoſe the veſſels. (9) The heel. (10) The ſole of the foot. (11) The ſuperficial lymphatic veſſels paſſing over the knee, to get to the thigh. (12) The poſterior tibial artery. (13) A lymphatic veſſel accompanying the poſterior tibial artery. (14) The ſame veſſel croſſing the artery. (15) A ſmall lymphatic gland, through which this deep-ſeated lymphatic veſſel paſſes. (16) The lymphatic veſſel paſſing under a ſmall part to the ſoleus, which is left attached to the bone, the reſt being removed. (17) The lymphatic veſſel croſſing the popliteal artery. (18,) (19) (20) Lymphatic glands in the ham, through which the lymphatic veſſel paſſes. (21) The lymphatic veſſel paſſing with the crural artery through the perforation of the triceps muſcle. (22) The lymphatic veſſel, after it has paſſed the perforation of the triceps, dividing into branches which embrace the artery (23.) (24) A lymphatic gland belonging to the deep-ſeated lymphatic veſſel. At this place thoſe veſſels paſs to the fore part of the groin, where they communicate with the ſuperficial lymphatic veſſels. (25) A part of the ſuperficial lymphatic veſſels appearing on the brim of the pelvis.

2. *Abſorbent Veſſels of the Trunk.*

The lymphatics of the lower extremities having now reached the trunk of the body, and having paſſed under Poupart's ligament, appear upon the ſides of the oſſa pubis near the pelvis at (27,27) Tab. XIV. A part of them paſſes up along with the illiac artery upon the brim of the pelvis ; and another part dips down into the cavity of the pelvis, and joins the internal iliac artery near the ſciatic notch. At this place they are joined ed by the lymphatics from the contents of the pelvis, particularly from the bladder and the veficulæ feminales in the male, and from the uterus in the female; and there are likewife a few branches which pafs thro' the fciatic notch from the neighbourhood of the glutei mufcles. The lymphatic veffels of the uterus, like its blood-veffels, are much enlarged, and therefore eafily diftinguifhed, in the pregnant ftate of that organ. At this part, where fo many lymphatics veffels join, there is commonly one or two glands.

Befides thofe lymphatic veffels which dip down into the cavity of the pelvis on the infide of the external iliac artery at (27, 27), there are others which keep on the outfide of that artery upon the pfoas mufcle, fome of which are feen on the left fide in the fame plate at (28). Of thefe, one part paffes up to the loins at (32), and goes under the aorta in different branches, getting from the left fide to the right, and joining the thoracic duct. Another part paffes under the iliac arteries, and appears upon the os facrum at (30), making a beautiful network, joining the lymphatics of the right fide, and paffing under the iliac artery, to form the network (31) upon the upper part of the right pfoas mufcle. In different parts of this courfe from Poupart's ligament to the loins, and alfo in the loins themfelves, there are, in moft fubjects, many lymphatic glands; none of which were filled in the fubject from which this plate was made.

The lymphatic veffels of the right fide, joined by fome from the left, having now reached the right lumbar region, appear there in the form of a plexus of large veffels, and pafs through feveral glands, which occupied the fpaces (33, 33, 33), but not being injected in the fubject are not reprefented. At this part likewife they receive large branches, under the aorta, from the plexus on the left fide of the loins, as is mentioned before; and having at laft got up as high as the fecond lumbar vertebra, they all join, and form a fingle trunk called

called the *tharacic duct*, which is ſeen at (36). At this part they are likewiſe joined by the lacteals, which ſhall be next deſcribed.

The lacteal veſſels, ſo called from their commonly conveying a fluid that is of the colour of milk, begin from the inner ſurface of the inteſtines, where they have patulous orifices deſtined to imbibe the nutritious fluid or chyle: From the cavity of the inteſtines theſe veſſels paſs obliquely through their coats, uniting as they go, ſo as to form larger branches. Theſe branches run on the outſide of the gut to get to that part which is next the meſentery; and, whilſt they are yet upon the gut, they are ſometimes of a ſize ſufficient to admit a ſmall pipe, ſo that they have been injected with mercury even in the human ſubject.

From the inteſtines they run along the meſentery and meſocolon, towards the ſpine; paſſing through in their way the conglobate or meſenteric glands. Theſe glands divide the lacteals into two regions: from the inteſtines to the glands theſe veſſels are called *lactea primi generis;* and from the glands to the thoracic duct, *lactea ſecundi generis.*

The lacteals of the ſmall inteſtines, as they run upon the meſentery, commonly accompany the ſuperior meſenteric artery, and unite, as they proceed, into larger branches; ſo that by the time they arrive at the root of the meſentery, they are of a conſiderable ſize, as may be ſeen at (34). From the meſenteric artery they deſcend by the ſides of the aorta, and open into the thoracic duct (36): whilſt the lacteals, or rather the lymphatics of the large inteſtines, accompany the inferior meſenteric artery, and communicate with the large lymphatic veſſels near its root.

Into the thoracic duct at (36), likewiſe enters the lymph of the other abdominal viſcera. This is brought by a number of veſſels; a plexus of which may be traced from each kidney, lying principally behind the emulgent artery, and opening into large lymphatic veſſels near

near the aorta: with thefe likewife go the lymphatics of the glandulæ renales, or renal capfulæ.

The lymphatic veffels of the fpleen pafs from the concave fide of that vifcus, along with the fplenic artery in the finuofity of the pancreas, by the lymphatic veffels of which they probably are joined.

To the ftomach belong two fets of lymphatic veffels, the one running upon its leffer, and the other upon its greater curvature. Of thefe, the former accompanies the coronary artery, and paffes through fome lymphatic glands that lie by its fides. The other fet paffes from the great curvature of the ftomach, through fome lymphatic glands that lie clofe to the arteria gaftrica dextra. Defcending by the pylorus, it meets the plexus that accompanied the coronary artery; and near the leffer curvature of the duodenum, forms a confiderable network. Into this not only the lymphatics from the fpleen enter, but likewife thofe from the gall-bladder, together with thofe of the liver, which are very numerous both in its convex and on its concave fide. Several branches proceed from this network, fome running under the duodenum, and others over it; which all open into the thoracic duct, near the termination of the large trunk of the lacteals, as feen at (36). The thoracic duct therefore is the common trunk which receives the abforbent veffels of the lower extremities, the lacteals, and the lymphatics of the abdominal vifcera.

As to the lymphatics of the larger vifcera, (fuch as the liver, the fpleen, and the kidneys), they are generally in two fets; one which lies upon the furface of the organ, and the other which accompanies the large blood-veffels in its centre. In the liver thefe two fets have been found to communicate with each other; fo that, by injecting mercury into the lymphatic veffels which lie upon its convex furface, Mr Hewfon has filled thofe which accompany the pori bilarii and vena portarum in its centre. Moft of the lymphatic veffels which lie upon the convex furface of the liver, run towards its falciform ligament, and pafs down by the fide of of the vena cava. But ſome of them run towards the right ligament of the liver, where they paſs down upon the diaphragm to get to the thoracic duct. The lymphatics on the concave ſurface run towards the portæ, where they join thoſe which come from the centre of the liver along with its large blood-veſſels. It is remarkable of thoſe lymphatic veſſels which run upon the ſurface of the liver, that their valves can readily be made to give way, ſo that they may be injected from their trunks to their branches, and to great minuteneſs.

It has been ſuggeſted by Dr Meckel, that the lymphatics of the ſtomach do not open into the thoracic duct like thoſe of the other viſcera, but only open into the ſanguiferous veins of the ſtomach: but from repeated diſſections of the human ſubject, Mr Hewſon has been convinced of the contrary; and likewiſe from the analogy with other animals, particularly fiſh, whoſe lymphatic veſſels either have no valves, or the valves readily give way, ſo that he has repeatedly puſhed injections from the thoracic duct into the lymphatics of their ſtomachs, as he has alſo done into the lymphatics of the other viſcera contained in the cavity of their abdomen.

The thoracic duct, which receives all the veſſels that we have yet deſcribed, differs in its ſize in different ſubjects, but is always ſmaller in its middle than at its beginning, as is ſeen in the plate. Sometimes its lower part (36) is ſtill larger in proportion than is there repreſented; and that enlargement has been called the *receptaculum chyli*, and is conſiderable in ſome quadrupeds, in turtle, and in fiſh: but many anatomiſts have denied that there is any part of the thoracic duct in the human ſubject that deſerves the name of *receptaculum*, having never ſeen any thing like a pyriform bag, as it has been deſcribed, but merely an enlargement not unlike a varix, and that only in few ſubjects; for that commonly it appears only a little larger than at its middle. This lower extremity of the thoracic duct is formed by the union of two, three,

three, or four very large trunks of lymphatic veſſels: Theſe large veſſels unite ſo as to form the duct about the lower part of the firſt, or the upper part of the ſecond vertebra lumborum, reckoning downwards.

Theſe large lymphatic trunks which form the thoracic duct are ſpread out upon the ſpine, thoſe of the right ſide lying below the right crus diaphragmatis, and thoſe of the left paſſing between the aorta and the ſpine; whilſt the thoracic duct itſelf lies on the right ſide of the aorta, between that artery and the right crus diaphragmatis, and behind the emulgent artery of the right ſide, as at (37). From this part it paſſes upwards, being at firſt diſcovered by the crus diaphragmatis, and afterwards appears at (38) in the thorax, upon the ſpine between the aorta and the vena azygos. In the thorax it receives ſome lymphatics from the intercoſtal ſpaces; a few of which are ſeen at (39), and afterwards it receives veſſels from the lungs.

The lymphatics of the lungs are in two ſets. One ſet paſſes on the poſterior part of each lobe by its root, into the thoracic duct, near the middle of the thorax; the other paſſes from the forepart of each lobe up towards the jugular and ſubclavian veins. Some of the lymphatics on the poſterior part of the left lobe paſs under the aorta to get to the thoracic duct.

At the root of the lungs, where the large blood-veſſels enter, are many glands called *bronchial*. They are generally of a blackiſh colour in the human ſubject, and have been ſuſpected to ſecrete the mucus which is ſpit up from the trachea; but Mr Hewſon having more than once diſtinctly filled them with mercury by injecting the lymphatic veſſels of the lungs, thinks it evident that they are not mucous but lymphatic glands.

The lymphatic veſſels from the anterior part of the left lobe of the lungs paſs into the angle between the jugular and ſubclavian vein of the ſame ſide, joining the thoracic duct at its termination; whilſt thoſe from the forepart of the right lobe do not communicate with the

the thoracic duct, but paſs into the angle between the right jugular and the right ſubclavian vein. Theſe lymphatics from the anterior parts of the lungs are probably accompanied by thoſe of the heart, which are repreſented by the accurate Nuck in his *Adenographia*, *fig.* 41.

The thoracic duct, after receiving the veſſels beforementioned, paſſes behind the aſcending aorta, and goes to the left ſide, terminating in the angle between the jugular and the ſubclavian vein. But, juſt before its termination, it generally goes higher up than the angle, and then bends down towards it; ſee Tab. XIV. n° 42, 43. Sometimes, though rarely, there are two thoracic ducts inſtead of one. Sometimes the duct ſplits near the upper part of the thorax; and the two branches, after ſpreading out from one another, commonly unite again at their termination in the angle between the jugular vein and ſubclavian veins.

To the preceding account, it may not be improper to add the deſcription given of the *Lacteal Sac and Duct* by the late Dr Alexander Monro.

" The receptaculum chyli of Pecquet, or ſaccus lacteus of Van Horne, is a membranous ſomewhat pyriform bag, two-thirds of an inch long, one-third of an inch over in its largeſt part when collapſed; ſituated on the firſt vertebra of the loins to the right of the aorta, a little higher than the right emulgent artery, behind the right inferior muſcle of the diaphragm: it is formed by the union of three tubes, one from under the aorta, the ſecond from the interſtice of the aorta and cava, the third from under the emulgents of the right ſide.

" The lacteal ſac, becoming gradually ſmaller towards its upper part, is contracted into a ſlender membranous pipe, of about a line diameter, which is generally named the *thoracic duct*. This paſſes betwixt the muſ-

muſcular appendices or inferior muſcles of the diaphragm, on the right of, and ſomewhat behind, the aorta: then, being lodged in the cellular ſubſtance behind the pleura, it mounts between the aorta and the vena azygos as far as the fifth vertebra of the thorax, where it is hid by the azygos, as this vein riſes forwards to join the deſcending or ſuperior cava; after which the duct paſſes obliquely over to the left ſide behind the œſophagus, aorta deſcendens, and the great curvature of the aorta, until it reaches the left carotid artery; behind which, on the left ſide of the œſophagus, it runs to the interſtice of the firſt and ſecond vertebræ of the thorax, where it begins to ſeparate from the carotid, ſtretching farther towards the left internal jugular vein by a circular turn, whoſe convex part is uppermoſt. At the top of this arch it ſplits into two for a line and an half; the ſuperior branch receiving into it a large lymphatic veſſel from the cervical glands. This lymphatic appears, by blowing air and injecting liquors into it, to have few valves. When the two branches are again united, the duct continues its courſe towards the internal jugular vein, behind which it deſcends, and, immediately at the left ſide of the inſertion of this vein, enters the ſuperior poſterior part of the left ſubclavian vein, whoſe internal membrane duplicated, forms a ſemilunar valve that is convex externally, and covers two-thirds of the orifice of the duct; immediately below this orifice, a cervical vein from the muſculi ſcaleni enters the ſubclavian.

“ The coats of the ſac and duct are thin tranſparent membranes; from the inſide of which, in the duct, ſmall ſemilunar valves are produced, moſt commonly in pairs; which are ſo ſituated as to allow the paſſage of liquors upwards, but oppoſe their return in an oppoſite courſe. The number of theſe is generally ten or twelve.

“ This is the moſt ſimple and common courſe, ſituation, and ſtructure of the receptaculum, chyli, and tho-

thoracic duct; but having had occasion to observe a variety in these parts, of different subjects, I shall set down the most remarkable of them.

" The sac is sometimes situated lower down than in the former description; is not always of the same dimensions; is not composed of the same number of ducts; and frequently appears to consist of several small cells or ducts, instead of being one simple cavity.

" The diameter of the duct is various in most bodies, and is seldom uniform in the same subject; but frequently sudden enlargements or sacculi of it are observable.——The divisions which authors mention of this duct are very uncertain. I have seen it divided into two, whereof one branch climbed over the forepart of the aorta at the eight vertebra of the thorax, and at the fifth slipped behind that artery, to join the other branch which continued in the ordinary course.—— The precise vertebra, where it begins to turn to the left side, is also uncertain.——Frequently it does not split at its superior arch; in which case a large sac is found near its aperture into the subclavian vein.—— Generally it has but one orifice; though I have seen two in one body, and three in another: Nay, sometimes it divides into two, under the curvature of the great artery; one goes to the right, another to the left subclavian vein; and I have found this duct discharging itself entirely into the right subclavian.——The lymphatic vessel which enters its superior arch, is often sent from the thyroid gland.

" Whether is not the situation of the receptaculum chyli so much nearer the muscular appendices of the diaphragm in men than in brutes, designed to supply the disadvantageous course the chyle must otherwise have in our erect posture?

" Does not the descent of the end of the duct to the subclavian vein, and the opening of the lymphatic into the top of the arch, contribute to the ready admission of the chyle into that vein?"

In the defcription of the lymphatic veffels which lie near the fpine, only a few glands have been mentioned; and in the figure where thofe veffels are exhibited no glands are reprefented. For the lymphatic glands not being conftant either in number or fituation, the defcribing them particularly in any one fubject appeared lefs neceffary, fince we cannot be fure of finding them exactly the fame in any other. It may, however, be neceffary to mention where they are commonly feen.

The mefentery of the human fubject is well known to contain a confiderable number of them; they are likewife found in the mefocolon, where the lymphatics of the large inteftines pafs through them. The ftomach has alfo feveral glands which belong to its lymphatic veffels, and lie near the arteria coronaria and the gaftrica dextra. There are likewife a few upon the omentum in fome fubjects; and there are alfo many by the fides of the pancreas, particularly near the leffer lobe of that vifcus, clofe to the duodenum.

Befides thefe glands which belong to the inteftinal tube, there are many more in the cavity of the abdomen, and a few in the cavity of the pelvis, which belong to the lymphatic veffels of the other organs.

There is commonly a pretty confiderable gland feen juft on the infide of the edge of the tendon of the external oblique mufcle, called *Poupart's ligament*, on the outfide of the iliac artery; and there are others near that artery, where it lies upon the pfoas mufcle. There are likewife commonly one or two near the internal iliac artery in the cavity of the pelvis; and there is a confiderable number generally met with by the fides, and upon the lumbar vertebræ.

Near the fpleen, liver, kidneys, and renal capfulæ, there are alfo lymphatic glands which belong to the lymphatic veffels of thefe organs.

There are likewife lymphatic glands fometimes obferved by the fides of the thoracic duct, particularly about

about the middle of the thorax, which glands belong principally to the veſſels of the lungs.

There alſo many lymphatic glands (called *bronchial*) near the root of the lungs: theſe glands are placed upon the lympbatic veſſels, juſt where they quit the lungs. But no lymphatic glands have yet been obſerved in the ſubſtance of the lungs; and the tubercles, which ſome ſuſpect to be obſtructed lymphatic glands, ſeem to have a different origin. There are likewiſe ſome glands ſeen on the lymphatic veſſels which lie near the ſubclavian veins at the upper part of the thorax, and which belong to the forepart of the lungs.

Beſides theſe there are ſome lymphatic glands upon the aorta near the œſophagus, and there are alſo others occaſionally met with in the intercoſtal ſpaces, and there are generally two or three contiguous to the thoracic duct at the lower part of the neck and upper part of the thorax, near the termination of that duct, in the angle beween the left jugular and the left ſubclavian vein.

§ 3. *Lymphatics of the Head and Neck.*

By the ſide of each internal jugular vein is a large lymphatic veſſel, which is the trunk of thoſe of one ſide of the head and neck; that of the right ſide is ſhown Tab. XIV. n° 48. Smaller lymphatics are ſeen near the branches of the external carotid artery. There are alſo lymphatic glands by the ſides of the parotid and maxillary glands, by the ſides of the large artery where it lies upon the chin, and by the ſide of the occipital artery; and Mr Hewſon ſaw one upon the root of the maſtoid proceſs of the os temporis. Thoſe glands, which accompany the lower part of the artery that runs upon the face, are ſometimes ſwelled in conſequence of abſorption from the lips and the parts adjacent, and alſo from gum-boils; and thoſe which accompany the occipital artery are frequently enlarged in conſequence

of

of the abſorption of matter from wounds of the ſcalp; from which facts it is evident that the external parts of the head are ſupplied with lymphatic veſſels. In quadrupeds thoſe veſſels may be diſtinctly ſeen, particularly in a dog or an aſs, by paſſing a ligature round the large blood-veſſels of their necks immediately after killing thoſe animals. Mr Hewſon made ſome experiments of this kind with a view to determine whether the brain had lymphatic veſſels: but he informs us he was never able to ſee any on that organ; neither when he tied up the lymphatics on the necks of thoſe animals, and thereby ſtopped the courſe of the lymph; nor when he diſſected the human brain, with a view to diſcover thoſe veſſels, although he particularly ſought for them in the plexus choroides, where they have been ſuſpected to be ſeen, and near the glandula pituitaria.

But although lymphatic veſſels have not yet been demonſtrated in the brain, it is probable from analogy, that this organ is not deſtitute of them.

The ſmall lymphatics which accompany the branches of the external carotid artery unite upon the neck, and form a large trunk, which accompanies the internal jugular vein, paſſing through ſome lymphatic glands, near the termination of this trunk in the angle between the jugular and ſubclavian veins; there are likewiſe ſome glands on the outſide of this angle, which ſeem to belong to the lymphatics from the back of the neck, and of the ſhoulder.

The glandula thyroidea has many lymphatic veſſels, which can ſometimes be inflated by blowing air into the cells of the gland: theſe veſſels paſs on each ſide of the trachea, one part going into the angle of the right ſubclavian and jugular, and the other joining the thoracic duct upon the left ſide.

In Tab. XIV. which exhibits the trunk ſo prepared as to ſhow the lymphatics and the thoracic duct, (1) is the neck. (2) The ſhoulder. (3) The arm. (4) The out end of the clavicle. (5) The extremity of the firſt rib,

rib. (6) The ſubclavian muſcle. (7) The rib. (8) The trachea. (9) The aorta aſcendens. (10) The ſpine. (11) Vena azygos. (12) The aorta deſcendens. (13) The cæliac artery. (14) The ſuperior meſenteric artery. (15) The right crus diaphragmatis. (16) The kidney. (17) The right emulgent artery. (18) The common iliac artery. (19) The diviſion of the common iliac into the external and internal iliac arteries. (20) The cavity of the pelvis. (21) The ſpine of the os ilium. (22) The groin. (23) A lymphatic gland in the groin, into which lymphatic veſſels from the lower extremity are ſeen to enter. (26) The pſoas muſcle with lymphatic veſſels lying upon its inſide. (27) A plexus of lymphatics, which having paſſed over the brim of the pelvis at (25), having entered the cavity of the pelvis, and received the lymphatic veſſels belonging to the viſcera contained in that cavity, next aſcends, and paſſes behind the iliac artery to (29). (29) The right pſoas, with a large plexus of lymphatics lying on its inſide. (30, 30,) The plexus lying on each ſide of the ſpine. (31, 31, 31) Spaces occupied by the lymphatic glands; which are not here repreſented, not having been injected in the ſubject. (32) The trunk of the lacteals lying on the under ſide of the ſuperior meſenteric artery. (33) The ſame dividing into two branches; one of which paſſes on each ſide of the aorta, that of the right ſide being ſeen to enter the thoracic duct at (34.) (34) The thoracic duct beginning from the large lymphatics. (38) The thoracic duct paſſing under the curvature of the aorta to get to the left ſubclavian vein. (39) A plexus of lymphatic veſſels paſſing upon the trachea from the thyroid gland to the thoracic duct. (40) The upper part of the thoracic duct lying between the left carotid and the left jugular vein, and paſſing behind that veing downwards and outwards towards the angle between the left jugular and the left ſubclavian. (41) The extremity of the thoracic duct entering the angle between the left jugular and the left ſubclavian vein. (46) That network paſſing under the right ſubclavian vein, and under the ſubclavian muſcle, the clavicle being removed.

N. B. The other n°s are explained in the courſe of the deſcriptions.

§ 4. *Lymphatics of the Upper Extremities.*

LIKE the leg, each arm has two ſets of lymphatic veſſels. One ſet, which lies immediately under the integuments, belongs to the ſkin and the cellular membrane, connecting it to the muſcles; the other accompanies the large arteries, and belongs to the parts deeper ſeated.

The ſuperficial ſet of lymphatic veſſels may be diſcovered in emaciated dropſical ſubjects, by a careful diſſection on the fore and back part of the arm. In Tab. XIII. fig. iii. they are ſeen running on the back part of the fore arm at (6, 6) moſt of them paſſing on its outſide, and twiſting to the fore part, near the head of the radius, as at (7). But in this repreſentation, there is a veſſel which paſſes towards the inſide, under the inner condyle of the os humeri at (8), and ſends a branch amongſt the muſcles; which branch perforates the interoſſeous ligament, getting between the radius and ulna to the forepart, where it joins a deep-ſeated one that had accompanied the radial artery.

