

**A compendium of anatomy. Containing a short but perfect view of ... humane bodies. In which all the parts of the human body are succinctly and clearly described and their uses explained / By Laurence Heister. Translated from the last edition of the original Latin ; greatly augmented and improved by the author. To which are added notes by M. Henault [i.e. F.J. Hunauld] and the editor. Illustrated with 8 large copper plates.**

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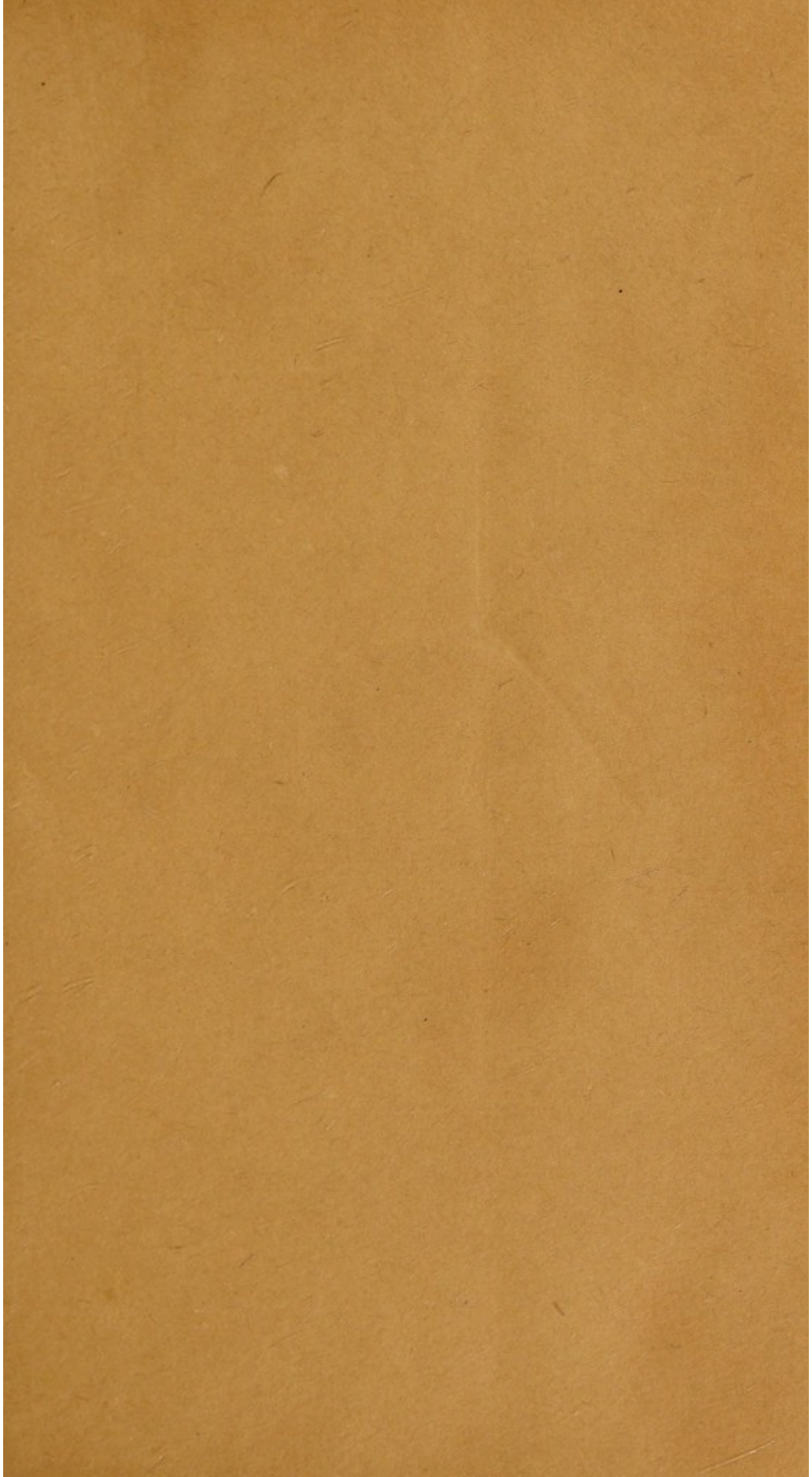
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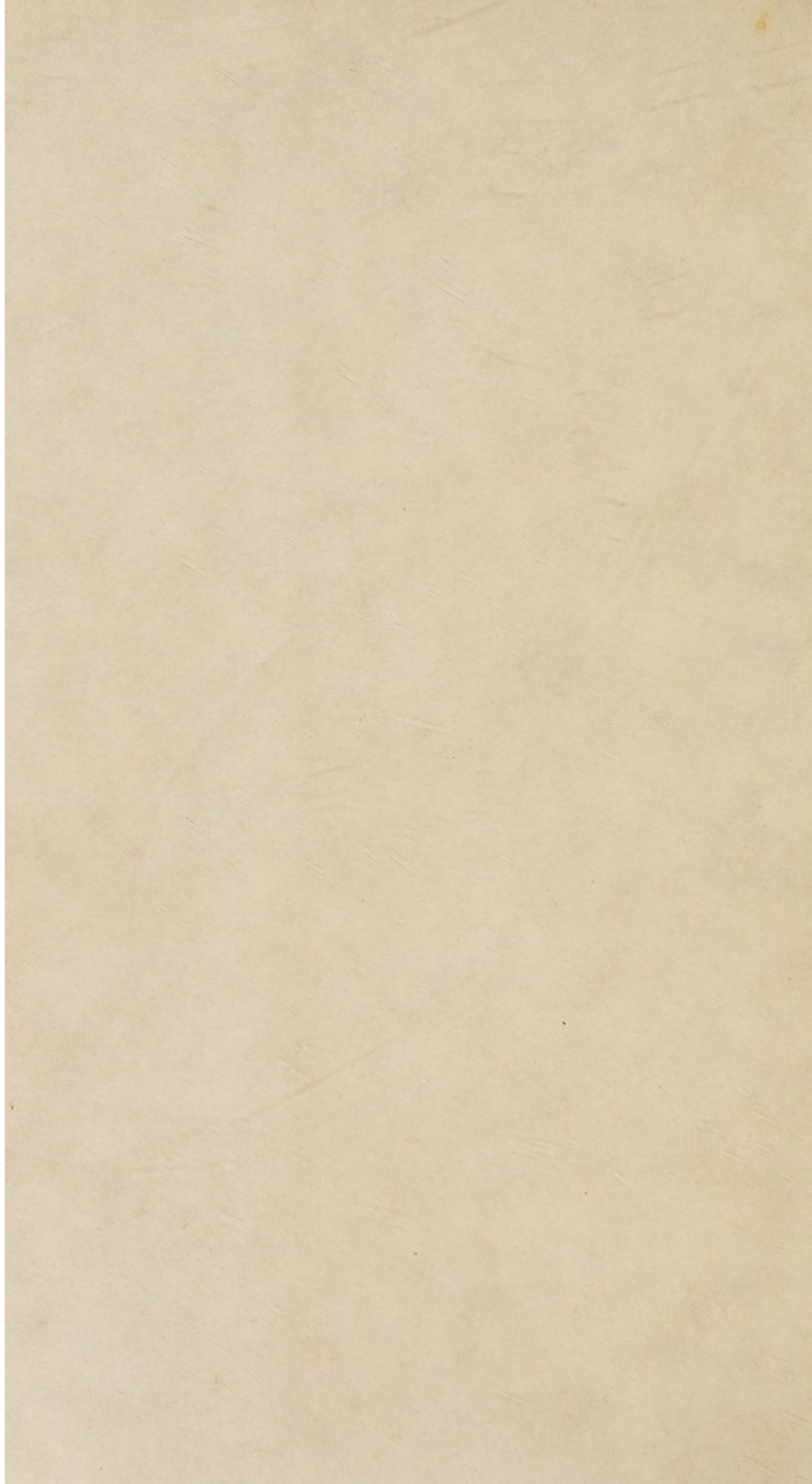





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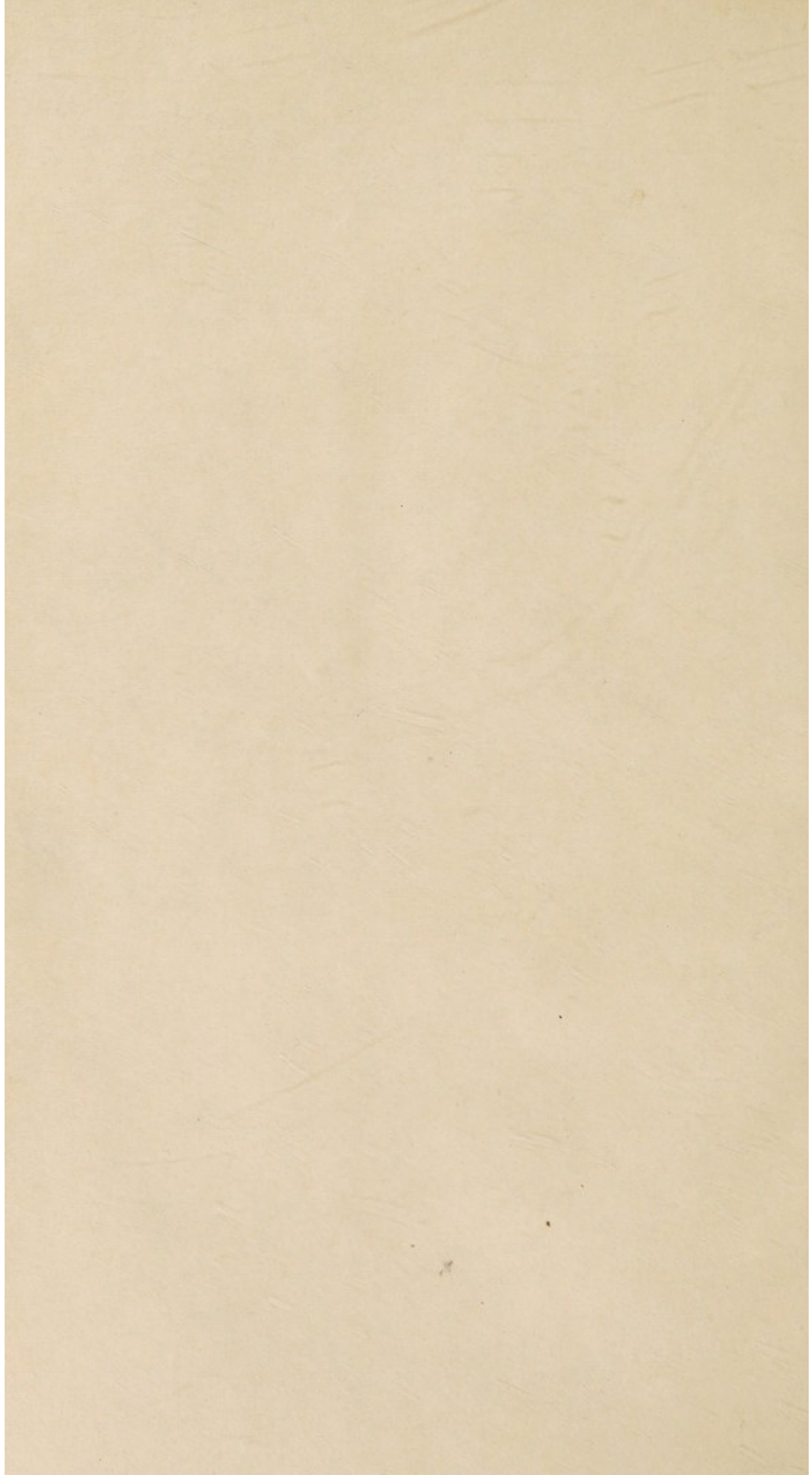






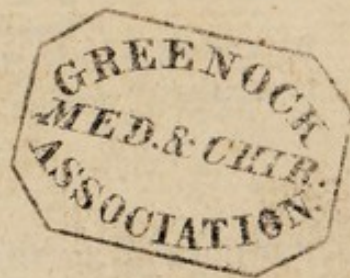


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C O M P E N D I U M  
O F  
A N A T O M Y.



COMPENDIUM

OF

ANATOMY.



A *Wm Spens* 767  
*2.1.*

COMPENDIUM  
OF  
ANATOMY.

In which all the  
PARTS of the HUMAN BODY

Are succinctly and clearly described;

AND

Their USES explained.

By LAURENCE HEISTER, M. D.

Professor of PHYSICK and SURGERY in the University of  
HELMSTADT, and Fellow of the Royal Societies of  
LONDON and PARIS.

Translated from the last Edition of the original Latin:  
Greatly augmented and improved by the Author.

To which are Added,

NOTES by M. HENAULT, and the Editor.

Illustrated with Eight large COPPER PLATES.

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L O N D O N :

Printed for W. INNYS and J. RICHARDSON, in Paternoster-  
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Row.

MDCCLII.



To the  
Greenock

Medical & Churgical  
Association

from  
Wm Spence M.D.



THE  
P R E F A C E  
OF THE  
T R A N S L A T O R.

**T**HE great utility of an accurate and perfect Compendium of Anatomy, cannot but be allowed by every one who has at all thought upon that subject; and the reception which this in particular has met with, for so many years, seems to evince, that it has been regarded as approaching very nearly to that character.



rafter. The author, who has lived to see feveral editions of it, has liberally added the fruits of his fucceeding obfervations to each of them; and, wherever there has feemed a deficiency, the tranflator has attempted, on the fame plan on which himfelf had proceeded, to fupply it. The author profeffes to have fearch'd into the anatomical books publifhed in the intermediate time between his feveral editions, and to have collected from each of them their principal discoveries, with which he has improved the laft edition of this work: what books of credit have appeared in this fci-ence fince his laft edition, have been examined with this intent, the very late one of Verdier not excepted; and fome things, of no little confequence, added from it. Senac's animadverfions have been carefully examined alfo, and feveral additions made from them; which Dr. Heifter, though he had met with that work, without knowing its author, had omitted: nor has his other and more valuable method of addition to his own obfervations been neglected, where difficulties, undetermined by him, have been hitherto left as *defiderata*. In this cafe, infpection into the parts themfelves, with the help of microfcopes, and the affiftance of the preparations of fome of our moft eminent anatomifts, fuperior to thofe of any former ones, have been the means of at-



tempting farther certainty. Where, with these helps, the discovery has been clearly made out, it is added; where ever but the least doubt remained, every thing is left as it was.

Whatever is done of this kind is added in the notes. The author's text is every where preserved sacred: and his notes, which are printed separately at the end of this work, make a great part of the comment on the whole.

The pains this Compendium has cost its author, may be seen in the accuracy with which he has finished it, especially in the latter impressions; and the difficulties that attended the executing it, are obvious. It was of consequence to the extensive character of Dr. Heister to convince the world, that it was not a trivial thing he was publishing: he is, therefore, to be excused for having taken some pains to prove it. The necessity of such a work could only be shewn, by pointing out the deficiencies of authors, highly esteemed at the time when he wrote it; and it is in this sense that we are to understand his remarking so many instances of it.

The many editions this work has gone through in the original, sufficiently shew its demand to have arose from its general usefulness to all who profess this science; and  
we



we doubt not but it will be as acceptable and useful to all gentlemen of the profession, as his General System of Surgery has appeared to be, since its translation into the English language.

A C O M-

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A  
COMPENDIUM  
OF  
ANATOMY.

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BOOK I.

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CHAP. I.

*Of Anatomy in general.*

1. **A**NATOMY is an art which teaches Anatomy the situation, figure, connections, functions, actions, and uses of the several parts of the body.

2. The primary object of anatomy is the human body: the secondary ones are, the bodies of other animals. These serve for the more accurate distinctions of several parts, and supply the defect of human subjects: this part of it is called comparative anatomy, or the anatomy of beasts; sometimes zootomy\*.

3. The person who is skilled in the art of dissecting human and other bodies, and of clearly

\* See on this subject Severinus's Zootomia, Blasius's Anatomie Animalium, Collins's Anatomy, the dissections of various animals by the academy of Paris, and Valentini's Amphitheatrum Zootomicum.



demonstrating their nature, so that, from his instructions, the hearers may learn the position, communication, structure, actions, and uses of the several parts, is called an anatomist.

Its means.

4. The means by which the anatomist performs this, are principally section, or the opening the body, and separating its parts; and the assistance of microscopes, and of injections; with some others to be treated of hereafter, in their places. The means by which the young student is to qualify himself, in the science, are, 1. Diligent attention while the anatomist is dissecting. 2. Imitation of what he has been doing, as well in human subjects as in brutes. 3. A careful perusal of the authors, who have written well on the subject.

The best writers on it.

5. The principal and most necessary to be consulted, among the earlier writers, are Galen, Vesalius, C. Stephanus, Eustachius, Ingrassias, Columbus, Fallopius, Coiterus, Vidijs, Varolius, Valverde, Fabricius ab Aquapendente, Bauhine, Spigelius, Casserius, Laurentius, Asellius, Laurentbergius, Pavius, Casp. Bartholine the elder, M. A. Severinus, and C. Hoffman.

6. Among the after-writers, the most necessary to be consulted are Harvey, Vesslingius, Riolanus the son, Wharton, Glisson, Pecquet, Willis, Lower, Highmore, Needham, Marchett, Molinet, Diemerbroek, Kerkringius, Blasius, Steno, Malpighi, Bellini, Rolfinch, Schneider, Hornius, De Graaf, Swammerdam, T. Bartholine, Liferus, Gagliardus, Peyerus, Bourdonus, Drelincurt, Nuck, and Havers.

7. And finally, among the moderns, Ruysch, Bidloo, Du Verney, Bohn, Bruner, Vieussens, Ortlobius, Verheyen, Schelhamer, J. Maurice Hoffman, Dionis, Cowper, Ridley, C. Bartholine the



the younger, Keil, How, Morgagni, Valsalva, Fanton, Pacchionus, Bianchus, Drake, Vercellonius, Cheselden, Arent. Cant, Noguez, and Santorini. To these might be added a number of others; but it is not necessary to make this list too long: Magnet's *Bibliotheca* and *Theatrum Anatomicum*, will give an account of many of them; and we are to add, that the discoveries and new observations in anatomy, recorded in the works of the royal societies of France, England, Italy, Germany, and other parts of the world, are by no means to be passed over. The student, who wishes to be acquainted with more of the anatomical writers, may turn to Gœlickius's *History of Anatomy*, Dr. James Douglas's *Specimen of a Bibliographia Anatomica*, and to our author's oration de *Incrementis Anatomies*, published at Helmstadt in the year 1720.

8. The intent and ends of anatomy are various: Its end the primary one is an acquaintance with, and an <sup>and in-</sup>admiration of, the work of the Creator in the <sup>tents.</sup> human frame: a serious contemplation of the structure of this amazing fabrick, of the appropriated figure of the several parts of it, their connections, communications, actions and uses, is one of the strongest of all arguments against atheism: it carries a proof not only of the existence of a Deity, but at the same time of his amazing greatness and wisdom; and leads the observer immediately to the adoration, as well as the acknowledgment, of a God. The glory of the Creator may, therefore, be very justly declared to be the great and primary end of anatomy. The science, treated in this light, may therefore be called philosophical, physical, or theological anatomy, and is highly useful to every one who studies true wisdom and theology.



## A COMPENDIUM

9. The secondary ends of anatomy are many. Of these, the first is health: this is the greatest good we can know in this life; and nothing can lead us more immediately to the knowledge of the means of preserving it, or of restoring it when impaired by diseases, or even preventing the access of them, than a true knowledge of the structure of that frame which is injured by them. Anatomy, in this sense, is stiled medical; and many establish this as the first species of it, and the preserving and restoring health as its primary object.

10. Another of the secondary ends of this science, is the determining the cause of suspicious deaths. If the bodies of persons newly dead be exposed for enquiry into the cause of their dying, and are ordered to be opened, that, from the inspection of the parts, a true relation of the occasion of the violent or suspected death may be delivered, and a proper judgment formed on that, whether a blow, a wound, or poison, or any other violence, have occasioned the death of the person, or whether it were owing to some other more common or natural cause, whether internal or external; nothing can enable a person to execute this with justice and truth, but a knowledge of anatomy. The science, in this light, is called juridical anatomy. There are, beside these, also a number of other cases, which concern a court of judicature, in which a knowledge of anatomy is equally necessary. Impotency, barrenness, and causes of divorce, can only be properly adjudged by means of a skill in this science: nor can disputes about the true times of pregnancy and delivery, abortions, pretended parturition, the vitality of the child, the causes of its death, the mortality of wounds, and a multitude of other medico-legal



legal cases, of as great importance as these, be any way rationally adjusted or determined, but by means of a knowledge of this science \*.

11. A third and very great end of anatomy, is the determining the cause and manner of the death of diseased persons, from a subsequent dissection of the body. This is called practical anatomy, as of the utmost use in the practice of physick. The latent causes of multitudes of diseases, have been long since discovered by means of these dissections; and, to this time, the same means continue to furnish us with still other discoveries of a like kind, of what the anatomists themselves, of all ages before, had been ignorant of †. The knowledge of the real causes of a disease, is the first rational step towards its cure; and, without the assistance of dissections, how was the world to have been truly informed of the nature of the stone in the bladder, of an empyema, an ascites, hernias, cataracts, glaucomas, and a number of others.

12. Anatomy, therefore, from its various in- Anatomy  
tents and ends, may be said to be of four kinds: of four  
1. The philosophick, physiologick, or theological. kinds.  
2. The juridical, or medico-legal. 3. The medi-  
cal, or that leading immediately to the cure of dis-  
eases; and, 4. The speculative or theoretick.

The speculative or theoretick anatomist is one, who, without ever having dissected himself, has acquired such a degree of knowledge in the structure of the body, as contents him, from reading the best authors on the subject, and attending to the dissections made by others. Many people are

\* The author has treated this subject much more largely in an academical oration, de Medicinæ & cumprimis Anatomies utilitate in Jurisprudencia.

† See Bonet's Sepulchretum Anatomicum.



said to understand anatomy in this sense, who have never been at the pains of going thro' the laborious part of the means necessary to the acquiring a knowledge of it. In contradistinction from these speculative anatomists, he who employs himself in dissecting bodies, in separating, making preparations of, and enquiring nicely into the structure of the parts, is called the practical anatomist; and the science itself is, in this light, called practical anatomy.

*Its utility.* 13. Upon the whole it appears, that the use of anatomy is very great, nor is confined to the bounds of medicine alone. The theologist, and the philosopher, ought to know it; and the magistrate, or the several members of a court of judicature, are under a necessity of having information from it: the physician and the surgeon, however, are the people to whom it is most immediately necessary, and who cannot do justice to the world in their professions without a knowledge of it. What the needle is to the mariner, that is anatomy to both these. Whatever the ignorant or malevolent may say against it, there is no doubt but both these most useful sciences would be rather detrimental than beneficial to mankind, without the assistance of anatomy to direct them.

## C H A P. II.

### *Of Anatomical Instruments.*

*Instruments.*

14. **T**HE anatomist must necessarily be furnished with his apparatus and instruments: without these, dissections, separation of the parts, and investigations of their fabrick and uses, cannot be performed. The anatomists of several ages have invented a multitude of them; but



but a much smaller number than they describe, will do all that is necessary.

15. The first article of the anatomist's apparatus must be a table, for the laying the body to be dissected upon. He must also have a second table, appropriated to the dissections of living animals, with cords for the fixing them down. He must have a number of dissecting knives, which are to be strait, and to have an edge only on one side. Knives with two edges, crooked ones, and a multitude of others, devised for this purpose, are superfluous, and of less convenient use than these plain and simple ones. Of these, however, some must be larger, some smaller; some more delicate, and others more robust. Beside these, he must have forceps, *forfex's*, *volsella's*, hooks, and styles of different sizes, with bristles and hairs of different strength and fineness, for the investigation of the ducts in some parts; strait and crooked needles, of various sizes, must also be in readiness for various purposes; and thread, finer and coarser, and pins, large and robust, as well as smaller. He must also have saws, *scalpra*, *clavæ*, and *mallei*, and an elevatory for opening the skull: and, finally, tubes of various apertures and dimensions for the inflating the ducts and vessels, and also the intestines, stomach, and urinary bladder: the lungs are most commodiously inflated by means of bellows, with proper nozels.

16. Finally, microscopes are necessary for the examination of the smaller and finer parts. And syringes of brass, or other materials, are as necessary as any thing already mentioned. There must be, at least, two of these for injections: the one for throwing in waxy, or other viscous, thick, or solid matter; the other, for only injecting fluids. These must have tubes of different diameters



fitted to them, according to the different purposes they are to serve for. Beside these also, a tube of iron is necessary for the introducing crude mercury into the vessels. Sponges must always be in readiness for the absorbing extravasated humours, and the cleaning the parts; a hone and strap, for giving of an edge to the knives; and borers of various sizes, for perforating the bones. Brass wire must not be wanting, for the connecting the bones of a skeleton; and the air-pump may be of great use in the filling the vessels, and for many other purposes. The anatomist ought also to have his dissecting-frock and sleeves, to keep the blood, &c. from his cloaths and linnen; and a number of dishes, pots, and other vessels, with utensils of that kind, may be added at the dissector's pleasure.