In this figure, which exhbits a back-view of the fore-arm and hand, (1) Is the hand. (2) The lower extremity of the radius. (3) The lower extremity of the ulna. (4) The muſcles on the back of the fore-arm turned aſide to exhibit a deep-ſeated lymphatic veſſel, which perforates the interoſſeous ligament to get to the fore part. (5) The olecranon.—The veſſels have been already referred to.

In Tab. XIII. fig. iv. the lymphatic veſſels are ſeen on the fore part of the upper extremity; thoſe ſuperficial

cial branches which paffed on the outfide of the back of the fore-arm appearing now on the forepart at (8); and afcending under the fkin that covers the fupinator longus and the biceps, they enter fome glands in the axilla at (12, 12), whilft that veffel which paffed on the infide of the back of the fore-arm under the internal condyle, appears on the fore part at (9), and juft above the condyle enters a gland (10), and then paffes up on the infide of the arm, communicating with a lymphatic from the forepart of the wrift, and paffing to the axillary glands.

A fuperficial lymphatic is feen under the fkin, on the forepart of this extremity juft above the wrift; a pipe was introduced at (7), and the veffel thereby injected with mercury. Paffing under the integuments over all the mufcles, this veffel joins the lymphatic from the back part of the fore-arm at (11), and there forms a plexus which paffes under the integuments, on the infide of the arm, to the axillary glands at (12).

Befides thefe fuperficial lymphatics upon the upper extremity, our author traced a deeper feated one near the radial artery, and injected it from a pipe fixed at (13). This veffel accompanies the radial artery, and paffes (14) firft under the interoffeous, and then under the ulnar artery, which in this fubject runs over the mufcles. Near the part where it paffes under the interoffeous artery, it receives the branch from the back of the fore-arm. After paffing under thefe arteries, this lymphatic appears on the infide of the bracheal artery at (15), where it is deep feated. Afcending clofe to that artery, and near the middle of the arm, it paffes through the two glands (16, 16); after which it appears confiderably enlarged, goes under one of the arteriæ anaftomaticæ at (17, 18), and then afcends to the lymphatic glands in the axilla (19, 19).

In the above figure, which exhibits a fore view of the upper extremity, (1) is the fcapula, (2) the clavicle, (3) the extremity of the brachial artery, (4) the mufcles lying on the infide of the arm, (5) the inner condyle of the os humeri, (6) the lower extremity of the radius. N. B. The fubfequent nos denoting the veffels have been explained in the defcription.

Thefe veffels, however, as they here appear, altho' reprefented from an uncommonly fuccefsful injection, are only a part of the larger lymphatic veffels of the arm; as there are probably fome accompanying the ulnar and interoffeous arteries, although not here injected. They fhould moreover be confidered as only trunks of the lymphatics; fince it is probable, that every (even the fmalleft) part of this, as well as all other parts of the body, has one of thefe veffels adapted to abforption. That this is the cafe, feems to be proved by the experiments made with the variolous matter; for at what part foever of the arm that matter is inferted, the lymphatic veffels take it up and carry it into the body, as can be traced by its inflaming the conglobate glands through which thefe veffels pafs.

In Tab. XIV. the termination of all thefe lymphatic veffels is exhibited. Two of the trunks of thofe of the left arm are feen at (42, 42). They pafs under the clavicle, whofe cut end is feen at (4); and under the fubclavian vein. Here, having joined, they form the large trunk (43), which appears juft above the left fubclavian vein, and joins the extremity of the thoracic duct at its entrance into the angle between that vein and the jugular.

The thoracic duct is not only joined by this trunk of the lymphatics of the left arm, but alfo by the lymphatic veffels of the left fide of the thyroide gland, and by the trunk of the lymphatics of the left fide of the head and neck, and alfo by thofe from the forepart of the lungs of the fame fide.

The lymphatic veffels of the right fide are commonly feen to terminate in the angle between the jugular vein and the fubclavian. When feen to enter the fubclavian

vian vein at any other part, Mr Hewſon is inclined to conclude it as only an accidental variety.

Theſe lymphatic veſſels of the right ſide form four conſiderable trunks, which join near their termination. Theſe trunks are, 1. One from the upper extremity, which appears at (47), lying above the clavicle between the ſubclavian artery and vein: This trunk is formed by the lymphatic (44), which comes up with the brachial artery, and the plexus (45), which likewiſe belongs to the arm, and paſſes under the ſubclavian vein. 2. The trunk of the lymphatic veſſels of the right ſide of the head and neck, which paſſes down on the outſide of the jugular vein, as is ſhown at (48). 3. A lymphatic from the thyroide gland. This veſſel is ſeen at (49), paſſing under the right jugular vein to get to the others. 4. A trunk from the fore part of the lungs of the right ſide: This trunk is diſtinctly traced under the ſubclavian vein to its termination, in common with the others, at the union of the jugular and ſubclavian veins.

A

SYSTEM OF ANATOMY.

PART VIII.

OF THE HUMAN NERVES.

By the late DR ALEX. MONRO,

With CORRECTIONS.

CHAP. I.

Of the NERVES in General.

1. THE numerous turns which the carotid and vertebral arteries make before they paſs thro' the dura mater, theſe arteries having neither ſwelling muſcles nor preſſure of the atmoſphere to aſſiſt the courſe of the blood in them after they enter the ſkull, and their diviſion into innumerable communicating branches in the pia mater, and its proceſſes, ſhow, that the liquors muſt move more ſlowly and equally in them than in moſt other parts of the body.

2. By the aſſiſtance of injections and microſcopes, the very minute branches of theſe veſſels are diſcovered to go from the pia mater, into the cortex, cineritious, or aſhy-coloured part of the cerebrum, cerebellum, and ſpinal marrow; whereas we can only ſee longitudinal veſſels, without numerous ramifications or reticular plexuſes, in the white medullary ſubſtance of theſe parts.

3. The continuity of the cortex with the medulla of the

the encephalon and ſpinal marrow is obſervable with the naked eye, and is more diſtinctly ſeen with the aſſiſtance of a microſcope.

4. In diſſecting the brain and cerebellum, we ſee the ſmall beginnings of the medulla proceeding from the cortex, and can trace its gradual increaſe by the addition of more ſuch white ſubſtance coming from the cortex.

5. Both theſe ſubſtances are very ſucculent; for being expoſed to the air to dry, they loſe more of their weight than moſt other parts of the body do.

6. In ſeveral places we can obſerve the medulla to be compoſed of fibres laid at each others ſides.

7. The medullary ſubſtance is employed in forming the white fibrous cords, which have now the name of *nerves* appropriated to them. Within the ſkull we ſee the nerves to be the medullary ſubſtance continued; and the ſpinal marrow is all employed in forming nerves.

8. The common opinion concerning the riſe of the nerves, founded on a ſuperficial inſpection of thoſe parts, is, that the nerves are propagated from that ſide of the encephalon, at which they go out of the ſkull. But it having been remarked, after a more ſtrict inquiry, and preparing the parts by maceration in water, that the medullary fibres decuſſate or croſs each other in ſome parts of the medulla; as for example, at the corpus annulare, and beginning of the ſpinal marrow: and practical obſervators having related ſeveral examples of people whoſe brain was hurt on one ſide, while the morbid ſymptom, palſy, appeared on the other ſide of the body, of which I have ſeen ſome inſtances; and experiments made on brutes having confirmed theſe obſervations, it has been thought, that the nerves had their riſe from that ſide of the encephalon, which is oppoſite to their egreſs from the ſkull. It may, however, ſtill be ſaid, that this laſt opinion is not fully demonſtrated, becauſe a decuſſation in ſome parts is not a proof that it obtains univerſally; and if there are examples of pal-

ſy

ſy of the ſide oppoſite to where the leſion of the brain was, there are alſo others, where the injury done to the brain and the palſy were both on the ſame ſide.

9. The nerves are compoſed of a great many threads lying parallel to each other, or nearly ſo, at their exit from the medulla.

This fibrous texture is evident at the origin of moſt of the nerves within the ſkull; and in the cauda equina of the ſpinal marrow, we can divide them into ſuch ſmall threads, that a very good eye can ſcarce perceive them; but theſe threads, when looked at with a microſcope, appear each to be compoſed of a great number of ſmaller threads.

10. How ſmall one of theſe fibrils of the nerves is, we know not; but when we conſider that every, even the moſt minute part of the body is ſenſible, and that this muſt depend on the nerves (which, all conjoined, would not make a cord of an inch diameter) being divided into branches or filaments to be diſperſed through all theſe minute parts, we muſt be convinced, that the nervous fibrils are very ſmall. From the examination of the minimum viſible, it is demonſtrated, that each fibre in the retina of the eye, or expanded optic nerve, cannot exceed the ſize of the 32,400 part of a hair.

11. The medullary ſubſtance, of which the nervous fibrils are compoſed, is very tender, and would not be able to reſiſt forces as the nerves are expoſed to within the bones, nor even the common force of the circulating fluids, were not the pia mater and tunica arachnoides continued upon them; the former giving them firmneſs and ſtrength, and the latter furniſhing a cellular coat to connect the threads of the nerves, to let them lie ſoft and moiſt, and to ſupport the veſſels which go with them.

It is this cellular ſubſtance that is diſtended when air is forced through a blow-pipe thruſt into a nerve, and that makes a nerve appear all ſpongy, after being diſtended with air till it dries; the proper nervous fibrils ſhrivelling

ſhrivelling ſo in drying, that they ſcarce can be obſerved.

12. Theſe coats (§ 11.) would not make the nerves ſtrong enough to bear the ſtretching and preſſure they are expoſed to in their courſe to the different parts of the body; and therefore, where the nerves go out at the holes in the cranium and ſpine, the dura mater is generally wrapped cloſely round them, to collect their diſgregated fibres into tight firm cords; and that the tenſion which they may happen to be expoſed to may not injure them before they have got this additional coat, it is firmly fixed to the ſides of the holes in the bones through which they paſs.

13. The nervous cords, thus compoſed of nervous fibrils, cellular coat, pia and dura mater, have ſuch numerous blood-veſſels, that after their arteries only are injected, the whole cord is tinged of the colour of the injected liquor; and if the injection is puſhed violently, the cellular ſubſtance of the nerves is at laſt diſtended with it.

14. A nervous cord, ſuch as has been juſt now deſcribed, has very little elaſticity, compared with ſeveral other parts of the body. When cut out of the body, it does not become obſervably ſhorter, while the blood-veſſels contract three-eights of their length.

15. Nerves are generally lodged in a cellular or fatty ſubſtance, and have their courſe in the interſtices of muſcles and other active organs, where they are guarded from preſſure; but in ſeveral parts they are ſo placed, as if it was intended that they ſhould there ſuffer the vibrating force of arteries, or the preſſure of the contracting fibres of muſcles.

16. The larger cords of the nerves divide into branches as they go off to the different parts; the branches being ſmaller than the trunk from which they come, and making generally an acute angle where they ſeparate.

17. In ſeveral places, different nerves unite into one cord,

cord, which is commonly larger than any of the nerves which form it.

18. Several nerves, particularly thofe which are diftributed to the bowels, after fuch union, fuddenly form a hard knot confiderably larger than all the nerves of which it is made. Thefe knots were called *corpora olivaria*, and are now generally named *ganglions*.

19. The ganglions have thicker coats, more numerous, and larger blood-veffels, than the nerves; fo that they appear more red and mufcular. On diffecting the ganglions, fibres are feen running longitudinally in their axes, and other fibres are derived from their fides in an oblique direction to the longitudinal ones.

20. Commonly numerous fmall nerves, which conjunctly are not equal to the fize of the ganglion, are fent out from it, but with a ftructure no way different from that of other nerves.

21. The nerves fent to the organs of the fenfes, lofe there their firm coats, and terminate in a pulpy fubftance. The optic nerves are expanded into the foft tender webs, the retinæ. The auditory nerve has fcarce the confiftence of mucus in the veftibulum, cochlea, and femi-circular canals of each ear. The papillæ of the nofe, tongue, and fkin, are very foft.

22. The nerves of mufcles can likewife be traced till they feem to lofe their coats by becoming very foft; from which, and what we obferved of the fenfatory nerves (§ 21.), there is reafon to conclude, that the mufcular nerves are alfo pulpy at their terminations, which we cannot indeed profecute by diffection.

23. It would feem neceffary that the extremities of the nerves fhould continue in this foft flexible ftate, in order to perform their functions right: for, in proportion as parts become rigid and firm by age, or any other caufe, they lofe of their fenfibility, and the motions are more difficultly performed.

24. Tho' the fibres in a nervous coat are firmly connected, and frequently different nerves join into one trunk,

trunk, or into the ſame ganglion; yet the ſenſation of each part of the body is ſo very diſtinct, and we have ſo much the power of moving the muſcles ſeparately, that, if the nerves are principal agents into theſe two functions, which I ſhall endeavour to prove they are, we have reaſon to believe that there is no union, confuſion, or immediate communication of the proper nervous fibrils, but that each fibre remains diſtinct from its origin to its termination.

25. Changes produced any way upon the coats of the nerves, cannot, however, miſs to affect the nervous fibrils. The cellular ſubſtance may be too full of liquor, or may not ſupply enough; the liquor may not be of a due conſiſtence, or it may be preternaturally obſtructed and collected. The pia or dura mater may be too tenſe, or too lax; their veſſels may be obſtructed; their proper nerves may be violently irritated, or loſe their power of acting; and a great many other ſuch changes may happen, which will not only occaſion diſorders in particular nerves, but may be a cauſe of the ſympathy ſo frequently obſerved among the nerves; which is ſo neceſſary to be attentively regarded in a great many diſeaſes, in order to diſcover their true ſtate and nature, that, without this knowledge, very dangerous miſtakes in the practice of phyſic and ſurgery may be committed.

26. Many experiments and obſervations concur in proving, that when nerves are compreſſed, cut, or any other way deſtroyed, the parts ſerved by ſuch nerves, farther from the head or ſpine than where the injuring cauſe has been applied, have their ſenſations, motions, and nouriſhment weakened or loſt; while no ſuch effects are ſeen in the parts nearer to the origin of thoſe nerves: and in ſuch experiments where the cauſe impeding the nerves to exert themſelves could be removed, and the ſtructure of the nerves not injured, as for example when a ligature made upon a nerve and ſtopping its influence has been taken away, the motion and

and ſenſation of the parts ſoon were reſtored. From which it would appear, that the nerves are principal inſtruments in our ſenſations, motions, and nouriſhment; and that this influence of the nerves is not inherent in them, unleſs the communication between theſe cords and their origin is preſerved.

This concluſion is juſt, notwithſtanding that ſometimes, upon cutting a nerve, the effects above-mentioned have been felt for a ſhort time, but afterwards the perſon was ſenſible of no numbneſs or immobility: for wherever this is ſaid to have happened, the cut nerve was only one of ſeveral which were ſent to the member; the want of whoſe influence was felt no longer, than till the habit was acquired of performing the functions eaſily by the other nerves.

Nor is it of greater weight as an objection, that ſometimes when a ligature is drawn very hard upon a nerve, and then is taken away, the nerve never again recovers its influence upon the parts it is diſtributed to beyond the ligature, but is of as little effect as if it had been cut through; which is to ſay, that its texture has been altered beyond recovery. The ſame thing is to be ſeen by tying a thread tight round a tender twig of any vegetable; it decays.

27. Experiments and obſervations ſhow, too, that when parts of the encephalon or ſpinal marrow have been irritated, compreſſed, or deſtroyed, the parts of the body, whoſe nerves had their origin from ſuch affected parts of the encephalon or ſpinal marrow, became convulſed, paralytic, inſenſible, or waſted; and in ſuch caſes where the injuring cauſe could be removed from the origin of the nerves, the morbid ſymptoms obſerved in the parts to which theſe nerves were diſtributed, went off upon the removal of that cauſe. From which it is thought reaſonable to conclude, that the nerves muſt not only have a communication with their origin, but that the influence they have upon the parts

they are diftributed to depends on the influence which they derive from the medulla encephali and fpinalis.

28. Tho' the fpinal marrow has its own veffels and cineritious fubftance, which affifts to form its medulla; yet a very large fhare of the medullary fubftance within the fpine is derived from the encephalon, whofe medulla oblongata defcends from the head; and the influence of the fpinal marrow on its nerves depends in a great meafure on this medulla oblongata of the head. Hence an injury done to any part of the fpinal marrow, immediately affects all the parts whofe nerves have their origin below where the injuring caufe is applied. A laxation of a vertebra in the loins makes the lower extremities foon paralytic; a tranfverfe fection of the medulla at the firft vertebra of the neck, foon puts an end to life.

29. If fuch caufes produce conftantly fuch effects (§ 26, 27, 28.) in us and other creatures living in nearly the fame circumftances as we do, the conclufions already made muft be good, notwithftanding examples of children and other creatures being born without brains or fpinal marrow; or notwithftanding that the brains of adult creatures can be much changed in their texture by difeafes; and that tortoifes, and fome other animals, continue to move a confiderable time after their heads are cut off. We may be ignorant of the particular circumftances requifite or neceffary to the being or well-being of this or that particular creature; and we may be unable to account for a great many phenomena: but we muft believe our eyes in the examination of facts; and if we fee conftantly fuch confequences from fuch actions, we cannot but conclude the one to be the caufe and the other the effect. It would be as unjuft to deny the conclufions made in the three preceding articles, becaufe of the feemingly preternatural phænomena mentioned at the beginning of this, as it would be to deny the neceffity of the circulation of the blood in us and moft quadrupeds, becaufe a frog

frog can jump about, or a tortoife can walk long after all the bowels of its thorax and abdomen are taken out, or becaufe the different parts of a worm crawl after it has been cut into a great many pieces. It is therefore almoft univerfally allowed, that the nerves are principal inftruments in our fenfations, motion, and nourifhment; and that the influence which they have is communicated from their origin, the encephalon and medulla fpinalis. But authors are far from agreeing about the manner in which this influence is communicated, or in what way nerves act to produce thefe effects.

30. Some alledge, that the nervous fibres are all folid cords acting by elafticity or vibration; others maintain, that thofe fibres are fmall pipes conveying liquors, by means of which their effects are produced.

31. The gentlemen, who think the nervous fibres folid, raife feveral objections to the other doctrine; which I fhall confider afterwards; and endeavour to fhow the fitnefs of their own doctrine to account for the effects commonly obferved to be produced by the nerves.

The objects of the fenfes plainly (fay they) make impulfes on the nerves of the proper organs, which muft fhake the nervous fibrils: and this vibration muft be propagated along the whole cord to its other extremity or origin, as happens in other tenfe ftrings; and thefe vibrations being differently modified, according to the difference of the object, and its different application, produce the different ideas we have of objects.

32. To this account of fenfation, it is objected, firft, That nerves are unfit for vibrations, becaufe their extremities, where objects are applied to them, are quite foft and pappy (§ 21.), and therefore not fufceptible of the vibrations fuppofed; and if there could be any little tremor made here by the impulfe of objects, it could not be continued along the nervous cord, becaufe the cellular fubftance by which each particular fibre is connected to the neighbouring ones (§ 11.),

and the fatty ſubſtance in which the nervous cord is immerſed (§ 15.), would ſoon ſtifle any ſuch vibratory motion.

A ſecond objection to this doctrine is, That ſuppoſing the nerves capable of vibrations by the impreſſions of objects, theſe vibrations would not anſwer the deſign. For if what we know of other vibrating ſtrings, to wit, that their tone remains the ſame, unleſs their texture, length, or tenſion is altered, and that different ſubſtances ſtriking them do no more than make the ſound higher or lower; if theſe properties are to be applied to nerves, then it will follow, that the ſame nerve would conſtantly convey the ſame idea, with no other variety than of its being weaker and ſtronger, whatever different objects were applied to it; unleſs we ſuppoſed the nerve changed in its texture, length, or tenſion, each time a different object is applied; which, it is preſumed, nobody will undertake to prove does happen.

Nay, 3dly, If ever ſuch a variety of vibrations could be made, our ſenſations would notwithſtanding be confuſed and indiſtinct; becauſe the tremulous nervous fibre being firmly connected and contiguous to ſeveral other fibres of the ſame cord, would neceſſarily ſhake them too, by which we ſhould have the notion of the object as applied at all the different parts where the extremities of theſe fibres terminate.

33. In whatever way the favourers of the doctrine of ſolid nerves pleaſe to apply the elaſticity of nerves to the contraction of muſcles, their adverſaries inſiſt that nerves are too weak to reſiſt ſuch weights as the muſcles ſuſtain; they would ſurely break, eſpecially as they are in a great meaſure, if not wholely, deprived of their ſtrong coats before they come to the part of the muſcle they are immediately to act upon (§ 22.)—The nerves being found to have little or no elaſticity to ſhorten themſelves (§ 14.) ſhows them altogether unfit for ſuch an office as this of contracting muſcles in the way propoſed

posed of their acting by elasticity; and when a nerve is viewed with a microscope while the muscles it serves are in action, no contraction or motion is observed in it.——Nay, if they were elastic, they would equally exert their power of contracting muscles nearer to their origin as well as farther from it, when they were put into contraction or vibration, by irritation of any part of them. The former, however, does not happen.

34. As a further objection against either motion or sensation being owing to the elasticity of the nerves, it is said, that if this doctrine was true, the sensations would be more acute, and the contractions of muscles would be greater and stronger, when the parts become firmer and more rigid by age; for then their elasticity is increased: Whereas, on the contrary, it appears (§ 23.) that then the sensations are blunted, and muscular contraction becomes less and weaker.

35. If the nerves were granted to be elastic, and to communicate a springy force to all the parts they are distributed to, they might appear necessary in this view to assist the application of the nutritious particles of the fluids to the sides of the vessels which these particles were to repair; and so far might well enough account for the share which nerves are thought to have in nutrition: But if we cannot make use of elasticity in the other two functions, sensation and motion, we must also endeavour to find out some other way for the nerves to act in nutrition; which will be done afterwards.

36. Having thus stated the reasons for and against the nerves acting as solid strings, let us likewise relate the arguments for nerves being pipes, and the objections to this doctrine.

A great argument of those who think the nerves to be tubes conveying liquors, is the strong analogy of the brain and nerves to other glands of the body and their excretories, where a manifest secretion of liquor is made in the glands, to be conveyed by the excretories to the proper places in which it ought to be deposited:

they think that the vafcular texture of the cortex of the encephalon and fpinal marrow (§ 2.) the continuation of the cortex in forming the medullary fubftance (3, 4.) the fibrous texture (§ 5.) and fucculent ftate of this medulla (§ 6.) and its being wholly employed to form the nerves (§ 7.) where the fibrous texture is evident (§ 9.); all thefe things, fay they, confpire to fhow fuch a ftrong analogy between thefe parts and the other glands of the body, as carries a conviction that there is a liquor fecreted in the encephalon and fpinal marrow, to be fent out by the nerves to the different parts of the body.

37. The following objections are raifed to this argument in favour of liquor conveyed in the nerves from the analogy of the glands. 1*ft*, Other glands, it is faid, have their excretories collected into a few large pipes, and not continued in fuch a great number of feparate pipes, as far as the places where the liquors are depofited; which laft muft be the cafe, if the nerves are the excretories of the glandular brain. 2*dly*, We fee the cavities, and can examine the liquors in the excretories of other glands much fmaller than the brain; which cannot be done in the nerves. 3*dly*, If the nerves were pipes, they would be fo fmall, that the attraction of the liquors to their fides would prevent that celerity in the motion of the liquors, which is requifite to fenfations and motions. 4*thly*, If the nerves were pipes, they would be cylindrical ones, and confequently not fubject to difeafes; or at leaft we could have no comprehenfion of the difeafes in them.

38. The anfwer to the 1*ft* of thefe objections is, That there are other glands where there is a manifeft fecretion, and in which the difpofition of the excretories is in much the fame way as in the encephalon: the kidneys, for example, have a reticulated cortex of veffels, from which the Euftachian or Bellinian medulla, confifting of longitudinal fibres and a few blood-veffels in the fame direction, proceeds; and this medulla is collected into ten, twelve, or more papillæ, each of which is

is formed of numerous ſmall ſeparate pipes, which ſingly diſcharge the urine into the large membranous tubes; and theſe united form the pelvis. Upon comparing this texture of the kidneys with that of the encephalon (§ 2, 3, 4, 5, 6, 7, 9.) the analogy will be found very ſtrong.

39. In anſwer to the 2*d* objection, in § 37. it is granted, that microſcopes, injections, and all the other arts hitherto employed, have not ſhown the cavities of the nervous fibrils, or the liquors contained in them; and from what was ſaid (§ 10.) of the ſmallneſs of the nervous fibrils, it is not to be expected that ever they ſhould be ſeen. But ſo long as ſuch a number of little animals can every hour be brought to the objectors, in which they can as little demonſtrate the veſſels or contained fluids, it will not be allowed to be concluſive reaſoning, that becauſe ocular demonſtration cannot be given of either the tubes or their contents, therefore they do not exiſt. For if we have any notion of an animal, it is its being an hydraulic machine, which has liquors moving in it as long as it has life. If therefore ſuch little animals have veſſels and liquors which we cannot ſee, why may not ſome of the veſſels and liquors of the human body be alſo inviſible to us?

To avoid this anſwer to the objection, it is further urged, That though we might not ſee the nervous tubes or the liquors they contain as they naturally flow; yet if ſuch liquors really exiſt, they ought to diſcover themſelves, either by a nerve's ſwelling when it is firmly tied; or that, however ſubtle their fluids are, they might be collected in ſome drops, at leaſt, when the cut end of a nerve of a living animal is kept ſome time in the exhauſted receiver of an air-pump. It is affirmed, that neither did the tied nerve ſwell between the brain and ligature, nor was there any liquor collected in the receiver of the air-pump; from which it is concluded, that there is no liquor in the nerves.

Some, who ſay they have tried theſe experiments, affirm, that in young animals the nerve does ſwell above the ligature, and that a liquor does drill out upon cutting a nerve.——Whether ſwelling or liquor is ſeen or is not ſeen in theſe experiments, no concluſion for or againſt a nervous fluid can be made from them; for the ſwelling of the nerve after it is tied, or the efflux of liquors from its extremity, will never prove either to be the effect of the fluid in the proper nervous fibrils, ſo long as they might be occaſioned by the liquors in the larger veſſels of the cellular ſubſtance of the nerves; and if theſe ſame veſſels of the coats of the nerves do not diſcover their liquors by theſe experiments, it is far leſs to be expected that the much more ſubtle nerves will diſcover theirs.

40. The 3*d* objection to the doctrine of the brain being a gland, and the nerves its excretories, ſuppoſes a more rapid motion neceſſary in the fluid of the nerves than what moſt of the defenders of the nervous fluid will now allow; and is afterwards to be conſidered particularly in a more proper place.

41. The 4*th* objection being, That if nerves are excretories of a gland, they muſt be cylindrical pipes, in which no obſtructions or diſeaſes would happen; but ſince we daily ſee diſeaſes in the nerves, they muſt therefore not be ſuch excretories. The anſwer is, That diſeaſes happen often in the excretories of other glands, as of the liver, kidneys, &c. notwithſtanding their cylindrical form, and their much ſhorter and leſs expoſed courſe. When we conſider the very tender ſubſtance of the brain, the vaſt complication of veſſels there, the prodigious ſmallneſs of the pipes going out from it, the many moving powers which the nerves are to undergo the ſhock of, and the many chances which the veſſels, membranes, and cellular ſubſtance accompanying the nerves, have of being diſordered, and then affecting the nervous fibrils, we have very great reaſon to be ſurpriſed, that theſe cylindrical pipes are not much more frequently put out of order, by too great or too ſmall a quantity of liquors; by too viſcid or too thin fluids; by

liquors confifting of too mild and fluggifh particles, or of too acrid pungent ones; by too great or too little motion given to the liquors; by the diameters of the pipes being too much ftraitened, or too much enlarged; and by a great many other varieties of circumftances which might be thought capable of difturbing the functions of the nerves, fuppofing them to be cylindrical excretories of the gland, the brain.

42. The numerous veffels of the encephalon have brought fome of the gentlemen who affert the nerves to be folid, to acknowledge, that there is a liquor fecreted in the brain: but then they will not allow that this liquor is fent out by the proper nervous fibrils, but that it is poured into the cellular fubftance in which the nerves lie, to keep them moift and fupple, and therefore fit for exerting their elafticity, vibration, &c. by which, in their opinion, the effects commonly afcribed to nerves are produced.

43. Befides the objections already mentioned (§ 32, 33.) againft the nerves acting as elaftic ftrings, this opinion has fome other difficulties which may be objected to it: for inftance, there is not one analogous example in the whole body of liquors fecreted in a large gland, to be poured into a cellular fubftance, as is here fuppofed; the liquors in the cells of the tela cellularis of other parts are feparated from the little arteries which are diftributed to thefe cells.

Further, it cannot be imagined, how a liquor fecreted in the cortex of the brain fhould make its way thro' the medulla, to come out into the cellular membranes on the furface of that medulla.

Laftly, A very fimple experiment, of injecting water by the artery of any member, and thereby filling the cellular fubftance of the nerves of that member, fhows evidently, that the liquor of the cellular fubftance of the nerves has the fame fountain as the liquor has in the tela cellularis any where elfe, that is, from the little arteries difperfed upon it.

44. The

44. The doctrine of a fluid in the nerves, is not only thus supported by the analogy of the brain and nerves to the other glands and their excretories, but thofe who maintain this doctrine mention an experiment which they think directly proves a fluid in the nerves. It is this: After opening the thorax of a living dog, catch hold of and prefs one or both the phrenic nerves with the fingers, the diaphragm immediately ceafes to contract; ceafe to comprefs the nerves, and the mufcle acts again: a fecond time, lay hold of the nerve or nerves fome way above the diaphragm, its motion ftops. Keep firm the hold of the nerve, and with the fingers of the other hand ftrip it down from the fingers which make the compreffion towards the diaphragm, and it again contracts: a repetition of this part of the experiment three or four times, is always attended with the fame effects; but it then contracts no more, ftrip as you will, unlefs you remove the preffure to take hold of the nerves above the place firft pinched; when the mufcle may again be made to contract, by ftripping the nerve down towards it. This experiment I have done with the fuccefs here mentioned. Let any one try if he can imagine any other reafonable account of thefe appearances, than that the preffure by the fingers ftopped the courfe of a fluid in the nerve; that fo much of this fluid as remained in the nerve, betwixt the fingers and diaphragm, was forced into that mufcle by ftripping; and when it was all preffed away, the fingers above preventing a fupply, the mufcle contracted no more till the fingers were removed, and a frefh flow by that means was received from the fpinal marrow, or from that part of the nerve which had not yet been fo ftripped.

It has been objected to the conclufions from this experiment, 1. That the diaphragm is fet in motion by ftripping the nerve from, as well as towards, this mufcle; and this may be well expected; for a liquor in fuch fmall pipes hindered to flow backwards by ligature, pinching fingers, or even the flow of their liquors from the

the ſountain, will regurgitate forewards with velocity when preſſed backwards. We ſee it happen in the ſtalks of tender ſucculent plants.

2. It is ſaid, that muſcles ceaſe to act when their veins are tied, as well as when their arteries or nerves are tied or cut, but that muſcles continue to act when their veins are cut: by which it would appear, that the overloading of the veſſels is an impediment to the action of muſcles; and therefore the ceaſing of their action, when their arteries or nerves are tied or cut, may alſo be owing to the liquor in the branches of theſe pipes of muſcles ſtagnating when it is not propelled by the flow of more liquor from their trunks, and not to any influence or moving power, which now ceaſes to be conveyed to them.

It is to be obſerved, in making the experiments juſt now mentioned, that the contraction of the muſcles ceaſes ſooneſt when the nerves, and lateſt when the veins are tied.——That when veins are tied, not only are the veſſels overloaded, but all the cellular ſubſtance of the muſcles is filled with coagulated blood; whereas when the arteries and nerves are tied, the reverſe is ſeen, the muſcles are lax, and of leſs bulk. So that in theſe caſes, the ceaſing of the contraction of the muſcles ſeems to depend on very different cauſes, to wit, a deprivation of neceſſary liquors in the one, and a redundancy of ſuperfluous blood in the other. An elaſtic ſtick may be deprived of its elaſticity, by being made either too dry or too wet.

45. Some gentlemen, convinced of the reaſonableneſs of the ſecretion of a liquor in the brain to be ſent out by the nerves, but not comprehending how a fluid could have ſuch a rapid retrograde motion as they imagined was neceſſary for conveying the impreſſions of objects made on the extremities of nerves to the ſenſorium, ſuppoſed two ſorts of nerves; one that conveyed a liquor for muſcular motion and nutrition; the other compoſed of ſolid nerves, that were to ſerve for

organs of the ſenſes, to convey the vibrations communicated from objects to the ſenſorium.

46. To this opinion (§ 45.) the objections againſt the ſenſatory nerves acting by vibration (§ 32.) may be made; and there is ſo little reaſon to ſuſpect any difference in the texture of the different parts of the brain or nerves, that, on the contrary, the ſtructure is every where ſimilar, and branches of the ſame nerve often ſerve both for ſenſation and motion.

How little neceſſity there is for ſuppoſing extremely rapid motions of the nervous fluid, is to be examined ſoon.

47. The hypotheſis of great celerity in the motion of the fluid of the nerves being neceſſary, gave alſo riſe to another diviſion of the nerves, into arterious or effluent, and venous or refluent. It was ſaid, that muſcular motion and nutrition depended on the arterious nerves; and that the ſenſations depended on an accelerated motion of the nervous fluid towards the brain, by the impreſſions which the objects of the ſenſes make upon the venous nerves. By this ſuppoſition, the abſurdity of rapid fluxes and refluxes in the ſame canal was prevented; and an advantage was thought to be gained by it, of ſaving too great a waſte of the fluid of the nerves, which otherwiſe the encephalon and ſpinal marrow could not ſupply in ſufficient quantity to anſwer all the exigencies of life.

48. To this opinion (§ 47.) it has been objected, 1*ſt*, That there is no example in the body, of a ſecreted liquor being returned immediately and unmixed to the gland by which it was originally ſeparated from the maſs of blood; which would be the caſe were there venous nerves. 2*dly*, There is no occaſion for ſaving the fluid of the nerves in the way propoſed; the organs for ſecreting that fluid being large enough to ſupply all that is neceſſary of it in the common functions of life. 3*dly*, If the fluid of the nerves was to be thus kept in a perpetual circulation, it would ſoon become too acrid for

for continuing with ſafety in ſuch ſenſible tender veſſels as the brain and nerves are compoſed of. *4thly*, This hypotheſis will not anſwer the deſign for which it was propoſed: for though the momentary application of an object might cauſe an acceleration in the fluid of venous nerves, yet if the object was kept applied to the nerves, it would ſtop their fluid, ſo that it could not go foreward to the brain; and therefore, according to this doctrine, we ſhould be ſenſible of no objects, except thoſe whoſe application to the organs of the ſenſes was momentary.

49. Let us now ſuppoſe it probable, that the encephalon and ſpinal marrow ſecern a liquor from the blood which is ſent into all the nerves, and that by the means of this liquor the nerves perform the offices commonly aſſigned to them; it is next neceſſary to inquire what kind of liquor this is, and how it moves, in order to determine how well its nature and motion are fitted for performing what is expected from it.

50. The liquor of the nerves has been fancied by ſome to be of a very ſtrong acid or alkaline nature: But ſince none of our juices appear to be of this ſort, and ſince ſuch liquors irritate and deſtroy the parts of the body which they are applied to, we cannot conceive how the brain can ſeparate, or the nerves could bear any thing of ſuch an acrid nature. This tenderneſs and ſenſibility of theſe organs muſt hinder us abſolutely from ſuppoſing that the liquor of the nerves can be acrid or pungent, or of the nature of ſpirit of wine, hartſhorn, &c.

51. Some have imagined the liquor of the nerves to be capable of vaſt exploſion like gun-powder, or of violent ſudden rarefaction like air, or of ſtrong ebullition like boiling water, or the mixture of acids with alkaline liquors. But as the maſs of blood from which this fluid is derived, is not poſſeſſed of any ſuch properties, we cannot ſuppoſe the blood to furniſh what it has not in itſelf. Beſides, all theſe operations are too

 violent

violent for the brain or nerves to bear; and when once they are begun, they are not ſo quickly controlled or reſtrained, as experience teaches us the nerves can be made to ceaſe from acting.

52. We are not ſufficiently acquainted with the properties of an æther, or electrical effluvia, pervading every thing, to apply them juſtly in the animal œconomy; and it is as difficult to conceive how they ſhould be retained or conducted in a long nervous cord. Theſe are difficulties not to be ſurmounted.

53. The ſureſt way of judging what kind of liquor this of the nerves muſt be, is to examine the liquors of ſimilar parts of the body. All the glands ſeparate liquors from the blood much thinner than the compound maſs itſelf; ſuch is the liquor poured into the cavity of the abdomen, thorax, ventricles of the brain, the ſaliva, pancreatic juice, lymph, &c. Wherever there is occaſion for ſecreted liquors being thick and viſcid, in order to anſwer better the uſes they are intended for, nature has provided reſervoirs for them to ſtagnate in, where their thinner parts may be carried off by the numerous abſorbent veins diſperſed on the ſides of thoſe cavities; or they may exhale where they are expoſed to the open air. The mucus of the noſe becomes viſcid by ſtagnation; for when it is immediately ſecreted, it is thin and watery, as appears from the application of ſternutatories, &c. The cerumen of the ears is of a watery conſiſtence when juſt ſqueezing out. The mucus of the alimentary canal grows thick in the lacunæ. The bile in the hepatic duct has little more conſiſtence than lymph; that in the gall-bladder is viſcid and ſtrong. The urine is much more watery as it flows from the kidneys, than when it is excreted from the bladder. The ſeed is thin as it comes from the teſticles, and is concocted in the veſiculæ ſeminales, &c.

54. Hence (§ 53.) we may ſafely conclude, that a thin liquor is ſecreted in the cortex encephali and ſpinal mar-

marrow; and feeing the thinnefs of fecreted liquors is generally, as the divifions of the veffels, into fmall fubtle branches, and that the ramifications within the fkull are almoft infinitely fubtle, the liquor fecreted in the encephalon may be determined to be among the fineft or thinneft fluids.

55. Seeing alfo that we can obferve no large refervoir, where the liquor fecerned in the cortical fubftance is depofited, to have its finer parts taken off, we have reafon to think that it goes forward into the nerves in the fame condition in which it is fecerned.

56. By fine or fubtle animal liquors, is meant no more than thofe which are very fluid, and which feem to confift of a large proportion of watery particles, and a leffer one of the oily, faline, and terreftrious particles. Some of the liquors which we can have in fufficient quantity to make experiments with, are fo fluid, and have fo little vifcidity or cohefion of parts, that when laid upon a piece of clean mirror, they evaporate without leaving a ftain. Such is the liquor oozing out from the furface of the pleura, the lymph, and feveral others.

If then thefe liquors, which are fubject to our examination, the fecerning veffels of which are fo large that we can fee them, have fuch a fmall cohefion of parts, it might not be unreafonable to fay, that the liquor of the nerves is as much more fine and fluid than lymph as the veffels feparating it are fmaller; and therefore that the fluid of the nerves is a defecated water, with a very fmall proportion of the other principles extremely fubtilized.

57. Two experiments are faid to contradict this opinion of the liquor of the nerves being fo fluid and fubtle. One is, that upon cutting the cauda equina of a living animal, a liquor as vifcid as the white of an egg drops out. The other is, that a wounded nerve yields a glairy fanies. But thefe do not appear to be the proper fluid of the nerves; fince it is evident, that what

what is difcharged in both thefe cafes comes out of the cellular fubftance involving the nervous fibrils.

58. Confidering how many experiments make it evident, that there is a conftant uninterrupted ftream of liquors flowing through all the canals of animals, which convey liquors compofed of particles fmaller than the diameter of their canal, which is always the cafe of the nerves in a natural ftate, it is furprifing how it ever could be thought, that the liquid of the nerves fhould be obliged to flow from the brain to each mufcle the moment we will; or that this liquor fhould flow back with the like fwiftnefs from the extremity of each nerve, to which an object of fenfation is applied. The nerves, as well as the other excretories of the glands, always are full of liquor; the degree of diftention of the canals not being at all times alike even in a found ftate. But this happens without inconvenience, as the fides of the canals have a power to accommodate themfelves to the prefent quantity, unlefs it is very much above or below the natural ftandard; in both which cafes difeafes enfue.

59. The motion of the fluid in the nerves is therefore not only conftant, but it is alfo equal, or nearly fo: for though the blood in the larger arteries is moved unequally by the unequal forces, the contraction of the ventricle of the heart, and the weaker power, the fyftole of the arteries; yet the difference between thefe two moving powers comes to be lefs and lefs perceptible as the arteries divide into fmaller branches; becaufe of the numerous refiftances which the liquors meet with, and becaufe the canals they move in become larger, till in the very fmall arterious branches there is no fenfible difference in the velocity of the liquors from the effect of the heart or arteries. The motion of the fluids muft ftill be more equal in the excretories of glands, and particularly in thofe where the veffels have divided into very minute branches, and the liquors have no other propelling force but the heart and arteries, (fee

(ſee § 1.); therefore the nervous fluid moves conſtantly, equally, and ſlowly, unleſs when its courſe is altered by the influence of the mind, or by the preſſure of ſome neighbouring active organ.

60. As there is neither proof nor probability of the valves ſuppoſed by ſome in nerves, we are not to aſſume them in accounting for any phenomena.

61. We have not, and perhaps cannot have, any idea of the manner in which mind and body act upon each other; but if we allow that the one is affected by the other, which none deny, and that the fluid of the nerves (whatever name people pleaſe to give it) is a principal inſtrument which the mind makes uſe of to influence the actions of the body, or to inform itſelf of the impreſſions made on the body, we muſt allow that the mind can direct this inſtrument differently, particularly as to quantity and celerity, though we muſt remain ignorant of the manner how many phenomena depending on this connection of mind and body are produced. Thus we would in vain attempt to account for animals continuing, after their heads were ſtruck off or their hearts were cut out, to perform actions begun before they ſuffered any injury.

62. Let us now ſuppoſe the nervous fluid ſuch as has been argued for, to wit, a very fluid ſaponaceous water, moving in a conſtant, equal, ſlow ſtream, from the encephalon and ſpinal marrow, in each of the proper nervous fibres, except when the motion is changed by ſome acceſſory cauſe, ſuch as the mind, preſſure of other parts, &c.; and let us examine how well ſuch a ſuppoſition will agree with the phenomena of the three great functions, nutrition, ſenſation, and muſcular motion, which the nerves are principal inſtruments of.

63. In general, we may ſay, that nerves can carry fluids to the moſt minute part of the body, to ſupply what is waſted in any of the ſolids; that the impreſſion made by the objects of the ſenſes on the very ſoft pulpy extremities of the nerves of the organs of the ſenſes,

muſt make ſuch a ſtop in the equal-flowing nervous fluid, as muſt inſtantaneouſly be perceptible at the fountain-head from which the pipes affected ariſe; that the conſtant flow of the liquor of the nerves into the cavities of the muſcular fibrillæ, occaſions the natural contraction of the muſcles, by the as conſtant niſus it makes to increaſe the tranſverſe and to ſhorten the longitudinal diameter of each fibre; and that it is only to allow the mind a power of determining a greater quantity of this ſame fluid with a greater velocity into what muſcular fibres it pleaſes, to account for the voluntary ſtrong action of the muſcles.

64. But ſince ſuch a ſuperficial account would not be ſatisfactory, it will be expected, that the principal phenomena of theſe three functions ſhould be explained by the means of ſuch a fluid as has been ſuppoſed, and that the ſeveral objections againſt this doctrine ſhould be anſwered: let us attempt this; and where we cannot extricate ourſelves from difficulties which may be thrown in, let us honeſtly acknowledge ignorance.

65. *α*. If water, with a very ſmall proportion of oils and ſalts from the earth, proves a fit nouriſhment for vegetables, ſuch a liquor as the fluid of the nerves has been deſcribed (§ 56.) may not be unfit for repairing the waſte in animals.

β. The ſlow continual motion of this nervous fluid (§ 58, 59.) to the moſt minute parts of the body (§ 10.) is well enough calculated to ſupply the particles that are conſtantly worn off from the ſolids by the circulation of the liquors and neceſſary actions of life.

γ. The greater proportional ſize of the encephalon in young creatures than in adults, ſeems calculated for their greater proportional growth: for the younger the animal is, the larger encephalon and ſpeedier growth it has.

δ. A palſy and atrophy of the members generally accompanying each other, ſhow, that nouriſhment, ſenſation, and motion, depend on the ſame cauſe.

ε. It

*. It was ſaid (§ 26.), that the nerves were principal inſtruments in nutrition: it was not affirmed, that they were the ſole inſtruments; and therefore an atrophy may proceed from the compreſſion or other leſion of an artery, without being an objection to the doctrine here laid down.

66. *a.* All objects of ſenſe, when applied to their proper organs, act by impulſe; and this action is capable of being increaſed by increaſing the impelling force. In tangible objects, that is clearly evident; the cloſer they are preſſed to a certain degree, the more diſtinct perception enſues. Odorous particles need the aſſiſtance of air moved rapidly to affect our noſe: ſapid ſubſtances, that are ſcarce ſufficient to give us an idea of their taſte by their own weight, are aſſiſted by the preſſure of the tongue upon the palate: the rays of light collected drive light bodies before them: ſound communicates a vibration to all bodies in harmonic proportion with it.