### CHAP. III.

*Of the names and division of the external parts of the human body.*

External  
parts of  
the body.

17. **A**FTER the enumeration of the instruments necessary for the anatomist, before we proceed to the examination of the several parts of the human body, it is necessary to say something of the appellations of them, and first of those of the external ones. It is not, under this head, our business to lay down those common and generally used appellations which are in the mouths of every body; nor, on the other hand, to treat of those more particular ones, which occur in the investigation of the parts themselves; as of the eye, the ear, the nose, and the like. The first are unnecessary to be mentioned at all; the others are to be hereafter explained in their place,



place. The more general terms among those not universally known, are the business of this chapter.

18. The human body is divided by anatomists <sup>Their division.</sup> into two parts: the *trunk*, and the *limbs*, or the *extremities*. The trunk consists of the head, neck, thorax, and abdomen. The limbs are divided into the upper and the lower: the upper are the arms and hands; the lower, the legs and feet.

19. In the head, the first parts to be distinguished are the hairy part, or *scalp*, and the naked part, or the *face*. After this, we are to attend to the division into the *sinciput*, and *occiput*, or the *fore* and *hinder part of the head*; the *temples*, the *crown* or *vertex*, the *bucca*, the cheeks, and the *philtrum* or *lacuna*. The rest is obvious, and sufficiently known.

In the neck, the *jugulum* or throat, and the *pomum adami*, are to be regarded. In the thorax, the *præcordia*\*, and the back. In the abdomen, the *scrobiculus cordis*, the *epigastrick region*, the *hypocondria*, the *regio iliaca*, the loins, the *inguina*, the *pubes*, the *perinæum*, and the *regio ischiatica*.

20. In the upper extremities, or limbs, we are to observe the shoulder or *humerus*, the *axilla* or *ala* the arm-pit, the arm, the *cubitus*, the *carpus* or wrist, the *metacarpus*, the palm and the back of the hand, and the fingers.

In the lower extremities, we are to distinguish the *femur* or thigh, the knee, the leg, the shin,

\* Authors are not well agreed about what is to be understood by the term *Præcordia*. Faber, and most of the lexicographers, understand by it the anterior part of the breast, or all that part of it which is placed before the heart. But Celsus uses it to express the whole breast; and that the antient Romans did so, is evident from Virgil: *redit in præcordia virtus*.



the malleoli, the tarsus, the metatarsus, the soal of the foot, and the toes.

21. It might seem not improper, from this enumeration of the principal and obvious parts of the body, to proceed to the common integuments of it; and from those, to the internal parts: but as beginners will better understand the descriptions of the compound parts, after they have conceived proper ideas of the more simple ones, it will be best to discourse of those first.

The simple solid parts.

22. The parts of the human body are either solid and continent, or fluid and contained. The solid parts are to be divided into such as are similar or simple in their structure, and such as are dissimilar or compound. These last are called by the generality of authors, *organical parts*.

The similar or simple parts of the human body, if we would speak with exact propriety, are only the *fibres*; for of these are all the other parts constructed in an amazing manner. But anatomists understand the term in a laxer sense, and refer to this head of simple parts a number of others, which seem simple or similar to the senses; or, in more express words, which are more simple than the more evidently organized ones; such as the lungs, the heart, the hand, &c. These simple parts, as they call them, are those which are employed in the formation of the others which they call organical; tho' not all of these to each of those.

Of the number of simple parts, in this accustomed sense of the term, are arteries, veins, nerves, membranes, ligaments, muscles and tendons; with fat, lymphatick and lacteal vessels, excretory ducts, bones, cartilages, glandules, the nails, and the hair. The other solid parts of the human body are referred to the dissimilar or the  
orga-



organical ones; and these are usually divided again into the more noble and the less noble ones, according to the greater or lesser uses they are of in the œconomy, or their being more or less immediately necessary to life.

23. A fibre is a perfectly simple body, or at least as simple as any thing visible in the human structure. It is fine and slender like a thread, and serves to the construction and formation of all the other parts. Hence some fibres are hard as the boney ones, and others soft as those destined for the formation of all the other parts. They are divided also, according to their situation, into such as are strait, oblique, transverse, annular and spiral. They are found arranged in all these directions, in different parts, according to the necessity of their manner of conformation, and of their use.

24. An artery is an elastick canal or vessel, endued, while the subject is living, with a pulsatory motion. It is of a conic figure; and its office is to carry the blood from the heart to the several other parts of the body. The veins, on the contrary, are vessels of the figure of an inverted cone; not endued with pulsation; and whose office it is to carry back, from all parts of the body, the blood, which the arteries had conveyed thither, to the heart again.

25. The nerves are white, cylindrick bodies, proceeding, like threads, from the brain and spinal marrow, to all parts of the body; and serving to the purposes of sensation, motion, and nutrition.

26. Membranes are parts which resemble, in some degree, pieces of linnen or paper, and are destined to various uses in the human structure. What are called tunics, scarce in any thing differ from membranes. The words are often used indifferently, as names of either. The ligaments

Liga-  
also ments.



also are nearly allied to these. Their different use is the principal thing which distinguishes them. Where substances of this kind are destined to the joining two bones together, in a very firm manner, they assume the name of ligaments: where their office is the surrounding or inclosing things, they are called tunics and membranes.

There are, however, some ligaments which are very like nerves or tendons, and are very different from membranes in their rounded or cylindrick figure: such are those in the junctures of the thigh and the patella.

**Muscles.** 27. The muscles are those fleshy red parts of the body, which constitute the instruments of motion; and are what we call, in the whole, flesh.

**Tendons, and Aponeuroses.** The tendons are white, firm, and tenacious parts, continuous to these, and usually forming their extremities. These, if they are broad, and expanded in the manner of membranes, are not called tendons, but aponeuroses.

**Fat.** 28. The fat is a thick, oily matter, secreted from the blood, and contained in membranaceous cells. It is destined for various purposes. What is lodged within the cavities of the bones, and called marrow, scarce differs at all from this, unless in its subtility, and the place where it is lodged\*.

**Lymphatics.** 29. The lymphatic vessels are subtile canals, of a fine texture, pellucid, and destined for the carrying a thin, fine, and almost aqueous liquor, from several parts of the body toward the heart.

\* The fat might be naturally enough referred to the number of the fluid parts; and indeed is, by many authors, treated of among them: but as, in dissection, it always offers itself in a solid form, and its cellules are always evidently solid, it seems more natural, in a work of this kind, to give it a place among the solids.



The lacteal vessels are tubes of a like kind, but they are placed only in the mesentery and intestines. Their office is to receive the chyle, which is a liquor of a milky colour, produced by the concoction of our food, from the intestines, and to carry it thro' the mesentery into an appropriated duct, formed for the reception of it. Lacteals.

30. The excretory ducts, are canals destined for the reception of a fluid secreted in certain glandules, and other viscera, and for the excretion of it in the appropriated places. Excretory ducts.

31. The bones are hard, white bodies, destined for the support and defence of the softer and weaker parts. Bones.

What we call cartilages, are bodies much approaching to the nature of bones; but lubricous, flexible, and elastick. They contain either none at all, or, at the utmost, but a very little of the medullary matter, and serve for various uses. Cartilages

32. The nails are parts, which, in many respects, approach greatly to the nature of cartilages. They are thin laminæ, of a horny substance, affixed to the extremities of the fingers and of the toes. The hairs are filaments placed on various parts of the body, especially on the head, and growing out a great way from the surface. Nails.

33. Glands are parts of a peculiar structure: the antients supposed them formed of a different kind of flesh from that of the rest of the body. They are, in reality, composed of a congeries of extremely small arteries, veins and nerves, and usually have also an excretory duct. They are surrounded by a peculiar membrane, and are of various figures, colours, and consistencies, as they are destined to different offices. Their several business is the secreting from the blood some fluid: but of this, more in its proper place. Glands.



Fluids of  
the human  
body.

34. The fluids of the body, or the parts contained in the several solids already enumerated, are the following: chyle, milk, blood, serum, lymph, animal spirits, saliva, gall, the liquor of the pancreas, that of the stomach, of the intestines, of the œsophagus, of the brain, of the eyes, of the thorax, of the pericardium, of the abdomen, of the tunica vaginalis of the testes, the semen, and the liquor of the prostaticæ; the mucus of the nose, of the tonsils, of the articulations, of the urethra, of the uterus, of the vagina, of the tubes of the uterus; the humor of the ova, and that in which the foetus swims; the ear-wax, the urine, and sweat.

General  
division of  
anatomy.

35. The business of anatomy is usually divided into two parts, under the names of osteology and sarcology; the first comprehending the doctrine of the bones, or harder parts; the latter, of the flesh, and softer. It is most convenient to enter on the osteological part first, as on the bones depends the basis and foundation of all the rest, and as the other parts will be the more easily understood after the descriptions of these.



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A  
**COMPENDIUM**  
 OF  
**ANATOMY.**

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**BOOK II.**

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*Of* **OSTEOLOGY.**

**CHAP. I.**

*Of the Bones in general.*

36. **W**HOEVER is desirous of attaining to Osteology a perfect knowledge of the structure and parts of the human body, must first inform himself perfectly of the bones.

37. The objects of osteology are the bones, <sup>Its ob-</sup> whether they be recent or dry'd, whether they <sup>ject.</sup> have belonged to an infant or an adult; and with the bones are to be considered their periosteum, medulla or marrow, the ligaments, and the cartilages.

38. An artificial conjunction of the bones, in <sup>A skele-</sup> the same order and situation in which they are <sup>ton.</sup> placed in the body, is called a skeleton.

39. The study of the bones is to be considered in two lights, as theoretical, or as practical. In the first sense, osteology only extends to the ex-  
I
ternal



ternal conformation, and use of the bones : in the latter, or practical sense, it comprehends the more intimate knowledge of their interior structure and connections. 1. If their internal parts are to be examined, they are to be cut or broken. 2. If their articulations are the subject of enquiry, the ligaments about their junctures are to be examined in dissected bodies. 3. If the making a skeleton be the intent, their preparation and preservation come into this branch.

Bones,  
their sub-  
stance.

40. The substance of the bones may be considered either chemically or anatomically. The chemical examination succeeds best with the bones of infants and embryo's; the anatomical enquiry into their nature, with those of adults.

Examined  
chemi-  
cally.

41. In the chemical analysis by the retort, bones afford, with the different degrees of fire carefully managed, a water, a salt, a spirit, and an oil. After this, there remains in the retort a merely earthy substance, retaining the exact figure of the bones employed, but brittle : and the spirit produced from them, may, by a rectification, be separated into water, salt, and oil. Hence it appears, that bones are composed of four principles or elements, which are connected so together, as to form a very strong and durable compages.

Examined  
anatomically.

42. The bones, anatomically examined, are found, first of all, in the time of their formation and origin, to be like so many soft membranes, composed of a number of fibres and vessels of an extreme subtilty and minuteness, from which they receive their nutrition, and are increased in size, and hardened. These fibres and membranes grow by degrees harder, and more cartilaginous ; and, in fine, are arranged into a sort of tables, or lamellæ. Over the lamellæ first formed, there are expanded, by degrees, new strata of fibres and vessels :



vessels: each stratum, thus added, forms a new lamella upon the old ones; and all these, by degrees, growing harder, and being connected to one another, by means of oblique and tranverse fibrillæ, the compages becomes gradually more close, and the matter more dry; and thus, at length, a bone is formed \*. The bone is thicker or thinner, the more or the fewer of these lamellæ and fibres are laid over one another for the formation of it; and these leave between them a multitude of cavities, some strait, others oblique, some longitudinal, others tranverse, all which are filled up with a fat, medullary juice.

43. The bones of the several parts of the body Their differences. differ from one another in their sizes, their cavities, their qualities, their figures, and their uses, as will appear, when we come to a particular consideration of them: but, before we enter on that, some general observations on them are not to be omitted.

44. In every bone we examine, there come into consideration, 1. The bone itself. 2. Its cavities. 3. Its conjunctions with the other bones. 4. Its uses.

45. In regard to the bone itself, three things are to be considered, 1. The body of it, which, according to Galen, is called the diaphysis. 2. The apophyses; and, 3. The epiphyses.

46. The diaphysis, or body of the bone, is its larger and principal portion, which, in young subjects, is the first part that indurates; and is, as it were, in the place of a basis or foundation to the rest.

\* See Harvey on the generation of animals, Kerkring's Osteogenia foetus, Ruyfch's Thesaur. Anat. Malpighi's Anatome plantarum, Gagliard's Anat. ossium, and Havers's Osteologia.



Apophy-  
fis.

47. An apophysis is a protuberance or excrescence from the body of the bone, of which it is a true continuous part, as a branch is of a tree.

48. This part of a bone has several other names besides apophysis. The terms process, prominence, protuberance, eminence, tubercle, and tuberosity, so frequent in the works of the anatomical authors, all signify nearly the same thing.

49. The apophyses also receive several additions to these names, by way of epithet, expressing their peculiar situation, use, or figure: such are coracoides, mammillaris, mastoides, glenoides, coronoides, styloides, condyloides, pterygoides, odontoides or dentiformis, anchoroides, spinosa, recta, obliqua, transversa, superficialis, and the like.

The head of the apophysis has also its peculiar names; such as condylus, corone, spina, supercilium, labrum, and the like, as will be seen more at large, when we come to treat of the bones singly.

50. The principal uses of the apophyses of the bones, are, 1. For the making the better articulations, whether these be intended to have motion or to be fixed. 2. To afford a proper and firm place of origination and insertion for the muscles: and, 3. To defend the other parts. The more specifick and peculiar uses, will be delivered under the heads of the several different bones.

Epiphyfis.

51. An epiphysis is a bony substance, or, as it were, a lesser bone, affixed to a larger or principal bone by the intervention of a cartilage. In young subjects, these epiphyses are not continuous to the principal bone; but are only connected by the intermediate cartilage, and hence they are called appendages to the bones.



52. The principal things to be observed of these epiphyses are, 1. That they are all cartilaginous in infants, and tho' they afterwards grow by degrees more hard; yet they never arrive at the true density of a bone, but are always lax and spongy. 2. That most of them degenerate into apophyses in adults. 3. That they do not grow along the plane surface of the bone, but unequally, or by a mutual ingress with the body of it. 4. That their nature and conjunctions are much more obvious in younger than in older subjects. 5. That the body of the principal bone itself is spongy, and tender about the place of the conjunction.

53. The use of the epiphyses is very different in infants and in adults.

54. In adults they seem to serve the bones, which contain large quantities of marrow, by way of operculum, that this soft matter may not run out. 2. They are of service to the articulations, rendering the motions more easy as well as more determinate. 3. They make the whole bone lighter than it would be, if their place were supplied by absolute boney matter, as they are much more spongy. 4. They greatly increase the power of the muscles about the tendons, by means of their prominences. 5. They add greatly to the size of the places destined for receiving the insertions of the muscles. 6. They give a firmer cohesion to the ligaments which serve in the articulations, and allow an entrance to the blood-vessels.

55. The uses of the epiphyses in infants, are, 1. That, by means of their yielding softness, they may give way to the compression in the uterus, and suffer the whole bulk to be more folded together than otherwise it could, so that it may lie in a



smaller compass. 2. That they may give way to the elongation and growth of the bones, that, as the body grows, they may be proportionably extended, as necessary. 3. That they may prevent the frequent fractures, which would otherwise unquestionably happen to children from their falls, and the other accidents they are liable to.

Cavities.

56. Of the cavities of the several bones, some are made for the sake of the articulations, some for other reasons. Those of the former kind are called by the various names of cotyle, acetabulum, and glene: they are deeper in fresh bones than in such as have been dried, because of the cartilaginous eminences, intended by nature for the assistance of the articulation, being taken away in these. These cavities contain a fatty, mucous liquor, secreted by a peculiar set of glands, called the mucous or mucilaginous glands, and by the ligaments \* of the articulations, and probably also from the marrow itself; this is destined for the lubricating the bones, and facilitating their moving on one another.

57. The cavities in the bones, not serving for the purpose of articulation, are of two kinds, internal and external. The internal ones, if large, contain marrow; if smaller, a red medullary juice, or oily matter. These latter are called the cellules of the bones.

58. The external cavities of this kind have various names, according to their various figure: they are called foveæ, fossæ, foramina, canals and ducts, sinus's, fulcus's, and incisuræ.

\* It appears extremely probable, that a part of this fluid is secreted from the ligaments themselves; since the glands, which are in general said to secrete it, are not to be found in some of the articulations; and the membranaceous parts, of which nature the ligaments evidently are, in other places do secrete such a fluid.



59. The conjunctions or articulations of the bones, are generally treated of before the several bones of the skeleton are explained; but this is certainly erroneous. The young student will scarce find it possible to understand these parts and the uses of the bones, unless he first understand the figure, structure, and offices of the several bones themselves; wherefore we shall reserve this for the last part of our osteology, and begin what we have farther to say in this place, with the explication of the several bones which constitute a skeleton.

## CHAP. II.

### *Of the bones of the head.*

60. **T**HE skeleton is divided, like the whole Division of a skeleton. body, into two parts; the trunk, and the extremities, or limbs. The trunk of the skeleton consists of the head, the spine, the bones of the breast, and the ossa innominata.

61. The head expresses that part of the skeleton which is placed upon the top vertebra of the neck: it is divided into the cranium and maxillæ.

62. The cranium, called also the calvaria, is Skull. that part of the head which forms its great boney cavity, which contains the brain in the living subject: the several bones, therefore, which go to the formation of this cavity, are called ossa cranii.

63. In the cranium, we are to consider its shape, which is oval; its exterior surface, which is convex; and its interior, which is concave; its size; its thickness, which is unequal in the several parts; its substance, which is formed of two lamellæ or tables, an exterior, and an interior, between which there is a diploë or medullium; its



composition, which is of several bones ; and the connections of these several bones, which is by futures ; and its uses.

64. The bones of the cranium are eight, viz. The os frontis, the two parietal bones, the two bones of the temples, the occipital, the sphenoides, and the ethmoides \*.

Os frontis. 65. The os frontis, which is called also the coronal bone, is the first of the bones of the cranium to be examined : it is double in infants, but in adults it is usually single ; sometimes, however, it is divided in these into two parts, down to the nose. In this we are to observe its situation, its irregular figure, its connection, its internal surface, in which there are a fovea or furrow, and an eminence, to be noted, to which the longitudinal sinus of the dura mater adheres : we are also to regard its external superficies, on which we are to observe the place where the frontal and temporal muscles, and the cartilaginous annule of the musculus trochlearis of the eye, are situated : there are seven apophyses also on it, six of which concur together to form the orbit, and the seventh sustains the bones of the nose. We are then to observe the frontal sinuses †, their use and various constitution in adults, and their surprising origin in children ‡.

Ossa parietalia.

66. The parietal bones, called also the ossa bregmatis and ossa sincipitis, make the second and third bones of the cranium. In these we are to

\* Many of the anatomical writers give other names, beside these, to the bones of the skull ; but these are the most used and received. The enumeration of the others, would only confuse the young student.

† See Schneider de Catarrh. fig. 1. p. 484. Palfin's Osteolog. T. 1. and 2.

‡ The uses of these, and the other foramina of the bones of the skull, will be delivered together hereafter.

observe



observe the situation, the figure, which is nearly a square, their size, their connections, and their thickness. Their external surface is to be examined; and in it, the place of part of the temporal muscle, or *crotaphites*. Then their internal surface, in which there are furrows representing little shrubs: these are formed by the arteries of the dura mater; and beside these, there are other foveæ; and finally, we are to observe the place called the bregma, and in infants the fontanella, or *fons pulsabilis*, and the manner in which it is found in them.

67. The temporal bones, called also the *ossa squamosa* and *petrosa*, make the fourth and fifth bones of the cranium. In these we are to regard the situation, the figure, which is very irregular; the connection, the substance, which is, as their other names express, *squamosa* and very hard: their four apophyses, which are, the jugal or *zygomatick*, the *mammillar* or *mastoides*, the *styloide*, and the *petrose*: the place where the lower jaw is articulated: the *meatus auditorius*, or auditory passage: the place where the ligament of the ear is inserted, near the *mastoides process*: the *sigmoidal fossæ*, where the lateral sinus's of the dura mater are placed: the incisure under the *mastoides process*, where the *biventer muscle* has its origination: the *fovea*, in which is buried the sinus of the jugular vein: the sinuses in the *mastoides processes*, opening into the cavity of the *tympanum*: and, finally, we are to inform ourselves of the state of these bones in *foetus's*, in which they are formed of the *petrose* and *squamosa* parts, on a bony circle or *annulus*; on the fissure of which the membrane of the *tympanum* grows, which afterwards, in process of time, be-

*Ossa temporalium.*



comes wonderfully expanded into the boney meatus auditorius.

Ossa auditus.

68. In the temporal bone, and particularly in its petrose part, are to be observed the cavity of the tympanum; and, in it, the ossicula auditoria, or bones serving to the sense of hearing. These bones are commonly said to be four, and there are as many foramina. The first of them is called the malleus: in this we are to observe the head, the neck, and the handle, which is joined to the membrane of the tympanum. Two apophyses are also to be remarked in this: the one very long, called, from its supposed discoverer, Raviana, but erroneously; for it had been before described by Folius\*. This serves for the insertion of the external muscle of the malleus. The second is the incus, in which we are to observe the body of the bone, and its fovea, or hollow, serving for its articulation with the malleus, and its two crura or legs; to the longer of which there is joined another bone, called the stapes. In this we are to observe the head, which is joined to the longer leg of the incus; its basis, which stands on the fenestra ovalis of the labyrinth of the ear; and its two lateral parts, which have their internal surface furrowed.

What is generally called the fourth bone of the ear, is placed between the incus and the stapes, and is named the os orbiculare; but this is not truly a distinct or separate bone, but is merely an epiphysis of the longer leg of the incus.

Foramina of the ear.

Of the foramina, the first is the fenestra ovalis, on which the base of the stapes stands. Near this

\* See Boerhaave's Instit. Med. cap. de Auditu; and Folii nova auris internæ descriptio; as also Barthol. Anat. Reform. p. 715. but this last author's figure is not so expressive as it might be.



is the second, which is called the fenestra rotunda: this leads to the cochlea, the other to the vestibule of the ear. The third foramen, by means of a canal, is carried to the mouth: this is called the eustachian duct, or tube: 'tis through this that some people have a way of discharging, at the ears, the smoak of tobacco taken in at the mouth; and 'tis by means of this also, that people, subject to deafness, hear best when their mouths are open. The fourth foramen opens into the cellules of the mastoide process. All these are of use in hearing.

69. The inner part of the ear has obtained, <sup>Labyrinth</sup> from its various and wonderful meanders, <sup>of the ear.</sup> the name of the labyrinth. In this we are to remark, the cavity, constituting the middle of the labyrinth, and called its vestibule: on one part of this are three canals, known by the name of the semicircular ones, and distinguished by the epithets of the largest, the middle one, and the least: these open by five orifices into the vestibule. In the other part is the cochlea, which forms two spiral windings and a half: in this we are to observe the nucleus, and the canal, which is divided into two by a spiral lamina. The upper of these opens into the vestibule, and is called the scala vestibuli: the lower, tending toward the hollow of the tympanum, by the fenestra rotunda, is called the scala tympani by Valsalva \*. Finally, we are to remark the canals of the auditory nerve: 1. The common and larger, in which there are little apertures into the labyrinth: and, 2. The proper, narrower, and longer, terminating partly by a little aperture in the cavity of the cranium, and partly in the aqueduct of Fallopius †.

\* Tract. de Aura humana.

† Ibid. Tab. 7. fig.



Os occi-  
pitis.

70. The os occipitis is the sixth bone of the cranium. In this we are to observe the situation, the figure, which is irregular, and the state of it in infants, in whom it usually is composed of four pieces or fragments. After this we are to regard its connections, its substance, which is very thick; its three apophyses, two of which are condyloide, and serve for the articulation of it with the upper vertebra of the neck, and support the whole head: the third is extended to the fella equina. In the internal surface of this bone, in adults, there is a figure of a cross, and to this adhere the sinuses and processes of the dura mater; and within this there are also four hollows, in which the posterior lobes of the brain and the cerebellum lie. In the external superficies, there are several superficial eminences and depressions to be observed after the great foramen: these serve for the insertions of several of the muscles of the head.

Os sphe-  
noides.

71. The seventh bone of the cranium is the os sphenoides, called also the os cuneiforme and basilare: this is fixed, in the manner of a wedge, among the other bones of the cranium; and serves as a basis, as it were, to support several of them, and some of those of the upper jaw. The figure of this bone is very irregular: in its upper part is seen the fella equina, or turcica, under which there is a sinus, called the sphenoidal sinus: this is sometimes double, and opens into the nostrils: sometimes it is totally wanting.