The impulſes made thus by any of theſe objects on the ſoft pulpy nerves (§ 21.), which are full of liquor, preſs their ſides or extremities, and their liquor is hindered to flow ſo freely as it did. The canals being all full (§ 58.) this reſiſtance muſt inſtantaneouſly affect the whole column of fluids in the canals that are preſſed, and their origins, and have the ſame effect as if the impulſe had been made upon the origin itſelf. To illuſtrate this by a groſs compariſon: Let any one puſh water out of a ſyringe, through a long flexible pipe fixed to the ſyringe; and he is ſenſible of reſiſtance or a puſh backwards, the moment any one ſtops the orifice of the pipe, or cloſes the ſides of it with his fingers. This impulſe made on the nerves, and thus communicated to their origin, varies according to the ſtrength or weakneſs, the quickneſs or ſlowneſs, the continuance or ſpeedy removal, the uniformity or irregularity, the conſtancy or alternation, &c. with which objects are applied to the nerves.

b. Whenever any object is regularly applied with due force to a nerve rightly diſpoſed to be impreſſed by it, and is communicated, as juſt now explained, to the ſenſorium, it gives a true and juſt idea of the object to the mind.

c. The various kinds of impulſes which the different claſſes of objects make, occaſion in animals, which ought to have accurate perceptions of each object, a neceſſity of having the different organs of the ſenſes variouſly modified, ſo that the ſeveral impulſes may be regularly applied to the nerves in each organ; or, in other words, we muſt have different organs of the ſenſes fitted to the different claſſes of objects.

d. As the objects have one common property of impulſe, ſo all the organs have moſt of the properties of the organ of touching in common with the papillæ of the ſkin. In the noſe and tongue this is evident: in ſome operations of the eyes, we can alſo perceive this; as we may likewiſe do in ſome caſes where matter is collected in the internal ear.

e. Theſe properties common to the different objects and organs, occaſion frequently uncommon effects in the application of an object to an organ proper to another object of ſenſation: for ſometimes we have the ſame idea as if the object had been applied to its own proper organ; at other times the object is as it were changed, and we have the idea as if the organ had had its own proper object applied to it. Thus, for example, light is the proper object to be applied to the eye, to give us any idea of colours; yet when all light is excluded from the eyes, an idea of light and colours may be excited in us by coughing, ſneezing, rubbing or ſtriking the eye-ball.——A cane vibrating, ſo as not to excite ſound perceptible to the ear, applied to the teeth, raiſes a ſtrong idea of ſound; as a little inſect creeping in the meatus auditorius alſo does. The fingers applied to two rough ſurfaces, rubbing on each other, are ſenſible of the ſound they make; ſurgeons of any practice in-

in the cure of fractured bones can bear witnefs to the truth of this.——The fingers dipped in acid and feveral other acrid liquors, have a fenfation very like to tafting.——Smelling and tafting, every body knows, are fubfervient and affifting to each other. From fuch examples we have further proof of one general caufe of our fenfations, to wit, impulfe from the objects; and of fuch a fimilarity and relation in the organs, as might give reafon for imagining that any one of them would be capable of producing the effect of another, if the impulfes of the different objects could be regularly applied to each.——Hence light and found may affect infects and other animals that have not eyes or ears.

f. If the impulfe of an object is applied with due force, but irregularly, a confufed idea of the object is raifed. Diftant objects are confufed to myopes, as very near ones are to prefbytæ.

g. If the application of the impulfe is regular, but the force with which it is applied too weak, our perception of the object is too faint. One may whifper fo low as not to be heard.

h. If the application of objects is too violent, and there is any danger of the tender organs of our fenfes being hurt or deftroyed, an uneafy fenfation we call *pain* is raifed, whatever the organ thus injured is. The object of feeling affects every organ: thus preffure, ftretching, cutting, pricking, acrid falts, pungent oils, great heat, violent cold, &c. occafion pain, whereever they are applied. Befides, every particular organ can be affected with pain by the too violent application of its own proper object. Too much light pains the eyes; very loud found ftuns the ears; very odorous bodies and too fapid objects hurt the nofe and tongue. A pretty fure proof this, that the objects of our fenfes all act, and that the organs are all impreffed, in nearly the fame way.

i. Since a middle impulfe, neither too fmall, nor too great, is neceffary for a clear perception of objects, we would often be in danger of not diftinguifhing them, if we were not fubjected to another law, to wit, that numerous impulfes made at once, or in a quick fucceffion to each other, increafe our perceptions of objects. Thus, fuch found as would not be heard on a mountain-top, will be diftinctly heard in a wainfcotted chamber.—— We feel much more clearly a tangible object when our finger is drawn alongft it than when applied with the fame force, but by a fingle preffure upon it.——We make repeated applications of odorous and fapid objects, when we wifh to fmell or tafte accurately.—— The end of a burning ftick appears much more luminous when quickly whirled in a circle than when at reft.

k, Whenever the uneafy fenfation, pain, is raifed by the too ftrong application of objects, a fort of neceffity is as it were impofed upon the mind, to endeavour to get free of the injuring caufe, by either withdrawing the grieved part of the body from it, as one retires his hand when his finger is pricked or burnt; or the injuring caufe is endeavoured to be forced from the body, as a tenefmus excites the contraction which pufhes acrid fœces out of the rectum. In both thefe operations, a convulfive contraction is immediately made in the lefed part, or in the neighbourhood of it; and if the irritation is very ftrong or permanent, the greater part of the nervous fyftem becomes affected in that fpafmodic or convulfive way.——Is it this neceffity which obliges the mind to exert herfelf in refpiration, or in the action of the heart, when the lungs or heart are gorged with blood? or the iris to contract the pupil, when the eye is expofed to ftrong light? or fneezing to be performed when the nofe is tickled? &c.— ——Will not a ftimulus of any nerve more readily affect thofe with which it is any where connected than the other nerves of the body?——May not this fympathy ferve as a monitor of the mind rather to employ the organs furnifhed with nerves thus connected, to affift in in freeing her of any uneafy fenfation, than to make ufe of any other organs?——Will not this in fome meafure account for many falutary operations performed in the body, before experience has taught us the functions of the organs performing them?

This nifus of the mind to free the body of what is in danger of being hurtful, may ferve to explain the phænomena of a great many difeafes, when we are acquainted with the diftribution of the particular nerves; and from this we can underftand the operation of medicines that ftimulate; and may learn how, by exciting a fharp, but momentary pain, we may free the body of another pain that would be more durable; and that, by having it thus in our power to determine a flow of the liquor of the nerves to any particular part, for the benefit of that part, or the relief of any other difeafed part, we can do confiderable fervice by a right application of the proper medicines.

l. If a pain giving caufe is very violent or long continued, it deftroys the organs either irrecoverably, or puts them fo much out of order, that they only gradually recover. People have been made blind or deaf for all their lives after a violent effect of light on their eyes, or of found on their ears; and we are frequently expofed to as much light and found as to make us unfit to fee or hear for a confiderable time. I would explain this by a ligature put round the tender branch of an herb. This ligature drawn to a certain degree, may weaken the canals fo as to be unfit for the circulation of the juices a good while, till they are gradually explicated and made firm by thefe juices: A ftricter ligature would diforder the ftructure of the fibres fo much, that the liquors could not recover them. The analogy is fo plain, that it needs no commentary.——Thus the influence of a nerve tied with an artery in the operation of an aneurifm, may ceafe for fome time, but be afterwards recovered.

67. (1.) In applying the fluid of the nerves to the ac-

tion of mufcles, it was faid, that the natural or involuntary contraction of mufcles was the nifus which the nervous fluid, flowing conftantly into the mufcular fibres, makes to diftend thefe fibrils, by enlarging their tranfverfe diameters and fhortening their axes; and that voluntary contraction was owing to a greater quantity of that nervous liquor determined towards the mufcle to be put in action, and poured with greater momentum into the mufcular fibrils, by the power of the mind willing to make fuch a mufcle to act, or obliged to do it by an irritating pain-giving caufe (§ 66. *k*.)

(2.) Some object to this account of mufcular motion, that if there is no outlet for the liquor fuppofed to be poured into mufcular fibres, mufcles would always be in a ftate of contraction, which they are not; and if there is a paffage from the fibrils, the liquor would flow out as faft as it was thrown in; and therefore no diftention of the fibres, or contraction of the mufcles, could be made.

(3.) In anfwer to this objection, it is obferved, that notwithftanding the evident outlet from the arteries into the veins, yet the arteries are diftended by the fyftole of the heart, or any other caufe increafing the momentum of the blood.

(4.) It has been alfo objected to § 1. that, if it was true, the volume of the mufcle in contraction neceffarily would be confiderably increafed by fo much liquor poured into its fibrils; whereas it does not appear, by any experiment, that the volume of a mufcle is increafed by its being put into action.

(5.) To this it has been anfwered, 1. That when the axes of mufcular fibres are fhortened, and their tranfverfe diameters are enlarged, the capacities of their fibres, and confequently their volume, may not be changed, the diminution one way balancing the increafe in the other. 2. That the fpaces between the mufcular fibres are fufficient to lodge thefe fibres when they

they ſwell during the contraction of a muſcle, without any addition to its bulk; and that it plainly appears that theſe ſpaces between the fibrils are thus occupied, by the compreſſion which the larger veſſels of muſcles, which run in thoſe ſpaces, ſuffer during the action of the muſcle; it is ſo great as to drive the blood in the veins with a remarkable accelerated velocity.

(6.) Another objection to the action of muſcles being owing to the influx of a fluid into their fibrils is, That muſcular fibres are diſtractile, or capable of being ſtretched; and therefore, when a fluid is poured into their hollow fibrils, they would be ſtretched longitudinally, as well as have their tranſverſe diameters increaſed; that is, a muſcle would become longer, as well as thicker, when it is put into action; whereas it is certainly known that a muſcle is ſhortened while it acts.

(7.) In anſwer to this, it has been remarked, That though muſcular fibrils are diſtractile, yet they will not yield to or be ſtretched by every force, however ſmall, that might be applied to them: A cord that can be ſtretched in length by the weight of a pound or two, would not yield in the leaſt to an ounce or two; and it muſt likewiſe be obſerved, that gradually as any body is ſtretched, its reſiſtance to the ſtretching force increaſes. A rope may be ſtretched to a certain length by a pound weight appended to it, which would require two pounds to ſtretch it very little further; and therefore the general obſervation of animal fibres being diſtractile, cannot be a reaſonable objection to the account of muſcular motion above-mentioned, unleſs a proof is brought, that the force which the liquid of the nerves muſt exert upon each fibre of a muſcle, in order to make it act, is capable of diſtracting or ſtretching the fibres; which has not yet been attempted to be proved.——It would appear from the pain cauſed by too great an effort of muſcles, eſpecially in weak people, that

that mufcular fibres can bear very little diftraction without danger of a folution of continuity.

(8.) Mufcles ceafing to act when their arteries are tied or cut, and being brought into motion by injecting liquors into the arteries even of a dead animal, has been mentioned as objections to the nervous influence caufing their contractions.

To the firft of thefe experiments it may be anfwered, That the tying or cutting of the nerves fooner produces the effect of making the contraction ceafe, than ftopping the influx of the arterious blood does; and it will be univerfally allowed, that the influx of blood into mufcles is neceffary for performing their functions right.

Whoever obferves the motion which injecting water, or any other liquor, into the arteries of a dead animal, caufes in its mufcles, will not compare it to what contraction, whether voluntary or excited by irritation, he may fee in a living one.

(9.) If mufcular motion depends on the influx of the nervous liquid, the inftantaneous contraction of a mufcle, when the mind wills to make it act, will be eafily underftood from the nerves being always full of their liquor (§ 58, 66, *a*.)

(10.) If either the nerves of any mufcle do not furnifh a fufficient quantity of their liquor, or if the fibres of a mufcle become too eafily diftractile, fuch a mufcle will be unactive or paralytic.

(11.) If too great a quantity of the liquor of the nerves is determined to a mufcle or mufcles, by any caufe which the mind cannot command, fuch mufcle or mufcles will be convulfed.

(12.) If the motion of the liquid of the nerves is not uniform, but by difeafe becomes irregular, an alternate relaxation and contraction of mufcles may be the confequence. Hence trembling palfies, chorea Sancti Viti, &c. Hence alfo the convulfive tremors which animals have when they lofe much blood.

(13.) Though the nerves may not furnifh fo much liquor as may be fufficient to make mufcles contract with ftrength enough to overcome the refiftances to their actions, yet there may be a fufficient quantity of liquor in the nerves to allow the impreffions of objects to be conveyed to the fenforium. This may be one caufe of a member's being fometimes fenfible after it cannot be moved.

(14.) Unlefs the liquor of the nerves acquires fome energy in the brain, which we have no reafon to think the circulation of the fluids in the veffels can give it, or unlefs it has other properties than what we can difcover in it, or unlefs there is an agent regulating its momentum and courfe to different parts which we are not confcious of; if fome of thefe, I fay, do not obtain, the action of the heart continuing of equal force to propel our liquors, notwithftanding all the refiftances that are to it, is not to be explained.

(15.) All mufcles, but efpecially the heart, continue to contract in an irregular way, after they are cut away from the animal to whom they belonged; which may be owing to the liquors continuing to flow in the fmall veffels, and being poured irregularly into the mufcular fibrillæ.

(16.) It is faid, that a mufcle cut out of the body continues fome time to be capable of contraction; whereas by tying its arteries or nerves, while it is otherwife entire in the body, it lofes its contracting power, which therefore does not depend on thefe organs, the arteries or nerves.

The lofs of the power of acting when the arteries or nerves are tied while the mufcle is in the body, is denied by fome who made the trial; and it might be expected that the motion of a mufcle would be more confpicuous where there is no refiftance to it, as is the cafe when it is cut away from all the parts it is connected with, than when its connection remains with parts refifting its contractile efforts.

(17.) After

(17.) After the heart, or any other mufcle cut away from an animal, has ceafed to contract, its contraction may again be reftored, by breathing upon it, or pricking it with any fharp inftrument. That heat or pricking fhould, by their ftimulus (§ 66, *k.*) occafion contraction in a living creature, may be underftood; but how they fhould have the fame effect in a mufcle feparated from an animal, I know not.

68. Some have thought the ganglions of nerves (§ 18, 19, 20.) to be glandular, and to perform a fecretion.——Others, from their firm texture, fuppofe them to be mufcular, and to ferve to accelerate the motion of the liquor in the nerves which proceed from them; but as no proof is offered of either of thefe opinions, they cannot be maintained.———Others would make them ferve, 1. To divide a fmall nerve into many nerves, and by thefe means to increafe the number of nervous branches. 2. To make nerves come conveniently by different directions to the parts to which they belong. 3. To re-unite feveral fmall nervous fibres into one large nerve.——Since no proof is brought that thefe three things cannot be done without the interpofition of a ganglion, but on the contrary we fee them performed where there are no ganglions, we muft continue to acknowledge ignorance concerning the ufes of thefe knots, the ganglions.

CHAP.

C H A P. II.

Of the Particular Nerves.

IT is generally ſaid, that there are 40 pair of nerves in all; of which 10 come out from the encephalon, and the other 30 have their origin from the ſpinal marrow.

Of the ten pair of nerves which come from the encephalon, the firſt is the *olfactory*, which long had the name of the *mamillary proceſſes* of the brain, becauſe in the brutes, cows and ſheep, which were moſt commonly diſſected by the ancients, the anterior ventricles of the brain are extended forwards upon theſe nerves, and adhere ſo firmly to them, that they ſeem to make the upper ſide of the nerves. Each of them being large, where it begins to be ſtretched out, and gradually becoming ſmaller as it approaches the cribriform bone, was imagined to reſemble a nipple. Thoſe who miſtook the ventricles for part of the nerves, obſerving the cavity in them full of liquor, concluded, that theſe olfactory nerves ſerved to convey the ſuperfluous moiſture of the brain to the holes of the ethmoid bone through which it paſſed into the noſe. But in man, the ventricles of whoſe brain are not thus extended forwards, theſe nerves are ſmall, long, and without any cavity, having their origin from the corpora ſtriata, near the part where the internal carotid arteries are about to ſend off their branches to the different parts of the brain; and in their courſe under the anterior lobes of of the brain, which have each a depreſſion made for lodging them, the human olfactory nerves become larger, till they are extended to the cribriform bone; where they ſplit into a great number of ſmall filaments, to paſs through the little holes in that bone; and being joined by a branch of the fifth pair of nerves, are ſpread on the membrane of the noſe.

The tender ſtructure and ſudden expanſion of theſe nerves on ſuch a large ſurface, render it impoſſible to trace them far; which has made ſome authors deny them to be nerves: but when we break the circumference of the cibriform lamella, and then gently raiſe it, we may ſee the diſtribution of the nerves ſome way on the membrane of the noſe, where they form a beautiful net-work.

The contrivance of defending theſe long ſoft nerves from being too much preſſed by the anterior lobes of the brain under which they lie, is ſingular; becauſe they have not only the prominent orbitar proceſſes of the frontal bone to ſupport the brain on each ſide, with the veins going into the longitudinal ſinus, and other attachments bearing it up, but there is a groove formed in each lobe of the brain itſelf for them to lodge in.—Their ſplitting into ſo many ſmall branches before they enter the bones of the ſkull, is likewiſe peculiar to them; for generally the nerves come from the brain in diſgregated filaments, and unite into cords, as they are going out at the holes of the bones. This contrivance is the beſt for anſwering the purpoſe they are deſigned for, of being the organ of ſmelling; for had they been expanded upon the membrane of the noſe into a medullary web, ſuch as the optic forms, it would have been too ſenſible to bear the impreſſions of ſuch objects as are applied to the noſe; and a diſtribution in the more common way, of a cord ſending off branches, would not have been equal enough for ſuch an organ of ſenſation.

The *ſecond* pair of nerves, the *optic*, riſing from the thalami

lami nervorum opticorum, make a large curve outwards, and then run obliquely inwards and forwards, till they unite at the forepart of the ſella turcica; then ſoon divide, and each runs obliquely forwards and outwards to go out at its proper hole in the ſphenoid bone, accompanied with the ocular artery, to be extended to the globe of the eye, within which each is expanded into a very fine cup-like web, that lines all the inſide of the eye, to within a little diſtance of the edge of the cryſtalline lens, and is univerſally known by the name of *retina*.

Though the ſubſtance of this pair of nerves ſeems to be blended at the place where they are joined; yet obſervations of people whoſe optic nerves were not joined, and of others who were blind of one eye from a fault in the optic nerve, or in thoſe who had one of their eyes taken out, make it appear, that there is no ſuch intimate union of ſubſtance; the optic nerve of the affected ſide only being waſted, while the other was large and plump. And the ſame obſervations are contradictory to the doctrine of a decuſſation of all the nerves (§ 8.): for the diſeaſe could be traced from the affected eye to the origin of the nerve on the ſame ſide. In many fiſhes, indeed, the doctrine of decuſſation is favoured; for their optic nerves plainly croſs each other, without any union at the part where they are joined in men and moſt quadrupeds.

Thoſe people whoſe optic nerves were not joined, having neither ſeen objects double, nor turned their eyes different ways, is alſo a plain proof, that the conjunction of the optic nerves will not ſerve to account for either the uniform motions of our eyes, or our ſeeing objects ſingle with two eyes, though it may be one cauſe of the remarkable ſympathy of the one eye with the other in many diſeaſes.

The retina of a recent eye, without any preparation, appears a very fine web, with ſome blood-veſſels coming from its centre to be diſtributed on it; but, af-

ter

ter a good injection of the arteries that run in the ſubſtance of this nerve, as is common to other nerves, it is with difficulty that we can obſerve its nervous medullary ſubſtance.——The ſituation of theſe veſſels in the central part of the optic nerve, the want of medullary fibres here, and the firmneſs of this nerve before it is expanded at its entry into the ball of the eye, may be the reaſon why we do not ſee ſuch bodies, or parts of bodies, whoſe picture falls on this central part of the retina.—An inflammation in thoſe arteries of the retina, which ſeveral fevers and an ophthalmia are generally attended with, may well account for the tenderneſs in the eyes, and inability to bear the light, which people have in theſe diſeaſes.——The over-diſtention of theſe veſſels may likewiſe ſerve to account for the black ſpots obſerved on bright-coloured bodies eſpecially, and for that ſmoky fog through which all objects are ſeen by people in ſome fevers.——If theſe veſſels loſe their tone, and remain preternaturally diſtended, no object affects our retina, though the eye externally appears ſound; or this may be one cauſe of an amauroſis or gutta ſerena.——From a partial diſtention of theſe veſſels, or paralyſis of a part of the retina, the central part, or the circumference, or any other part of objects, may be loſt to one or both eyes.

The *third* pair riſe from the anterior part of the proceſſus annularis; and piercing the dura mater a little before and to a ſide of the ends of the poſterior clinoid proceſs of the ſphenoid bone, run along the receptacula, or cavernous ſinuſes, at the ſide of the ephippium, to get out at the foramina lacera: after which each of them divides into branches; of which one, after forming a little ganglion, is diſtributed to the globe of the eye; the others are ſent to the muſculus rectus of the palpebra, and to the attollens, adductor, deprimens, and obliquus minor muſcles of the eye-ball. Theſe muſcles being principal inſtruments in the motions of the eye-lid and eye-ball, this nerve has therefore got the

the name of the *motor oculi.*——I have frequently obſerved in convulſions the eye-lids widely opened, the cornea turned upward and outwards, and the eye-balls ſunk in the orbit; which well deſcribed the conjunct action of the muſcles which this pair of nerves ſerves. ——The diſtention of a conſiderable branch of the carotid, which paſſes over this nerve near its origin on each ſide, may poſſibly be the reaſon of the heavineſs in the eye-lids and eyes, after drinking hard or eating much.

The *fourth* pair, which are the ſmalleſt nerves of any, derive their origin from the back-part of the baſe of the teſtes; and then making a long courſe on the ſide of the annular protuberance, enter the dura mater a little farther back and more externally than the third pair, to run alſo along the receptacula, to paſs out at the foramina lacera, and to be entirely ſpent on the muſculi trochleares, or ſuperior oblique muſcles of the eyes. Theſe muſcles being employed in performing the rotatory motions, and the advancement of the eye-balls forward, by which ſeveral of our paſſions are expreſſed, the nerves that ſerve them have got the name of *pathetici.*—Why theſe ſmall nerves ſhould be brought ſo far to this muſcle, when it could have been ſupplied eaſily by the motor oculi, I know not.

The *fifth* pair are large nerves, riſing from the annular proceſſes, where the medullary proceſſes of the cerebellum join in the formation of that tuber, to enter the dura mater near the point of the petrous proceſs of the temporal bones; and then ſinking cloſe by the receptacula at the ſides of the ſella turcica, each becomes in appearance thicker, forms a diſtinct ganglion, and goes out of the ſkull in three great branches.

The firſt branch of the fifth is the *ophthalmic*, which runs through the foramen lacerum to the orbit, having in its paſſage thither a connection with the ſixth pair. It is afterwards diſtributed to the ball of the eye with the third; to the noſe, along with the olfactory, which the branch of the fifth that paſſes through the foramen orbitarium internum joins, as was already mentioned in the deſcription of the firſt pair. This ophthalmic branch likewiſe ſupplies the parts at the internal canthus of the orbit, the glandula lacrymalis, fat, membranes, muſcles, and teguments of the eye-lids; its longeſt fartheſt extended branch paſſing through the foramen ſuperciliare of the os frontis, to be diſtributed to the forehead.

The ſmall fibres which this firſt branch of the fifth and third pair of nerves ſen'd to the eye-ball, being ſituated on the optic nerve, and, after piercing the ſclerotic coat, running along the choroid coat on the outſide of the retina in their courſe to the uvea or iris, may be a cauſe of the ſympathy between the optic nerve and the uvea; by which we more readily acquire the habit of contracting the iris, and thereby leſſen the pupil, when too ſtrong light is excluded; and, on the contrary, enlarge the pupil when the light is too faint.—This, with the ſympathy which muſt ariſe from ſome of the nerves of the membrane of the noſtrils, being derived from this firſt branch of the fifth pair of nerves, may alſo be the cauſe, why an irritation of the retina, by too ſtrong light, may produce ſneezing, as if a ſtimulus had been applied to the membrane of the noſe itſelf;——why preſſing the internal canthus of the orbit ſometimes ſtops ſneezing;——why irritation of the noſe or of the eye cauſes the eye-lids to ſhut convulſively, and makes the tears to flow plentifully; and why medicines put into the noſe, do often great ſervice in diſeaſes of the eyes.——In the megrim, all the branches of the nerves diſcover themſelves to be affected: for the forehead is racked with pain; the eye-ball is pained, and feels as if it was ſqueezed; the eye-lids ſhut convulſively, the tears trickle down, and an uneaſy heat is felt in the noſe. Hence we can underſtand where external medicines will have the beſt effect when applied to remove this diſeaſe, to wit, to the mem-

membrane of the nofe, and to the fore-head ;——why alternate preffure near the fuperciliary hole of the frontal bone, or fneezing, fometimes gives immediate relief in the megrim ;——why the fight may be loft by an injury done to the fupra orbitar branch ;——how it may be reftored by agitation of that branch of this nerve.

The fecond branch of the fifth pair of nerves may be called *maxillaris fuperior*, from its ferving principally the parts of the upper jaw. It goes out at the round hole of the fphenoid bone, and fends immediately one branch into the channel on the top of the antrum maxillare; the membrane of which and the upper teeth are fupplied by it in its paffage. As this branch is about to go out at the foramen orbitrarium externum, it fends a nerve through the fubftance of the os maxillare to come out at Steno's duct, to be diftributed to the fore-part of the palate ; and what remains of it efcaping at the external orbitar hole, divides into a great many branches, that fupply the cheek, upper lip, and noftril. —The next confiderable branch of the fuperior maxillary nerve, after giving branches which are reflected through the fixth hole of the fphenoid bone, to join the intercoftal where it is paffing through the fkull with the carotid artery, and the portio dura of the feventh pair as it paffes through the os petrofum, is fent into the nofe by the hole common to the palate and fphenoidal bone ; and the remaining part of this nerve runs in the palato-maxillaris canal, giving off branches to the temples and pterygoid mufcles, and comes at laft into the palate to be loft.——Hence, the ach in the teeth of the upper jaw occafions a gnawing pain deep-feated in the bones of the face, with fwelling in the eye-lids, cheek, nofe, and upper lip ; and on the other hand, an inflammation in thefe parts, or a megrim, is often attended with fharp pain in the teeth.——Hence, an obftruction in the duct of the maxillary fimus, which obliges the liquor fecreted there to find out a preternatural route for itfelf, may be occafioned by the pain of the teeth. ——Hence, the upper lip often fuffers when the palate or nofe is ulcerated.

The third, or *maxillaris inferior*, branch of the fifth pair going out of the oval hole of the fphenoid bone, ferves the mufcles of the lower jaw, and the mufcles fituated between the os hyoides and jaw: All the falivary glands, the amygdalæ, and the external ear, have branches from it: It has a large branch loft in the tongue, and fends another through the canal in the fubftance of the lower jaw to ferve all the teeth there, and to come out at the hole in the fore-part of the jaw, to be loft in the chin and under-lip.——— Hence a convulfive contraction of the mufcles of the lower jaw, or the mouth's being involuntarily fhut, a great flow of fpittle or falivation, a pain in the ear, efpecially in deglutition, and a fwelling all about the throat, are natural confequences of a violent irritation of the nerves of the lower teeth in the toothach; and pain in the teeth and ear, is as natural a confequence of an angina.——Hence alternate preffure on the chin may fometimes relieve the violence of a toothach.—— Hence deftroying the nerves of a tooth by actual or potential cauteries, or pulling a carious tooth, fo often removes immediately all thefe fymptoms.—Hence no cure is to be found for fome ulcers in the upper or lower jaw, but by drawing a tooth.—Hence, in cancers of the upper lip, the falivary glands are in danger of being affected, or the difeafe may be occafioned to the lip by its beginning in the glands.—Perhaps the fympathy of the organs of tafting and fmelling may in fome meafure depend on their both receiving nerves from the fifth pair.

The *fixth* pair, which is the fmalleft except the fourth, rifes from the forepart of the corpora pyramidalia; and each entering the dura mater fome way behind the pofterior clinoid procefs of the fphenoid bone, has a long courfe below that membrane, and within the receptaculum at the fide of the fella-turcica, where it is im-

immerfed in the blood of the receptacle ; but for what purpofe, I am ignorant. It goes afterwards out at the foramen lacerum into the orbit, to ferve the abductor mufcle of the eye.—A defect in this nerve may therefore be one caufe of a ftrabifmus.—In the paffage of this nerve below the dura mater, it lies very contiguous to the internal carotid artery, and to the ophthalmic branch of the fifth pair of nerves. At the place where the fixth pair is contiguous to the carotid, a nerve either goes from each of them in an uncommon way, to wit, with the angle beyond where it rifes obtufe, to defcend with the artery, and to form the beginning of the intercoftal nerve, according to the common defcription ; or, according to other authors, this nerve comes up from the great ganglion of the intercoftal, to be joined to the fixth here.

The arguments for this latter opinion are, That, according to the common doctrine, this beginning of the intercoftal nerve, as it is called, would rife in a manner not fo ordinary in nerves. In the next place, it is obferved, that the fixth pair is larger nearer to the orbit, than it is before it comes to the place where this nerve is faid to go off ; and therefore it is more probable, that it receives an addition there, rather than gives off a branch. Laftly, It is found, that upon cutting the intercoftal nerves of living animals, the eyes plainly were affected ; they loft their bright water ; the gum, or gore, as we call it, was feparated in greater quantity ; the pupil was more contracted ; the cartilaginous membrane, at the internal canthus, came more over the eye ; and the eye-ball itfelf was diminifhed.

To this it is anfwered, in defence of the more common doctrine, 1ft, That other branches of nerves go off in a reflected way, as well as this does, fuppofing it to be the beginning of the intercoftal ; and that the reflection would rather be greater, if it is thought to come up from the intercoftal to the fixth. 2dly, It is denied that this nerve is for ordinary thicker at its fore than at its back-part; and if it was ſuppoſed to be thickeſt nearer to the orbit, the concluſion made above could not be drawn from this appearance, becauſe other nerves enlarge ſometimes where there is no addition made to them, as in the inſtance already mentioned of the trunk of the fifth pair while below the dura mater. 3dly, The experiments on living animals ſhow indeed, that the eyes are affected upon cutting the intercoſtal nerve; but not in the way which might have been expected, if the intercoſtal had furniſhed ſuch a ſhare of the nerve that goes to the abductor muſcle of the eye: for it might have been thought, that this muſcle would have been ſo much weakened immediately upon cutting the intercoſtal, that its antagoniſt the adductor would have greatly prevailed over it, and have turned the eye ſtrongly in towards the noſe; which is not ſaid to be a conſequence of this experiment. So that the arguments are ſtill equivocal; and more obſervations and experiments muſt be made, before it can be determined with certainty whether the ſixth pair gives or receives a branch here. In the mean time, I ſhall continue to ſpeak about the origin of the intercoſtal with the generality of anatomiſts.

At this place where the intercoſtal begins, the fifth pair is contiguous and adherent to the ſixth; and it is generally ſaid, that the ophthalmic branch of the fifth gives a branch or two to the beginning of the intercoſtal, or receives ſuch from it. Others deny any ſuch communication between them; and thoſe who affirm the communication confeſs, that in ſome ſubjects they could not ſee it. After examining the nerves here in a great many ſubjects, I cannot determine whether or not there are nervous filaments going from the one to the other. Sometimes I have thought that I traced them evidently; at other times I obſerved, that what I diſſected for nervous filaments, was collapſed cellular ſubſtance; and in all the ſubjects where I had puſhed an

injection

injection fuccefsfully into the very fmall arteries, I could only obferve a plexus of veffels connecting the one to the other. In any of thefe ways, however, there is as much connection as, we are affured from many experiments and obfervations on other nerves, is fufficient to make a very great fympathy among the nerves here.—Poffibly the appearances in the eyes of dogs, whofe intercoftal nerves were cut, might be owing to this fympathy.

The *feventh* pair comes out from the lateral part of the annular procefs, behind where the medullary procefs of the cerebellum are joined to that tuber; and each being accompanied with a larger artery than moft other nerves, enters the internal meatus auditorius, where the two large bundles of fibres, of which it appeared to confift within the fkull, foon feparate from each other: one of them entering by feveral fmall holes into the veftibule, cochlea, and femicircular canals, is ftretched on this inner camera of the ear in a very foft pulpy fubftance; and being never feen in the form of a firm cord, fuch as the other parcel of this and moft other nerves become, is called the *portio mollis* of the auditory nerve.

The other part of this feventh pair paffes through Galen's foramen cæcum, or Fallopius's aquæduct, in its crooked paffage by the fide of the tympanum; in which paffage, a nerve fent to the lingual branch of the inferior maxillary nerve, along the outfide of the tuba Euftachiana, and crofs the cavity of the tympanum, where it has the name of *chorda tympani*, is commonly faid to be joined to it. The very acute angle which this nerve makes with the fifth, or the fudden violent reflection it would fuffer on the fuppofition of its coming from the fifth to the feventh, appears unufual; whereas, if we fuppofe that it comes from the feventh to the fifth, its courfe would be more in the ordinary way, and the chorda tympani would be efteemed a branch of the feventh pair going to join the fifth, the fize of which is

 increafed

increafed by this acquifition. This fmaller bundle of the feventh gives branches to the mufcles of the malleus, and to the dura mater, while it paffes through the bony crooked canal, and at laft comes out in a firm chord named *portio dura*, at the end of this canal, between the ftyloid and maftoid proceffes of the temporal bone, giving immediately filaments to the little oblique mufcles of the head and to thofe that rife from the ftyloid procefs. It then pierces through the parotid gland, and divides into a great many branches, which are difperfed in the mufcles and teguments that cover all the fide of the upper part of the neck, the whole face and cranium, as far back as the temples, including a confiderable part of the external ear. Its branches having thus a confiderable connection with all the three branches of the fifth pair, and with the fecond cervical, occafion a confiderable fympathy of thefe nerves with it.—Hence in the tooth-ach, the pain is fometimes very little in the affected tooth, compared to what it is all along the fide of the head and in the ear.——Hence probably the relief of the toothach from blifters applied behind or before the ear, or by a hot iron touching the antihelix of the ear.——By this communication or connection poffibly too it is, that a vibrating ftring held between one's teeth, gives a ftrong idea of found to the perfon who holds it, which nobody elfe can perceive.——Perhaps too the diftribution of this nerve occafions the head to be fo quickly turned upon the impreffion of found on our ears.

The *eighth* pair of nerves rife from the lateral bafes of the corpora olivaria in difgregated fibres; and as they are entering the anterior internal part of the holes common to the os occipitis and temporum, each is joined by a nerve which afcends within the dura mater from the tenth of the head, the firft, fecond, and inferior cervical nerves: this, every body knows, has the name of the *nervus acceffórius*. When the two get out of the fkull, the acceforius feparates from the eighth, and, de-

fcending

ſcending obliquely outwards, paſſes through the ſterno-maſtoideus muſcle, to which it gives branches, and afterwards terminates in the trapezius muſcle of the ſcapula. In this courſe it is generally more or leſs joined by the ſecond cervical nerve.——Why this nerve, and ſeveral others which are diſtributed to muſcles, are made to pierce through muſcles, which they might have only paſſed near to, I do not know.

The large eighth pair, ſoon after its exit, gives nerves to the tongue, larynx, pharynx, and ganglion of the intercoſtal nerve; and being disjoined from the ninth and intercoſtal, to which it adheres cloſely ſome way, runs ſtraight down the neck behind the internal jugular vein, and at the external ſide of the carotid artery. As it is about to enter the thorax, a large nerve goes off from the eighth of each ſide: this branch of the right ſide turns round from the fore to the back part of the ſubclavian artery, while the branch of the left ſide turns round the great curve of the aorta; and both of them mounting up again at the ſide of the œſophagus, to which they give branches, are loſt at laſt in the larynx. Theſe are called the *recurrent nerves*, which we are deſired to ſhun in the operation of bronchotomy, though their deep ſituation protects them ſufficiently.——The muſcles of the larynx being in a good meaſure ſupplied with nerves from the recurrents, it is to be expected, that the cutting of them will greatly weaken the voice, though it will not be entirely loſt ſo long as the ſuperior branches of the eighth pair are entire.——Why the recurrent nerves riſe ſo low from the eighth pair to go round a large artery, and to have ſuch a long courſe upwards, I know not.

The eighth pair, above and at or near the place where the recurrent nerves go off from it, or frequently the recurrents themſelves, ſend off ſmall nerves to the pericardium, and to join with the branches of the intercoſtal that are diſtributed to the heart; but their ſize and ſituation are uncertain.

After

After theſe branches are ſent off, the par vagum on each ſide deſcends behind the great branch of the trachea, and gives numerous filaments to the lungs, and ſome to the heart in going to the œſophagus. The one of the left ſide running on the forepart of the œſophagus, communicates by ſeveral branches with the right one in its deſcent to be diſtributed to the ſtomach: the right one gets behind the œſophagus, where it ſplits and rejoins ſeveral times before it arrives at the ſtomach, to which it ſends nerves; and then being joined by one or more branches from the left trunk, they run towards the cæliac artery, there to join into the great ſemilunar ganglion formed by the two intercoſtals.

From the diſtribution of this par vagum, we may learn, how tickling the fauces with a feather or any ſuch ſubſtance, excites a nauſea and inclination to vomit; —why coughing occaſions vomiting, or vomiting raiſes a cough.——Hence we ſee how the nervous aſthma and the tuſſis convulſiva, chincough, are attended with a ſtraitening of the glottis;—why food difficult to digeſt occaſions the aſthma to weakly people; and why emetics have frequently cured the aſthma very ſpeedily;—why an attempt to vomit is ſometimes in danger of ſuffocating aſthmatic people;—why the ſuperior orifice of the ſtomach is ſo ſenſible as to be looked on as the ſeat of the ſoul by ſome;—why people ſubject to diſtentions of the ſtomach, have ſo often the ſenſation of balls in their breaſt and throat;——why the globus hyſtericus is ſo often attended with a violent ſtrangulation at the glottis.

The *ninth* pair of nerves comes from the inferior part of the corpora pyramidalia, to go out of the ſkull at their proper holes of the occipital bone. After their egreſs they adhere for ſome way firmly to the eighth and intercoſtal; and then ſending a branch, that in many ſubjects is joined with branches of the firſt and ſecond cervical nerves, to be diſtributed to the thyroid gland, and muſcles on the forepart of the trachea arteria, the

ninth

ninth is loſt in the muſcles and ſubſtance of the tongue. Some have thought this nerve, and others have eſteemed the third branch of the fifth pair of nerves, to be the proper guſtatory nerve. I know no obſervation or experiments to prove either opinion, or to aſſure us that both nerves do not ſerve for taſting and for the motion of the tongue.——May not the diſtribution of this nerve to the muſcles below as well as above the os hyoides, contribute to their acting more uniformly in depreſſing the lower jaw or head?

The *tenth* pair riſes in ſeparate threads from the ſides of the ſpinal marrow, to go out between the os occipitis and firſt vertebra of the neck. After each of them has given branches to the great ganglion of the intercoſtal, 8th, 9th, and 1ſt cervical nerves, it is diſtributed to the ſtreight, oblique, and ſome of the extenſor muſcles of the head. Whether the name of the tenth of the head, or of the firſt vertebral, ought to be given to this pair of nerves, is of no ſuch conſequence as to deſerve a debate, though it has ſome of the marks of the ſpinal nerves, to wit, its being formed of filaments proceeding from both the fore and back part of the medulla, and a little ganglion being formed where theſe filaments meet.

In the deſcription of the ſixth pair, I followed the uſual way of ſpeaking among anatomiſts, and called that the beginning of the intercoſtal nerve which comes out of the ſkull; and therefore ſhall here ſubjoin a curſory deſcription of this nerve, notwithſtanding its much larger part is compoſed of nerves coming out from the ſpinal marrow. There is no greater incongruity in point of method to ſay, that the nerve we are deſcribing receives additions from others that have not been deſcribed, than it is to repeat in the deſcription of a great many nerves, that each of them gives branches to form a nerve which we are ignorant of; which is all the difference between deſcribing the intercoſtal before or after the ſpinal nerves.

The

The branch reflected from the fixth pair, joined poffibly by fome filaments of the opthalmic branch of the fifth, runs along with the internal carotid artery, thro' the crooked canal formed for it in the temporal bone, where the little nerve is very foft and pappy, and in feveral fubjects divides and unites again, and is joined by one or more branches from the fifth, particularly of its fuperior maxillary branch, before it comes out of the fkull. May the compreffion of this nerve by the carotid artery, when ftretched during the fyftole, contribute to the diaftofe of the heart? As foon as the nerve efcapes out of this bony canal, it is connected a little way with the eighth and ninth; then feparating from thefe, after feeming to receive additional nerves from them, it forms a large ganglion, into which branches, from the tenth of the head, and from the firft and fecond cervical, enter. From this ganglion the nerves come out again fmall to run down the neck along with the carotid artery, communicating by branches with the cervical nerves, and giving nerves to the mufcles that bend the head and neck. As the intercoftal is about to enter the thorax, it forms another ganglion, from which nerves are fent to the trachea and to the heart; thofe defigned for the heart joining with the branches of the eighth, and moft of them paffing between the two great arteries and the auricles to the fubftance of that mufcle. The intercoftal after this confifting of two branches, one going behind, and the other running over the forepart of the fubclavian artery, forms a new ganglion, where the two branches unite below that artery; and then defcending along the fides of the vertebræ of the thorax, receives branches from each of the dorfal nerves; which branches appearing to come out between the ribs, have given the name of *intercoftal* to the whole nerve. Where the addition is made to it from the fifth dorfal nerve, a branch goes off obliquely forewards; which being joined by fuch branches from the fixth, feventh, eighth, and ninth

dorfal

dorſal, an anterior trunk is formed, and paſſes between the fibres of the appendix muſculoſa of the diaphragm, to form, along with the other intercoſtal and the branches of the eighth pair, a large ſemilunar ganglion, ſituated between the cæliac and ſuperior meſenteric arteries: the roots of which are as it were involved in a ſort of nervous net-work of this ganglion, from which a great number of very ſmall nervous threads runs out to be extended on the ſurface of all the branches of thoſe two arteries, ſo as to be eaſily ſeen when any of the arteries are ſtretched, but not to be raiſed from them by diſſection; and thus the liver, gall-bladder, duodenum, pancreas, ſpleen, jejunum, ilium, and a large ſhare of the colon, have their nerves ſent from this great ſolar ganglion or plexus.—May not the periſtaltic motion of the inteſtines depend in ſome meaſure on the paſſage of the intercoſtal nerves through the diaphragm?

Several fibres of this ganglion, running down upon the aorta, meet with other nerves ſent from the poſterior trunk of the intercoſtal, which continues its courſe along the ſides of the vertebræ: they ſupply the glandulæ renales, kidneys, and teſtes in men, or ovaria in women; and then they form a net-work upon the inferior meſenteric artery where the nerves of the two ſides meet, and accompany the branches of this artery to the part of the colon that lies in the left ſide of the belly, and to the rectum, as far down as to the lower part of the pelvis.

The intercoſtal continuing down by the ſide of the vertebræ of the loins, is joined by nerves coming from between theſe vertebræ, and ſends nerves to the organs of generation and others in the pelvis, being even joined with thoſe that are ſent to the inferior extremities.

The almoſt univerſal connection and communication which this nerve has with the other nerves of the body, may lead us to underſtand the following and a great many more phænomena:—Why tickling the noſe cauſes

ſes ſneezing :—Why the too great quantity of bile in the cholera occaſions vomiting as well as purging :—Why people vomit in colics, in inflammations, or other irritations of the liver, or of the ducts going from it and the gall-bladder :—Why a ſtone in the kidneys, or ureters, or any other cauſe irritating thoſe organs, ſhould ſo much more frequently bring on vomiting and other diſorders of the ſtomach, than the ſtone or any other ſtimulating cauſe in the bladder does :—Why vomiting is a ſymptom of danger after child-birth, lithotomy, and other operations on the parts in the pelvis :—Why the obſtructions of the menſes are capable of occaſioning ſtrangulations, belching, colics, ſtomach-aches, and even convulſions in the extremities : —Why veſicatories, applied from the ears to the clavicles of children labouring under the tuſſis convulſiva, are frequently of great ſervice :—Why worms in the ſtomach or guts excite an itching in the noſe, or grinding of the teeth :—Why irritations in the bowels or the belly occaſion ſometimes univerſal convulſions of the body.

The Spinal Nerves riſe generally by a number of diſgregated fibres from both the fore and back part of the medulla ſpinalis ; and ſoon after form a little knot or ganglion, where they acquire ſtrong coats, and are extended into firm cords ; but the ganglion is entirely formed by the poſterior bundle. They are diſtinguiſhed by numbers, according to the vertebræ from between which they come out ; the ſuperior of the two bones forming the hole through which they paſs, being the one from which the number is applied to each nerve. There are generally ſaid to be thirty pair of them : ſeven of which come out between the vertebræ of the neck, twelve between thoſe of the back, five between thoſe of the loins, and ſix from the falſe vertebræ.

The *firſt* cervical pair of nerves comes out between the firſt and ſecond vertebræ of the neck ; and having given

given branches to join with the tenth pair of the head, the fecond cervical and intercoftal, and to ferve the mufcles that bend the neck, it fends its largeft branches backwards to the extenfor mufcles of the head and neck; fome of which piercing through thefe mufcles, run up on the occiput to be loft in the teguments here; and many fibres of it advance fo far forward as to be connected with the fibrils of the firft branch of the fifth pair of the head, and of the portio dura of the auditory nerve.——Hence poffibly it is, that a clavus hyftericus changes fuddenly fometimes from the forehead to a violent pain and fpafm in the back-part of the head and neck.

The *fecond* cervical is foon joined by fome branches to the ninth of the head and intercoftal, and to the firft and third of the neck; then has a large branch that comes out at the exterior edge of the fterno-maftoideus mufcle, where it joins with the accefforius of the eighth pair; and is afterwards diftributed to the platyfma myoides, teguments of the fide of the neck and head, parotid gland, and external ear, being connected to the portio dura of the auditory nerve, and to the firft cervical. The remainder of this fecond cervical is fpent on the levator fcapulæ and the extenfors of the neck and head. Generally a large branch is here fent off to join the accefforius of the eighth pair, near the fuperior angle of the fcapula.

To the irritation of the branches of this nerve it probably is, that, in an inflammation of the parotid gland, the neck is pained fo far down as the clavicle, the head is drawn towards the fhoulder of the affected fide, and the chin is turned to the other fide.——In opening the external jugular vein, no operator can promife not to touch fome of the cutaneous branches of this nerve with the lancet; which occafions a fharp pricking pain in the mean time, and a numbnefs of the fkin near the orifice for fome time after.

The *third* pair of the neck paffes out between the third

third and fourth cervical vertebræ; having immediately a communication with the fecond, and fending down a branch, which, being joined by a branch from the fourth cervical, forms the *phrenic* nerve. This defcending enters the thorax between the fubclavian vein and artery; and then being received into a groove formed for it in the pericardium, it has its courfe along this capfula of the heart, till it is loft in the middle part of the diaphragm. The right phrenic has a ftraight courfe; but the left one is obliged to make a confiderable turn outwards to go over the prominent part of the pericardium, where the point of the heart is lodged. Hence, in violent palpitations of the heart, a pungent acute pain is felt near the left orifice of the ftomach.—The middle of the diaphragm fcarce could have been fupplied by any other nerve which could have had fuch a ftraight courfe as the phrenic has. If the fubclavian artery and vein have any effect upon this nerve, I do not know it.

The other branches of the third cervical nerve are diftributed to the mufcles and teguments at the lower part of the neck and top of the fhoulder. No wonder then that an inflammation of the liver or fpleen, an abfcefs in the lungs adhering to the diaphragm, or any other caufe capable of irritating the diaphragm, fhould be attended with a fharp pain on the top of the fhoulder, as well as wounds, ulcers, &c. of this mufcle itfelf.—If the irritation of this mufcle is very violent, it may occafion that convulfive contraction of the diaphragm which is called an *hiccough*; and therefore an hiccough in an inflammation of the liver has been juftly declared to be an ill fymptom.