The sphenoides has thirteen apophyses; six of them are internal, and are placed near the fella equina; and the other seven are external: four of these are of a pterygoide form, and thence named; two, of the other three, are very small and styloide; and the seventh is placed under the vomer. There are also three fossæ or cavities in  
this



this bone; one in the fella equina, and the other two between the pterygoide apophyses.

72. The eighth and last bone of the cranium *Os cribro-* is the *os ethmoides*, or *os cribrosum*, or *cribri-* forme. In this we are to observe, after the situation, its extension thro' the nostrils and orbits, its figure, its connection, and its state in infants; its four apophyses; the *crista galli*, which is the upper part of the *septum narium*; the two *ossa spongiosa superiora*, which are called also by some *turbinata* \*: to which Morgagni has added two other smaller ones †; the *cribrose*, *cavernose*, *papyraceous* or plane parts; and under this the various little sinuses. And, finally, we are to enquire into the uses of these several parts.

73. All the bones of the cranium are found to be imperfect in new-born infants. The sinus and its medullium are almost wholly wanting: the boney fibres, in the formation of almost all of them, are carried, in form of rays, from a centre, toward the circumference; and most of them are not single, as in adults; but are composed each of several frustules, or little pieces: nor are the sutures at that time formed: And, finally, there are frequently triquetrous little bones between them.

74. In adults, the several bones of the skull The su- are, in general, joined by sutures. These sutures are tures. either common or proper: the proper sutures are distinguished into the true and the false, or spurious: they are called true sutures, when the bones are jointed together in an amazing manner, by means of a multitude of unequal denticulated eminences, forming an appearance somewhat like the edge of a

\* Some take these spongy parts of the *ethmoides* for peculiar bones; but they are always continuous in adults.

† *Adversar, Anatom. 6. T. 2. fig. 3. qq.*



saw: these denticulations enter mutually into each other's sinuses, and are most plainly visible externally: of this kind are those called the coronal, sagittal, and lambdoidal futures. The false or spurious futures, are those squammose ones of the temporal and parietal bones, and of the os frontis and sphenoides in the angle, where they unite with the parietal ones.

The common futures are, the transversal one, which joins the os frontis with the bones below it; the sphenoidal, the ethmoidal, and the zygomatick\*: but these are of little moment. Anatomical authors mention the having met with skulls, in which there were no futures at all†.

75. Between the futures, particularly the lambdoidal and the sagittal, there are found, in many skulls, certain small bones. These are called by some ossa triquetra, from their figure; by others, ossa Wormiana, tho' they were known to Galen: they are uncertain in their figure and situation, and are joined to the others by futures. These bones are, by some, esteemed a great medicine in epilepsies §.

76. The use of the futures, is, 1. That the dura mater may, in those places, be very firmly joined to the cranium and pericranium. 2. That, in infants, the head may the more easily be extended in its growth, from the several bones being at that period disunited at these places. 3. That

\* Some authors mention also a number of other common futures; such as the nasal, the palatine, the lachrymal, and the like; but these more properly belong to the junctures per harmoniam.

† See Fallopius de ossibus, and Meibomius de futuris cranii.

§ Our author preserved a skull in which the lambdoidal future was two fingers broad, and there were more than twenty of these distinct bones.

the



the transpiration from the brain may be the more free and easy, at that time of life in which they are open, and at which also the habit is more humid. 4. That very large fractures of the skull might be, in some measure, prevented. And, finally, there is another advantage in their openness in children, namely, that medicinal applications to the external part of the head may penetrate, and do service.

77. After the examination of the cranium, we <sup>The</sup> are to descend to the maxillæ: by this term we <sup>maxillæ.</sup> understand, the bones of the head not hitherto mentioned, and placed under the anterior part of the cranium, but forming no part of its cavity: the one of these is called the maxilla superior, or upper jaw, and is immoveable, adhering firmly to the other bones of the head: the other is called the maxilla inferior, or lower jaw, which is moveable, and contrived for various purposes.

78. The jaws are shorter in the human frame than in that of any other animal, in proportion to the size of the body; and this is a circumstance that adds greatly to the beauty of the face.

79. The upper jaw is composed of thirteen bones, and has, when the number is complete, sixteen teeth in it.

80. Of the thirteen bones of the upper jaw, there are twelve in pairs: these are, 1. The lachrymal. 2. The nasal. 3. The jugal. 4. The maxillar. 5. The spongiosum inferius. And, 6. The palatine. The thirteenth is an odd bone, and is called the vomer.

Many of the anatomical authors do not distinguish these six pair of the bones of the upper maxilla by name, but only by number; calling them the first, second, third, fourth, fifth, and sixth pairs: but this may easily lead the young student



student into confusion and error. Such appropriated names, for the several pairs of them, as are here given, are more easily retained than numbers : and we are to add, that numbers conveying no idea of the bones themselves, the name of first pair may as well belong to the lachrymal as to the nasal, to one pair as to another ; whereas, in this way, they are kept distinct, and the name of one cannot be applied to another.

81. These several bones of the upper maxilla are united to one another by a kind of juncture, which appears equal and even, and is called, by anatomists, *junctura per harmoniam*.

82. The first pair are the *ossa lachrymalia*, or, as they are called by some, *ossa unguis*. In these, after understanding the origin and reason of their name, we are to observe the situation, size, and circumference, their connections, [their substance, which is very tender ; the furrow in them, made for the nasal canal ; their use : and, finally, the operation performed by surgeons on this part in the *fistula lachrymalis*.

83. The second pair are the *ossa nasi* : in which we are to observe the situation, circumference, figure, and substance, their two surfaces, their connections, and their uses.

84. The third pair are the jugale or zygomatick, called also by many the *ossa malæ*. In these we are to enquire into the reason of their name, their situation, and circumference ; their substance, which is hard ; their connection, their four apophyses, the places where the *masseter* and the zygomatick muscle have their origin, and the foramina in them, with their uses.

85. The fourth pair are the maxillary ones : in these we are to regard the situation, the circumference, the size, and the four apophyses. 1. The jugale.



jugale. 2. The upper nasal. 3. The lower nasal, to which the septum of the nose is joined. And, 4. The palatine\*. In these we are also to observe the palatine and nasal excavations, the sockets or alveoli of the teeth, and the sinus commonly called antrum Highmorianum†, tho' not very properly named from that anatomist, since it was evidently known, before his time, to Vesalius and others. The size of this is to be regarded, and the construction of the orifice or aperture in living subjects: also its use, which is double, 1st, for the assistance of the voice; 2d, for the secretion of a mucous matter. We are also to observe the nasal canal; and to inform ourselves of the operation in one of the species of the ozena, in which this part is concerned.

86. The fifth pair are the ossa spongiosa, or the turbinata inferiora, as others call them: these are small, oblong, and friable bones: they adhere to the interior part of the maxillaria in the cavity of the nostrils. These serve to take off the sharpness of the cold air, rushing this way into the lungs: they also prevent the getting of little insects, &c. into the fauces; and they increase also the expansion of the pituitary membrane, for various purposes‡.

\* These palatine apophyses have improperly been called, by some, peculiar bones, and described under the name of ossa palatina antica; but they never are distinct and separate from the bones of which they are here made a part.

† See Palfin. Osteolog. T. 2. fig. 2. Also Drake's Anatomy, T. 18. fig. 1, and 2. Morgagni, however, observes that these sinuses are sometimes wanting, though this is very rarely. Adv. Anat. 6.

‡ Santorini, Obs. Anat. p. 88. does not allow these to be distinct bones; but makes them apophyses only of the bones of the palate: dissection, however, shews that they are really and truly distinct.



87. The sixth pair make the *ossa palati*, or bones of the palate. In these we are to observe the figure, which is very irregular, and their extension thro' the nostrils to the orbits; their body, and their various apophyses; the pterygoide, the nasal, and the orbital \*; the furrow in their upper surface, where the vomer is joined to them: and, finally, their uses, which are, 1st, to form the palate, the orbit, and the maxillary sinus; 2d, to sustain the membrane of the palate and uvula; 3d, to assist in the modulation of the voice.

88. The last or thirteenth bone of the upper jaw, which is single, not pair'd as the others, is called vomer, from some resemblance that it bears, or is supposed to bear, to the share of a plow. In this we are to observe the situation, the substance, which is thick in the upper part, and thin in the lower; the circumference, the double lamella that composes it, with the intermediate space; the connections, the structure, and use of the septum narium †.

The orbits.

89. Before we have gone thro' the examination of the maxilla superior, there are yet to be observed the great cavities, in which are placed the eyes. These are called the orbits, *orbitæ*; and they are composed of a concourse of seven bones: these are, 1st, the coronal; 2d, the sphenoidal; 3d, the plane part of the ethmoide; 4th, the jugale; 5th, the maxillar; 6th, the lachrymal; and, 7th, the palatine.

\* See, in regard to this bone, Winslow in Hist. Acad. Reg. Paris, anno 1720.

† Santorini will have this bone to be a part of the ethmoides; but tho' we cannot but allow that it concretes into one body with that bone in adults, yet in young subjects it is always perfectly distinct.



90. In these we are to remark the figure, the large opening, and narrower base; the places where the muscles of the eyes and eyelids have their origination, and where the lachrymal sacculus, gland and caruncle are placed.

91. The maxilla inferior, or lower jaw, is that <sup>The lower</sup> large moveable bone of the head which contains <sup>jaw.</sup> the lower series of teeth: on the mobility of this depends, in a great measure, the power we have of chewing our food.

92. In this we are to regard, 1st, the bone itself; and, 2d, the teeth in it.

93. In the bone or maxilla itself, we are to observe its number and state in infants, in whom it is composed of two bones; its size, figure, and substance, which is externally firm, and internally spongy. We are also to observe its external and internal appearance, and its external and internal margin or edge; its connection, and the place where the two bones, of which it is composed in children, unite; its posterior eminence at the roots of the dentes incisores, for the insertion of several muscles; the chin, the condyloide apophyses, cover'd with a moveable cartilage\*; as also the coronoides, and their use; the two angles, with the alveoli, or sockets of the teeth; and the four foramina, which form two openings, affording a passage to the blood-vessels and nerves. The great use of both the jaws is for speaking, and chewing our food.

94. The teeth come next to be considered: <sup>The teeth.</sup> they are the furniture of both the jaws; and are very hard, bony substances, fixed in their proper cavities in them, in the manner of nails. This kind of articulation is called gomphosis.

\* See this very accurately delineated by Morgagni, Advers. 2. fig. 1, 2, 3.



95. In regard to the teeth, we are to consider their situation in deep sockets; and their connections, by means of the periosteum and gums. Their natural colour is white; their number from twenty-eight to thirty-two, fourteen, fifteen, or sixteen, being placed in each jaw, if the number be perfect. They are divided into, 1st, four incisores; 2d, two canini, or eye-teeth; 3d, eight molares, or grinders, in each; and two dentes sapientiae.

We are to observe their base, which is composed of a double substance, a stoney or porcelain-like matter, and a medullary one. Their roots are sometimes simple, as in the incisores, canini, and the foremost of the molares; sometimes double, triple, or quadruple, as in the hinder molares: finally, we are to observe their cavities, which are covered with a vasculo-nervous membrane\*, and the foraminula, or little holes in the roots of them, serving for the ingress of the vessels, which afford them nutrition and sensation.

We are to enquire into the origin and accretion of the teeth in infants, the change and regeneration of them at about seven years old, and sometimes over again in very old people; and, finally, the collapsing and coalescence of the alveoli in old people, after the teeth are fallen out†.

96. There are also some singularities, in regard to the teeth, by no means to be overlooked: such are their standing too distant, or their coalescing with one another, or with their alveoli in their growth‡; and, finally, their appearing sometimes from the palate, or out of their natural place.

\* Described by Ruysch in his *Thef. Anat.* i. p. 48.

† See Ruysch's *Observ.* p. 17. Our author had also the skull of an old person of the same kind: in both jaws of it all the teeth were wanting; and the whole alveoli, so far as they had touched the teeth, were consumed and destroyed.

‡ Columbus de re Anatomica.



97. The uses of the teeth are, 1st, to break our food; 2d, to be of assistance to us in speaking; 3d, to add to the beauty of the face.

98. The foramina in the cranium are numerous, and their uses important: they will be the better retained in the memory of the young student, from our treating of them together.

Foramina  
of the  
cranium.

They are to be divided into external and internal: by the external, we mean those which are easiest discovered on the external surface of the skull: by the internal, those which are most obvious in the internal surface.

99. Of the larger internal foramina, we count eleven pair affording passage to the arteries, veins, and nerves of the brain: and beside these, we are to remark one which is single, namely, the great foramen of the occipital bone, which gives passage to the medulla spinalis, and with it to the accessory spinal nerves, and to the vertebral arteries.

100. We are to pay a particular regard to the first pair of these foramina, (which may, indeed, be more properly called a congeries of the foramina of the os cribrosum:) these give passage to the filaments of the first pair of nerves, called the olfactory nerves. The second pair are in the sphenoidal bones, and give passage to the optic nerves. The third pair are called the unequal and lacerated foramina, and give passage to the third and fourth pair of nerves, to the first branch of the fifth pair, and to the sixth pair; as also to the emissary of the receptacles of the dura mater\*. The fourth pair are in the sphenoidal bone, and give passage to the second branch of the fifth pair of nerves, which is distributed to the several parts of the upper jaw. The fifth or oval

\* Santorini Obs. Anat. p. 75.



foramina, give passage to the third branch of the fifth pair, and to the emissary of the dura mater \*. The sixth is a very small foramen, and admits an artery, which is distributed over the dura mater, and is that which forms the impressions of little shrubs or trees on the parietal bones. The seventh is placed between the fella equina and petrose apophysis, and it transmits no vessels, but is shut up by the dura mater. The eighth pair of foramina give passage to the carotid arteries, whence it is called the carotic foramen; and the intercostal nerve has its egress also at this opening. Thro' the ninth, which is in the os petrosum, passes the auditory nerve: thro' the tenth, which is between the os petrosum and the occipital bone, pass the par vagum, and the lateral sinuses of the dura mater, together with the spinal nerve. The eleventh is in the os occipitis, near the edge of the foramen magnum; and thro' this pass the ninth pair of nerves, called the linguale.

101. Beside these foramina, there also are a number of little ones in the os petrosum, often very fairly visible. One of these carries back a branch of the auditory nerve to the dura mater; and the other principal one transmits the sanguiferous vessels to the labyrinth, or internal organ of hearing.

102. Of the external foramina of the cranium, there are two proper ones of the os frontis, a little above the orbits. These are, from their situation, called supraorbitalia: they give passage to the ophthalmick nerve of Willis; but, in their place, we often meet with only a superficial incisure. Beside these, there are four other foramina, common to the os frontis, and to the plane

\* Santorini Obs. Anat. p. 75.



or papyraceous bones of the orbit : two of these are placed on each side, and they transmit little nerves and vessels to the sinus of the ethmoidal bone.

In the parietal bone, there is one which serves for the passage of a vein from the cutis of the cranium into the sagittal sinus of the dura mater, or from the sagittal sinus to the external veins of the head : this, however, is often wanting ; and many anatomists, therefore, do not mention it.

In each of the ossa temporum there are three common foramina : the first of these is the foramen jugale, which serves for the passage of the crotaphite muscle : a second is large, in which is the sinus of the jugular vein ; and the third is the ductus eustachii, already mentioned, situated between the petrosum and sphenoides, and leading from the mouth into the internal ear. Beside these common foramina of the ossa temporum, there are also three proper ones : 1. The meatus auditorius, or auditory passage. 2. The aquæduct of Fallopius, situate between the mastoide and styloide process, and transmitting the hard portion of the auditory nerve. 3. A foramen behind the mastoide process, serving for the ingress of a vein into the lateral sinus ; or for the egress of one from the lateral sinus to the veins of the occiput \*.

In the occipital bone there are two foramina, situate behind the condyloide apophyses, and serving to give passage to the vertebral veins into the lateral sinuses of the dura mater ; these foramina, however, are wanting in many skulls.

\* Bartholine observes, that Lyserus was the first who observed the communication between this sinus and the external veins.



In the sphenoides, beside the internal ones already described, and the apertures of the sinuses into the nostrils common to them, with the bones of the palate, and which are the apertures of the nares and fauces; there is another canal in the upper part of the pterygoide processes, serving for the passage of the novum emissarium of the dura mater\*.

In the os ethmoides there are, 1. Those common to this bone with the os frontis, situated in the interior side of the orbit, and already described; and, 2. The apertures of the ethmoidal sinuses into the nostrils.

Foramina  
of the  
maxillæ.

103. The foramina in the os maxillaris of the upper jaw, are, 1. One called the foramen palatinum anticum, situate behind the foremost dentes incisores, and opening into the nostrils; but this is usually so closed up in living, and even in dead subjects, by the membrane of the palate, that nothing of its aperture is distinguishable within the mouth; nor is it certainly known that any thing is transmitted thro' it†. It is also to be observed, that as the membrane of the mouth is evidently joined to that of the nostrils, by means of this canal, a very sufficient use of it may be the making the union between that membrane and that of the palate, the more strong.

The second foramen of the maxillaris of the upper jaw, is the infraorbitale. The name of this

\* Santorini Obs. Anat. p. 75.

† Most of the anatomical writers alledge, that a liquid is transmitted from the nose into the mouth thro' this opening; and hence they usually call it Steno's passage from the nose to the palate. This, indeed, in a dried skull, is obvious and open enough; but, otherwise, it is so small, that our author alledges, he never could find that it opened into the mouth at all; or ever could pass a bristle, or any other the smallest thing, thro' it.



declares its situation. Its use is to give passage to the fifth pair of nerves.

Thirdly, there are other foramina behind the posterior molares, thro' which the vessels and nerves pass to the maxillary sinuses.

Fourthly, there is an incisure in the exterior side of the bottom of the orbit, common to this and to the sphenoidal bone, and serving to give passage to the vessels going to the eyes and nose.

The fifth is the nasal canal, common to this bone and the os unguis.

The sixth are the apertures of the sinuses into the nostrils.

And the seventh is the posterior palatine foramen, common to this bone, with that of the palate, and serving to convey the nerves to the palate.

In the os jugale there are, 1. The jugale, or common foramen. 2. The proper foramen of the jugale, which is sometimes single, sometimes double, and serves for the passage of a nerve.

In the os palati, beside the foramen common to that, with the adjoining bone, there is a proper one, situate near where it is joined to the pterygoide processes, and serving for the passage of nerves to the palate.

104. In the maxilla inferior, there are two foramina in the internal surface, serving for the passage of an artery, a vein, and a nerve, into the very substance of the maxilla, for its nutrition, and that of the teeth; and there are also two in its external surface, which serve to give egress to the same vessels, which are thence distributed to the gums and the chin.

105. In the examination of different skulls, other foramina, beside these, will occasionally be found in different places. These are either extra-



ordinary, and *lufus naturæ*, as is often the case; or they are otherwise such as serve only to give passage to vessels, serving for the nutrition of the bones in which they stand.

Os hy-  
oides.

106. There is yet another bone to be mentioned in this place, as it is usually referred to those of the head: this adheres to the base of the tongue, and has hence been called by some os linguale; and by others, from its resemblance to the Greek letter ( $\upsilon$ ), os hyoides and hypsiloides: others also have called it from its shape, os bicornis. In young subjects the os hyoides is composed of three bones, or *frustæ*, a base, occupying its middle part, and two lateral ones, called its horns: it is to these that the tongue is connected. In adults there are often, at the junctures of these with the base, two other *frustæ*, very small, and thence overlooked by most writers. These are nearly of the shape of a wheat-corn, and may thence be called *ossæ triticeæ*: there are ligaments affixed to these, by means of which they adhere to the styloide processes. And, finally, in these ligaments themselves sometimes, tho' very rarely, there are found some other little bones. Vesalius also, occasionally, had met with six of these; and some others, after him, have reckoned eleven bones to the formation of the os hyoides. The use of the os hyoides is to give a firm basis to the tongue; and several muscles of the tongue, and of the larynx, serving to the necessary motions of both, are inserted into it.

Bones of  
the larynx.

107. As four of the cartilages of the larynx are subject to ossify in old people, many have reckoned them among the number of the bones: they are called the thyroide, the cricoides, and the two arytaenoides. The nature and use of these parts, however, are much better understood when they



they are examined recent, than when in the skeleton; of which, at best, they make but an improper part. We shall say nothing more of them here; but reserve our account of them to the chapter in which we treat of the lungs: from the bones of the head, we shall now proceed to mention those of the trunk.

## C H A P. III.

*Of the Bones of the Trunk.*

108. **T**HE trunk, which makes the second part of the skeleton, consists of the spine of the back, the bones of the breast, and the ossa innominata.

109. The spina dorsi, called by the Greeks <sup>Spina</sup> rachis, is the boney column reaching from the <sup>dorsi.</sup> head down to the anus, and containing the medulla spinalis, or spinal marrow.

110. We shall consider the spine first in a general view, and afterwards in regard to its several parts.

111. In the general view of the spine, we are first to observe its name; its figure, which is nearly pyramidal\*, and bent somewhat like the letter S; and to enquire into the reason and use of this figure.

112. When we consider the spine, according <sup>Vertebræ.</sup> to its parts, there occurs, first, its division into the neck, the back, the loins, and the os sacrum and coccygis.

113. The neck, the back, and the loins, consist of vertebræ and spondyli; and, in regard to these, we shall have occasion to observe some

\* See, on this subject, Winslow in Act. Reg. Par. 1720.



things in the general, some more particularly of the several parts.

114. In the general consideration of the vertebræ, we are to observe their number, which is twenty-four: and in the examination of them singly, there will readily occur in each the body or basis; seven apophyses, one of them spinose, two transverse, two superior, two inferior: and after these, we are to observe the cartilaginous epiphyses.

The articulation, by which every one receives another of them, and is again received itself by another, in the same manner: the foramina, of which there is one proper and large one, for the passage of the spinal marrow; and four common or half foramina, two on each side; which, together, form twenty-four apertures on each side of the column, thro' which the nerves of the medulla pass out of the spine. Beside these, there are also several smaller foramina visible in the vertebræ, which serve for the entrance of vessels destined to the nutrition of the bone.

115. In adults the vertebræ consist each of a single bone; but, in infants, each is composed of three frustæ: the body, and the two sides of the bone in these, are three distinct bones; and the spinose apophyses are not found at that time.

116. The neck consists of seven vertebræ; and in these, as in the others, we are to observe some things in general; and afterwards, others of the vertebræ in particular.

Vertebræ  
of the  
neck.

117. The vertebræ of the neck are smaller than those of the back; but they are of a firmer consistence, and harder: their body is more compressed than in the others, and is sinuated on the upper part, and convex below.

Most



Most of these vertebræ have nine apophyses; the tranverse and posterior ones, called the spinose apophyses, are usually bifurcated: the tranverse ones are perforated also, for the passage of the vertebral vessels to the head.

The common foramina are seven pair, for the passage of the nerves of the neck from the medulla.

118. In the consideration of the vertebræ singly, we are to observe, that the upper one has a peculiar name: it is called *atlas*. This wants the body and the spinose apophyses, and approaches to the figure of a ring: its substance is more solid than that of any other, and it receives both above and below; but it is not received itself. The head is articulated at its anterior part, and it is by means of this articulation that the head is bent, and is extended. The proper foramen is greater in this than in any other vertebra, which arises from its wanting the body: the tranverse processes are also longer than in the others. It has also a peculiar semi-circular ligament, by which it embraces the dentiform process of the succeeding vertebræ\*.

119. The second vertebra is called *epistrophæus* and *axis*. In this, after understanding the name, we are to observe the dentiform or odontoid process, just mentioned; its articulation in the manner of a hinge, with the first vertebra; and the rotatory motion of the head, dependent on it.

120. The third vertebra is also called by some *axis*; but it has nothing to warrant such a name: there is nothing of particular observation in this, or in any of the succeeding vertebræ of the neck, more than has been observed of them in general.

\* Vesalius Hum. Corp. fab. l. 1. cap. 15.



121. The part of the skeleton distinguished by the names of *dorsum* and *thorax*, has twelve *vertebræ*. Of these we are to remark, in general, the size, which is of a middle kind, between that of the *vertebræ* of the neck and of those of the loins; the spinose apophyses, which are very long, and (except in the two last) very much inclined: the cartilages between the bodies of these, are smaller than those in the neck, which is intended by nature, to prevent too lax a motion in this part, which would be inconvenient to the breast. The transverse apophyses are thick, and have a depression in them for the articulation with the ribs; for which purpose also, in the sides of the two conjoined bodies, there is a small excavated eminence observable: there are also twelve common foramina on each side, serving for the egress of the twelve pair of nerves of the spine.

122. In our consideration of the several *vertebræ* particularly, we are to observe, that the first is called the axillary, or eminent vertebra; and to this is joined the upper rib. Authors have given peculiar names also to the others; but this is without any necessary foundation, as they are very well distinguished only by numbering them.

Vertebræ  
of the  
loins.

123. The *vertebræ* of the loins are five: we are to observe, in general, of these, that their bodies, and also the intervening cartilages, are very thick; the transverse apophyses very long, but smaller than in those of the back; the spinose apophyses are thick, strait, and set farther asunder than in the others, to give way to a laxer motion in this part; and that there are, on each side, five common foramina, serving to give egress to the lumbal nerves.

Some authors have given particular names also to each of these *vertebræ*; but it is not at all necessary:



cessary: they are sufficiently distinguished by numbering them.

124. In the examination of the os sacrum, we are to observe its name, situation, and connection; its figure, which is triangular; its external surface, which is rough; and its internal one, which is smooth and hollow; its substance, which is spongy; its basis; its apex; its two large lateral apophyses, which serve for its articulation with the ossa innominata\*; its two smaller upper apophyses, with the glenoid cavities for the articulation into the lower vertebra; its inferior apophysis, for its articulation with the os coccygis; its canal, for the end of the spinal marrow; its anterior and posterior foramina, which are sometimes four, sometimes five pair: and finally, we are to observe the difference of this bone in male and in female subjects.

125. The uses of this bone are, 1st, to serve as a basis to the spine; 2d, to form the pelvis with the ossa innominata, and to defend the parts contained in it; 3d, to contain in its sinus the lower part of the spinal marrow, or cauda equina; 4th, to give passage, at its foramina, to the nerves of the intestinum rectum, the bladder, and of the parts of generation, and to the large crural and ischiadic ones: these all pass thro' its anterior foramina: the posterior ones have either absolutely nothing, or, at the utmost, only nerves so minute, as scarce to be visible, passing thro' them. 5thly, it serves for the place of origin to many of the muscles.

\* Schelhammer tells us, that himself was the first who observed, that the connection of the os sacrum with the ossa innominata was moveable. *Analect. diff. 6. S. 57.*

See more of this articulation, and of the ligaments by which these bones are connected, under the head of the *Ossa Innominata*.



126. In adults the os sacrum is one continued bone; but in infants it is almost entirely cartilaginous; and in children more grown up, it always consists of several frustæ, or pieces: in adults, it shews always the marks of the joinings of four or five of these.

Os coccy-  
gis.

127. The os coccygis, in adults, is usually a single bone; but in younger subjects, it consists of three or four frustæ; and in infants it is merely cartilaginous. In the examination of this bone, we are to remark its name, situation, connection, figure, and substance; its base, and its apex; its small transverse apophyses; its glenoide cavity, where it is joined to the os sacrum; its motion; its state in female subjects; and its use in supporting the intestinum rectum.

128. In quadrupeds of many kinds this bone is long, and composed of a number of frustæ, and is bent outward, and constitutes the tail: in this case it is called the os caudæ. In man it is short; and is, to answer many purposes, bent inward.

## CHAP. IV.

### *Of the Bones of the Thorax.*

Thorax. 129. **T**HE second part of the trunk in the skeleton is called the thorax, pectus, or breast. This is composed of those bones which form the great cavity, in which are contained the heart and the lungs.

130. In the consideration of this part, we are to observe, that its structure is partly osseous or boney, partly muscular; and to enquire into the reasons of it. We are then to attend to its figure, its circumscription, its size; and the three parts  
into



into which it is naturally divided, namely, the vertebræ, the ribs, and the sternum. The vertebræ we have already spoken of in their place. It remains here to mention the ribs and the sternum.

131. In our examination of the ribs, we are to Ribs. observe their situation; their size, which is very different in the different ones, the middle ones being the largest, and the upper and lower much smaller; their singular bending downwards; their connections; their number, which is twelve on each side; their division into the true and spurious ribs; and finally, their use.

132. The substance of the ribs is partly boney, partly cartilaginous: the latter structure takes place in their anterior part, the former in their posterior. Their figure is crooked, concave within, and convex without: they are thus formed for the better conformation of the breast.

133. The parts of the ribs are, their body and their extremities. In the examination of the body, we are to observe the external and internal surface of it; the interior and exterior labrum, and the inferior and superior; as also the furrow in the inferior labrum; the superior ones having nine or ten hollows in them, for the reception of the vessels of the ribs. The several ribs have been distinguished by many authors, each under its peculiar name; but this is not necessary: they are as easily distinguished by the names of first, second, &c.

134. In the anterior extremities, the cartilages of the seven true ribs are all joined to the sternum: the eighth, ninth, and sometimes also the tenth, cohere either with the sternum, or else mutually adhere to one another, by means of their transverse cartilages. The anterior extremities  
of



of all the others are loose and free, between the muscles of the abdomen and the diaphragm. In the posterior extremities there are, in most of them, two capitulæ, or heads, which are firmly joined to the vertebræ of the back; yet so as to form moveable articulations\*.

Sternum. 135. In the examination of the sternum, we are to regard its situation; its figure, which is like that of a dagger; and inform ourselves of its state in infants†. We are to observe also the number of portions, or frustæ, of which it is composed in adults; in whom it is, indeed, sometimes single; but has also sometimes two, sometimes three pieces concurring to form it. Its substance is fungous and spongy: its upper part is called the manubrium, or handle; and in this there is, on each side, a cavity for the articulation of the clavicles. Its middle is narrow, and its lower part is again broad: to this also there adheres a cartilage, called, from its figure, cartilago ensiformis, or xiphoides. This is usually single; sometimes it is bifurcated, and not unfrequently it is boney throughout; and on each side of the sternum there are seven cavities, for the articulations of the seven true ribs.

The uses of the sternum are, first, to form the anterior part of the breast; 2d, to support the ribs and the clavicles; 3d, to defend the parts contained in the cavity of the breast; 4th, to serve for the insertion of the mediastinum, and for the sustaining the heart itself, and of several muscles.

\* Of the use of these articulations in respiration, see Winslow Act. Reg. Par. 1720.

† In what manner the sternum is composed of several bones in infants, and furnished with abundance of blood-vessels, see Ruysch Advers. Anat. Dec. 2.



136. The extreme part of the trunk is composed of two bones, commonly called by the odd name of *ossa innominata*. These, tho' single in adults, are, in infants and youths, each composed of three perfectly distinct bones, each of which has its peculiar name: the upper one is called the *ileum*; the anterior one, the *os pubis*, or *os pectinis*; and the posterior one, the *os ischium*. These are joined by the intervention of a cartilage, as it were, in the middle \* of that singular cavity called the *acetabulum*, and continue visibly distinct there to the age of puberty. After this they coalesce, and form one intire and continuous bone; and that so completely and perfectly, that there is not the least vestige remaining that they ever were separate.

137. The *ossa innominata* are joined, on each side, in the hinder part, to the *os sacrum*, by ligaments and cartilages, and form a very firm and strong, tho' somewhat moveable articulation with it; and, with this bone, they form also that cavity which is called the *pelvis*. In the anterior part, the *ossa pubis* cohere with one another, by means of a cartilage †; and in this place they sometimes, in the time of delivery, especially in young women, recede a little from one another, to give way to the egress of the *fœtus*: this seldom happens, however, but when the labour is a very difficult and violent one §.

\* It appears hence, how improperly they express themselves, who say that the *acetabulum* is formed in the *ischium* only; for it is evidently a cavity common to three bones.

† Santorini is of opinion, that the conjunction of these bones is not by *synchondrosis*, l. c. cap. 11. but this is yet to be determined.

§ Morgagni has quoted passages from several authors, who have observed this. *Adv. Anat.* 3. p. 28.



Beside the connections of these bones, they cohere also with the os sacrum on each side, by means of two peculiar and very robust ligaments, a finger's breadth broad, and two or three fingers breadth long each \*. The upper one of these goes off from the posterior acute apophysis of the ischium, to the os sacrum; the other, or lower one, joins the tubercle of the ischium to the os sacrum: but notwithstanding this strong connection, the os sacrum, and ossa ilei, certainly do frequently recede from one another in the time of delivery, especially in difficult labours †.

138. In the ossa innominata, we are to observe the figure, the external and internal superficies, where many muscles have their origin; the two anterior apophyses, an upper and a lower; and the two posterior ones, which are large and acute: between the two latter, there is a large incisure. The crista ilei also is to be observed; and the tubercle, or tuberosity of the ischium, which gives origin to a ligament, and to several muscles. The foramen in the ossa pubis is also to be remarked: it is the largest of all the foramina of the bones. We are also to regard the acetabulum, formed for the articulation of the thigh-bone §; in which there is also a smaller cavity, for the lodgment of a mucilaginous gland; and an incisure, to facilitate the ingress of the vessels into this gland, and into the ligamentum teres of the thigh ||. The place of the  
insertion

\* As to these ligaments, see Cowper's *Myotamia nova*, and Santorini.

† See Parey. lib. 23, c. 13; and Guillemeau *Oeuvr. chir.* p. 298.

§ Of the vessels of this part, see Ruysch's *Advers. Anat.* Dec. 2. Obs. 1.

|| Andree and Petit had great contentions at Paris, as to the denomi-



insertion of this ligament, is also to be observed; and the supercilia are to be examined, and their uses enquired into.

139. Finally, we are not to pass over unob-  
served, the singular difference which nature has Differences of these parts in males and females.  
established in these parts, between the males and females. In women, all these bones, but particularly the ossa pubis, are smaller, and are placed at a greater distance, than in men. By this means the cavity of the pelvis is rendered larger in females; and the angle between the ossa pubis and ischii, is also larger: a structure very favourable, not only to the gestation of the fœtus, but to its exclusion also.

140. The uses of these bones, beside what have already been mentioned, are, 1. To support and sustain the spina dorsi, and indeed all the parts above themselves. 2. To make a firm and proper juncture of the other parts of the body with the thighs. 3. To serve for the place of origin to several muscles. 4. To form the cavity of the pelvis, and to defend its contents from external injuries.

## CHAP. V.

### *Of the upper Extremities.*

141. **T**HE extremities of the human body are four; two superior, and two inferior: the two superior are the arms and hands; the two inferior, the legs and feet.

denomination of this ligament, whether it should be called teres or planum. It is certain, that dissection always shews it plane, not rounded; but custom has established the other name for it.



The arms. 142. Under the term superior extremities, in the skeleton, we comprehend the scapula, the clavicles, the os humeri, the cubit, and the hand.

The scapula. 143. In the examination of the scapula, called by the Greeks homoplata, we are to consider the figure, connection, and situation: we are to observe the head of the bone, with its glenoide cavity, tho' some call it the acetabulum of the scapula; its neck; its base; its two angles, the superior and inferior; its superior and inferior costæ; its anterior surface, which lies upon the ribs, and is smooth and concave; and its posterior, which is uneven. After these we are to observe its spine, its crest, and its acromion; its supra and infra spinate cavity; its coracoide process, and its two incisures, the one between the neck and the acromion, the other behind the coracoide process; and the robust ligament which joins the acromion and coracoide process, and prevents the laxation of the os humeri upwards:

The uses of the scapula are, 1st, to sustain the arms, and join them to the body; 2d, to serve for the insertion of several muscles; 3d, to add somewhat to the necessary defence of the parts contained within the thorax.

The acromion and the coracoide processes, are but cartilages in infants: afterwards they become epiphyses; and after this, about the age of sixteen, they are to be perceived separate bones, and so to the twentieth year. This is more particularly the case of the acromion.

144. In the consideration of the clavicles, we are to observe the number, the transverse situation, and the connections with the sternum and acromium; their figure, which is somewhat like that of the letter S; their substance, which is spongy and brittle; their body, which is a fixed point



point for the deltoide, mastoide, pectoral, and some other muscles; and their protuberance for the subclavian muscle; their two extremities, the rounder of which is articulated with the sternum, and with the first rib; and the flatter, which is articulated with the acromion. The uses of the clavicles are, 1. To keep the arms, that they do not fall too forward upon the breast: several of the motions of the arm are also facilitated by this. 2. To serve for the place of origin for several muscles. 3. For the defence of the great subclavian vessels, which run under them.

145. In the examination of the os humeri, or Os humeri, as it is otherwise called, we are to observe its situation, its articulation, and its size: its body, into which a great number of muscles are inserted, and which is, in its upper part, thicker and rounder; in its under part, thinner, and somewhat compressed. After this, we are to observe its rough protuberance about the middle, serving for the insertion of the deltoide and pectoral muscles; its external and internal spine, which terminate in two condyles; its remarkably large cavity, containing the marrow; and, finally, its motion, which is evidently the most free and extensive of that, of any bone in the human body.

146. In its upper extremity, we are to observe its head and its neck, into which a ligament, and several muscles, are inserted; and its sulcus, receiving one of the heads of the biceps muscle.

147. In its inferior extremity, we are to observe the figure, and the articulation with the bones of the cubit, by means of three heads and two cavities; its two condyles or tubercles, of which the external affords a fixed point for the extensors of the carpus, and the internal for the flexors; its two cavities, the anterior and posterior, which,



in the extension and flexion of the cubitus, alternately receive two processes of the ulna.

Cubitus.

148. In the cubitus we are to observe, in general, its situation, the binary number of the bones it is composed of, for the sake of the more easy and varied motion: these are the ulna, or cubitus, properly so called, and the radius.

We are to observe their size, their different thickness, and their junctures, as well with one another at their extremities, as with the os humeri and the carpus.

And, finally, the robust ligament, by which the bodies of both are connected: this serves, first, for their more firm union; and, secondly, for the commodious insertion of a number of muscles there.

149. In the ulna, while the hand is disposed in a supine posture, we are to observe its interior situation, and its length, which is greater than that of the radius; its three angles or spines, to the exterior of which the ligament just mentioned is fixed; and to the two internal ones, there are affixed several muscles. This bone has a motion of flexion and extension.

Ulna.

150. In the superior extremity we are to remark, 1st, a remarkable depression, called the sigmoidal or semi-lunar cavity, with an eminence in its middle, corresponding to the eminences and cavities of the os humeri; and, 2dly, a small cavity in the external side, serving for the articulation with the crista of the radius. We are then to observe its two processes, the anterior or coronoid, and the posterior or anconæus, or olecranon, and their uses; and, finally, the tubercle, which serves for the insertion of the brachialis internus muscle, and of the flexor cubiti.



151. In the inferior extremity we are to observe the head, which forms a kind of malleolus, in which there is, 1st, a cavity of little depth, serving for its articulation with the carpus; and, 2dly, a small styloide apophysis, serving to strengthen the articulation just mentioned; and, 3dly, a crest, serving for its articulation with the radius.

152. In the radius, we are to observe its situa- Radius.  
tion, which is exterior; and its length, which is less than that of the ulna; its spine, to which the ligament already mentioned (148) is affixed; and its motions of pronation and supination\*.

153. In its upper extremity, we see a head with a glenoide cavity, serving for its articulation with the head of the humerus; a crest, by means of which it is articulated with the ulna; its neck; and, finally, its tubercle, serving for the insertion of the biceps muscle.

154. In the lower extremity, we find a head thicker, and more angular in its figure, than that of the other, with a very large hollow at the extremity for its articulation with the wrist: in the interior side, there is a cavity formed to give way to the rotation of the crest of the ulna; and on the exterior side is a short apophysis, but considerably thick, which serves to strengthen the beforementioned articulation of the carpus: in the posterior face there are some slight incisures, and in these are placed tendons of the extensor muscles of the fingers, but particularly of that serving to the extension of the thumb.

\* In quadrupeds, the radius is firmly united with the ulna; as is also the fibula with the tibia; they have no occasion for a power of pronation and supination in these parts; therefore the mechanism of the human arm was unnecessary to them. Schelham Analect. diff. 78.



The hand. 155. After our examination of the bones of the arm, those of the hand offer themselves to our consideration. These are divided, by anatomists, into those of the carpus, metacarpus, fingers, and the ossa sesamoidea; of each of which in their order.

Carpus. 156. In the carpus we are to consider situation and name, the eight bones of which it is composed, their irregular figure, their connection one with another; their back, which is convex, and the opposite side, which is hollowed for the more commodious passage of the tendons and blood-vessels to the fingers; then the double order in which they are arranged; the first, or superior, forms a kind of head for the articulation with the radius; and the inferior forms a cavity for the furnishing a moveable articulation with the inferior series, which is joined to the bones of the metacarpus\*.

The articulation of the bones of the carpus, therefore, is triple: 1st, with one another; 2dly, with the bones of the metacarpus†; 3dly, with the cubitus.

Metacarpus. 157. In the metacarpus there are four bones to be examined; and these also have a triple articulation, 1st, with one another; 2dly, with the carpus; and, 3dly, with the fingers. In each of these bones, we are to examine the body, and the extremities. In the bodies of these bones, we are to observe the figure, which is nearly cylindrick; the cavities for the lodgment of the marrow; and

\* The same Schelhammer observes, that himself was the first who observed this manifest articulation in the carpus.

† Many authors have given peculiar names to all the bones of the carpus; but it is unnecessary: the names of first, second, and third, &c. serve the same purpose, without burthening the memory.



their size, which is larger than that of the bones of the fingers.

The gibbous or convex part of these bones, constitutes the back of the hand; the hollow part, the palm. Their bodies are placed distant from one another; and the interstices between them are filled up with muscles, called *musculi interossei*, and serving to move the fingers: but tho' their bodies stand at a distance, their heads are contiguous.

They differ greatly in size: that which supports the little finger is smaller than the rest; the subsequent ones, toward the thumb, become sensibly longer all the way, otherwise than as in the bones of the fingers. The extremity, joined to the carpus, is of an irregular figure; but that which comes to the bones of the fingers, has round and large heads, which are articulated with the glenoid cavity of the bones of the fingers.

158. In our observations of the bones of the <sup>Bones of</sup> fingers, we are to remark their number, situation, <sup>the fin-</sup> and the peculiar names the several fingers they <sup>gers.</sup> belong to are called by, are also to be remembered, that we may be able to speak properly of the bones of each. Their names are, reckoning from the thumb, 1st, *pollex*; 2d, *index*; 3d, *medius*; 4th, *annularis*; 5th, *auricularis*. There are in each three bones, which make three phalanges; the upper of which are much larger than the lower. Their exterior surface is gibbous, or convex; and their interior is plane, but somewhat hollowed, for the convenience of seizing and laying hold of things. The first phalanx, in the part where they are articulated with the bones of the metacarpus at their heads, have a glenoid cavity, by means of which articulation they have a free motion every way. In the other extremity there



there are two heads, with two cavities, joined to the second phalanx, where the motions of flexion and extension are all that are possible; and the same is the case between the second phalanx and the third. In the upper extremities of the bones of the second and third phalanx, there is to be observed an eminence, placed between two cavities: this has the same use with the olecranon. The farthest extremity of the last phalanx, has a point or apex somewhat broader than the body.

The  
thumb.

159. The thumb, considered separately, has the bones thicker than those of the fingers: the first of these agrees, in all respects, with the bones of the metacarpus in figure, situation, and articulation; but in its motion it is widely different. The articulation of the first with the second, and of the second with the third, are like the articulation and motions of the second and third phalanges of the other fingers.

In the bones of the other fingers, nothing worthy particular observation occurs, more than has been remarked here. The sesamoid bones of the fingers remain to be spoken of; but we shall treat of these more properly hereafter (S. 180.) We are now to proceed to the bones of the legs and feet.

## CHAP. VI.

### *Of the Bones of the lower Extremities.*

160. **T**HE lower extremities of the human body, called by the Latins pedes, consist of several bones; the femur, tibia, patella, pes extremus, and ossa sesamoidea. They serve to support the weight of the whole body.

161.



161. The femur is the largest and strongest Femur.  
bone of the whole human frame. In the examination  
of it, we are to remark its situation and figure, its  
body, and its extremities, and to enquire into the  
uses of each part of it.

162. In its upper extremity we see, 1<sup>st</sup>, a very  
large head, and in this a cavity, destined for the  
ligament, commonly called the ligamentum ro-  
tundum, and ligamentum teres; tho', in reality,  
it is not round, but flat\*. It is by means of this  
ligament that it is fixed in the acetabulum, and its  
laxation upwards is prevented. We are to observe  
also the place where it adheres to the acetabulum,  
its oblique situation, and its articulation with the  
acetabulum. 2. Its neck, to which is affixed a  
robust annular ligament†, which contains the  
head and neck of the bone, as it were, in a cap-  
sula, or case: we are also to remark the progress  
of this neck, which is not strait, but oblique,  
nearly horizontal, but turning somewhat outward:  
this is the contrivance of nature, for the keeping  
the thighs asunder, by means of which we tread  
the firmer; and by this situation of the neck of  
this bone also, several muscles have a much more  
commodious insertion than could otherwise have  
been possible. We are next to remark the spon-  
gy cavernous structure of this extremity of the  
bone, by reason of which it is liable to fractures,  
particularly in this part: the apertures for the in-  
gress of several vessels, are also observable; and  
there are two apophyses, called trochanters, a  
greater and a lesser, which serve for the insertion

\* The disputes about this ligament, are given at large by  
Andry, in his Examen, p. 77.

† See delineations of these in Bourdon, T. 5. fig. 31.  
Their vessels are elegantly figured by Ruysch, Advers. Anat.  
Deced. 2. T. 3.



of the muscles of the thigh, and which, together with the head, become, before puberty, distinct epiphyses\*.

163. In the lower extremity of the femur, we observe, 1st, two heads, with a cavity between them, for the articulation with the tibia; 2dly, a posterior cavity, intended to give safe passage to the vessels of the tibia; 3dly, an anterior cavity, for the placing of the patella; 4thly, two condyles, or tubercles, placed near the heads, and serving for a fixed point to the origin of the muscles which are to move the foot. In the exterior part of these we observe a peculiar depression, and often a single sesamoide bone; and sometimes there is also found another of these, in the other tubercle: this usually happens, however, only in very old subjects†. This whole extremity of the femur is seen, quite to the age of puberty, a perfectly distinct epiphysis.

164. In the body of the thigh-bone, we are to observe the anterior surface, which is convex, and the posterior, which is somewhat concave: The obliquity of this part of the bone is also singular: its strength and firmness are surprisingly great; and we are to remark its spine, or, as some call it, the *linea aspera*, which serves for the insertion of the triceps muscle; as also its great cavity for the containing the marrow.

The use of the thigh-bone is to support and sustain the weight of the whole body; and its moveable articulation at the head, gives way to the easy motion of the body, while the feet are unmoved.

\* Cheselden speaks of a very robust ligament, discovered by Dr. James Douglass, in the upper part of the articulation of this bone; but our author does not allow it.

† See these delineated, T. 1. fig. 1, 2, 3, 4.



165. The patella, called also by some rotula, Patella. comes next to be examined. In this bone we are to observe the situation, number, figure, and size; its different thickness; its anterior surface, which is convex; and its posterior one, which is unequal, having an eminence and two depressions. Its substance is spongy, and consequently it is brittle: it is connected by tendons and ligaments to the tibia and os femoris \*: it has a motion of ascent and descent in the flexion of the tibia. In infants, and even in children, for several years afterwards, it is merely cartilaginous.

166. In the tibia, we are to remark the situa- Tibia. tion, and the two bones which are understood to form it, viz. that properly and strictly called the tibia, and the fibula: we are to observe the different size and thickness of these two bones; and the articulations of each, as well with one another as with the femur and the foot.

167. In the tibia, properly and distinctively so called, we are to remark its situation, its body, and its two extremities: in its upper extremity we are to observe the thickness, the two glenoide cavities for its articulation with the femur, on which there are lodged two moveable semi-lunar cartilages †; the eminence that is between these, and is, as it were, bifid, serving for the insertion of the nervous and cruciform ligaments, by which it is joined to the femur; and the cavity behind that eminence, in which the mucose glandule is lodged. In its anterior face, we are to observe the tubercle, to which the extensores tibiæ, on

\* The ligament by which it is connected to the thigh, see in Ruyfch, Thes. Anat. 7. T. 3. fig. 1.

† See Morgagni, Advers. 2. fig. 4, and 5. Winslow, in Act. Paris, anno 1719, who has spoke very justly of their mechanical disposition and use, &c. Cant. T. 5. fig. 4.



which the patella stands, are inserted; and at its sides two tubercles, affording fixed points to some of the muscles of the foot, and to the exterior of which the fibula is firmly connected; but that in such a manner, as to have nothing to do with the articulation with the femur, as it does not touch that bone.

168. In the lower extremity of the tibia, we are to remark an excavation, formed for its articulation with the tarsus; and, in its exterior side, another for its articulation with the fibula; and also on its internal side, a thick and robust apophysis, called the internal malleolus, and serving for the firmer articulation of the foot.

169. In its body we are to observe three angles or spines, to the exterior of which the ligamentum interosseum is connected, which joins the fibula to it: the anterior angle is the most acute, and is indeed covered only by the skin and periosteum, whence there is often extremely violent pain attending its contusions. These angles scarce appear at all in infants. Finally, we are to observe that this bone has a large cavity for the marrow.

Fibula.