An irritation of the thoracic nerves which produces fneezing, may fometimes free the phrenic nerves from any fpafm they occafion: fo that fneezing fometimes takes away the hiccough; and a derivation of the fluid of the nerves any other way may do the fame thing: or the hiccough may alfo be fometimes cured, by drawing up into the nofe the fmoke of burning paper or other acrid fumes, fwallowing pungent or aromatic medicines, and by a furprife, or any other ftrong application of the mind in thinking, or in diftinguifhing objects: or, when all thefe have failed, it has been put away by the brifk ftimulus of a bliftering plafter applied to the back.

The *fourth* cervical nerve, after fending off that branch which joins with the third to form the phrenic, and beftowing twigs on the mufcles and glands of the neck, runs to the arm-pit, where it meets with the *fifth*, *fixth*, and *feventh* cervicals, and *firft* dorfal, that efcape in the interftices of the mufculi fcaleni, to come at the armpit, where they join, feparate, and rejoin, in a way fcarce to be rightly expreffed in words; and, after giving feveral confiderable nerves to the mufcles and teguments which cover the thorax, they divide into feveral branches, to be diftributed to all the parts of the fuperior extremity. Seven of thefe branches I fhall defcribe under particular names.

1. *Scapularis* runs ftraight to the cavitas femilunata of the upper cofta of the fcapula, which is a hole in the recent fubject, by a ligament being extended from one angle of the bone to the other, giving nerves in its way to the mufcles of the fcapula. When it has paffed this hole, it fupplies the fupra-fpinatus mufcle; and then defcending at the anterior root of the fpine of the fcapula, it is loft in the other mufcles that lie on the dorfum of that bone.

2. *Articularis* finks downwards at the axilla, to get below the neck of the head of the os humeri, and to mount again at the back-part of it; fo that it almoft furrounds the articulation, and is diftributed to the mufcles that draw the arm back, and to thofe that raife it up.

3. *Cutaneus* runs down the fore-part of the arm near the fkin, to which it gives off branches; and then divides on the infide of the fore-arm into feveral nerves, which

ſupply the teguments there, and on the palm of the hand.——In opening the baſilic vein of the arm at the ordinary place, the ſame ſymptoms are ſometimes produced as in opening the external jugular vein, and from a like cauſe, to wit, from hurting a branch of this cutaneous nerve with the lancet.

4. *Muſculo-cutaneus*, or perforans Caſſeri, paſſes thro' the coraco-brachialis muſcle; and after ſupplying the biceps flexor cubiti and brachiæus internus, paſſes behind the tendon of the biceps, and over the cephalic vein, to be beſtowed on the teguments on the outſide of the fore arm and back of the hand.——This nerve is ſometimes hurt in opening the cephalic vein, and cauſes pain and numbneſs for a ſhort time.

5. *Muſcularis* has a ſpiral courſe from the axilla, under the os humeri, and backward to the external part of that bone, ſupplying by the way the extenſor muſcles of the fore arm, to which it runs between the two brachiæi muſcles, and within the ſupinator radii longus.—At the upper part of the fore-arm, it ſends off a branch, which accompanies the ſupinator longus till it comes near the wriſt, where it paſſes obliquely over the radius, to be loſt in the back of the hand and fingers.——The principal part of this nerve pierces through the ſupinator radii brevis, to ſerve the muſcles that extend the hand and fingers, whoſe actions are not injured when the ſupinator acts. Part of this nerve ſeems to be loſt upon the ligament of the wriſt.

6. *Ulnaris* is extended along the inſide of the arm, to give nerves to the muſcles that extend the fore-arm and to the teguments of the elbow: towards the lower part of the arm, it ſlants a little backward to come at the groove behind the internal condyle of the os humeri, through which it runs to the ulna: in its courſe along this bone, it ſerves the neighbouring muſcles and teguments; and as it comes near the wriſt, it detaches a branch obliquely over the ulna to the back of the hand, to be loſt in the convex part of ſeve-

ral

ral fingers. The larger part of the nerve goes ſtraight forward to the internal ſide of the os piſiforme of the wriſt; where it ſends off a branch, which ſinks under the large tendons in the palm, to go croſs to the other ſide of the wriſt, ſerving the muſculi lumbricales and interoſſei, and at laſt terminating in the ſhort muſcles of the thumb and fore-finger. What remains of the ulnar nerve after ſupplying the ſhort muſcles of the little-finger, divides into three branches; whereof two are extended along the ſides of the ſheath of the tendons of the flexors of the little-finger, to furniſh the concave ſide of that finger; the third branch is diſpoſed in the ſame way upon the ſide of the ring-finger next to the little-finger.

When we lean or preſs on the internal condyle of the os humeri, the numbneſs and prickling we frequently feel, point out the courſe of this nerve. I have ſeen a weakneſs and atrophy in the parts which I mentioned this nerve to be ſent to, after a wound in the internal lower part of the arm.

7. *Radialis* accompanies the humeral artery to the bending of the elbow, ſerving the flexors of the cubit in its way; then paſſing through the pronator radii teres muſcle, it gives nerves to the muſcles on the fore-part of the fore-arm, and continues its courſe near to the radius, beſtowing branches on the circumjacent muſcles. Near the wriſt, it ſometimes gives off a nerve which is diſtributed to the back of the hand, and the convex part of the thumb and ſeveral of the fingers, inſtead of the branch of the muſcular. The larger part of this nerve, paſſing behind the annular ligament of the wriſt, gives nerves to the ſhort muſcles of the thumb; and afterwards ſends a branch along each ſide of the ſheath of the tendons of the flexors of the thumb, fore-finger, mid-finger, and one branch to the ſide of the ring-finger, next to the middle one, to be loſt on the concave ſide of thoſe fingers.

Though the radial nerve paſſes through the pronator mufcle, and the mufcular nerve feems to be ftill more unfavourably placed within the fupinator brevis; yet the action of thefe mufcles does not feem to have any effect in hindering the influence of thefe nerves; for the fingers or hand can be bended while pronation is performing vigoroufly, and they can be extended while fupination is exercifed.

The manner of the going off of thefe nerves of the fingers, both from the ulnar and radial, is, that a fingle branch is fent from the trunk to the fide of the thumb and little finger fartheft from the other fingers; and all the reft are fupplied by a trunk of a nerve, which fplits into two fome way before it comes as far as the end of the metacarpus, to run along the fides of different fingers that are neareft to each other.

It might have been obferved, that, in defcribing the pofterior branches of the ulnar and mufcular nerve, I did not mention the particular fingers, to the convex part of which they are diftributed. My reafon for this omiffion is, the uncertainty of their diftribution; for though fometimes thefe pofterior branches go to the fame fingers, to the concave part of which the anterior branches of the ulnar and radial are fent, yet frequently they are diftributed otherwife.

The fituation of thefe brachial nerves in the axilla, may let us fee how a weaknefs and atrophy may be brought on the arms by long-continued preffure of crutches, or fuch other hard fubftances on this part; and the courfe of them from the neck to the arm may teach us, how much better effects veficatories, or ftimulating nervous medicines, would have, when applied to the fkin covering the tranfverfe proceffes of the vertebræ of the neck, or at the axilla, than when they are put between the fhoulders, or upon the fpinal proceffes, in convulfions or palfies of the fuperior extremities, where a ftimulus is required.

The *twelve dorfal* nerves of each fide, as foon as they efcape from between the vertebræ, fend a branch forward

ward to join the intercoſtal, by which a communication is made among them all; and they ſoon likewiſe give branches backwards to the muſcles that raiſe the trunk of the body, their principal trunk being extended outwards to come at the furrow in the lower edge of each rib, in which they run toward the anterior part of the thorax, between the internal and external intercoſtal muſcles, giving off branches in their courſe to the muſcles and teguments of the thorax.

The *firſt* dorſal, as was already obſerved, is particular in this, that it contributes to form the brachial nerves; and that the two branches of the intercoſtal, which come down to the thorax, form a conſiderable ganglion with it.

The *ſix* lower dorſal nerves give branches to the diaphragm and abdominal muſcles.

The *twelfth* joins with the firſt lumbar, and beſtows nerves on the muſculus quadratus lumborum and iliacus internus.

May not the communications of all theſe nerves be one reaſon, why the parts they ſerve act ſo uniformly and conjunctly in reſpiration, and conſpire together in the convulſive motions of coughing, ſneezing, &c.— The twitching ſpaſms that happen ſometimes in different parts of the muſcles of the abdomen, by an irritation on the branches of the lower dorſal nerves, are in danger of occaſioning a miſtake in practice, by their reſemblance to the cholic, nephritis, &c.———The communications of theſe lower ones with the intercoſtals, may ſerve to explain the violent effort of the abdominal muſcles in a teneſmus, and in childbearing.

As the intercoſtal is larger in the thorax than any where elſe, and ſeems to diminiſh gradually as it aſcends and deſcends, there is cauſe to ſuſpect that this is the trunk from which the ſuperior and inferior pairs are ſent as branches.

The *five lumbar* nerves on each ſide communicate with the intercoſtal and with each other, and give branches backwards to the loins.

The *firſt* communicates with the laſt dorſal, ſends branches to the abdominal muſcles, to the pſoas and iliacus, and to the teguments and muſcles on the fore-part of the thigh; while its principal branch joins with the other nerves, to form the crural nerve.

The *ſecond lumbar* nerve paſſes through the pſoas muſcle, and is diſtributed nearly in the ſame way as the former: as is alſo the *third.*

Branches of the ſecond, third, and fourth, make up one trunk, which runs along the fore-part of the pelvis; and paſſing in the notch at the fore-part of the great hole common to the os pubis and iſchium, is ſpent on the adductor muſcles, and on the teguments on the inſide of the thigh. This nerve is called the *obturator*, or *poſterior crural nerve.*

By united branches from the firſt, ſecond, third, and fourth lumbar nerves, a nerve is formed that runs along the pſoas muſcle, to eſcape with the external iliac veſſels out of the abdomen, below the tendinous arcade of the external oblique muſcle. This nerve, which is named the *anterior crural*, is diſtributed principally to the muſcles and teguments on the fore-part of the thigh. A branch, however, of this nerve runs down the inſide of the leg to the upper part of the foot, keeping near to the vena ſaphena; in opening of which with a lancet at the ankle, the nerve is ſometimes hurt, and occaſions ſharp pain at the time of the operation, and numbneſs afterwards.

The remainder of the fourth lumbar and the fifth join in compoſing the largeſt nerve of the body, which is ſoon to be deſcribed.

Whoever attends to the courſe of theſe lumbar nerves, and of the ſpermatic veſſels and nerves upon the pſoas muſcle, with the oblique paſſage of the ureter over that muſcle, will not be ſurpriſed, that when a ſtone is paſſing in this canal, or even when it is inflamed, the trunk

of

of the body cannot be raiſed erect, without great pain; or that the ſkin of the thigh becomes leſs ſenſible, and the thigh is drawn forward, and that the teſticle often ſwells and is drawn convulſively towards the ring of the abdominal muſcles.

The *ſix pair* of the falſe *vertebræ* conſiſt each of ſmall poſterior branches ſent to the hips, and of large anterior branches.

The firſt, ſecond, and third, after coming thro' the three upper holes in the fore-part of the os ſacrum, join together with the fourth and fifth of the loins, to form the largeſt nerve of the body, which is well known by the name of *ſciatic* or *iſchiatic* nerve: This, after ſending large nerves to the different parts of the pelvis, and to the external parts of generation and the podex, as alſo to the muſcles of the hips, paſſes behind the great tuber of the os iſchium, and then over the quadrigemini muſcles to run down near to the bone of the thigh at its back-part, giving off nerves to the neighbouring muſcles and teguments. Some way above the ham, where it has the name of the *poplitæus* nerve, it ſends off a large branch that paſſes over the fibula, and ſinking in among the muſcles on the anterior external part of the leg, runs down to the foot, to be loſt in the upper part of the larger toes, ſupplying the neighbouring muſcles and teguments every where in its paſſage. The larger branch of the ſciatic, after giving branches to the muſcles and teguments about the ham and knee, and ſending a large cutaneous nerve down the calf of the leg, to be loſt at laſt on the outſide of the foot and upper part of the leſſer toes, ſinks below the gemellus muſcle, and diſtributes nerves to the muſcles on the back of the leg; among which it continues its courſe, till, paſſing behind the internal malleolus, and in the internal hollow of the os calcis, it divides into the two plantar nerves: The internal of which is diſtributed to the toes in the ſame manner that the radial nerve of the hand ſerves the concave ſide of the thumb and fingers; and the external plantar is divided and diſtributed to the ſole of the foot and toes, nearly as the ulnar nerve is in the palm of the hand, and in the concave part of the fingers.

Several branches of thefe nerves, that ferve the inferior extremities, pierce through mufcles.

By applying what was faid of the nerves in general to the particular diftribution of the nerves of the inferior extremities, we may fee how people with fractured legs, efpecially where there are fplinters, fhould be fubject to convulfive ftartings of the fractured member :—— Why, upon tying the blood-veffels in an amputation of the leg, the patients fhould fometimes complain of violent pain in their toes ;——why fuch patients fhould alfo be troubled with ftartings;——why, for a confiderable time after the amputation of the difeafed limb, when the fuppuration is well advanced, they fhould complain of pain in the fore which occafioned the amputation.

The *fourth*, which, with the two following, is much fmaller than the three fuperior, foon is loft in the vefica urinaria and inteftinum rectum.

The *fifth* comes forward between the extremity of the os facrum and coccygis, to be diftributed principally to the levatores ani.

The *fixth*, which may be confidered as the termination of a fubftance called *ligamentum denticulatum*, advances forward below the broad fhoulders of the firft bone of the os coccygis, and is loft in the fphincter ani and teguments covering it.

The branches of the four laft cervical nerves, and of the firft dorfal, which are beftowed on the fuperior extremities, and the two crurals, with the fciatic, which are diftributed to the inferior extremities, are much larger proportionally to the parts they ferve, than the nerves of the trunk of the body, and efpecially of the vifcera, are ; and for a very good reafon, that in the moft common neceffary actions of life, a fufficient quantity of fluid, on which the influence of nerves feems to depend, may be fupplied to the mufcles there, which are obliged to perform more frequent and violent con-

tractions

tractions than any other parts do.——The ſize of the nerves of the inferior extremities ſeems larger proportionally than in the ſuperior extremities; the inferior extremities having the weight of the whole body to ſuſtain, and that frequently at a great diſadvantage.—— What the effect is of the nerves here being injured, we ſee daily: When people happen, by ſitting wrong, to compreſs the ſciatic nerve, they are incapable for ſome time after to ſupport themſelves on the affected extremity; and this is ſtill more remarkable in the ſciatica or hip-gout, in which the member is not only weakened, but gradually ſhrivels and waſtes.

Explanation of Tables XV. and XVI.

Tab. XV.—(1) The firſt branch of the fifth pair of nerves. (2) The ſecond branch of the fifth pair. (3) The third branch of the fifth pair. (4) The trunk of the eighth pair cut. (5) The recurrent nerve. (6) The great ſympathetic nerve. (7) The uppermoſt ganglion of the great ſympathetic nerve. (8) The ramus ſplanchnicus of the great ſympathetic nerve. (9) A branch of the ſub-occipital, or tenth pair of the head, joining the great ſympathetic nerve. (10) The firſt cervical nerve. (11) The ſeventh cervical nerve. The intermediate cervicals come out in a ſimilar manner. (12) The phrenic nerve. (13) The axillary plexus. (14) The muſcular nerve of the arm. (15) The articular nerve. (16) The ſpiral nerve. (17) The radial nerve. (18) The ulnar nerve. (19) The firſt intercoſtal nerve. (20) The laſt intercoſtal nerve. The other ten come out in the ſame manner. (21) The firſt lumbar nerve. (22) The laſt lumbar nerve. The three intermediate lumbar nerves come out in a ſimilar way. (23) Branches from the external thoracic nerves running down upon the ſide of the thorax. (24) Branches ſent off from the intercoſtal and lumbar nerves to ſupply the outer part of the thorax and abdomen. (25) Nerves of the os ſacrum. (26) The obturator nerve. (27) The anterior crural nerve.

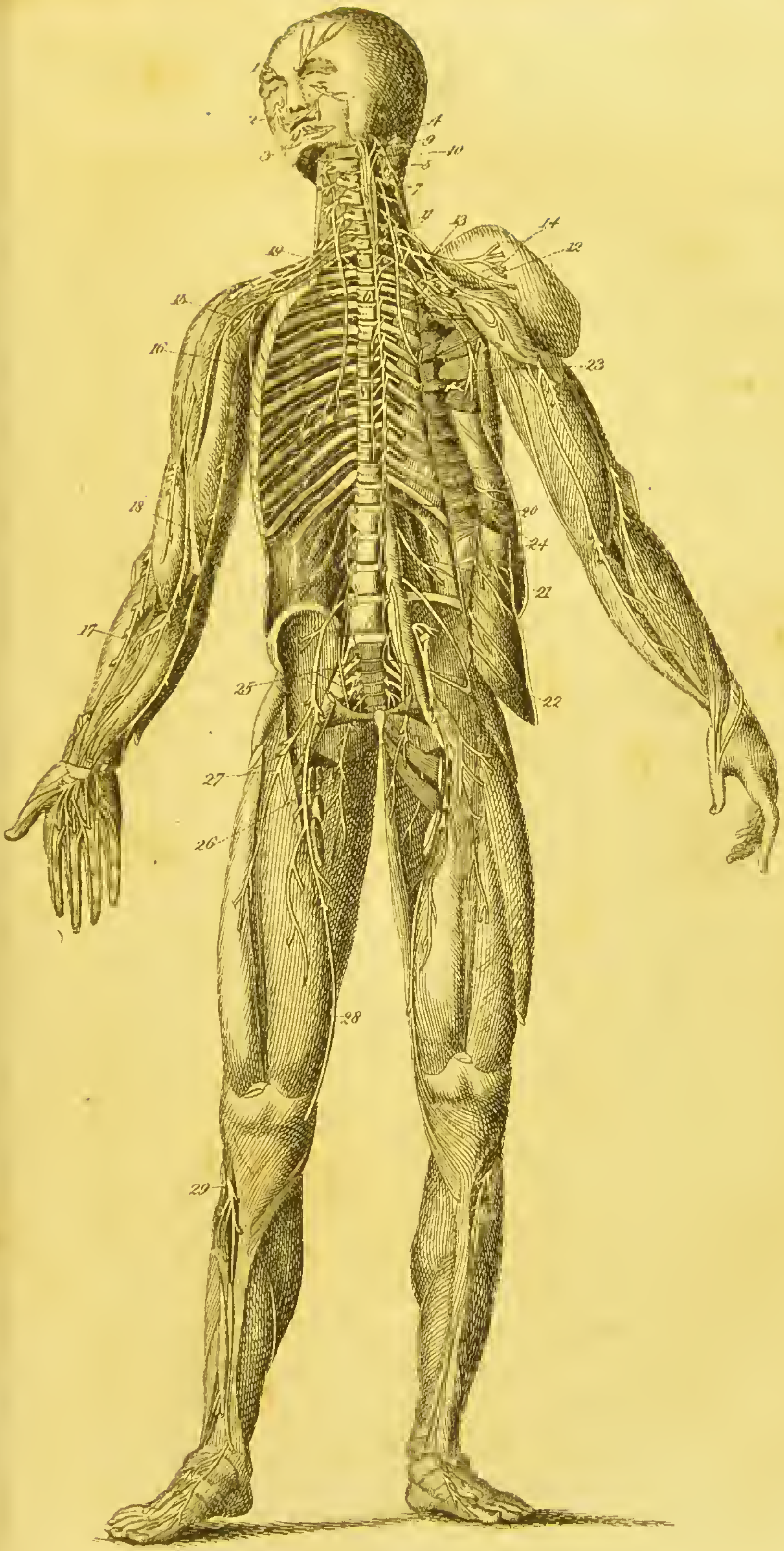
(28) A

(28) A branch of the anterior crural nerve, which runs near the vena ſaphena major. (29) The anterior tibial nerve running down to the foot.

TAB. XVI.—(1) The recurrent nerve. (2) A branch of the 4th cervical nerve, joining the recurrent one before it terminates on the muſculus trapezius. (3) Branches of the fifth pair, perforating theſcalenus medius to be ſpent upon the rhomboid muſcles. (4) Branches of the ſub-occipital nerve, running to the ſmall muſcles at the under and back part of the head. (5) Poſterior branches of the cervical nerves. (6) Poſterior branches of the dorſal nerves. (7) Poſterior branches of the dorſal and lumbar nerves running to the erector muſcles of the back. (8) Poſterior branches of the dorſal nerves, penetrating the intercoſtal muſcles. (9) Branches from the laſt dorſal, and from the lumbar nerves, ſupplying the lumbar and abdominal muſcles. (10) Branches from ſome of the lower cervical nerves, running to the muſcles on the back part of the ſcapula. (11) The articular nerve. (12) A branch from the axillary plexus running to the muſculus latiſſimus dorſi. (13) Another branch from the axillary plexus running to the latiſſimus dorſi and ſerratus magnus. (14) The ſpiral nerve. (15) The ulnar nerve. (16) Small branches coming through the holes in the back part of the os ſacrum on running to the muſcles, &c. there. (17) A ſmall branch running out between the os ſacrum and os coccygis. (18) The end of the cauda equina running through the canal at the back part of the os ſacrum. (19) The ſciatic nerve. (20) Branches from the ſciatic nerve to the muſcles on the back part of the pelvis. (21) Branches from the ſciatic nerve to the muſcles, &c. about the anus. (22) Branches from the ſciatic nerve to the gluteus maximus and muſcles at the upper and back part of the thigh. (23) Trunk of the ſciatic nerve, ſending off branches to the muſcles on the back part of the thigh. (24) The fibular nerve ſent off from the ſciatic one. (25) The poſterior tibial nerve, which is a continuation of the ſciatic nerve.