170. In the fibula, which is called also perone, we are to remark the situation, the juncture, the length, and the smallness of it: its upper extremity, which does not reach to the os femoris, but is only joined to the external side of the tibia; and its lower extremity, called the malleolus externus, which concurs to the articulation with the tarsus: its eminence gives a strength to that articulation, and renders a luxation of it less easy.

Its body is nearly of a triangular figure, and stands distant from the tibia: the ligamentum interosseum is annexed to its acute spine; and this, as well as the whole body of the fibula, serves for  
the



the commodious insertion of several of the muscles of the foot. The fibula solely follows the motion of the tibia: it has no peculiar motion of its own.

171. In our examination of the foot, we are The foot. to consider its length, which is greater in man than in any other animal, and serves for his firmer treading; and its situation: its upper part, or back, and its under part, or sole, called the planta, which is contrived hollow, lest the vessels should be pressed upon in walking, as we press with our whole weight there, while in this posture: finally, we are to observe its division into the tarsus, metatarsus, toes, and ossa sesamoidea.

172. In the tarsus, we are to observe the situa- The tar- tion and the number of the bones, which are seven, fus. namely, the astragalus, the calcaneum, the os naviculare, the os cuboides, and the three ossa cuneiformia; their irregular figure, their articulations with the tibia, with one another, and with the bones of the metatarsus, and their connections by very strong ligaments.

173. In the astragalus, called also the talus, we are particularly to observe its situation, its figure, articulation with the tibia and fibula, and with the calcaneum, and its head, formed for the articulation with the os naviculare.

174. In the calcaneum, or os calcis, we are to observe the situation and size; the articulation with the astragalus and os cuboides; its apophysis behind, which serves to prevent our falling backward, and on the posterior surface of which is inserted the tendo Achillis, which is the strongest tendon of the whole body: in its interior side there is an excavation, intended to give safe passage to the vessels running to the metatarsus and toes.



175. In the os naviculare, or os scaphoides, we are to observe the situation, the articulation, the glenoide cavity for its articulation with the head of the astragalus, and its three anterior faces, which receive the ossa cuneiformia.

176. In the os cuboides, we are to remark the situation, which is in the external side of the tarsus, where it receives the outer bone of the metatarsus, which is articulated with the little toe; and the bone of the metatarsus, which is next to it: after this, we are to observe its articulations with the neighbouring bones; and the incisure in the lower part, in which there is often a sesamoide bone in the tendon of the musculus peronæus posticus.

177. In the three ossa cuneiformia, the situation, their different size, and their articulations with the os naviculare, and with three of the bones of the metatarsus, viz. those which support the great toe, the second, and the third.

Metatar-  
sus.

178. In the examination of the metatarsus, we are to remark the situation, and the five bones, the bodies of which are nearly cylindrick, but convex above, and concave below; their interstices, which serve for the placing of the muscles; their posterior heads, which are joined with the tarsus, and are unequal; and their anterior ones, which are round, and serve for the articulations with the toes: these stand out a considerable way, and by this means give great power to the muscles, serving to move the toes. We are to remark also the different size of these bones; the large apophysis in the posterior head of the fifth or outer bone, on which the foot, and in consequence a great part of the weight of the body, rests.

Bones of  
the toes.

179. In the bones of the toes there is a great resemblance to those of the fingers. They are  
gene-



generally but thirteen in adults, tho' sometimes they are fourteen; much smaller and slenderer, except that of the great toe, than those of the fingers. They have not nearly so free a motion as those of the fingers. The bone of the great toe is the largest, tho' it have only two joints: the others are gradually smaller, all the way to the little toe; which is not the case in the bones of the fingers. The bone of the little toe usually, and often that of the toe which is next it, have, in old subjects, only two bones; the two extreme phalanges often growing together in old age, and forming only one continued bone: whence we find, in this case, a still smaller number than the thirteen before mentioned.

180. There remain now to be considered, the *Ossa sesamoides*. These are small bones, and are most conspicuous in old subjects: they somewhat resemble the seeds of the *sesamum*, whence they have their name. Their most usual situation is, 1st, in the thumb, and great toe: in each of which we often find two of them, though not unfrequently only one. 2. One in the juncture of the metacarpus with the little finger: this is frequently lodged in the abductor muscle of this finger\*. 3. One frequently in each external condyle of the *os femoris*†. 4. One under the *os cuboides* of the tarsus, in the tendon of the *peronæus postius*.

These are usually found in adults, or in elderly people: sometimes, tho' more rarely, there is one also in the internal condyle of the *os femoris*: and sometimes there is one in the external surface of the *os metacarpi*, which sustains the fore-finger, lodged in the tendon of the ad-

\* See its figure and situation, tab. 1. fig. 5.

† Tab. 1. fig. 2, 3, 4.



ductor muscle of the index; and often, in the thumbs, there is one wanting. Upon the whole, there are very rarely found more than sixteen of them, often fewer. Those anatomists, therefore, err greatly, who reckon more than forty of them, placing two at the articulation of each finger and toe: too many, however, have given into this error.

All these bones, except those that are found in the condyles of the femur, adhere to the tendons of the muscles: those excepted, are connected to the origin of the muscles. Their size and shape are various and irregular: they are cartilaginous in young subjects, but they grow hard and boney by age; and 'tis therefore that they are so much the more easily found in old people. They serve as a kind of trochleæ to the muscles, and increase their power.

## CH A P. VII.

### *Of the number of the Bones.*

The number of the bones.

181. **H**AVING thus gone thro' the enumeration of all the bones of the human body, it will be no great difficulty to inform ourselves of their true number, tho' authors have not a little varied upon this subject. In old people, we find, at the utmost, two hundred and sixty. In young subjects we find a greater number, but a very uncertain one; because several of those, which are at first distinct and separate, by degrees grow into one.

The



The bones of the head are in number sixty-nine: of these, there are in the cranium, including the six ossicula auditus,

In the maxilla superior, or upper jaw, 14

In the maxilla inferior, or lower jaw, 13

The teeth in the two jaws, are 1

In the os hyoides there are properly 32

In the larynx 5

In the trunk there are fifty-three bones, viz.

The vertebræ, 4

The ribs, 24

The sternum, when not composed of two frusta, 1

The os sacrum, 1

The os coccygis, 1

The ossa innominata, 2

In the extremities there are, in the whole, thirty-eight bones, viz.

The scapulæ, 2

The clavicles, 2

The ossa humeri, 2

The ossa ulnæ, 2

The ossa radii, 2

The bones of the carpus, of which there are eight in each hand, 16

The bones of the metacarpus, four in each hand, 8

The bones of the fingers, fifteen to each hand, 30

The ossa femoris, 2

The ossa tibiæ, 2

The ossa fibulæ, 2

The rotulæ, or patellæ, 2

The bones in the tarsus of both feet, 14

The bones of the metatarsus, 10

The bones of the toes, 26

The ossa sesamoidea, which are rarely more than 16

Therefore the whole number of the bones in a human body is usually 260



182. The epiphyses, (S. 51.) in subjects arrived at the age of puberty, are about one hundred and twenty-four: if these be added to the two hundred and sixty bones already enumerated, we increase the number to three hundred and eighty-four, which is the true number, as nearly as can be determined, of the bones and epiphyses; both which are often reckoned up, under the general name of bones in the human body.

### C H A P. VIII.

#### *Of the Junctures, or Articulations of the Bones.*

Junctures  
of the  
bones.

183. **N**OTHING can be more necessary to the surgeon, than a perfect acquaintance with the junctures of the bones. Anatomical writers have generally given this, therefore, the first place in their osteological part: but it appears much more rational to make it the last article on this subject; since, when the bones themselves are first known, their articulations are much the more easily understood.

184. The Greek writers have given names, in that language, to the several articulations, expressing their nature or essential character; but the later anatomical writers have varied greatly in their explication of them, and too many of them have written very confusedly on the subject. On consulting Hippocrates and Galen carefully, it will appear, that the following explication is not repugnant to what they have established on this head.

185. Synthesis, or syntaxis ossium, called by the Latins conjunctio, expresses, according to these authors, the junctures of bones of all kinds, whether with or without motion. This larger term



term comprehends two distinct genera of junctures, the arthron, and the symphysis.

*Arthron* expresses an articulation, or juncture: under this come into consideration the contact of two bones, or the figure of their conjunction, without respect to their connection: of this there are two kinds.

1. The diarthrosis, in which there is a manifest motion, and which comprehends,

1. The enarthrosis, in which the head of one of the bones is received into a deep cavity in the other, as in the articulation of the femur.

2. The arthrodia, in which the head of one of the bones is received into a slighter cavity in the other, as in the juncture of the os humeri with the scapula.

3. The ginglymus, in which the bones mutually receive and are received by one another, as is the case in the articulation of the humerus and cubitus.

To these Fallopius adds the trochoides, in which the motion is like that of a wheel about its axis, as is the case of the articulation of the first vertebra of the neck with the second.

And to all these, some of the modern anatomists have added also the amphiarthrosis, a term under which they comprehend all those junctures of bones which have a manifest motion, and which differ from the several articulations now described, either in regard to their figure, or the motion they allow of.

The second kind of the articulations expressed by the general term arthron, is the *synarthrosis*: in this there is either,



1. An obscure motion, as in the bones of the carpus and metacarpus, tarsus and metatarsus. Or,
2. No motion at all, as in the futures, gomphoses, and junctures per harmoniam.

The second general division of the junctures of the bones, used in contradistinction to the arthron, is the

*Symphysis*, or, as the Latins express it, *unio*. This indicates a connection of the bones, and is effected either,

1. Without a medium, or the addition of any intermediate substance different from the bones, at least in adults; as is the case in the junctures of the *os frontis*, the *maxilla superior*, the *ossa innominata*, the *vertebræ*, &c.
2. By the intervention of a medium, or by the addition of a substance different from the bones themselves. Of this division there are three species, and each with or without motion.
  1. The *synchondrosis*, which is seen in the *ossa pubis*, *vertebræ*, &c.
  2. The *synneurosis*, which is seen in all the junctures of the limbs, in the futures of the *cranium*, &c.
  3. The *fysarchosis*, as in the *scapula*, *os lingualis*, the gums, &c.



## CHAP. IX.

*Of parts appertaining to the bones ; the periosteum, marrow, ligaments, and cartilages.*

186. **T**HE periosteum is a nervous, vascu-<sup>Periof-</sup>  
lous membrane\*, endued with a very <sup>teum.</sup>  
quick sense ; immediately surrounding, in every  
part, both the internal and external surfaces of all  
the bones in the body ; excepting only so much of  
the teeth as stand above the gums, and the pecu-  
liar places on the bones in which the muscles are  
inserted. It is hence divided into the external  
and the internal periosteum ; and where it exter-  
nally surrounds the bones of the skull, it is gene-  
rally called the pericranium.

187. This membrane serves to constitute the  
first rudiments of the bones in a foetus *in utero* :  
it is the organ of secretion for the boney matter,  
as the membrana adiposa is for the fat ; all the  
bones, during the time of their growth, receiving  
from it their matter of accretion, and afterwards  
their nutriment. The blood-vessels of the perios-  
teum penetrate, in innumerable places, into the  
bones themselves ; as is evidently seen in the fresh  
bones of children.

The sensibility in the bones is wholly owing  
to this membrane ; for, when divested of this,  
they may be sawed, cut, or burnt without pain.  
It gives also the determination and figure to the  
bones ; as is evident from this, that, when it is  
wounded, exostoses, tophi, and caries arise in the  
part.

\* Ruysch has very elegantly figured these numerous  
vessels.



The periosteum is of different thicknesses in different parts; but, in general, the internal is vastly thinner than the external, and serves to nourish that part of the bones. It receives also nerves and blood-vessels from the outside, thro' certain canals in the substance of the bones, which it communicates to the marrow, in such as have any.

It is generally said to arise from the dura mater of the brain; but this is scarce right, as it is evidently formed at the same time with it in the foetus.

The marrow.

188. The medulla, or marrow of the bones, which anatomists of many ages supposed to be a mere shapeless and irregular mass of matter, is found, in reality, to consist of a fine subtile, fat, oleaginous substance; and of a number of minute vesicles, of a membranaceous structure, in which it is secreted from the arterial blood, in the same manner as the fat of the rest of the body. It is contained, in a greater or lesser quantity, in the cavities of most of the cylindrick bones: in the cavernous ones there is not properly any marrow, but a kind of red, fatty, medullary juice. The medullary vessels, found running here and there thro' their appropriated canals, penetrate into the inner cavity of the bones, and secrete the medullary matter from the blood there: the blood being afterwards returned again by the veins. The nerves are distributed to the same places, for the sake of sense and motion \*. It has been a common opinion, that the marrow increased and decreased in quantity, according to the increase and decrease of the moon; but this is idle and erroneous. It

\* See the experiments of Du Verney, in the memoirs of the French academy, 1700.

does,



does, indeed, increase or decrease in its several cavities, according to the exercise or rest of the animal, or to its eating more or less, or better or worse food. This subtile oleaginous substance penetrates in between the fibres of the bones, and preserves them from dryness, and from that brittleness which would be the consequence of it; but it does not nourish them, as was originally believed.

189. The ligaments are robust and strong Ligaments, as it were, of a membranaceous substance in general: they surround the moveable articulations in form of a ring, and connect them together: they are very firmly fixed to the necks of the bones. Some of them also are cartilaginous, nervous, or tendinous, and serve to fasten the bones together in the articulation: these are usually round.

There are, however, some ligaments also which do not connect the bones: these are always understood to be membranaceous parts, connecting certain other parts together: such are the ligaments of the tongue, of the uterus, of the penis, and of the muscles. Of all these we shall speak in their place.

190. Finally, to the bones belong also the cartilages: these, as already observed, are parts of the body very much emulating the appearance of bones, and are elastick; but they usually have either nothing or very little of any medullary substance in them.

191. The cartilages are surrounded with their perichondrium, as the bones are with their periosteum. They serve to several purposes, 1. For the joining the bones, as in the vertebræ. 2. For the forming the cavities of the articulations. And,



3. For the covering of the extremities of the bones, and rendering them smooth and even, where there is required the means of motion.
  4. They also serve for the formation of several of the other parts; as the aspera arteria, larynx, bronchia, nostrils, ears, and edges of the eyelids: of all which in their places.
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A  
 COMPENDIUM  
 OF  
 ANATOMY.

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BOOK III.

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*Of* SARCOLOGY.

CHAP. I.

*Of the common teguments of the human body.*

192. **W**E have hitherto been treating of the bones, which we have understood as the supports of the human frame; and have gone thro' the examination of the parts belonging to them. We are now to proceed to the consideration of the softer parts of the body, and enter on that branch of anatomy called Sarcology.

193. Sarcology may be divided into six parts.  
 1. The doctrine of the teguments, or common coverings of the several parts of the body.  
 2. Splanchnology. 3. Angiology. 4. Neurology. 5. Myology. And, 6. Adenology.

194. In splanchnology we are to consider, 1st, the viscera of the abdomen or chylopoëa: these  
 are



are destined to the offices of digesting our food, &c. and are the stomach, the intestines, the liver, the spleen, and the pancreas. 2. The uropœa, or such as serve for the secretion of the urine: these are the kidneys, the ureters, the urinary bladder, and the urethra. 3. The parts destined to generation. 4. The organs of respiration, and of the circulation of the blood, which are distributed in the neck and breast, and are the lungs, the heart, the diaphragm, and the parts belonging to them. And finally, the brain and organs of sense, deposited in the head.

195. Before we proceed to the examination of the interior soft parts, we are to consider the common teguments surrounding the whole body. In the brutes these are more numerous; but in man they are only three: they are, 1st, the cuticle; 2d, the skin; and, 3d, the fat; the cuticula, the cutis, and the pinguedo, or the membrana adiposa. These, and the rest of the parts of this division, we shall lay down our observations on in form of tables, that the young dissector may have, as it were, at one view, before him, every thing that he is to remark in every part of the body.

196. The cuticle is a thin membrane, closely lying upon the whole skin, or cutis, of which it seems a part: it is called also by a Greek name, *Epidermis*. In this we are to observe,

Its adhesion to the cutis, which is very firm, and is assisted by the intervention of the corpus reticulare of Malpighi; insomuch that, in dissections, it cannot be separated from the skin by the knife; but this is to be done by means of warm water. In living subjects we also see it separate from the cutis in burns, and by means of blisters.

The colour is white in the Europeans, black in many other nations.

We



We are next to remark its structure and substance: it is composed of a multitude of very minute lamellæ, or squammulæ, which adhere firmly together, and are easily distinguished by the microscope. In these there are very numerous foraminula, or apertures, which give passage to the hairs, to transpiration, and to the sweat: these last are generally called pores of the skin. Some authors say there are valves to these, for the preventing the too copious effusion of the sweat; but it is more probable, that this is done by the elastick power of these vessels.

The thickness of the cuticle is very different in the different parts of the body: it is greatest in the soles of the feet, and in the palms of the hands: in other places, in general, it is very thin.

Beside the pores and foraminula of the cuticle, there are a number of sulci, or lineæ, furrows or lines, called by Pliny incisuræ. These are some deeper, some slighter, and are visible in every part; but no where so plainly as in the palms of the hands: on the tops of the fingers they are spiral; and they seem to be intended for the defence of the excretory ducts of the cutis, which are arranged in this part in a regular order. The regeneration of the cuticle, in a living subject, is easy: but its origin is not, as was supposed by the earlier writers, from a condensation of the exhalations of the body by the external air; but rather, according to Lewenhoeck, from an expansion of the nervous papillæ of it, which form a multitude of small squammulæ, or lamellæ, cohering one with another; or, possibly, from both these causes together.

Even Ruyfch failed in his attempt to find blood-vessels in the cuticle; neither has any body, since his time, been able to distinguish any there.



From the absence of these it is, that it is without sensation, and that no blood flows from it, when cut ; but it is certain, that it is nourished and regenerated by a subtile fluid of some kind.

The use of the cuticle is to defend the cutis from injuries, from coming into contact with every thing, from dryness, and from pain ; and, 2dly, to assist, and, at the same time, to moderate the sense of feeling.

197. The corpus feticulare of Malpighi, or the reticulum cutaneum, is a very fine membrane, perforated, in the manner of a net, with a multitude of foramina. It is placed immediately under the cuticle ; and where that is separated from the cutis, whether by art or by accident, this adheres very firmly to it, and is scarce possible to be parted from it, seeming rather to be its inner superficies than a distinct substance. In regard to this, we are to observe, first, the places in which it is found, which are all those in which the sense of feeling is the most acute ; as in the palms of the hands, at the extremities of the fingers, and on the soles of the feet. The tongue, however, is the part where it is most accurately to be observed : it is more easily distinguishable there than in any other part ; and its nature and structure are most evidently seen there.

Its colour, in the Europeans, is white ; but in the negroes, and other black nations, it is black : in the tawny, it is yellowish. The skin itself, in both, is white ; and the blackness and yellowness depend altogether on the colour of this membrane \*.

The

\* See Ruysch's observations on this subject, *Adversar. Anat.* Dec. 3. p. 26. This accurate anatomist separated the cuticle from the cutis in a piece of the skin of a negroe, and found the



The uses of the corpus reticulare, are to preserve the structure of the other parts of the integuments, and keep them in their determinate form and situation. Its apertures give passage to the hairs, and let thro' the papillæ, and excretory ducts of the skin: it retains these in a certain and determinate order, that they cannot be removed out of their places; and has some share in preserving the softness of the papillæ, which renders them fit for the sense of feeling.

198. The cutis is a robust membrane, as thick The cutis. as a piece of strong leather, and is extended over the surface of the whole body. In this we are to consider the connection, which is double; its upper surface, adhering to the corpus reticulare, and the cuticula, and its under surface to the fat. In some places this connection is but lax, in others it is very firm.

The thickness of the cutis is very different in the several parts of the body; and as different in the skins of different animals, as appears from the leather made from it for common purposes. It has a multitude of sulci, or lines, which are common to it with the cuticle. It has foramina of two kinds in it: the larger, such as those of the

the cutis itself to be white, as in the Europeans; but the exterior superficies of the separated part of the cuticle was blackish; and its interior surface, where the corpus reticulare came in view, of a deep black. It is evident, from this, that the seat of the blackness in the skins of these people, is neither in the cuticle nor cutis, but in the corpus reticulare. Santorini observes the same thing in his *Obi. Anat.* p. 3. He says, that the colour of the skins of the Europeans, is owing to that of the bile; that it is yellow in the jaundice, black in its last stages, and of a dead whitish in the chlorosis, because the bile itself is of these several colours in these diseases. Malpighi de *Tactus Organo*, and Ruysch, who has greatly improved upon his observations, are to be looked carefully into on this head. See Ruysch's *Epist. prim.* fig. 4, 5, 6, 7.

mouth,



mouth, nose, ears, and the like; tho', in propriety, the cutis may rather be said to be reflected than perforated in these parts; and the smaller, called *pores*: these again are of different sizes, some larger, some smaller, and serve to give passage to the hairs, to the transpiration, and to the sweat. The pores are very large in the nose, where the naked eye may evidently perceive them: the smaller ones are distinguishable by the help of microscopes; and the passage of quicksilver thro' leather, shews them also.

We are to examine the substance and structure also of the cutis, and shall find it composed of a multitude of tendinous fibres, single, tenacious, and interwoven in a surprising manner together; of a vast number of blood-vessels, first shewn by Ruyfch in his preparations, and described at large in his works: and, lastly, of a great number of nerves, which constitute the pyramidal papillæ, and raise themselves thro' the pores of the corpus reticulare. These, when the cuticle is taken off, are very easily distinguishable in the palms of the hands, and under the soles of the feet; as also at the ends of the fingers, where they constitute the primary organ of feeling\*.

After these we are to observe the cutaneous miliary glands: these are said to be very numerous; and are allowed, since the days of Steno and Malpighi, by all the anatomical writers, to be found in every part of the cutis, and to serve for the excretion of the matter of perspiration. We are to observe that these, however, are not so easily demonstrated as spoken of: few of those, who have treated most largely of them, have been able to shew many of them; and the office assigned to

\* See Ruyfch, Epist. T. 17. fig. 2. and his Adversar. Anat. Dec. 2. T. 1. fig. 3.



them may as well be performed by the little arteries of the cutis, without any farther assistance \*.

Finally, we are to remark the folliculi, or receptacula cutanea; which are probably what have been described by others, under the name of sebaceous glands †.

The uses of the skin are numerous: 1st, to surround, cover, and defend the parts that lie underneath it. 2d, To be the organ of feeling. 3d, To be an universal emunctory to the body, cleansing the blood of its redundancies, by the means of sweat and perspiration; while these, at the same time, serve to prevent the aridity of the cutis itself.

199. After the examination of the skin, we The hair. are to speak of the hair, which is usually reckoned among the parts of it. When they grow on the body, they are called pili; when on the head, capilli: the last are most proper for examination. That part of them which is without the skin, appears cylindrick to the naked eye; but, when examined by the help of glasses, it is found to be unequal and irregular, and often knotty. It is pellucid, but is not hollow; but the extremities of them are often split into several parts, so as to resemble a pencil.

The part of the hair, that is within the skin, is called the root of it; and, from its roundish figure, the bulb. This part is hollow and vasculous, in the manner of the bases of the young feathers on birds: this vasculous part is inclosed in a follicle or case, and is most conveniently to be examined in the large hairs of a cat's whiskers, or of the beards of other animals.

\* Ruysch, Dec. 1. p. 9.

† Ruysch, *ibid.*

§ See Lewenhoeck, *Act. Erudit.* 1683, p. 511.



The origin of the hairs is in the cutis, and in the fat that lies underneath it<sup>\*</sup>; and probably from nerves, as there is a very acute pain felt in pulling them off<sup>†</sup>.

The nutritious matter of the hairs is probably the same with that of the other parts of the body; not merely excrementitious, as the old authors have supposed. It is a common assertion, that the hairs grow after the person is dead; but unquestionable experiments prove this to be of the number of vulgar errors, not at all the more true for being universally received as truth<sup>‡</sup>.

The colour of the hair is very different in the different people of the same country; but there are also general differences of it, peculiar, in a manner, to the climates. In the hottest countries it is very black; in the more temperate ones, it is brown, or of a less deep black; in the colder, it is yellowish, redish, or brown: but, in all places, it grows grey or white with age; and in the labourers in copper mines, and others, who are continually receiving the effluvia of that metal, it becomes greenish.

The length of the hair is, in the individual, very different. It is always much longer on the head than elsewhere. In general, it is short and curled under the torrid zone, and gradually longer in the more temperate climates.

Its consistence, to the touch, also varies greatly. 1. In regard to the different climates and subjects. In general, it is harsher in the Æthiopian than in the European; and harder and dryer in adults than in infants, whose habit abounds more with

\* Chirac. Suppl. 2. Act. Erudit. T. 8.

† See Ruysch, Epist. 1.

‡ See Ruysch, Thesaur. Anat. 10. p. 5.

† See Ruysch, Adversar. Anat. Decad. 2. p. 46.



humidities. 2. In regard to the parts of the body on which it grows : it is very harsh and hard under the arm-pits, and about the pudenda : on the head it is much softer ; and on all other parts of the body it is greatly softer than there, and very short.

As to the time of the origination of the hair, that of some parts of the body is of the same date with the parts it grows on ; such is that of the head, the eye-lashes, and eye-brows. That of others begins to grow only at a certain time ; such is that of the beard, of the arm-pits, and of the pudenda : and in the same manner some of the hair continues always increasing in length, while other parts of it never grow after the birth of the infant.

The use of the hair of the head is to keep that part warm, as well as to be an ornament to it : that of the rest of the hair, except only that of the eye-brows and eye-lashes, is not so easily determined.

200. After the hair, we are to observe the nails. The number, situation, figure, size, and colour of these, need no explanation : but we are to observe, that the several parts of the nail have their several names. 1. The extremity is called the apex ; the opposite part to this is the root or base : the first of these is thin and tender ; the latter more thick and firm. And, finally, near the base there is a white part, called the lunula, from its figure, somewhat resembling a segment of a circle.

As to the substance of the nails, they are composed of the cutaneous papillæ, elongated and indurated, and firmly connected to one another in a longitudinal direction ; for this reason, they are very sensible at the roots, where these papillæ are



yet tender : but at the apex, where they are perfectly indurated, they may be cut without pain.

The papillæ, of which the nails are formed, arise out of the skin, not only at the root of the nail, but all over the greater part of its under surface. It is by this means that the nails are so firmly connected to the skin ; and it is owing to the continual accession of more and more papillæ, as they approach toward the apex, that they become harder and firmer in that part. They may be easily separated intire, from dead subjects, by hot water.

We are next to enquire into the manner of their nutrition. As the rest of the papillæ of the cutis have their vessels, by which they are nourished ; so also these papillæ, which form the nails, have their vessels for the conveying nourishment to them at the base : but as these papillæ do not, in their own form, constitute the body of the nail, but become indurated as they are elongated, and seem only the roots or bases of hard and rigid fibres, as is also the case in the hairs ; so these indurated parts of them have fewer than the more tender, but yet enough for their nutrition are continued along them. Their growth is by means of these, and it continues as long as the person lives. It has been said of the nails, as well as of the hair, that they grow after the person is dead ; but this is evidently an error, as much as the other \*.

The uses of the nails are, 1st, To strengthen and defend the extremities of the fingers and toes, that they may not be so easily hurt by external accidents, as they otherwise would have been. 2. To assist the fingers, in the laying hold of little things, the more readily, and in the holding

\* See Ruyfch, Adversar. Anat. Dec. 2. p. 46.



them the more firmly. 3. To be convenient to us in cleansing the skin from any accidental foulnesses on its surface. 4. On the toes, they serve to make us tread the firmer, and to prevent the painful collision their ends would otherwise be almost continually subject to.

Among the various animals, the claws, which are perfectly analogous to our nails, serve them for seizing and tearing their prey, and for climbing trees: the squirrel, &c. make the latter use of them; the beasts of prey, in general, the former. Among the other animals, in some they serve as shoes to walk on; in others, they answer both this purpose and that of offensive weapons, as in the horse, to strike with\*.

201. We next come to the consideration of the pinguedo, or fat, and of the membrana adiposa. In these we are to observe, 1st, the situation, which is almost universally over the body, immediately under the cutis; and, beside this, in many parts in the interstices between the muscles, in the orbit of the eye, in the omentum and mesentery, about the kidneys, and elsewhere.

It is composed of a thin, transparent membrane, furnished with a multitude of cells, communicating in various manners with one another; and of a fat, oleaginous, or butyraceous matter, secreted from the blood, and filling up the cavity of these cells. This oleaginous matter, which is properly and distinctly called fat, is not secreted from glandules, but from the little arteries of the membrane themselves. In bodies greatly emaciated, we find only this cellular membrane with the cells empty.

Authors distinguish the fat of animals into two kinds, which they express by the words *sebum* or

\* See Schrader's *Dissertatio de Armatura Brutorum*:



*adepts*, and *pinguedo*. According to this distinction, there is no such thing as *sebum* or *adepts* in the human body: its fat is all of the kind expressed by *pinguedo*.

The blood-vessels of the *membrana adiposa* are very numerous: they are propagated from the circumjacent parts, and enter, and, as it were, surround the cells of the membranaceous cellules. The nerves are few, and very small; whence it has little sensation. Authors mention, beside the arteries, veins, and nerves of these parts, certain vessels, which they call *vasa adiposa*; but it does not appear certainly, that there are any vessels distinct from those already mentioned, and from the cells of the membrane.

That the oleaginous matter of the fat has a circulatory motion, or an egress into the veins, is very evident from the consumption of it in many diseases, which is extremely sudden; and from its vast and almost immediate diminution, only from the effect of violent exercise, or labour.

The uses of the fat are, 1. To serve as a kind of covering to the body, defending it from cold. 2. To defend the more tender and sensible parts from being too strongly vellicated by the salts. 3. To preserve in good order the flexion of the muscles, of the cutis, and of the other parts between and about which it is placed. 4. To facilitate the motions of some parts, as of the eyes, the jaw, &c. 5. To fill up a number of empty interstical spaces, and by that means to add greatly to the symmetry and beauty of the parts; as is evidently the case in the face, the neck, &c. and to facilitate the distension of the parts, the spaces between which it thus fills up: this is evidently a great use of the fat about the vagina, the anus, the *ossa ischii*, and *pudenda*; which fills up a great  
many



many large interstices there, and gives way greatly in the distention of those parts in the exclusion of the foetus, and even of the harder excrements.

6. To prevent the painful pressure and attrition of the parts, particularly in the soles of the feet, the nates, and other the like parts, on which we stand or sit, &c. in all which the fat is copiously disposed, and serves in the place of a cushion for the muscular flesh to rest upon. And, finally, there is great reason to suppose, that, when the body does not receive nutrition in the usual way, the regrefs of this into the veins supplies it.

202. The panniculus carnosus is described, by most of the anatomical writers, as a fourth common integument of the human body: it is a robust, musculous, and fleshy tunic, situated, in beasts, between the cutis and the fat; and it is by means of this, that those creatures are able to move their skin, either totally or in part, as we see them frequently do, to dislodge flies, &c. It is not allowable, however, to describe this as a part of the human fabrick, analogous to what we see of it in brutes: there is no such integument in man, except possibly about the face; and it is evident, that man cannot want it, as his body is defended by cloaths, from the occasion of the beast's exerting its motion.

203. The common membrane of the muscles is also, by some, reckoned among the number of the integuments of the human body: this has its place immediately under the fat, and is said to surround intirely all the muscles. This, however, is also improperly called a common or universal integument; since it is not expanded over the whole body, but is only found in some particular parts of it, and is wholly wanting in many. Magnetus and Verheyen very improperly divide

Pannicu-  
lus carno-  
fus.

Membra-  
na muscu-  
lorum  
commu-  
nis.



the tunica adiposa into three membranes, for the sake of making out the old number of integuments \*; since those which are wanting in the human frame, are by no means to be supplied by an imaginary partition of this.

204. Having thus gone thro' the enumeration of the common integuments of the body, we are to proceed, in the order of dissection, to the teguments of the abdomen in particular, or its continent parts: which are, beside the ossa innominata, the os sacrum and its appendage, and five vertebræ of the loins, the diaphragm, the muscles of the abdomen, and the peritonæum. The dissector always begins with this part, because the fæces, contained in it, render it, before all the other parts of the body, obnoxious to putrefaction; and all the others are kept longer sweet, and fit for examination, after the separating the contents of this.

Muscles  
of the ab-  
domen.

205. In regard to the muscles of the abdomen, we are to observe their situation: they occupy, and indeed compose, the greater part of the circumference of the abdomen. We are to remark also the linea alba, which extends itself from the sternum to the juncture of the ossa pubis, in form of a broad and strong white streak: this is composed of the tendons of the muscles of the abdomen, implicated together in an amazing manner; and in the middle of this is situated the umbilicus, or navel.

The number of these muscles is properly five pair †. The first pair are the recti: these have their origin in the ossa pubis, and terminate at the sternum and four of the ribs. In these there are various tendinous divisions.

\* See Morgagni, *Advers. Anat.* 2. p. 17.

† See excellent figures of these in Cowper's *Myotomia*.



The second pair are the oblique descendentes: these arise from the seven ribs, from the fifth to the eleventh; and terminate by their aponeuroses, in the spine of the ileum, the os pubis, and the linea alba, which several fibres however pass through.

The third pair are the oblique ascendentes: these arise from the ossa ilei, the os sacrum, and the spines of the loins; and are inserted partly in the lower side of the spurious ribs, and partly in the linea alba.

The fourth pair are the transversi: these arise from the transverse processes of the loins, and are connected to the diaphragm; and they terminate in the linea alba.

The fifth and last pair are the pyramidales: these are very small. They have their origin at the junctures of the ossa pubis: they thence rise straight to about four fingers breadth, and there terminate in the linea alba. Sometimes this pair is found wholly wanting, sometimes there is only one of them instead of the pair, and sometimes there are both.

These muscles are furnished with arteries and veins from the intercostal, lumbar, mammary, and epigastrick vessels; and with nerves, which are considerably large, from the dorsal and lumbar ones.

There is an annulus, or ring, in the lower part of the oblique descendens; and a perforation in the oblique ascendens, serving for the giving passage to processes of the peritonæum, and the spermatick vessels in men, and to the ligamenta rotunda of the uterus in women. In ruptures the intestine and omentum make their way also thro' this opening. The transversi are not penetrated, but their passage is under their limb.

Finally,



Finally, we are to observe the ligamentum poupartii, which is placed between the spina ilei and os pubis.

The uses of the muscles of the abdomen are,  
 1. To contain and defend the viscera lodged in the abdomen. 2. By their continual motion to assist in digestion, and in the progress of the chyle. 3. To promote the excretion of fæces and urine continually, and of the foetus and secundines in time of delivery. 4. To be of use in respiration. 5. To assist in the facilitating the various flexures of the body. 6. To assist in the motion which occasions the stomach to throw up its contents in vomiting. And, 7. In various other motions.

The peritonæum.

206. The peritonæum lies immediately under the transverse muscles of the abdomen, and adheres to them. It is a thin, smooth, and lubricous membrane, investing the whole internal surface of the abdomen; and containing most of the viscera of that part, as it were, in a bag: it coheres also with the diaphragm, and with all the viscera lodged in this part. It intirely encloses the stomach, the intestines, the mesentery, the omentum, the liver, the spleen, and the pancreas: these are, therefore, said to be lodged in the duplicature of the peritonæum. The kidneys, ureters, and smaller vessels of the abdomen, it covers only on their anterior part; and the urinary bladder only on the posterior. This is the case in the human body, and this is very different from what comparative anatomy shews us among the brutes\*.

The peritonæum is composed of a double membrane, or lamella: the exterior one has longitudinal and slender fibres; the interior has trans-

\* In what manner the peritonæum covers the bladder, Cheselden has elegantly shewn in his treatise on Lithotomy.



verse and more robust ones \*. There are also ligaments formed from it: 1. That which suspends the liver. 2. The two ligamenta lata of the uterus in women.

Its processes, which it sends out of the abdomen, are two: they serve to surround and enclose the spermatick vessels and the testicles. In regard to these, we are to observe, 1. Their surprising passage between the muscles of the abdomen. 2. Their hiatus, so visible in the abdomen of a dog, but wanting in the human body. 3. The septum, serving to separate the testicles, are the upper part.

We are also to observe the involucra of the ligamenta rotunda in women, and their diverticula: Nuck has finely delineated these in his *Adenographia*, p. 39, 40.

The arteries and veins of the peritonæum are supplied from the epigastrick, mammary, lumbar, and diaphragmatick vessels; and to these some add lymphaticks.

The nerves are propagated from those of the diaphragm, back, loins, and os sacrum. Many of the anatomical writers have also mentioned glands in the peritonæum; but, in the natural state of the part, no such are observable.

The uses of the peritonæum are, 1. To inclose the contents of the abdomen; for when this part is dilated, wounded, or broken, they fall out of their due places, and ruptures are formed. 2. To give an external covering to almost all the parts contained in the abdomen, which are therefore generally said to have their external membrane from the peritonæum. 3. To form the processes of the peritonæum, and the tunica vaginalis of the testes.

\* See Santorini, p. 164.



## C H A P. II.

*Of the Contents of the Abdomen.*

207. **W**HEN the peritonæum is carefully laid open, there appear the vasa umbilicalia, which, in adults, are found degenerated into ligaments: these are two arteries, a vein, and the urachus, lodged within the double lamella of the peritonæum\*. These almost entirely disappear in adult brutes; or, at the utmost, are much less distinguishable in them than in men. Du Verney observes, however, that the umbilical arteries always retain their cavity down to the fundus of the urinary bladder, and that the bladder always receives branches from them†.

After these comes in sight the omentum, or epiploon, lying upon the intestines; and under this the intestines themselves, which fill up the greater part of the abdominal cavity; the smaller intestines lying in the middle, the larger toward the circumference.

We are then to observe the mesentery, or membrane, which connects the intestines; the stomach, which occupies the upper part of the cavity toward the left side; the liver, with the gall-bladder, situated on the right side, or in the right hypochondrium; the spleen, on the left side, behind the stomach, and adhering to the diaphragm and the spurious ribs: the situation of this part prevents its coming in sight, till the stomach is removed. The two kidneys, which are hid, as it were, behind the intestines, and lie upon the loins; the

\* See Santorini, Obs. Anat. p. 164.

† See Garengot's Chirurg. T. 1. p. 222. See also more of these vessels in our chapter of the Fœtus.



urinary bladder, placed in the lowest part of the abdominal cavity, called the pelvis, and connected with the ossa pubis, by means of the peritonæum. The bladder in the human body, when empty, is so small, that it is scarce observable, unless distended.

After this we are to observe the pancreas, which is a large gland placed under the stomach; and then the parts serving to generation, as, in men, the vesiculæ seminales, &c. and, in women, the uterus, its ligaments, the ovaries, the Fallopian tubes, and the other parts belonging to the uterus.

We are to observe, in this cavity also, the aorta, or great artery; and the vena cava, and vena portæ; and the emulgent iliac, mesenterick, and other arteries and veins, which are conspicuous and numerous.

208. The omentum is a membranaceous part, usually furnished with a large quantity of fat, and is placed under the peritonæum, and immediately over the intestines. It is called, by some authors, rete and reticulum, from the number of holes appearing in it when raised, and giving it the resemblance of a net; but these are not natural. The Greeks called it epiploon.

As to its situation, it usually occupies only the upper part of the abdomen; but sometimes we find it extended to the lower part also. Its weight in an adult human subject, not remarkably fat, or remarkably lean, is about half a pound: in brutes it varies extremely, in proportion to their being more or less fat. As to its connections, its lower part is evidently loose and free: in its upper part it is joined, in its anterior part, to the bottom of the stomach, the duodenum, and the spleen; and in its posterior part, to the colon and pancreas.

It



It is composed of a very tender double membrane, forming a kind of pouch, with a cavity called by authors its *burfa*. It has a quantity of fat in certain cellules, destined for that purpose, and forming a kind of ducts: these surround the blood-vessels, and have between them certain areolæ, or membranaceous spaces.

Its arteries are called *arteriæ epiploicæ* \*: they come from the *cœliaca*, and are very numerous. Its veins are derived from the *vena portæ*, and principally from the splenic branch: its nerves are from the intercostals, and the *par vagum*; and beside these, it has some lymphatics.

It has a very remarkable natural aperture, discovered by Winslow, by which it may be conveniently and elegantly distended by inflation; and there are generally some small natural foramina in it; tho' the larger ones, from which it had its name *rete*, are adventitious. Malpighi has been at great pains to describe what he calls *ductus adiposi*, in the omentum; but what he gives this name to, are no other than the lateral diverticulations of the blood-vessels, which running to the cells, there secrete and deposit the oleaginous or fat matter. These cellules, as well as the others †, where fat is lodged in other parts of the body, communicate also with one another, and with the veins of the part.

The uses of the omentum are, 1. By its lubricity, to render the necessary and natural motions of the intestines easy. 2. To cherish and defend the intestines from cold. 3. To assist in the formation of the bile, the fatty part of which is wholly owing to the vessels of the omentum,

\* See an accurate delineation of these arteries in Ruysch's *Thesaur. Anat.* 2. T. 5. fig. 1.

† See Maur. Hoffman, *idea*, p. 23.



every thing that returns from this part, going into the liver. 4. To temperate the acrimony of the humors. And, probably, 5. To serve, as all the other fat parts of the body, to give it nourishment, when it is incapable of being nourished any other way.

209. The stomach, or ventricle, is a hollow membranaceous part; placed, for the most part, in the left hypocondrium, immediately under the diaphragm, and, in an oblique situation, between the liver and the spleen. In this we are to observe, 1. Its figure, which is like that of the bag of a pair of bag-pipes. 2. Its division into three parts, that is, into two orifices and a bottom.

Its left orifice, called cardia, is placed much higher than its right, and is continuous with the gula, and furnished with a great number of nerves.

Its right orifice is called the pylorus, and is connected with or opens into the intestines: in this part there is a singular valve, the office of which is to close the stomach \*. We are also to observe the ligament, by which the pylorus is connected to the upper part of the stomach.

The size of the stomach, in human subjects, is very various: in people addicted to gluttony, it is usually very large; and in men it is, in general, larger than in women. In the human body it is always single; but many of the beasts have several stomachs.

Its vessels are arteries, veins, nerves, and lymphatics. Its arteries, called gastricæ, it receives from the coeliac: the gastrick veins all run to the vena portæ. Among these we are to observe the vasa brevia, which go off to the splenic branch, and the vena coronaria, which surrounds the stomach.

\* See its figure, Tab. 6.



Its nerves principally enter at the left orifice: they come from the par vagum, and are very large; and hence it is, that the stomach is so sensible.

The lymphaticks go to the receptaculum chyli.

The substance of the stomach is membranaceous: it is composed of four coats.

The first coat is membranaceous, in the strict sense of the term: the fibres of this run transversely. The second is musculous; and in this the course of the fibres is various, and, as it were, inextricable: some of them run circularly, as it were, from the upper part to the lower; and others only on the upper part of the stomach, between the two orifices: others run obliquely from the left side to the right, and some surround the orifice.

The third coat of the stomach is nervous: this forms a multitude of wrinkles, and is furnished with a number of sanguiferous vessels and small glands, which secrete the liquor gastricus, or liquor of the stomach. This is more readily observed in hogs than in the human body.

The fourth is villose, thin, and porous\*: it adheres very firmly to the former.

The use of the stomach is for the digestion of our food, that is, to receive, contain, dissolve, and change what is swallowed by the mouth; and after a sufficient concoction, to expel it thro' the pylorus into the intestines: possibly also, it absorbs and retains the more subtile parts of what it has thus prepared for nutrition. It also is the organ in which the sensation of hunger resides.

\* See Ruysch's Thesaur. Anatom. 2. T. 5. fig. 2. and of the papillæ of the stomach, see the same author, Advers. 3. P. 33.



210. The intestines are long and large, cylindrick, hollow, membranaceous bodies; or rather one such continued body, reaching from the stomach to the anus. In these we are to observe, <sup>The intestines.</sup>  
 1. Their length, which is usually six times as much as the height of the man they belong to.  
 2. Their wonderful circumvolutions, and the uses of them.  
 3. Their connection, by means of the mesentery, with the vertebræ of the loins.  
 4. Their number, which tho' properly and exactly, as before observed, it be but one, yet is usually made six. Of the six intestines of this division, three are called the smaller intestines, *intestina tenuia*; and the other three the larger, or *intestina crassa*.

Of the first three, called the small guts, or *Duodenum*, <sup>num.</sup> *intestina tenuia*, the first is the duodenum, so named from its length, which is about that of twelve fingers. This has its origin at the pylorus, and at its beginning ascends a little; but after this it descends; and toward its end, finally ascending again, it runs transversely toward the left kidney: it receives, at the distance of three or four fingers from the pylorus, at one prominent hiatus or mouth, the oscula, or apertures of the cholidick and pancreatick ducts, for the susception of the bile and the pancreatick juice. The thickness of the coats of the duodenum is greater than that of any other of the small guts; and its cavity is also greater than that of any of them: in its beginning it has no valves, nor rugæ; but in its continuation it has very numerous and remarkable ones, called by authors *juga* \*. It has also the glands called *glandulæ brunneri*, in great number, serving for the secretion of a thin aqueous fluid †;

\* See Santorini, p. 167.

† See Santorini, Tract. de Valv. Duodeni.



and it has an artery from the *cœliac*, and a vein, as the rest of the intestines have, from the *porta*.

*Jejunum*. The second of the small guts is the *jejunum*, so called because it is usually found empty. This is owing to the fluidity of the *chyle*, the greater stimulus of the bile in it, and the abundance of the *lacteal* vessels which it is furnished with. Its situation is in the region above the navel: it has a great many connivent valves. Its beginning is where the *duodenum* ends; and its termination in the place where the valves, just mentioned, are obliterated. Its length is different in various subjects: it is usually, however, between that of thirteen and sixteen spans. It is generally shorter than the *ileum*.

*Ileum*. The third and last of the small guts is the *ileum*. Its situation is principally below the navel, near the *ossa ilei*, whence it has its name. Its length is various: sometimes not more than fifteen, sometimes twenty spans, or more. Its beginning is where the valves of the *jejunum* cease to be conspicuous, and its end is where the larger intestines begin; in which place it is, in a very singular manner, inserted into the left side of the colon\*. Valves it has none, unless that great one at the end, which is called, by many, *valvula coli Bauhini*: its glands are, in general, more numerous toward the end than in any other part.

*Cœcum*. Of the three large intestines, called, from their size, *intestina crassa*, the first is the *cœcum*: this is situated at the right of *ileum*, and resembles a bag, and has a vermiform or worm-like appendage fixed to it. It begins at the termination of the *ileum*, and terminates in the bottom of the bag or *sacculus* which it forms: its length is not

\* See the author's dissertation de *Valvula Coli*. See also here fig. 7. and Morgagn. *Advers.* T. 3. fig. 2.



more than three or four fingers breadth. In the appendage, opening into the side of the cœcum, there are some glands; which, together with its erect situation, as that is usually the case, seems to shew that some fluid is secreted there. In hens this is double; as also in many others fowls. In fishes there are frequently a vast number of them; in some species, not less than four hundred\*. In man it is, at the utmost, single, and is often wanting†.

The second of the intestina crassa is the colon. Colon. The situation of this is at the circumference of the smaller intestines; and it is usually, strangely, and variously convoluted and flexuous. Its beginning is above the termination of the ileum, and its end is at the os sacrum. It is connected with the os ilei, the right kidney, the gall-bladder, the liver, the stomach, the spleen; and, finally, with the left kidney. Its length is from five to seven spans: its diameter is the greatest of that of any of the guts. It has three ligaments running longitudinally in it, and terminating in the vermiform process§. It has also certain external adipose appendiculæ, which serve to lubricate it‡. The connivent valves are larger in this than in any other of the guts; and the coats it is composed of, are stronger than in the small guts.

The third and last of the intestina crassa is the Rectum. rectum. It is thus called from its situation, which is strait or perpendicular upon the os sacrum. Its length is about three hands breadth; and its diameter about three fingers. It has its beginning at the lowest vertebræ of the loins: its extremity is

\* See Grew's Comparative Anatomy of Guts.

† See Morgagni, Advers. 3. p. 27.

§ See Morgagni, Obs. Anat. 3. p. 27. fig. 3.

‡ Ruyfch, Mus. Anat. p. 75, and 76.



what is called the anus. This is furnished with three muscles; one called the sphincter, whose office it is to close the anus; and two others, called elevatores, whose office is to draw it up. Of these we shall speak in their proper place, among the muscles. It is connected to the os sacrum, the os coccygis, and the urinary bladder, in men; but in women to the vagina uteri. The coats of the rectum are more thick and fleshy, than those of any other of the intestines: it has, in general, no valves; but it has several rugæ. The absence of valves here, is to prevent the expulsion of the fæces from being retarded. The anus is surrounded with a large quantity of fat, to the end that it may be easily dilated, in the evacuation of its contents.

Structure  
of the in-  
testines.

211. The structure and substance of the intestines is membranaceous: they are formed, in every part, of five coats or tunics.

The first is the common coat, from the peritonæum, and is membranaceous.

The second is cellular; and is called, by the late writers, tunica cellulosa Ruyschii. This is continuous with the mesentery, and is to be discovered by inflating it \*. This coat, in fat animals, also frequently contains abundance of fat.

The third is muscular: this is composed of a double series of fibres, in part longitudinal, and in part annular; and these assist the motion of the guts.

The fourth coat is nervous: it is furnished with abundance of cellules, vascules and glands, and is thicker than the others. From this arise the rugæ, and the valves of the intestines.