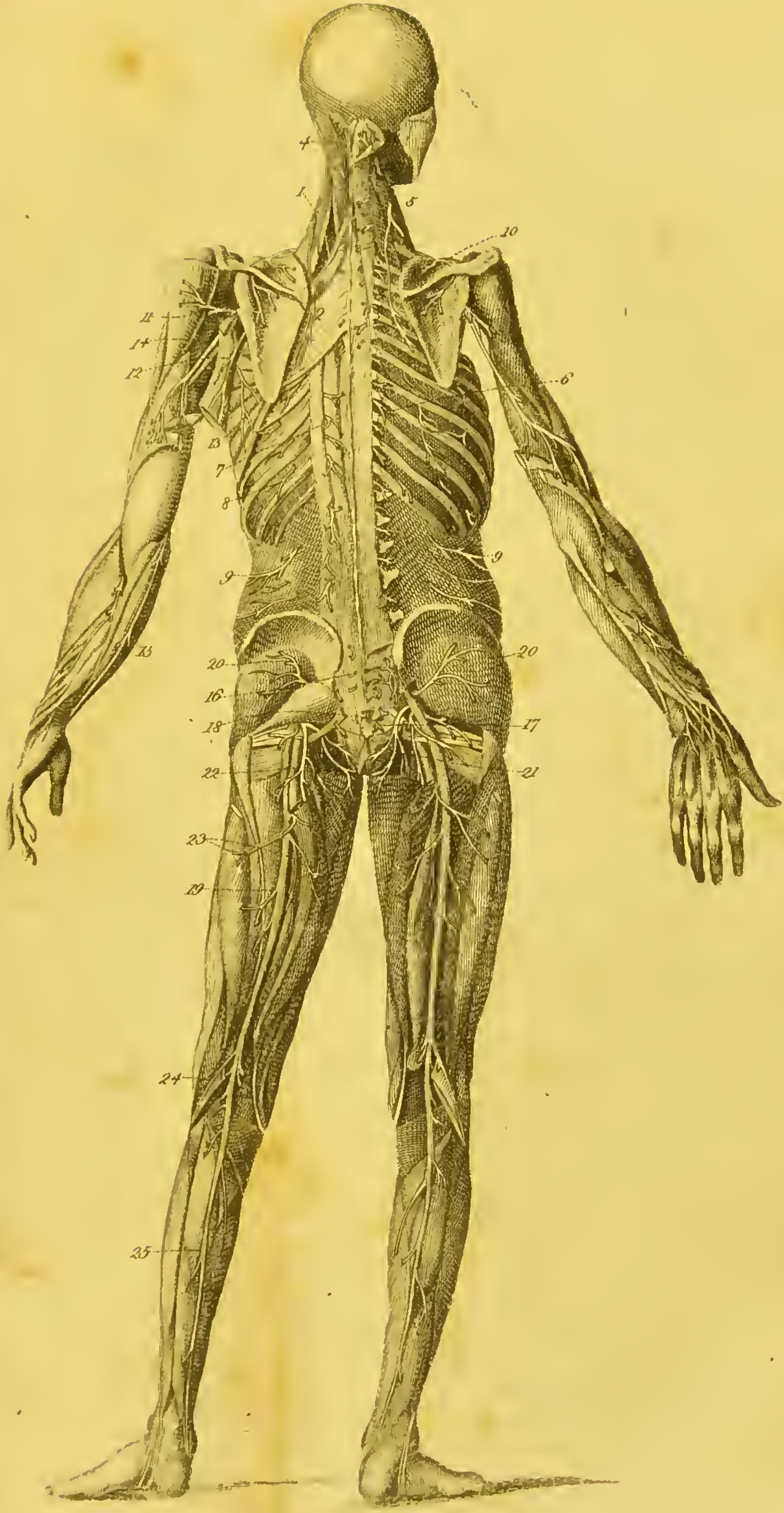
INDEX

TAB. XV.



D. Lizars Sculp.t

TAB. XVI.



I N D E X

TO VOLUME II.

A.

ABDOMEN deſcribed, 248. Integuments of it, 250. Its cavity, 251. Its form, 248, 249, 251. How divided, 252. Veins on the back-part of it, 481.
Accelerator, a muſcle in women terminates like it, 369.
Acceleratores deſcribed, 356.
Alæ of the abdomen, 367.
—— minores, five internæ, a name of the nymphæ, 370.
Allantois in quadrupeds deſcribed, 385.
Amnii liquor, where the embryo floats, 377, 385. Falſe water, where collected, 386.
Amnion deſcribed, 385.
Amnios deſcribed, 376.
Antiproſtatæ deſcribed, 353.
Anus deſcribed, 280. Its muſcles, *ib.*
Aorta, receives the blood from the left ventricle of the heart, 226, 397, 398. Its ſmall capital branches, 399. almoſt always in pairs, *ib.* General diſtribution of its branches, 400. General diviſion of it, 399. Anterior branches of the inferior part of it, 402. Poſterior branches of its inferior part, 403.
—— aſcendens, 399.
—— deſcendens, 226, 399.
Appendices coli adipoſæ, 276.
—— epiploicæ, 315.
Appendicula vermiformis, 273.
Aqua pericardii, 231.
Areola of the breaſts deſcribed, 216.
Arteria angularis, 406.
—— articularis, 419.
—— auditoria interna, 414.
—— axillaris, a name of the ſubclavian artery, 401.
—— baſilaris, 414.
—— brachialis, 419.
—— bronchialis, 415.
—— carotis interna, 408.
—— cervicalis, 412.
—— cœliaca, 399, 426.
—— colica ſuperior, 431.
—— carotis interna, 408.
—— colica ſiniſtra, 432.
—— cubitalis, 420.
—— diaphragmatica, 426.
—— duodenalis, 428.
—— epigaſtrica, 436.
—— gaſtrica dextra, 428.
Arteria gaſtrica major, *ib.*
—— gaſtrica ſuperior, 427.
—— glutæa, 438.
—— gutturalis ſuperior, 405.
—— hæmorrhoidalis externa, 439.
—— hæmorrhoidalis interna, 432.
—— hepatica, 427.
—— hypogaſtrica, 403, 427.
—— iliaca externa, 403.
—— iliaca minor, 438.
—— intercoſtalis ſuperior, 414.
—— maxillaris externa, 405.
—— maxillaris interna, 406.
—— meningæa poſterior 414.
—— meſenterica ſuperior, 399, 430.
—— meſenterica inferior, 399, 432.
—— obturatrix, 440.
—— occipitalis, 407.
—— occipitalis poſterior, 412.
—— peronæa, 445.
—— peronæa poſterior, 442.
—— plantaris externa, 444.
—— plantaris interna, *ib.*
—— poplitæa, 442.
—— pudica communis, 439.
—— pudica externa, 439.
—— pulmonaris, 427.
—— pylorica, 428.
—— radialis, 420, 424.
—— ſciatica, 428.
—— ſiniſtra, 429.
—— ſpheno-maxillaris, 406.
—— ſpheno-ſpinalis, 407.
—— ſplenica, 428.
—— ſubclavia, 410.
—— ſublingualis, 405.
—— tibialis anterior, 442, 444.
—— tibialis poſterior, 444.
—— ventriculi coronaria, 427.
—— vertebralis, 413.
—— umbilicalis, 437. *Vide* alſo Arteriæ, Arteries, and Artery.
Arteriæ adipoſæ, 403, 426.
—— axillares, 417.
—— biliariæ, 429.
—— bronchiales, 402.
—— capſulares, 403.
—— cardiacæ, 403.
—— carotides, 404.
—— coronariæ, 229.
—— crurales, 440.
—— cyſticæ, 428.
—— diaphragmaticæ inferiores, 402.
—— emulgentes, 399.
—— gaſtro-epiploicæ ſiniſtræ, 429.

Arteriæ

Arteriæ hepaticæ propriæ, 429.
—— iliacæ, 398, 435.
—— intercostales, 402.
—— intercostales inferiores, 416.
—— lumbares, 403, 434.
—— mammariæ internæ, 411.
—— mediastinæ, 221, 410.
—— œsophagiæ, 403, 416.
—— pancreaticæ, 306, 429.
—— pericardiæ, 410.
—— phrenicæ, 426.
—— renales, 399, 403.
—— sacræ, 403, 435.
—— scapulares, 418.
—— spermaticæ, 433.
—— spinales, 414.
—— subclaviæ, 399.
—— thoracicæ, 418.
—— thymicæ, 222, 227, 401.
—— brachiales, 401.
—— venæ renales, 322.
—— umbilicales, 334. In the fœtus, 393. *See also* Arteria, Arteries, and Artery.

Arteries spermatic, 338. Of the uterus, their communication, 365. The heart throws the blood into two great ones, 347. Of the dura mater described, 36. Of the brain and medulla spinalis, 71—75. Of the stomach, 261. Collateral ones, 421. Interosseus of the fore-arm, 422. *Vide* Arteria, Arteriæ, and Artery.

Artery, renal, 326. pulmonary, 237. bronchial, 238. Of the dura mater, called *speno spinalis*, 407. *Vide* Arteria, Arteriæ, and Arteries.

Aryteno-epiglottici muscles, 180.

Arytenoidæi, 180, 182.

Auriculæ of the heart, 222, 227. Appendix of the left, 228.

Axillary veins, 450, 462. Where they receive the name of subclavian, 463.

Axis arteriæ cœliacæ, 427.

Azygos uvulæ described, 189.

B.

Basilic vein, 451, 458.

Basioglossus muscle, 193.

Bile, account of it, 295. Different kinds of it, 302.

Bladder: its situation, figure, and division, 332. Its structure, 333. Its blood-vessels and nerves, 335. Its sphincter, 373.

Blood-vessels: two different kinds of them in the lungs, 237.

Brain and its appendages described, 31. Blood-vessels of it and of the medulla spinalis, 71. Its uses and appendages in general, 75—79. Dissertation on the anatomy of it by M. Steno, 79. Total ignorance of its substance, 80—82. Method of unfolding the plicæ, 82. True method of dissecting it impracticable, *ib.* Hypothesis of Willis concerning the brain, 84. Of Descartes concerning the glandula pinealis, 86. Bad figures of Variolus, 90. Method of discovering anatomical truths, 94. Uncertainty of every thing that has been said concerning the brain, 96. Passages of Descartes referred to in the dissertation, 105, 106.

Breasts described, 214. Their body what, 215.

Breath, what, 245.

Bronchiæ described, 235. Their numberless divisions, *ib.* 241.

Buccinatores muscles, 203.

Bulb of the urethra, 349.

Bulbo-cavernosi muscles described, 356.

C.

Callosities, how formed on the hands, feet, &c. 11.

Canalis arteriosus of the fœtus described, 392.

Canals, semicircular, of the ear, 160. Their substance in children, 161.

Canini muscles, 204.

Caninus minor, 205.

Capsula of the crystalline, 115. venæ portæ, 295. Of the spleen, 310. Glissoni, 429.

Capsulæ atrabiliariæ, 329.
—— renales, *ib.*

Capsular arteries, 330.
—— vein, *ib.*

Cartilagines arytenoidææ, 174.
—— crico-thyroideæ, 179.
—— crico-arytenoideæ posteriores, *ib.*
—— crico-arytenoidææ laterales, *ib.*

Cartilago thyroidæa, 173.
—— cricoides, *ib.*

Caruncula lachrymalis, 128. Of the urethra, 350.

Carunculæ myrtiformes, 368. Why so called, 372. Described, *ib.*

Cellulæ mastoidææ, 166.

Centrum ovale of the brain, 46.

Cephalic vein, 450, 460.

Ceratoglossus described, 193.

Cerebellum described, 53.

Cerebrum described, 43.

Cheeks described, 200. Muscles of them, 203.

Chewing; use of the tongue in that operation, 199.

Chondro-glossus described, 193.

Chorda tympani, 198, 559.

Chorion,

Chorion, diſtinguiſhed into the true and falſe, 376. The true one deſcribed, 384.
Chyle deſcribed, 263. The ſtrainer of it, 317.
Cilia deſcribed, 127.
Circulation of the blood, 233.
Circulus membranoſus deſcribed, 372.
Clitoris deſcribed, 363, 369. Its trunk and muſcles, 369. Origin of its blood-veſſels, *ib.*
Coats of the eye particularly deſcribed, 109
Cochlea of the ear, 161. Its courſe, diviſion, &c. 162, 163.
Coccyx, its muſcles, 251.
Cœcum: A diviſion of the inteſtine ſo called, 265. Its nerves, 290.
Colon: an inteſtine, 265. Nerves of its arch, 290. Of its laſt convolutions, *ib.* Arteries of its ſtraight portion, *ib.*
Columnæ ſepti palati deſcribed, 187. Of the heart, 223.
Commiſſures of the uterus, 367.
Conglobate glands, 489. Their ſituation, 492.
Conception, different hypotheſes concerning it, 379.
Conglomerate glands: the pancreas one of that kind, 305.
Conſtrictores iſthmi faucium deſcribed, 188.
Cor, 222.
Cord, umbilical, deſcribed, 381. Its uſe, *ib.*
Cornea deſcribed, 109.
Corpora ſtriata, their deſcription and ſituation, 49.
—— olivaria, a kind of knots on the nerves, 519.
Corpus calloſum, 45.
Coſtales, 221.
Cremaſter muſcle, its deſcription, origin, and uſe, 345—347.
Crico-thyroidæi muſcles, 179. Their uſes, 181.
—— arytenoidæi poſteriores, *ib.*
—— arytenoidæi laterales, *ib.*
Criſta of the glandulæ renales, 329.
—— clitoridis, 369.
Crura, internal, of the clitoris, 373.
Crural veins, 451.
Cuticula deſcribed, 10. Its ſubſtance and origin, *ib.* Its colour, 11.
Cutis vera, 13. Its texture and eminences, *ib.* Various kinds of them, 14. Its pores, 15.

D.

Dartos muſcle deſcribed, 342.
Decidua reflexa, 377. Its ſtructure, appearance, and colour, 384.
Diaſtole, what, 233.
Didymi, 339.
Digeſtion, how performed, 263.
Dorſales muſcles deſcribed, 221.
Duct, thoracic. Its difference of ſize in different ſubjects, 501. Its courſe, 503.
—— lacteal, *ib.* Its coats, 504. Diameter, 505 Diviſions uncertain, *ib.*
Ducts, biliary, the ſtructure of their internal ſurface, 301.
Ductus aquoſi, 490.
—— arterioſus in ligamentum verſus, 415.
—— auris palatinus, 163.
—— choledochus, 298.
—— cyſticus, 300.
—— cyſto-hepatici, *ib.*
—— hepaticus, 296.
—— inciſorii, 145. Deſcription, and method of diſcovering them, 146.
—— lactiferi, 216.
—— pancreaticus, 305.
—— ſalivalis Whartoni, 289.
—— thoraeicus, 247.
—— venoſus of the fœtus, its uſe, 392.
—— Virſungi, 305.
Duodenal vein, 472.
Duodenum, a diviſion of the inteſtine ſo called, 265. Its ſituation and connections, 266. Structure, 267. Glands, 268. Arteries and veins, 287. Nerves, 290.
Dura mater, its ſituation, diviſion, compoſition, &c. 32.

E.

Ear, 148. External, figure and diviſions of it, 149. Muſcles, 151, 152. The ſkin and lobe, 152, 153. Arteries, 154. The bony parts of it, *ib.* Internal ſoft parts, 163.
Epididymis deſcribed, 340, 341.
Epiglottis, its figure, 174. Uſe, 182.
Erectores muſcles of men, 356.
—— of women, 369.
Expiration, 245.
Eye, 106. Its ſituation and compoſition, *ib.* The orbits, 107 Humours and capſulæ, 113. Muſcles of the globe, 116. Their number, names, ſituation, and uſe, 117, 118, 119. Veſſels and appendages, 132. Nerves, 135. Uſes, 136.

F.

Fibres of the tongue the ſame with muſculi linguales, 192.
Fœtus, its evolution, 379. Circulation, how carried on in it, 392. Its poſition

position in utero, 393. Its figure, *ib.* Its peculiarities, 394.
Foramen commune posterius, 51.
—— cæcum Morgagnii, 191. Salival ducts opening into it, *ib.*
Fornix, description of it, 47, 48.
Fræna of the valvula coli how formed, 277.
Frænum of the tongue described, 196.
—— preputii, 554.
Fundus, a portion of the uterus, 360.

G.

Ganglion semilunar, 290.
Ganglions, a kind of knots on the nerves, 519. Their coats and blood-vessels more numerous than of the nerves, *ib.*
Genio-glossi muscles described, 194.
Genitals, their lymphatic vessels, 494.
Gemini muscles, 339.
Gestation, contents of the gravid uterus in the advanced stages of it, 380.
Gland, thyroid, described, 211.
Glands of the dura mater, 41. The lymphatic ones of the groin, 494. Salival, 208.
—— bronchial, 502.
Glandula pinealis, 51.
—— pituitaria, 53.
—— lachrymalis, 126.
Glandulæ amygdalæ, 211.
—— arytenoidææ, 210.
—— Brunnerii, 271.
—— bucales, 210.
—— ciliares, 127.
—— conglobatæ, 286.
—— labiales, 210.
—— linguales, *ib.*
—— maxillares, 209.
—— molares, 210.
—— palatinæ, *ib.*
—— parotides, 208.
—— renales, 329.
—— sebaceæ, 216.
—— sublinguales, 210.
Glans penis described, 350.
Globe or ball of the eye, 108. Its composition, coats, humours, &c. 109.
Glottis, 175.
Gums described, 200.

H.

Hairs, their description and use, 25, 26.
Hæmorrhoidal veins, 468, 479.
Hæmorrhoidalis interna, 289.
Head, 29.
Heart, particular situation of it, 230. Uses, fleshy fibres, substance, &c. 232.
Hepar, 291.
Humours of the eye, 113—116.
Hydatides, a kind of preternatural vesiculæ, 363.
Hymen, a membranous circle so called, 372.
Hyo-glossi muscles described, 193. Their uses, 195.
Hypoglossi majores et minores, 197.

I.

Jejunum, a division of the intestines so called, 265. Its situation and size, 269. Its structure, 270. Its arteries, 287. Nerves, 290.
Ileum, an intestine so called, 265. Its situation and structure, 272. Its blood-vessels, &c. 288. Sphincter or pylorus of it, 318.
Iliaci veins, 451, 478.
Iliaci described, 251.
Incisorii laterales, 204.
Iliaci minores Cowperi, 205.
—— inferiores, 206.
Incus of the ear described, 157.
Infundibulum, 52.
Inspiration, how performed, 244.
Integuments common, 9. How divided by the ancients, *ib.* By the moderns, 10. Those supposed by the ancients, 27.
Intercostals: description of the blood-vessels so called, 221. The superior sometimes arise from the bronchial artery, 238.
Intestina tenuia, 266.
—— crassa, 273.
Intestines, 264. Their situation, size, and division, *ib.* Their structure, 265. Their blood-vessels, 287.
Intestinum cœcum, its situation and structure, 273.
—— colon; its situation, &c. 275. Its cells, *ib.*
—— rectum, 251, 279.
Ischio cavernosi, 356, 369.
Jugular veins, 450, 452, 454—456.

K.

Kidneys; their situation, figure, and division, 321. Their blood-vessels, 322. Coats, 323. Substance, 324. Pelvis, 325.

L.

Labia, 329.
Labyrinth of the ear, 159.
Lactea primi generis, 499.
—— secundi generis, *ib.*
Lacteal vessels described, 487.
Lacunæ, the glandular ones of the jejunum, 271. Of the urethra, 353. Of the parts of generation in women, 366.
Laminæ, internal, 32. Of the pericardium, 231. Membranous, 252. Of the little omentum, 315.

Larynx,

Larynx, 172. Its ligaments and muscles, 177. How divided, *ib.* Its uses, 180
Levator proprius, 129.
Levatores palati, 189.
—— ani, 280, 282.
Lien, 307. Its structure, 308. The human one very different from that of brutes, *ib.* Its substance, 309.
Ligamenta tarsorum lata, 125.
—— rotunda, 360.
—— lata, 362.
Ligaments of the tongue chiefly membranous, 196. Of the lungs, 239. Of the liver, 293. Superior ligament of the bladder, 334. Broad ligaments of the uterus, 362. Round ligaments of it, *ib.*
Ligamentum arteriosum, 415.
Ligamentum coli dextrum, 285.
—— coli sinistrum, *ib.*
—— coronarium, 294.
—— cutaneum ossis coccygis, 281.
—— denticulatum, 576.
—— elasticum, *ib.*
—— Fallopii, 253.
—— hepatis suspensorium, improperly so called, 294.
—— intermaxillare described, 203.
—— pubis interosseum, 281.
—— suspensorium, 355.
Lips described, 200. Great variety in their muscles, 201. Enumeration of them, 202. Upper lip sometimes moved by the muscles of the nose, *ib.* The common muscles of them, 207. Their uses, *ib.*
Lobes of the liver described, 291. How situated, 295.
Lobuli, 236.
Lobulus Spigelii, the small lobe of the liver described, 292.
Liver, its external coats, 297. Remarks on its vessels, 302.
Lungs, their vessels, 241.
Lymphatics of the parts of generation in women, 366. Of the intestines described, 490. Their coats and blood-vessels, 491. Of the lower extremities, 493. Of the larger viscera. 500. Two sets of them in the lungs, 502. Their course, *ib.* Lymphatics of the head and neck, 507. Of the mesentery, 506. Of the glandula thyroidea, 508. Of the upper extremities, 510. A superficial lymphatic above the wrist, 511. One near the radial artery, *ib.*

M.

Malleus of the ear described, 158. Its form when in its true situation, *ib.* Its muscles, 166. Situation, 167.
Mammæ, described, 214. Their body, 215. Corpus adiposum, *ib.* Arteries, veins, and nerves, 218. Uses, *ib.*
Mammariæ externæ, 262.
—— internæ, *ib.*
Maxillaris inferior, 556. Its use, branches, &c. *ib.*
—— superior, 555.
Meatus externus described, 153. Wanting in children, *ib.*
Mediastinum described, 219.
—— scroti, 343.
Medulla oblongata, 56. Its substance, *ib.* Productions, 57—60.
—— spinalis described, 60. Substance and body, 61. Productions, 62.
Medullary arch, 46.
Membrana adiposa: its interstices, thickness, &c. 20, 21. Its increase and decrease by labour, 22. Differences in thickness, use, &c. 23.
—— caducea, 377.
—— conjunctiva described, 521. Its different names, 126.
—— decidua, 377, 383.
—— pituitaria, 141. Situation and use, *ib.* Why so named, *ib.* Its structure, *ib.* 142.
—— tympani, 165.
—— reticularis of the tongue described,
Mesenteric fasciculi, or plexus posterior; a name for the cœcum, 290.
Mesenterica inferior, 262.
—— superior, *ib.*
Mesentery described, 264. Its division, 283. Structure, 284.
Mesocolon, 264. A continuation of the mesentery, 285.
Meso-rectum, *ib.*
Mitrales valvulæ described, 223.
Motion peristaltic of the intestines, 263.
Motor oculi described, 553.
Mouth, 171. Meaning of the word, *ib.* Its external and internal parts, *ib.* 172.
Musculi abdominis, 251.
—— cutanei, 206, 207.
—— exteriores, *ib.*
—— frontales described, 121.
—— linguales, 192.
—— occipitales, 122. Their description and uses, 123.
—— polychresti, 195.
—— superciliares, 123. Description, insertion, and action, 124.
Musculus transversalis perinæi, 281.
—— uteri orbicularis, 366.

N.

N.

Nails, their production and substance, 24. Use 25.

Navicularis, the fossula so called, 368.

Nerves of the dura mater, 41. Of the brain and spinal marrow, 63. Of the medulla oblongata, 64. First and second pair, *ib.* Third pair, 65. Fourth pair, *ib.* Fifth and sixth pairs, 66. Seventh, eighth, and ninth pairs, 67. Tenth pair, 68. Nerves of the medulla spinalis enumerated, 68, 69. Their productions, 70. Nerves of the nose, 148. Of the lungs, very numerous, 239. Of the stomach, 262. Of the intestines, 290. Of the liver, 297. Of the pancreas, 307. Of the spleen, very numerous, 310. Of the kidneys, 322. Of the bladder, 336. Of the parts of generation in males, 359. Of the parts of generation in women, 366. Of the nerves in general, 515. Common opinion concerning their rise, 516. Composition, 517. Size of their fibres not known, *ib.* Their substance very tender, *ib.* Blood-vessels very numerous, 518. Changes produced on their coats affect their fibres, 520. Different opinions concerning their solidity, 523—529. Supposition of an extreme rapidity in the motion of the nervous fluid, 531. Various arguments for and against it, 532. Certain method of judging what this liquor is, 534, 535. Conclusions, 535. Motion of the nervous fluid constant and equal, 536. Improbability of their being any valves in the nerves, 537. The three functions explained on the hypothesis of the fluid described, 538. Arguments concerning the impulses made on the nerves, 539—549. Of the particular nerves, 549. Ten pairs come from the encephalon, *ib.* Of the olfactory nerves, *ib.* Their structure very tender, 550. Optic nerves, *ib.* Their origin, 551. Observations on their substance, *ib.* Sixth pair of the particular nerves, 566. Seventh pair, 559. Eight pair, 560. Recurrent nerves, 561. Ninth pair of the particular nerves, 562. Tenth pair, 563. Description of a branch of the 6th pair, 564. Suppositions concerning its functions, *ib.* 565. The spinal nerves described, 566. The first cervical pair, *ib.* The second cervical, 567. Third pair, *ib.* Its branches, 568. Phrenic nerve, 568. Fourth, fifth, sixth, and seventh cervicals, *ib.* The twelve dorsal nerves of each side, 572. The first dorsal, six lower, and the twelfth; 573. The five lumbar ones, *ib.* Anterior and posterior crural nerves, *ib.* Obturator, *ib.* Sixth pair of the false vertebræ, 575. First, second, and third pairs, *ib.* Fourth, fifth, and sixth, 576. Sciatic nerves how formed, 576. Poplitæus, *ib.*

Nervi pathetici, 553.