The fifth is the villose coat: this sustains the terminations of the excretory vessels, and the

\* Ruysch, Thes. Anat. 6. T. 5. fig. 2.



beginnings of the lacteals. Hence, when nicely examined, it has the appearance of a sieve\*. It is the organ of percolation of the chyle.

The intestines have vessels, in great abundance, running over every part of their substance. Their arteries are from the meseriatic ones; the upper meseriatic serving for the smaller intestines; the lower for the larger: these make a multitude of very singular and surprising anastomoses. The veins are the meseriatics, and go off to the vena portæ and the liver. The nerves are sent from the intercostals, and the par vagum. And beside these, we are to observe the lacteal vessels; of which we shall treat more at large hereafter.

The rectum, it is to be observed, receives blood-vessels also from the hypogastrics.

There are also, beside the brunnerian glands of the duodenum, other glands in the intestines, called, from the name of the person who discovered them, glandulæ Peyerii. These, in the small guts, are usually little, congregate, and miliary: sometimes they are single. They are larger as they are nearer the duodenum, and smaller as they approach toward the great guts. Their office is to discharge into the intestines a liquor, which serves for the attenuation of the chyle, and for the lubricating of the intestines. In the larger guts, and in the vermiform appendage, they are single and large, of a lenticular figure; and they are largest of all in the rectum. They have mouths, out of which there is secreted a fluid, serving to lubricate the sides of the intestines, and to soften the fæces, that they may be evacuated without pain.

The use of the smaller guts is to promote the formation of the chyle, to perfect its secretions,

\* Ruysch's Epist. 11. T. 12.



and to propel the remaining fæces to the larger. The office of the larger guts is to receive and collect the matter of the fæces, and at a proper time to expel it.

The mesentery.

212. The mesentery is a thick fat membrane, placed in the midst of the intestines, particularly of the smaller ones, whence it has its name. In observing this we are to regard, 1. Its substance, which is composed of membranes, fat, vessels of all kinds; and, in the human body, of a number of glands. 2. Its connections, which are, in the upper part, with the three superior vertebræ of the loins; in the lower, with the intestines, and particularly with the jejunum and ileum; to which it also gives their outer coat. 3. Its division, according to the anatomical writers, who call that part of it, which joins the colon, the mesocolon; that part which joins the other intestines, &c. the mesenterium, or meseræum. 4. Its circumference, in which, when separated from the intestines, there are several folds or plicæ, giving it the resemblance of gloves. Its length, in the whole, is about three ells; but the intestines, which are joined to it, are at least of four times that length.

Its coats or membranes are two, a superior, and an inferior; and between them there is a cellular substance, containing the fat; and the meseriack vessels and glands are also placed there. Many reckon this a third coat of the mesentery, and that not improperly: they call it the tunica cellulosa\*.

The vessels of the mesentery are blood-vessels, nerves, lacteals, and lymphatics. The blood-vessels are the same with those of the intestines,

\* See Wharton's Adenographia, cap. 8. and Ruysch's Thesaur. 6. p. 76.



and they make a multitude of strange meanders, and have very frequent anastomoses \*. The nerves also come from the par vagum, and the intercostals. The lacteals and lymphaticks we shall treat of, in their place, hereafter.

There are a multitude of glands dispersed throughout the whole mesentery †. These vary greatly, in different subjects, in their size, figure, and situation: in old subjects, they often almost disappear. In comparative anatomy we find, that in dogs there is only one, but that very large, and called pancreas Afellii. The lacteal vessels pass thro' these glands; and their office is to secrete a fluid, which is to serve for the diluting of the chyle.

The uses of the mesentery are, 1. To suspend, connect together, and retain, in their due place, all the intestines. 2. To sustain the sanguiferous and lacteal vessels of the intestines. And, 3. To make the way, for the lacteals to the receptacle, shorter.

213. The vessels called vasa chyliфера, comprehend the lacteals and the thoracic duct. They are fine subtile canals, situated in the intestines and the mesentery, and whose office it is to convey the chyle to its destined places.

Afellius has the honour of passing for the first discoverer of them. He demonstrated them in the year 1622; but they were long before observed by Erasistratus and Galen, who took them for arteries containing milk.

The most convenient method of demonstrating them is, in comparative anatomy, by feeding some animal plentifully; and, in about three

\* See these delineated in Eustachius, Drake and Cheselden.

† See these elegantly figured in Ruyfch's Opusc. de Gland. fabric.



hours afterwards, strangling it. In this case they are all turgid with chyle : at other times they are filled with a lymphatick juice, not with chyle ; and are accordingly called not chyliferous vessels, but lymphaticks.

When the creature is opened, the ductus thoracicus, hereafter to be described, is to be tied with a thread : this makes the seeing them the more certain and easy ; but often they may be distinguished without this assistance very plainly.

The difficulty of demonstrating them, in human subjects, arises from our not making our dissections of them immediately after death, or while the flesh is yet warm ; for, soon after death, they wholly disappear. Sometimes, however, they are obvious enough to be clearly distinguished, even in human subjects ; especially in such as have been suffocated or strangulated : sometimes in such as have died of particular diseases.

The origin of the chyliferous vessels is from the intestines, and principally from the small ones : in all these their roots are extremely numerous, and easily distinguishable ; much more so, indeed, in the human body than in dogs \*, which are the animals usually experimented upon. In the larger guts they are very few, and often none at all can be seen there †.

Anatomists distinguish the lacteals into two kinds, which they call lacteals of the first and of the second order. Those of the first order, are such as run from the intestines to the glands of

\* See a delineation of them, fig. 8. from a human subject. What draughts others have given of them, seem to have been taken from other animals.

† See our author's observations in the Ephemerides, N. C. Cent. 5. p. 234. and Philosophical Transactions of England, N<sup>o</sup>. 307.



the mesentery: those of the second order, are such as run from the glands to the receptacles, where they terminate. These last are larger than the former; but they are also fewer in number.

In the chyliferous vessels there are also semilunar valves: these are double, and are placed oppositely, and they prevent the reflux of the contents; but they are much less frequent in these vessels than in the other lymphaticks\*.

The use of the chyliferous vessels is to carry the chyle from the intestines, thro' the mesentery, to the common reservoir, or receptaculum chyli.

It is observable, that, in birds, there is a defect of the chyliferous vessels; the chyle, in these, entering the meseriatic veins.

The ductus thoracicus, or chyliferous duct, is a very tender canal, receiving the chyle from the chyliferous vessels, and the lymph from the lymphaticks, and carrying them to the thorax, and usually thro' it to the subclavian vein. Ductus  
thoraci-  
cus.

Pecquet has the honour of being accounted the first observer of it†: he demonstrated it in the year 1651; but Eustacius had discovered it long before him, tho' he has expressed himself too obscurely§.

The beginning of this duct is in the reservoir, or receptaculum chyli, which is situated in the left side of the upper vertebra of the loins, under the aorta, and the vessels of the left kidney: the rest of the duct has some resemblance of a sack or bag, and is larger, and irregular in its figure. Its end is usually in the left subclavian vein, sometimes in the jugular.

In dogs, and many other animals, its progress is under the aorta; but, in the human body, it

\* See Ruysch's Dilucidatio Valvularum.

† See Pecquet's Exp. Anatom.

§ See Eustacius, Lib. de Vena azygos.



ascends along the right side of the vertebra of the back, and passes between the aorta and the vena azygos; sometimes with a simple trunk, sometimes divided into two. Its breadth, where undivided, is about that of a wheat-straw.

The best method of demonstrating it in animals, is to feed a dog well, then strangle him; and, as soon as the body is opened, to tie it up with a thread in the breast, just by the subclavian: by this means the cistern, or receptacle of the chyle, and the chyliferous vessels and lymphaticks, all are exposed evidently to the view at once.

In a human body they may also be observed, any time after death, by injecting, according to Salzman \*, wax, or any fluid, or indeed only by inflating the great lymphatick vessel, which runs by the left emulgent vein: or otherwise, if, according to Henninger †, an injection, or barely an inflation, be made into a lacteal of the second order, to be traced out in the midst of the mesentery: or, finally, if the pleura be carefully cut between the aorta and the vena azygos, the duct will usually be easily found there.

It is composed of a fine, thin, and pellucid membrane; and within it there are valves, as in the lacteals and lymphaticks, which prevent the reflux of the chyle: there are more of these in the human body than in beasts. And, finally, there is a semi-lunar valve, closing its extremity, under the subclavian.

The use of the ductus thoracicus is to carry the chyle to the blood, thro' the thorax, as it receives it from the receptacle, and with it the lymph from the lymphaticks.

\* See Pecquet's Dissertation, printed at Strasburg 1711.

† See Ephemerides Nat. Cur. Cent. 4. App. p. 120.



215. Next to the chyliferous vessels, we are to mention the lymphaticks, which are of a very singular structure, and are to be demonstrated at the same time in dissections. They are thin, subtile, and pellucid vessels; and usually convey thro' them an aqueous fluid, called lymph: but in the intestines, particularly in the time of digestion, they are found filled with chyle; and at that time, as before observed, they are called lacteal vessels.

The first discovery of the lymphaticks is by some given to Bartholine, by others to Rudbeck, by some to Glisson, and by others to Charlton. Their situation is in the superficies of several parts, particularly of the concave side of the liver, the neck of the gall-bladder, and the trunk of the vena portæ. They are composed, like the lacteals, of a fine and delicate membrane. They have, very frequently, double semi-lunar valves: Ruysch has excellently described these in his book on the valves of the lymphaticks. They have their beginning in most of the parts of the body: they have not been discovered every where in it; but it is probable that they are there, tho' not yet found. Their terminations or insertions are, 1st, in several of the larger veins, particularly in the cava and porta. 2. In the cistern, or receptacle of the chyle. 3. In the thoracick duct itself.

The method of shewing them, in dissection, is by tying up either the thoracick duct or the vena cava, vena porta, the splenic, the renal vein, or any other of the large ones, either in an animal yet living, or but just dead; or by powerfully inflating the veins, arteries, or excretory ducts of the viscera, in an animal not yet cold.

The use of the lymphaticks is to carry off, from the several parts, the quantity of lymph that was redundant, in regard to their nutrition; and



and to convey it either into the mass of blood, or into the chyloferous ducts. The reflux lymph, thus conveyed thither by them, serves again for a new dilution of the chyle and of the blood.

**Pancreas.** 216. The pancreas is a large gland, of a flatish shape and fleshy colour, extended behind the stomach, and reaching from the duodenum transversely toward the spleen. In this we are to observe the connections it has with the duodenum, the mesentery, with the splenic vessels, and with the spleen itself. In the human body it is simple; but in dogs, cats, and many other animals, it is divided, as it were, into two parts. Its length is eight or nine inches: its breadth is about two fingers, or two and a half: its thickness about one finger: its weight about three ounces. In man the pancreas much resembles the tongue of a dog in shape: it is broadest towards the duodenum, and gradually narrower toward the spleen. It is surrounded with a membrane, which is continuous with the peritonæum; its substance is glandulous, and it seems formed by conglomeration of many others. It has arteries from the coeliac and ramus splenicus; and veins also from the splenic vein: its nerves are from the par vagum and the intercostals; its lymphatics are uncertain: and, finally, it has an excretory duct, composed of a number of others. Maurice Hoffman first discovered it in 1641, in a turkey; and afterwards it was discovered by Wirsungius in the human body, as Bartholine, who was present, informs us\*.

It is commonly single in the human body: sometimes, however, it is double. In many of the common birds it is double, and in some triple.

\* See T. Bartholine, *Anat. Reformat.* l. 1. c. 13. Also Maur. Hoffman, in *Hornii Microcosm*, p. 164.



Its situation is in the middle of the pancreas, where it resembles an empty vein, and is of about the thickness of a small straw. Its termination is in the duodenum: it enters it obliquely, four or five fingers breadth below the pylorus, usually at the same orifice with the ductus cholidocus: but sometimes it has a double aperture. In many beasts it is inserted into the duodenum by a particular orifice, at a considerable distance below the pylorus.

The use of the pancreas is to secrete a peculiar liquor, called the succus pancreaticus: this is of a salivose nature, and serves to attenuate the chyle.

217. The liver is a very large viscus, of a red The liver. colour, situated in the right hypocondrium, and serving for the secretion of the gall.

In this we are to observe its size, which is very large, that the bile may be secreted in large abundance; its figure, which is irregular; the upper surface convex, smooth, and equal; the lower, hollow and unequal, and containing the gall-bladder. There is a remarkable eminence in the liver, where the vena portæ enters it, called the porta.

In dogs the liver is divided into lobes; but in human subjects there is no such division. Its weight is about four pounds. It is connected, 1st, by the ligamenta lata with the diaphragm, and by the ligamentum rotundum with the navel: this last ligament has been in the fœtus, the vena umbilicalis. It is connected with the diaphragm also by the proper membrane of that part, and by the blood-vessels; principally the vena cava and vena portæ.

The membrane which surrounds the liver is thin, and is continuous with the peritonæum.

In



In the liver we are also to observe the capsula Glissonii, so called from its discoverer: this is a tunic, continuous with the peritonæum, and includes the branches of the vena portæ, and the biliary ducts, as they approach the liver, as well as within it.

The vessels of the liver are very numerous: it has arteries for its nutrition from, 1st, the coeliac; 2d, the cysticks; 3d, the diaphragmatics; and sometimes, 4th, from the superior mesenterick.

Its veins are, first, from the vena portæ, entering the concave surface of the liver: this vein supplies the place both of a vein and an artery in this part, bringing in the blood for the secretion of the bile; but of this, more in its place. 2d, from the vena cava: and, 3d, from the diaphragmatick vein, for the reflux of the abundant blood to the heart. The nerves of the liver arise from the plexus hepaticus of the intercostals.

The biliary vessels, near which there are often glands situated, are these, 1. The ductus cholidocus communis: this opens obliquely into the duodenum. 2. The ductus cysticus: this runs from the gall-bladder to the duct already mentioned. In man it is often tortuous, and has frequently valves of various kinds in it. 3. The ductus hepaticus: this runs from the liver to the ductus cholidocus; and the branches of this, distributed thro' the whole liver, make what are called the pori biliarii.

The lymphatick vessels of the liver are to be demonstrated, either by a ligature of the vena portæ in living animals, or by inflation into the artery, or the hepatick duct. To these vessels we are to add, the canalis venosus in the foetus, and the great sinus of the vena portæ.

The



The substance of the liver has been variously described by authors of different times. The ancients supposed it to be formed merely of blood, concreted into a firm mass, about the sanguiferous vessels. Malpighi, and many of the later writers, have determined it to be glandulous; and Ruysch makes it vasculous, declaring it to be formed of a congeries of very minute vessels.

The gall-bladder, called *vesicula* and *cystis fellea*, is a bladder usually of the shape of a pear, and is situated in the concave side of the liver. In this we are to observe the size, which is nearly that of a small hen's egg; its neck, which is capable of shutting, as it were, by a sphincter; and its fundus or bottom: this, in a man who stands erect, is its lower part; and its neck its upper. It lies upon the colon, and tinges that part of it with its own colour.

The gall-bladder.

We are to observe also its cohesion, which is by means of the common membrane, and of the vessels; its duct, called *ductus cysticus*, and mentioned already; and its *frænulum*, by which the cystick duct is joined to it.

It is composed of four membranes, or coats:  
1. The common coat. 2. A vasculous one.  
3. A muscular one, consisting of strait, oblique, and transverse fibres. And, 4. A nervous one, of a wrinkled or reticulated surface within, and furnished with an unctuous liquor. In this there are sometimes certain minute glands discoverable.

This fabrick seems also to be common to the biliary ducts. We are also to observe the vessels, which it has in common with the liver, and which in it are called *vasa cystica*, or cystick vessels\*; and the *radices felleæ* of authors, which are easily

\* These are excellently delineated by Ruysch, Ep. 5.



discoverable in oxen, and other large animals; but not so in man.

We are then to enquire into the manner in which the bile is carried into the cystis, or gall-bladder: in human subjects, the greater part of it seems evidently to enter into it thro' the ductus cysticus, from the ductus hepaticus, and ductus cholidocus; and part of it seems as evidently to be secreted within the bladder itself. In oxen, beside both these ways, there is a great part carried in by the hepatico-cystick duct, and the radices felleæ\*.

The use of the liver is to secrete the bile from the blood, brought thither by the vena porta. The antients supposed its use to be sanguification.

The use of the gall-bladder is to collect the bile, first secreted in the liver, and mixing it with its own peculiar produce, to perfect it farther; to retain it together a certain time, and then to expel it.

The use of the bile is to attenuate the chyle, to mix the oleaginous parts of the blood with the aqueous, to stimulate the intestines, and, in part, to change the acid of the chyle.

The bile is properly of two kinds, and is distinguished under them by the names of cystick and hepatick. The hepatick bile is thin, almost insipid, and scarce coloured. The cystick bile is thicker, more coloured, and very bitter.

The  
spleen.

218. The spleen: lien, or spleen, is a viscus of a deep blackish-red colour, situated on the left side of the stomach, under the diaphragm, and near the ribs. It is usually single, tho' sometimes there have been found several in the place of one†.

\* See Bohn, in the Acta Erudit, 1682, p. 20. 1683, p. 126. and Verheyen, T. 11. fig. 6.

† See Schelham. Analect. Diss. 10, and 11. and Cheselden's Anat. p. 181.



Its figure is somewhat uncertain; but it is usually that of a tongue, it is hollow toward the stomach, and convex toward the diaphragm and ribs: often however it is irregular, and has in many parts fissures. It is connected with the stomach by the *vasa brevia*; and with the pancreas omentum, the diaphragm, and the left kidney, by membranes. Its size is various. Its length is usually five or six inches in the human body. In dogs, hogs, and many other animals, it is much longer and thinner. Its breadth is about three inches: its thickness about an inch; and its weight about twelve ounces.

In human subjects the spleen has but one membrane; but in calves, and some other animals, it has two: in this case the external one is robust, common, and adheres but laxly, by means of the sanguiferous vessels, to the inner, which is proper and very thin, and, when the outer one is taken off, transmits the breath.

The vessels of the spleen, considering its size, are remarkably large. Its artery is from the *coeliac*, and is called the splenic artery: this, in human subjects, readily transmits water, air or mercury, thrown into it, into the veins.

The splenic vein, in calves, &c. is, soon after its ingress into the spleen, transformed into cells: but, in human subjects, it is, as in the other viscera, very much ramified; and its branches are carried throughout the whole spleen\*.

In calves both vessels enter at one extremity; but in the human body they are divided into various branches, and run over the whole concave or

\* Ruyfch has demonstrated this, against the opinion of most of the modern writers, *Epist. 4. T. 4.* Most other anatomists have given their draughts of the spleen from that of a calf, not from a human one.



internal surface. The nerves of the spleen are from the plexus splenicus. The spleen has no excretory duct; but there are in it lymphatick vessels, running to the receptacle.

The substance of the spleen has been said to be cellulose and glandulose. In calves, indeed, it is cellulose; but in man it is vasculous and fibrous. What authors have described as glands in the spleen, Ruysch has proved to be only vessels. There is, indeed, often found a lymphatick gland or two, of about the bigness of a bean, without the spleen, near where the vessels enter into it; but the substance of the viscus itself is not to be supposed glandulous for that reason.

The use of the spleen has been much controverted by authors. The most probable opinion seems, that it is to render more fluid the blood, out of which the bile is afterwards to be secreted, which is naturally thick; and that by this means obstructions, which must otherwise be frequent, are prevented, and the secretion of the bile is promoted.

The kidneys.

219. The kidneys, *renes*, are two red viscera, of an oblong figure, resembling, in some degree, that of a kidney-bean. They are situated at the loins, one on each side; and their hollowed side is turned inward, their convex side outward.

They are situated near the two lowest spurious ribs: but this is not exactly regular; for they are in some subjects a little higher, and in others a little lower: and one of them is not unfrequently placed a little above the other. Sometimes they are perfectly even: it is not always the same kidney that is placed highest; but sometimes the right, sometimes the left is so. The kidneys are connected with the loins, the lower ribs, the colon, the succenturiati, the renal vessels, and the ureters.



ureters. They have two membranes, the one robust and common, called the adipose membrane: this surrounds them but loosely, and is furnished with its own proper vessels. The other membrane is proper, and is very thin, and every where applied closely to the substance of the kidneys.

The length of the kidneys is five or six fingers, the breadth three, and the thickness about a finger and a half. The surface is, in adults, smooth and equal; but in the foetus in human subjects, and in the grown animals of many other kinds, it is irregularly divided, as it were, into a number of lobes.

The vessels of the kidneys are included, as those of the liver, in a membrane, from the peritonæum, or a kind of capsule. The arteries and veins are large, and are called emulgents and renal vessels: they are produced from the aorta and the vena cava. The nerves are from the plexus renalis; and there is a large excretory duct called the ureter. There are also a number of lymphatics, passing to the receptaculum chyli. The substance of the kidneys is firm and hard, and is of two kinds. 1. The exterior, or cortical, which, according to Malpighi, is glandulous; but, according to the discoveries of Ruysch, is throughout elegantly vasculous\*. 2. The interior, which is tubulous, and expressed by the name of tubuli urinarii Bellini: this terminates in ten or twelve papillæ, which open by a multitude of apertures into the pelvis†; but these papillæ are not found in all subjects§.

\* See Ruysch's Thesaur. Anat. 3. T. 4. fig. 2, and 3; and his Thes. 4. T. 1. fig. 1.

† See Ruysch's Thes. 3. fig. 3. and Thes. 3. T. 1. fig. 1.

§ See Schelham, Anal. Diff. 11.



The pelvis is a membranaceous cavity, sending out several processes, called the tubuli of the pelvis, and surrounding the renal papillæ.

The use of the kidneys is to secrete the urine from the blood into the pelvis, and send it thence by the ureters into the bladder.

Succenturiati.

220. The renes succenturiati, called also glandulæ renales, and by some capsulæ atrabiliaria, were first described by Eustachius\*. They are two yellowish glands, of a compressed figure, lying on each side of the upper part of the kidneys. They have a very narrow cavity, imbued with a brownish liquor of a sweetish taste.

Their figure is irregular, between square, triangular, and oval: sometimes it is nearly one of these, sometimes very different from them all. Their size also is various; but in adults they are, in general, about the bigness of large nux vomica. In the foetus they are larger, and often exceed the kidneys themselves in size. The membrane that surrounds them is very thin: it closely involves their whole substance, and connects them with the kidneys.

Their blood-vessels are sometimes sent from the aorta and vena cava; but more frequently they are from the emulgent: their nerves are from the plexus renalis, and their lymphatick vessels are numerous. There is no excretory duct discovered in them, and their use is therefore not certainly known. By their great size in the foetus, they seem destined rather to the service of that state than of any other.

The ureters.

221. The ureters are two membranaceous tubes, or pipes, nearly cylindrick in figure, and of about the thickness of a quill; but their diameter is very uncertain. They arise from the kidneys

\* See Eustachius, lib. de Renibus.



neys, one from each; and terminate in the urinary bladder. At their origin in the kidneys, they are expanded into the form of a funnel; and this expansion makes the pelvis of the kidneys, already mentioned. At their termination, which is in the hinder and lower part of the bladder, they pass obliquely in between its membranes, and open into the bladder by very narrow orifices, and can admit nothing into them from the bladder. They are not strait, but somewhat bent, so as to resemble the letter S. Their substance is membranaceous, and they are composed of three coats: the first, a common one from the peritonæum; the second, a thin muscular one; and the third, a nervous one, covered with a lubricous humour, and in this there are sometimes discovered glands\*. The blood-vessels and nerves come from the adjacent parts: The use of the ureters is to receive the urine, secreted in the kidneys, from the pelvis, and to carry it to the urinary bladder. When these are obstructed, a suppression of urine is the consequence; for there is no other way for the urine to get into the bladder, but thro' them.

They are often found of an unnatural size, owing to stones concentered from among the urine†.

222. The urinary bladder is a membranaceous hollow body, of the figure of a pear, situated in the pelvis, and destined to collect, and, at a proper time, to expel the urine. Its size is such, that it will conveniently hold about a pint in adults; but it is capable of distension, so as to hold much more. It is, in the human body, connected in a

\* See Ruysch's Observ. 15. and Morgagni's Advers. 3. 71.

† See Ruysch's Observ. 15. and Cockswith's Dissertat. de Valv. Uret.



singular manner by the peritonæum to the os pubis, otherwise than in other animals. It is also connected with the parts of generation by the urethra, with the navel by the urachus and umbilical arteries; and finally, in men, with the intestinum rectum; and in women, with the vagina.

It is divided into three parts, the body, the neck, and the fundus or bottom: the coats of the bladder are much thinner in the body, and the fundus, than they are at its neck. Its blood-vessels come from the hypogastrick, the umbilical, and the hæmorrhoidal vessels in men; and in women, from the spermaticks also. Its nerves are from the intercostals, and principally from those of the os sacrum. Its lymphaticks were discovered by Zeller \*.