—— sympathetici medii, 239.

—— sympathetici majores, *ib.*

Nervus accessorius, 560.

—— articularis, 569.

—— cutaneus, *ib.*

—— muscularis, 570.

—— musculo-cutaneus, *ib.*

—— radialis, 571.

—— scapularis, 569.

—— ulnaris, 570.

Nose, its external and internal parts described, 127. Of the nerves, 138. Cartilages, 139. Muscles, 140 Uses of them, 141. Arteries, 147. Nerves, 148. Upper lip sometimes moved by the action of its muscles, 202.

Nymphæ described, 368. Their substance, 370.

O.

Oesophagus, its situation, figure, &c. 246.

Omentum, 312. Its structure, 313. Vessels, 316.

—— little, described, *ib.*

Orbicularis, 202.

—— palpebrarum, 129. How divided, 130.

Orifice, arterial, 227.

—— auricular, 223, 227.

—— biliary, of the duodenum, 269.

—— of the omentum, 314.

—— internal, of the uterus, 361.

—— of the urethra, 353.

Orifices, how to discover them by means of a microscope, 186.

Os hyoides, muscles which move it, 193.

—— orbiculare, 159.

Ossicula auditus, 157. Ligaments of, 166.

Ova, 363

Ovaria, 362. Their composition and ligaments, 363.

Ovum, structure of it in early gestation, 376.

P.

Palate described, 186.

Palato-pharyngæi muscles described, 188.

Pal-

Palpebræ described, 124. Their muscles, 129.
Pari piniformes, appendices of the ductus thoracicus, 247
Pancreas described, 305. Its situation, division, and figure, *ib.*
Papilla of the breast, 216. Its body, texture, &c. 217.
Papillæ of the tongue, three sorts of them, 190.
—— of the tunica villosa, 271.
Pericardium, 222. Described, 230, 231.
Pericranium described, 29, 30.
Perinæum, 368.
Peritonæum, 251, 252. Cellular substance, 253. Its productions, *ib.* Round ligaments, *ib.* The aorta and vena cava involved in its cellular texture, 254.
Pharynx described, 182. Its muscles, 184, 185.
Pia mater described, 42.
Placenta described, 382. Twins sometimes have their placentæ together. *ib.* Fœtal part of it, 384.
Pleura described, 214, 218. Its arteries and veins, 220. Nerves, 221. Use, *ib.*
Plexus Pulmonaris, 239.
—— glandulosa Peyeri, 271.
—— mesentericus superior, 290.
—— mesentericus inferior, *ib.*
—— submesentericus, *ib.*
—— renales, 322.
—— retiformis, 372.
Pori biliarii, 296
Portæ, a name given by the ancients to the lobes of the liver, 292.
Portio mollis of the auditory nerve, 559.
Pregnancy, best mark of its existence, 388.
Preputium in men, 354.
—— in women, 368.
Prostatæ described, 349.
Psoas muscle, 251
Ptery-staphilini muscles described, 188.
Pubes, 366.
Pudicæ, arteries so called, 357. Their origin, *ib*
Pulmones, 234.
Puncta lachrymalia, 118.
Pylorus described, 260—263.

Q

Quadrati lumborum. 251
Quadratus muscle described, 206.

R

Raninæ, blood-vessels of the tongue so called. 196.

Raphe of the scrotum, 342.
Receptaculum chyli 501.
Rectum, a division of the intestines so called, 265. Its arteries furnished by the hæmorrhoidalis interna, 289 Its veins ramifications of the mesaraica minor, *ib.* Its nerves, 290.
Renes, 321.
—— succenturiati, 329.
Reticularis tunica nervosa, 271.
Retina, 112. From what produced, *ib.* 113. Described, 551.
Riolan's nosegay, 193.
Roots of the corpora cavernosa, 347.
Rope, spermatic, 344.
—— transverse, 307.
Ropes, vascular, described, 365.

S.

Sac, lacteal, 503. Its coats, 504.
Sacculus lachrymalis, 143. How divided, 144.
Scaphoides. 368.
Scissure, the great one described, 292.
Sclerotica, description of the coat of the eye so called, 109.
Scrotum described. 340.
Semi orbiculares muscles, 209.
—— lunares, 243.
Septum lucidum, 47.
—— palati, 189.
—— a kind of short one, how formed at the extremities of the vesiculæ seminales, 352.
Sinuses, frontal, maxillary, &c. how formed, 142.
—— sinister, 228.
—— of the vena portæ, 296.
—— venosus, 227.
Skin, its glands, 16. Their composition and uses, 17. Feeling, *ib.* Transpiration, 18.
Speech performed by means of the tongue, 199. Instances of people who spoke without one, *ib.*
Sphenoidal folds, 34.
Sphincters, 280
Spine, why few of its lymphatics mended, 306.
Spleen described, 307. Course of its lymphatic vessels, 500.
Stapes, a bone of the ear, 159. Its muscles, 166
Staphylinus muscle described, 189.
Sterno-thyroidæi muscles described, 178.
Stomach. 257. Its uses, 263. Its lymphatic vessels, 500.
Striata corpora, 324.
Subclavian veins 450.

Succus gaſtricus, or ſtomachicus, deſcribed, 260.
Sulcata corpora, 324.
Syſtole, what, 233.
Stylo-gloſſi muſcles, 193. Their uſes, 195.
Stylo-pharyngeus, 193.

T.

Tarſi of the palpebræ deſcribed, 125.
Taſte, how occaſioned, 198.
Tenſores palati, 189.
Teſtes deſcribed, 339. Nucleus of each, 340. Their coats, 345.
Thalami nervorum opticorum, 49.
Thorax, 212. Its cavity, 214. Arteries and veins of it, 220.
Thymus deſcribed, 221.
Thyro-arytenoidæi muſcles deſcribed, 179. Their uſes, 181.
Thyro-epiglottici, 180.
—— hyoidæi, 178.
—— ſtaphilini, 188.
Toes, their lymphatics, 493.
Tongue deſcribed, 190. Its fibres the ſame with the muſculi linguales, 192. Papillæ of three different kinds, 190. Its muſcles, 193. Ligaments and blood-veſſels, 196. Nerves, 197. Its uſes, 198. Inſtances of people who ſpoke without a tongue, 199.
Trachea arteria deſcribed, 240. Its ſeveral coats, 243.
Tranſverſales muſcles deſcribed, 356.
Triangulares muſclea, 205.
Tricuſpidal valves, 223, 226.
Triglochins, *ib.*
Trunk, its abſorbent veſſels, 497.
Tubæ Fallopianæ deſcribed, 363.
Tuberculæ of the brain, 50. Different names given them by the ancients and moderns, *ib.*
Tubularis, the ſubſtance of the kiduey, why ſo called, 324.
Tunica vaginalis, &c. of the teſticles, 346
—— filamenta, a name of the falſe chorion, 377.
—— cellulоſa, nervoſa, &c. 258, 259, 265, 355.
Tunica of the eye. *Vide* Eye.
Tympanum, 106, 155, 156, 157.

U. V.

Valvula palati deſcribed, 187.
—— coli, how formed, 275. Deſcribed, 277.
Valvulæ auriculares, 226.
—— conniventes, 266. Their formation, 268.
Valvular lymphatic veſſels, 492.
Vaſa deferentia how formed, 341. Deſcribed, 344. Particular paſſage into the veſiculæ ſeminales, 352.
Vaſa pampiniformia, 339.
—— ſpermatica, 366.
—— lymphatica, 239, 490.
—— brevia, 308.
Veins of the dura mater, 37—41. Bronchial known to Galen, 239. Of the ſtomach, 262. Hepatic, their uſe, 296. Splenic deſcribed, 310. Spermatic, 338. Of the parts of generation, 358. Pulmonary, 398. Vertebral, 450, 457.
Vena cava. 227, 446—451, 481.
—— portæ, 426, 470.
—— ſine pari, 449.
—— frontalis, 453.
—— angularis, *ib.*
—— temporalis, 455.
—— muſcularis, 456.
—— gutturalis, 457.
—— baſilica, 451, 458.
—— cubitalis externa, 459.
—— mediana baſilica, 459.
—— mediana cephalica, 461.
—— ſub-humeralis ſeu articularis, 460.
—— hepatica brachii, 460.
—— cephalica, 450, 460.
—— cephalica pollicis, 460.
—— radialis interna, 461.
—— cubiti profunda, *ib.*
—— axillaris, 462.
—— azygos, 449, 464.
—— ſubclaviana, 467.
—— meſaraica minor, ſeu hæmorrhoidalis interna, 468.
—— ſplenica, 469.
—— epiploica ſeniſtra, 469.
—— meſaraica major, 470.
—— cæcalis, *ib.*
—— epiploica dextra, 471.
—— gaſtro-colica, *ib.*
—— colica dextra, *ib.*
—— colica of Riolan, *ib.*
—— inteſtinalis, 472.
—— duodenalis, 473.
—— portæ hepaticæ, 473.
—— portæ ventralis, *ib.*
—— ſaphæna, 474.
—— ſaphæna minor, 475.
—— tibialis poſterior, 476.
—— peronæa, 477.
—— poplitæa, *ib.*
—— iliaca externa, 478. 480.
—— obturatrix, 479.
—— iliaca communis, 480.
—— iliaca interna, *ib.*
—— hypogaſtrica, 480.
Venæ mediaſtinæ, 221.
—— pulmonares, 228.

Venæ

Venæ coronariæ, 229.
—— lacteæ, 268.
—— finiftræ, 450.
—— hepaticæ, 451.
—— raninæ, 453.
—— fatellites arteriæ brachialis, 459.
—— pectorales internæ, 463.
—— intercoftales, 464.
—— bronchiales, 467.
—— cyfticæ gemellæ, 473.
—— pudicæ internæ, 479.
—— lumbares, 481.
—— emulgentes, 482.
Ventricle, fourth of the brain, 54.
Ventriculi laterales, 46.
Ventriculus, 256.
Vefica urinaria, 332.
Veficula fellis, 299.
—— umbilicalis, 378, 385.
—— lactea, 385.
—— alba, *ib.*
Veficulæ bronchiales, 236.
—— feminales, 351.
Vefpertilionum alæ, 362.
Veftibulum auris, 160.
Villofa, the internal coat of the rectum improperly fo called, 280.
Villous coat of the bladder, 333.
Vifcera abdominal, their ufe, 316.
Umbilical veffels, 255.
Urachus defcribed, 334.
Ureteres, 321. Their fituation with regard to the renal artery, 326. Their courfe, &c. 328.
Urethra, 348. In women, 370.
Uterine fyftem, its changes from impregnation, 386.
Uterus, 360—364. Its canal, commonly called the neck, 371. Its fituation and fubftance, 372. Inverfion of it, 390. Of the gravid uterus, 374. Its fize different in different women, 381.
Uvula defcribed, 187. Its glands, 210.

Z.

Zygomatici majores, 203.
—— minores, 204.

F I N I S.

DIRECTIONS for placing the PLATES of Vol. II.

Tables IX. X.	Between pages	396 and 397
XI. XII.		486 and 487
XIII XIV.		512 and 513
XV. XVI.		578 and 579

In the Press,

And will be published by Charles Elliot, *Edinburgh,* *about the first of April* 1784,

Corrected, much Enlarged, and completed,

In Five Volumes Octavo,

First Lines of the PRACTICE of PHYSIC,

By Dr William Cullen, Professor of Medicine in the University of Edinburgh.

In the press, and will also soon be published by C Elliot,

I. Lectures on CHEMISTRY and Natural History,

Translated from the French of M Fourcroy, M. D. Fellow of the Royal Society of Medicine at Paris.

Exhibiting a methodical view of the whole Chemical Knowledge acquired to the present time; with a comparison between the doctrines of Stahl and those of some Modern Chemists. The whole intended to serve as an abstract of a complete course of Lectures on both Sciences, *especially Chemistry;* with many additions, notes, and illustrations, by the Translator, in 3 vols octavo.

II. The NEW DISPENSATORY, on the plan of the late Dr Lewis; including the numerous Discoveries and Improvements since his time. By a Gentleman of the Faculty of this City.

The Edinburgh Pharmacopœia has been twice materially reformed. Several new medicines have been thought worthy of a place in the Materia Medica; others have been expunged; and the operations of many medicines on the human body, are now explained in a very different manner. These considerations render it very desirable, that so useful a Work should be improved to the utmost.

This work will also have several useful Tables, and a Set of Extemporaneous Prescriptions used by the most eminent Practitioners in Edinburgh and London. It will be comprised in one very large Volume octavo, about 7s. bound, and published as soon as possible.

III. A Second Volume of MEDICAL CASES, selected from the Records of the Public Dispensary at Edinburgh, with Remarks and Observations: being the Substance of Case-Lectures delivered from the year 1778 to 1783. By Andrew Duncan, M D. Fellow of the Royal College of physicians of Edinburgh, &c. &c. &c.

BOOKS

B O O K S

IN THE

DIFFERENT BRANCHES OF MEDICINE,

Printed for and fold by CHARLES ELLIOT, Parliament-Square, Edinburgh.

1. A SYSTEM OF SURGERY. By Benjamin Bell, Member of the Royal College of Surgeons of Edinburgh, and one of the Surgeons to the Royal Infirmary of that City. Illuftrated by Copperplates. Vol. I. and II. 8vo. 6s. each boards This work, when completed, with a former volume on Ulcers, &c. by the fame Author, will comprehend a full fyftem of Modern Surgery. The whole to be contained in other two vols 8vo. Vol. III. and IV. will be publifhed as foon as poffible.
2. A TREATISE on the Theory and Management of ULCERS; with a Differtation on White Swellings of the Joints. To which is prefixed, An Effay on the Chirurgical Treatment of Inflammation and its Confequences. By the fame Author. A new edition, being the third, greatly improved and enlarged, 6s. in boards.
3. OUTLINES of the Theory and Practice of MIDWIFERY, by Alexander Hamilton, M. D. F. R. S. Edin. Profeffor of Midwifery in the Univerfity, and Member of the Royal College of Surgeons, Edinburgh. Price 6s. bound, or with Dr Smellie's 40 Tables and Explanations (*Vide* N° 22 & 23.) 11s. boards, and 12s. bound.
4. The WORKS of ALEXANDER MONRO, M. D. F. R. S. Fellow of the Royal College of Phyficians, and late Profeffor of Medicine and Anatomy in the Univerfity of Edinburgh. Publifhed by his Son ALEXANDER MONRO, M. D. Prefident of the Royal College of Phyficians, Profeffor of Medicine, Anatomy, and Surgery, in the Univerfity of Edinburgh. To which is prefixed, the LIFE of the AUTHOR. In one very large volume in quarto, elegantly printed upon a royal paper, and ornamented with a capital Engraving of the Author by Mr Bafire, from a painting by Allan Ramfay, Efq; befides feveral Copperplates illuftrative of the fubjects. Price 1l. 5s. in boards.—The fine Engraving of the Doctor, by itfelf, at 5s. for proof-impreffions. The fimple engraving coft 40 guineas.
5. A TREATISE on COMPARATIVE ANATOMY, by Alexander Monro, M. D. F. R. S. &c. &c. Publifhed by his Son, Alexander Monro junior, M. D. A new Edition, with confiderable Improvements and Additions by other hands, 12mo. Price 2s. in boards.
6. The ANATOMY of the HUMAN BONES, NERVES, and LACTEAL SAC and DUCT; by Alexander Monro, M. D. F. R. S. &c. &c. To which is added, his Treatife of COMPARATIVE ANATOMY, as publifhed by his Son. A new Edition, corrected and enlarged, in 12mo. Price 4s. in boards.
7. A SYSTEM of ANATOMY, from Monro, Winflow, Innes, and the lateft authors.—Arranged, as nearly as the nature of the work would admit, in the order of the Lectures delivered by the Profeffor of Anatomy

tomy in the Univerfity of Edinburgh.—In Two Volumes Octavo, illuftrated with 16 Copperplates. Price 13s. boards.

8. SYNOPSIS NOSOLOGIÆ METHODICÆ, exhibens clariff. virorum Sauvagefii, Linnæi, Vogelii, et Sagari, fyftemata nofologica. Edidit, fuumque proprium fyftema nofologicum adjecit, Gulielmus Cullen, Med. D. et in Acad. Edinb. Med. Pract. Prof. &c. &c. &c. 2 vols 8vo. 3d edit. Price 12s. bound.

9. A fine Mezzotinto Engraving of Dr WILLIAM CULLEN, by Valentine Green, from a painting of W. Cochrane, Efq; done at the expence of the Royal Medical Society, *firft impreffions* 6s. *common ones* 3s.

10. CULLEN's (Dr William) Letter to Lord Cathcart on the Recovery of Drowned Perfons. 8vo, 1s. fewed.

11. Sharpe's TREATISE on the Operations of SURGERY, the 10th edition, with 14 copperplates, containing 54 figures. Price only 4s. 6d. bound.

12. ALBINUS's TABLES of the Skeleton and Mufcles of the Human Body, with Explanations, engraved by Andrew Bell. Neatly half-bound, 1l. 13s. or in boards, 1l. 11s. 6d. in folio.

13. INNES's eight Anatomical TABLES of the Human Body, containing the principal parts of the Skeleton and Mufcles reprefented in the large Tables of Albinus; to which are added, Concife Explanations. New edition, with an Account of the Author. Neatly half-bound, quarto, price 6s. 6d.

14. INNES's fhort defcription of the Human MUSCLES, chiefly as they appear on diffection, together with their feveral ufes, and the fynonyma of the beft authors; a new edition, greatly improved by Alex. Monro, M. D. 2s. 6d. in boards.

15. Differtatio de Natura et Ufu Lactis in diverfis Animalibus, auctore Thoma Young, M. D. in Academia Edinenfi Artis Obftetricæ Prof. 8vo, 1s. fewed.

16. MONRO's Account of the Inoculation of the Small-pox in Scotland, 8vo, 1s. fewed.

17. CELSUS de re Medicina, curavit A. Morris, cum Indice, 8vo, 5s. bound.

18. HALLER's Firft Lines of Phyfiology, tranflated from the correct Latin edition printed under the infpection of William Cullen, M. D. To which is added, a tranflation of the laborious Index compofed for that edition, 7s. bound.

19. Dr DUNCAN's Medical CASES, felected from the records of the Public Difpenfary at Edinburgh, with practical Remarks and Obfervations; new edition corrected, 5s. boards.

20. ———— Elements of THERAPEUTICS, or firft principles of the Practice of Phyfic, 2 vols, 6s. bound. The fame, one vol. 8vo, 3s. in boards.

21. ———— Heads of LECTURES on the Theory and Practice of Medicine, new edition corrected and enlarged, with the Pathology, 12mo, 3s. 6d. boards.

22. A TREATISE on the Theory and Practice of MIDWIFERY; by W. Smellie, M. D. To which is now added, his Set of Anatomical Tables, exhibiting the various cafes that occur in practice; accurately reduced and engraved by A. Bell, on 40 copperplates, (including an additional plate of inftruments, by the late Dr Thomas Young), with Explanations. A new edition, on fine paper, in 3 vols 12mo. Price 10s. 6d. in boards, or 12s. bound.

23. Dr

23. Dr SMELLIE's ſet of Anatomical TABLES, and an Abridgment of the Practice of Midwifery, with a view to illuſtrate his Treatiſe on that ſubject and Collection of Caſes, 8vo ſize 6 . 12mo ſize 5s. in boards.

24 LIND on the Putrid and Remitting MARSH-FEVER which raged at Bengal in the year 1762, being a Tranſlation of his Theſis, 8vo, 1s.

25. MEAD's whole Medical WORKS, complete in one volume 8vo, *with plates*, 6s bound.

26. THESAURUS MEDICUS. ſive diſputationum in academia Edinenſi ad rem Medicam pertinentium, a collegio inſtituto ad hoc uſque tempus, delectus, 2 vols 8vo. Vol. I. or II. or any of the ſubſequent ones, may be had ſeparately. The whole is executed by the approbation of the preſent profeſſors of the different branches of the healing art. Vol. II. brings this collection down to the year 1758, and is enriched with Dr A. Monro junior's celebrated theſis *De teſtibus et de ſemine in variis animalibus*, who obligingly furniſhed the publiſher with the accurate original engravings for illuſtrating this ſubject, 12s. boards. *A third and fourth volume are preparing for the preſs*, ſelected and approved of by the Royal Medical Society of Edinburgh

27. A Treatiſe upon the extraction of the Cryſtalline Lens. By Geo. Borthwick, Surgeon to the 14th Regiment of Dragoons, 8vo, 6d. ſewed.

28. The Univerſal SHORT HAND, being an Improvement on Mr Byrom's plan; in which are ſpecimens from Dr Cullen and Monro's lectures, &c. &c. To which is alſo ſubjoined, A new ſcheme of Short-hand Writing, being an improvemenn of Mr Palmer's; by which any perſon, without the aſſiſtance of a maſter, will be able in a ſhort time to follow any public ſpeaker. A great many copperplates, &c. Price only 6s. in boards. This is the cheapeſt book on the ſubject ever publiſhed.—Byrom and Palmer ſold together, formerly, at 1l. 1s 6d.

29. De morbis cœli mutatione medendis, auctore Jacobo Gregory, M. D. Med. Theoret. in Acad. Edin. Prof. &c. &c. &c. Edit. altera, auct. et emendat, 8vo, 2s. ſewed.

30. SWIETEN's (Baron Van) COMMENTARIES upon Boerhaave's Aphoriſms concerning the Knowledge and Cure of Diſeaſes, a correct edition, dedicated to Dr Cullen, 18 vols 12mo, royal paper, neatly bound in calf, 3l. 3s.

31. Compendium Anatomicum, totam rem Anatomicam breviſſime complectens. Auctore B. D. L. Heiſtero, M. D. Editio nova, in 12mo 3s. in boards.

32 Inſtitutiones Medicæ, in uſus annuæ exercitationis domeſticos, digeſtæ ab H Boerhaave, 8vo, 3s. bound.

33. Harveii exercitationes anatomicæ, de motu cordis et ſanguinis circulatione, fine foolſcap 8vo 3s. 6d, and fine thick poſt 8vo 5s. both neatly bound.

N. N. Any of the foregoing Books, as well as every other *Medical Book*, printed at Edinburgh, that cannot be got in London, C. ELLIOT will forward to any part of England, upon their value being paid to Mr Robinſon the publiſher of the preceding work in London.