Its structure is membranaceous, and consists of three coats or membranes. The first is called the common membrane: this is continuous with the peritonæum, and surrounds only the bottom of the bladder †; and there is usually some fat found under it. The second coat is muscular, and is composed of several series of fibres, running in various directions, but principally longitudinal and transverse. The third or inner coat is nervous, and is covered with a peculiar fluid of a mucous nature, which is secreted in glands situated in this coat, and principally in that part of it which is near the neck of the bladder §.

The sphincter of the bladder is composed of a series of transverse fibres, running cross-wise under the strait fibres of the neck of the bladder, in form of a circle, and serving to close it, to pre-

\* See Zeller's Disput. de Administr. vas. lymph. p. 3.

† See Cheselden's Lithotomy.

§ See De Graaf de Organ. Generat. T. 5. and Drake's Anthropolog. T. 3. fig. 1.



vent the involuntary discharge of the urine. In man this is connected to the fibres of the intestinum rectum; and in women, to those of the vagina.

The foramina of the urinary bladder are three; two where the ureters enter in, at which the urine is thrown into the bladder; and one, much larger than these, in the neck of the bladder, for the discharge of the urine out into the urethra. The uses of these apertures are too obvious to need explanation.

223. The urethra is a tube, or canal, of a membranaceous structure, and nearly of a cylindrical figure. It is continuous with the neck of the bladder: it seems to give passage to the urine out of the bladder. In women it is scarce two fingers breadth long: in men it is much longer. But of this, more in the description of the parts of generation.

### C H A P. III.

#### *Of the parts of generation in men.*

224. **I**N our examination of the parts of generation in men, we are to observe, first, the testicles; these are two, and are contained in a peculiar bag, called the scrotum. Their figure and size are sufficiently known. Their coverings are of two kinds, common and proper: in regard to these, we are first to observe the scrotum. This hangs down below the penis; and, in adults, is in part covered with hair. It has a longitudinal suture, by which it is divided into two sides, a right and a left. It is composed of the cuticula cutis, and a musculous membrane, called the dartos, by means of which it is contracted. It

Testicles.



has in the midst a septum, formed of the dartus, by a duplicature of it, and dividing the scrotum into two cells. Ruyfch and Ravius have treated largely and accurately of this septum. It has its vessels from the pudenda and hypogastricks; its nerves from the os sacrum. Its use is to contain and cherish the testicles.

Beside this external covering, the testicles themselves have three coats, or tunics: the first composes the cremaster muscle, the office of which is to raise the testicle. The second is the vaginalis tunica, formed of a process of the peritonæum, and laxly surrounding the testicle. And the third is the tunica albuginea: this is robust and strong, and adheres closely to the substance of the testicle. This receives the spermatick vessels, and conveys them to the testicle.

The vessels of the testicles, beside those already named, as common to them and to the scrotum, are, 1. The spermatick arteries, which arise from the aorta by a very narrow origin. 2. The veins, the right one from the cava, the left usually from the left emulgent: these have no valves; and they make many anastomoses in their course, and form what are called the corpus pampiniforme, and corpus pyramidale. Their nerves arise from the plexus of the nerves of the pelvis, and of the loins. There may also be discovered in them a great number of lymphatics, if they be examined in an animal yet living; otherwise it is not so easy to see them.

The substance of the testicles is vasculous. They are composed of a great number of extremely minute vessels, called *vascula feminalia*, which are convoluted about one another, in the manner of the intestines\*. These appear very

\* See Cheselden's Anatomy, T. 28. and Ruyfch's Thesaur. 4. T. 1. fig. 2. and Thesaur. 8. T. 3. fig. 3.



beautifully, after macerating the testicles in vinegar. There are no glands in them.

There is also a body, called, from the discoverer, corpus Highmori, in which there is a cavity formed for the reception of the semen. This in human bodies, is placed on the back of the testicle; but in dogs, and many other animals, it is in the middle of them\*.

The use of the testicles is to produce the semen masculinum for generation. In this liquid there have been discovered, by the microscope, multitudes of minute living animals†.

225. The epididymides, or parastatæ, are two in number; one to each testicle. They are oblong, nearly of a cylindrick figure, resembling, in some measure, the body of a caterpillar or silkworm, and laid on the upper circumference of the testicle. They are connected with the testicles, by means of the tunica albuginea, and also with the vas deferens. De Graaf has treated largely and accurately of these, as well as of the other parts of generation. Their origin is in the testicles, by five or six very small seminal vessels; and their termination is in the other extremity of the testicle, where the vas deferens begin. They are surrounded by a robust membrane, which is continuous with the albuginea of the testicle. They are composed of vessels, in the same manner as the testicles; but the vessels they are composed of, are much more conspicuous than those which form the substance of the testicles; and they are capable of being elegantly filled by injections. All these vessels terminate in one duct at last, and

\* See Highmore's Anat. T. 10, and 11.

† See Lewenhoeck in the Philosophical Transactions, Boerhaave's Inst. Med. and Vallisneri de Generat. T. 1. and Cheselden, T. 28.



this duct is what is called the vas deferens. Their vessels are the same with those of the testicles, and are called spermaticks. Their nerves proceed from the same branches with those of the testicles. Their use is to receive the semen from the testicles, to farther elaborate and perfect it, and, finally, to convey it into the vas deferens.

Vas deferens.

226. The vas deferens, called also by some, from its office, vas ejaculatorium, is a robust tube, of a whitish colour, resembling a nerve. It is of the thickness of a moderate straw. One of these vessels is carried from each of the epididymides to the vesiculæ seminales, and the urethra.

The progress of the vas deferens is thro' the process of the peritonæum up to the abdomen; and after this, down again to the urethra, bending back about the neck of the bladder. It terminates in the anterior part of the vesiculæ seminalis, partly running strait into the urethra, and partly obliquely into the vesiculæ seminales: by this means it discharges its contents, as the occasion requires, either into the vesiculæ seminales, or immediately into the urethra.

Its substance is robust, strong and tough, and much like that of the nerves. Its cavity, at the origin, is scarce large enough to admit a hog's bristle; nor does it much increase in the progress of the vessel, till it comes near the bladder; but it then grows much larger: and after this, toward the extremity, it is very narrow again; so that it never emits any thing into the urethra, except under the circumstances for which it was destined, that is, in coition.

The use of the vasa deferentia is to carry the semen masculinum from the epididymes continually to the vesiculæ seminales, and in the coitus to discharge it into the urethra: probably also, it has  
some



some share in the elaborating and perfecting that important fluid.

227. The *vesiculæ feminales* are two membranaceous cellular receptacles, joined to the posterior part of the neck of the bladder, and destined for the reception of the semen from the *vasa deferentia*, for the farther elaborating and perfecting that fluid, and for the discharging it at a proper time into the urethra, in order to its being thrown out to do its destined office in impregnation.

The *vesiculæ feminales* are in length about three fingers breadth, and in breadth about one. They are composed of a strong, vasculous, and, as it were, musculous membrane, which forms a number of cells, communicating with one another, and surrounded with a robust part of the peritonæum. These cellules may, however, all be resolved into one, as it were \*.

The excretory duct of the *vesiculæ feminales* is double. There is one from each vesicle, and it ordinarily terminates by a double orifice into the urethra. Leal is very erroneous, when he describes only one duct, and one aperture †.

The *vesiculæ feminales* have arteries and veins in great plenty, from the vessels of the bladder, and of the rectum. The nerves they have are from the plexus of the pelvis: their internal surface is wrinkled, and, as it were, reticulated like that of the *vesica fellea*, or gall-bladder §. There are not wanting authors who affirm, that there are glands in this part; but they are not easily seen.

\* See Leal de Part. Sem. Conf. fig. 2.

† See the same, p. 27.

§ See Santorini, p. 201.



The pro-  
statae.

228. The prostatae, or, as it might be more properly written, the prostata; for the two bodies, as they are called, of this name, form really but a single one; is of a roundish, or somewhat heart-fashioned shape; and is situated just before the neck of the bladder, and surrounds the whole beginning of the urethra \*. In size it is about equal to a wall-nut; and it has two prominences of a round figure in its hinder part, called prominentiae natiformes. Its eminence, called the caput gallinaginis, is in the urethra, and has two orifices, which are common to the vesiculae feminales, and the ejaculatory ducts; and not unfrequently, there is a little sinus also between these †.

The substance of the prostatae is glandulous and cavernous: it is very robust, and is surrounded by a strong membrane. The foraminula, or excretory ducts of this gland, discharge from the little cells, that are in it, a thin white fluid. In the human body there are ten or twelve of them: in dogs they are greatly more numerous. The vessels of the prostata are common with the vesiculae feminales.

The use of the prostata is to secrete a whitish fluid, which, because it is ejected in coition, some have supposed to be of use in generation: but this is evidently not the case; for eunuchs have it, and discharge it as others do. It seems destined by nature to lubricate the urethra, and to be a kind of vehicle to the semen, which is too thick otherwise to pass with the necessary ease.

The pe-  
nis.

229. The penis comes next under consideration. This is, in man, the primary organ of generation. It is called also mentula, virga, priapus, and by a multitude of other names. Ana-

\* See Cheselden's Lithotomy, T. 6.

† See Morgagni's Adversar. 4. p. 6. fig. 1, and 2.



tomists divide the penis into three parts, the body, the glans, and the urethra.

In the body of the penis we are to observe the cuticle, and cutis, as the common teguments. After these we are to examine the prepuce, which is a duplicature or replication of the cutis, covering the glans: in the lower part of this is fixed the frænulum, and both these are thickly beset with nervous papillæ, and little vesicles or folliculi, commonly supposed to be glands, but not truly such. These follicules are what Du Tyson calls glandulæ odoriferæ\*.

After this we are to observe the proper tegument, or coat of the penis. This is a robust coat, of a membranous nature, surrounding every part of the penis. It is sometimes double; and has, in the interstitial space, a cellulose coat, which is discoverable by inflation, and drying in that state†.

Under this are the two bodies which constitute the penis: these are called corpora spongiosa, and corpora cavernosa. They arise distinct, and separate on each side from the ossa pubis, as it were, from peculiar thalami§. After this they join, and in that original state are carried on to the glans. If any liquid be impelled into these, or if they be inflated, the penis becomes rigid. Between these two bodies is a septum, which rises from the conjunction of the parietes of these bodies. It is thicker in the hinder than in the anterior part, and is perforated in the manner of a sieve.

\* See Cowper's Myotom. reform. p. 228.

† See Ruysch, Epist. 15. T. 19. but he owns this cellulose tunic is not always to be found.

§ See Santorini, p. 188.



The penis is joined by synchondrosis to the ossa pubis by means of a ligament, called ligamentum vesalii \*, as also by its lateral ligaments.

The muscles of the penis are numerous: they serve principally for the erecting it; but these are to be treated of hereafter in the myologia.

The vessels of the penis are very numerous, and are distributed thro' it in a very surprising and beautiful manner. See them delineated Tab. 5.

The glans, called also the head, and the balanus of the penis, is its anterior extremity. Its surface is very smooth and polite; and it is very sensible to the touch, which is owing to a multitude of nervous papillæ distributed all over it, and most obvious when the penis is erected. In the front of this is the aperture, or extremity of the urethra: this is smaller than the rest of the cavity of the urethra; and immediately under this is inserted the frænum, or frænulum of the penis.

The posterior extremity of the glans, with its neck behind, is distinguished by the name of the corona. In this part some authors say they have discovered a number of minute glands †; but Santorini does not allow what they call so to be glands: he says, they are only the mouths of excretory ducts.

The glans is composed of the epidermis and the corpus cavernosum, which is continuous with the urethra; and in this part is expanded, as it were, into a kind of bulb or globe §. The coat of the penis is also added to these ‡.

\* See Morgagni, *Advers. Anat.* 1. T. 4. fig. 4.

† See Littrius *Hist. Acad. Reg. Par.* 1700. and Morgagni *Advers.* 1. T. 4. fig. 4.

§ See Ruysch *Obs. Anat.* 100.

‡ See Santorini, p. 191.



The urethra is a membranaceous tube or cana., nearly of a cylindrick figure, continuous to the neck of the bladder, and extended to the extremity of the glans. Its office is to give passage to the semen and urine.

The urethra is situated in a kind of furrow, formed between the two corpora cavernosa, in the bottom or lower part of the penis. It does not run perfectly strait; but is bent in a very singular manner\*. Its length is twelve or thirteen inches, from the neck of the bladder to the extremity of the glans. Its cavity is as large as that of a goose-quill. It is composed of two robust membranes, an exterior and an interior: their substance is firm and tough; and between them there is a spongy or cavernous matter, in which some authors pretend to have discovered glands: but this is uncertain†.

The bulb of the urethra is next to be examined. This is that part of it which is next to the prostatae: it is much thicker than the rest of the tube, and is about an inch long, and in some measure resembles a wall-nut. It is of a thick and spongy texture.

The interior surface of the urethra is full of roundish and oblong foraminula and furrows, out of which there may often be pressed a thick, viscous fluid: the use of this is to lubricate the urethra, and to defend it from the acrimony of the urine‡.

230. To the consideration of the penis, there yet also belong the glands, called, from their dis-

\* See Alghifius's Lithotom. and Morgagni Adv. 3. p. 82. where they are better expressed.

† See Terran. lib. de Gland. p. 32.

‡ See Morgag. Advers. 1. T. 4. fig. 4. c. See also Littr. nov. Urethra Descriptio.



Glandulæ coverer, glandulæ Cowperi mucosæ. He describes Cowperi. three of them \*: two of them are situated regularly one on each side the urethra, between the musculi acceleratores and the bulb. They are said to be of an oval figure, but somewhat compressed, and are of the size of a horse-bean. They secrete a mucous pellucid liquor, which each discharges at its own duct into the urethra. These ducts are separate and distinct, and are about two fingers breadth long, and perforate at their extremities the coats of the urethra. The use of the fluid, which they secrete, seems to be to lubricate the urethra, and to defend it from being hurt by the acrimony of the urine. Cowper is too accurate and faithful a writer, to have described parts which he did not find: but anatomists, since his time, have often failed of them; so that either there is some error in the account, or they are not universal in all subjects.

The third of them, which is single, is in the angle of the curvature of the urethra, under the os pubis, and within the corpus spongiosum, or cavernosum of the urethra. Such is the account of its situation given by Cowper; and he has figured it of the size of a small pea: but this also is wanting in bodies dissected by our best anatomists.

Glandula  
Littrii.

231. Finally, we are to observe the glandula Littrii †. This is a gland situated just below the prostata, and lodged between the two membranes or coats of the urethra. It is of a dusky redish colour, and is an inch broad, and about a sixth of an inch thick. It surrounds the interior membrane of the urethra, in the manner of a zone; and, perforating it with several small foraminulæ, it pours into it a mucous liquor; the office of

\* See Cowper's Descr. Gland. nuper detect. 4to, London.

† See Terran. de Gland. p. 65.

which



which is, like that of the other liquors of the same kind already mentioned, to lubricate and defend the urethra.

232. The vessels of the penis, urethra, and these glands, are in common. Their arteries are from the hypogastricks, and those of the pudenda. The veins, which all have valves, carry back the blood to the veins of the same parts; but, before they join them, they make various anastomoses, and form a wonderful kind of reticulation in the body of the penis, and under the ossa pubis. Santorini has well described this wonderful implexity of them, and calls it the labyrinth. The nerves come from the last of those of the os sacrum; and the lymphatick vessels are numerous, and are beautifully delineated by Cowper and Drake †.

233. The uses of the penis are two, a primary and secondary. The primary use of it is to serve in the office of generation: the secondary, for the excretion of the urine.

#### C H A P. IV.

##### *Of the parts of generation in women.*

234. **F**ROM the examination of the parts of generation in men, we are to pass to those of women. These are divided into the external and internal. The external parts, or those which may be seen without dissection, are these:

The pudendum, or vulva; in the midst of which is an opening, and the orifice of the vagina: at the lower part is the frænulum, and the perinæum.

\* See Memoirs of the Paris Academy, 1700.

† See Cowper's Myotom. reform. fig. 10. and Drake's Anthropolog. T. 6.



The labia are two; and over them is the mons veneris, which is tumid, from some fat that is within it, and is covered with hair.

The clitoris.

The clitoris, or, as some call it, *mentula muliebris*, is situated in the upper part of the aperture, and, in its common state, is almost entirely buried under the skin or prepuce. Its general size is about that of the uvula, or scarce so much: its shape also much resembles that of that part; but it sometimes is found of an extraordinary bigness, as large as the penis\*: but in this case it has no urethra. It has a glans, or apex, as the penis has; but this is not perforated: it is usually covered with a foetid matter, like that of the glans of the penis†. The prepuce, covering the glans of the clitoris, is formed of the cutis of the pudendum, and furnished with nervous papillæ: hence it is of exquisite sensibility to the touch. It has also a ligament, by which it is connected to the ossa pubis, in the same manner as the penis is in men§. It has two crura, or legs, which run from the ossa pubis, and are three times as long as the clitoris, in its natural state. It has also its two cavernous or spongy bodies, with a septum between them, which constitute its body, very much as in the penis, and these are surrounded with a nervous membrane.

There are two erector muscles also belonging to the clitoris, like those of the penis: these arise from the ossa ischii, and are inserted into the corpora cavernosa. The vessels are common to this,

\* See examples of this in Panarollus, Platerus, De Graaf, Tulpius, and others.

† See Santorini, p. 191.

§ See De Graaf de Mulierum organis, cap. 3. and also Morgagni Advers. p. 20.

and



and to the other external parts. The arteries and veins come from the hypogastricks, and those of the pudenda; and the nerves from the os sacrum. Several very large ramifications of these run along the back of the clitoris; and hence it is, that it is all over of such exquisite sense.

Its use is to produce a titillation in the coitus, and to increase the pleasure.

The nymphæ come next under consideration. <sup>The</sup> These are two membranaceous parts, situated on <sup>nymphæ.</sup> each side the rima. They are of a red colour, and cavernous structure, and somewhat resemble the wattles under a cock's throat. They are sometimes smaller, sometimes larger, and are continuous to the præputium of the clitoris, and joined to the interior side of the labia. In these we are to observe the nervous papillæ, which are very copious, whence their quick sense; and their small glands, which secrete a fatty matter\*. The use of the nymphæ is to increase the pleasure in coition, and to direct the course of the urine.

We are next to observe the orifice of the vagina, or the os uteri externum. This is surrounded with a cavernous substance, which swells in the time of coition: it is very small in virgins, larger in those who have had commerce with man, and much larger still in such as have borne children. It is always, however, much smaller than the rest of the vagina.

The hymen is a membrane, sometimes of a circular, sometimes of a semi-lunar figure, and sometimes of a form different from both †. It is

\* See Morgagni Advers. 1. T. 3. let. ee.

† See Morgagni Advers. 1. T. 3. in gg; and Santorini, T. 2. fig. 1. e. Our author found it in a girl of fourteen, just as there described.



always found in young subjects, and stops a part of the passage of the vagina. It has a small aperture in girls, and a larger in adults, who have not conversed with men: After the first coitus it is not to be found: it is always destroyed by it; and, if it have not been injured before, always some blood follows the rupture of it.

The *carunculæ myrtiformes* owe their origin to the breaking of the hymen: they are, therefore, not to be found in subjects in which that membrane exists intire. They are two, three, or four in number, and are placed where the hymen was.

The urethra, or urinary passage, is situated strait under the clitoris, and shews itself by a little eminence. Its length is about two fingers breadth: its diameter is greater than in man; but somewhat narrower at the end than elsewhere: it is capable of great dilatation. There are in it certain little ducts, which convey to its inner surface a mucous humor, for lubricating and defending it from the acrimony of the urine; but their origin is uncertain \*.

Finally, we are to observe the *lacunæ* of De Graaf: these are certain little oscula, visible about the urethra; and are ducts which serve to excrete a mucous humour, to lubricate the vagina. These arise from the *corpus glandosum* of the urethra †.

The vagina.

235. The internal parts of generation in women, are these:

The vagina, which is a large canal, not unlike the *intestinum rectum*; but more robust and strong. It is extended from the orifice, already mentioned, to the uterus. It runs between the rectum and the urinary bladder, and adheres to

\* See Morgagni *Advers.* 1. S. 10. and 4. p. 44. See also Terran. de Gland. p. 44.

† See Morgagni *Advers.* T. 1. fig. 3.



both of them. Its natural length is about six or seven fingers breadth ; but it is very distensible. Its diameter is naturally about equal to that of one of the small guts ; but it is capable of great dilatation, especially in the time of delivery. Its orifice is narrower than any other part of it, and is closed with a sphincter. Its substance is membranaceous ; and it is within rugose, and furnished with abundance of nervous papillæ : and to this is owing its quick sensation. Externally it is muscular, and by that is enabled to embrace the penis more closely in coitu.

Its upper part is connected with the bladder, its lower with the rectum, and its hinder extremity with the uterus. The wrinkles of the vagina are not circular, but rather as in the gut jejunum. They are largest and deepest in maids, and especially in the anterior part of the vagina. In people who have been much addicted to venery they are fainter, and seem as if worn down. In women who have borne children, they are almost intirely obliterated.

Their use is to increase the pleasure in coitu, both to the man and the woman, and to render the part capable of the necessary dilatation in parturition.

There are found certain lacunæ, or oscula, about the orifice of the vagina ; such as there also are about that of the urethra. These often are so large as to admit a bristle ; and they have their origin from the glandulæ substratæ, the prostaticæ of Bartholine. Their use is to secrete a fluid for the lubricating the vagina, and for stimulating to venery\*.

The sphincter, or contracting muscle of the vagina, is composed of a series of muscular fibres,

\* See Morgagni Advers. prim. S. 31. T. 3.



arising from the sphincter of the anus, and surrounding the orifice of the vagina; after which it is inserted under the crura of the clitoris. The corpus cavernosum also surrounds the orifice in the same place; and this being liable to distention, with the blood, at the time of the coitus, assists in pressing upon the penis.

The use of the vagina is to receive the penis and the semen, and to emit from the womb the menstrual discharges, the foetus, the secundines, and the lochia.

236. The uterus, called also the matrix, is a hollow body, of a form approaching to that of a pear, situated between the bladder and the rectum, and destined to the office of generation, for the containing the foetus. In this we are to observe,

Its connections in the anterior part with the vagina; and in its lateral part by the ligaments, which are of two kinds: its hinder part is loose.

Its two kinds of ligaments are the lata and rotunda. The ligamenta lata, or broad ligaments, are of a membranaceous structure: they are continuous with the peritonæum; and they join on each side the uterus, and the vagina, to the parietes of the pelvis. They consist of a double membrane, between which is lodged a cellular substance, as in the mesentery. This is easily shewn on inflation.

The ligamenta rotunda have their origin from the upper part of the uterus: they pass thro' the annules of the muscles of the abdomen, and are terminated in the fat, near the groins. They are composed of a double membrane, with a plexus of vessels\*, and a multitude of irregular fibres.

\* See Morgagni Advers. 4. p. 49, 50.

These



These are most distinctly seen in women with child \*.

In women not with child, the length of the womb is about three inches : its breadth, in the upper part, is about two ; and in the lower, it is about one. Its thickness is about an inch and a half : in virgins it is often much smaller than this ; but in women with child, it is of a different size, according to the different time. Anatomists divide it into two parts : the upper and broader part they call the fundus uteri ; the lower, they call the cervix. In this it is the vagina opens.

The orifice, or, as it is otherwise called, the internal mouth of the womb, opens into the vagina, in form of the glans penis in man. It is very small in virgins ; but in women who have had children, or who are but with child, it is larger : and in the last, it is always closed up with a glutinous humor. In the time of delivery it in a wonderful manner expands itself, so as to give passage to the child.

The substance of the womb is musculous : it is composed of a various plexus of fleshy fibres, with a great number of vessels between. In women not with child, it is compact and firm : in those who are with child, it is spongy and sinuous, and is capable of wonderful dilatation, without any diminution of its thickness. It is covered externally with a membrane from the peritonæum : internally its cavity is lined with a porous and nervous membrane. This cavity is very small in virgins † ; and in women with child, the inner membrane almost intirely disappears §.

\* See Santorini, Obs. p. 200.

† See Morgagni, Advers. 1. T. 3.

§ See the same Advers. 4. p. 47.



The blood-veffels of the uterus are tortuous, and make a thousand anastomoses with one another: in women with child, they are dilated into a kind of sinus's \*. They open by a number of little mouths into the uterus and vagina, and are the sources of the menstrual discharges in women.

The arteries are of three kinds: 1. Spermaticks from the aorta. 2. Very large ones from the hypogastricks. And, 3. Others from the hæmorrhoidal. These all communicate, in a surprising manner, with one another; so that, if they be but inflated, or mercury or wax be injected into any one of them, they are all filled in an instant; even those on the opposite side, as well as those of that on which the injection is thrown in. The veins of the uterus are also of three kinds, and of the same denominations: they have no valves, and are greatly larger than the arteries, especially in women with child. Air may often be thrown into the cavities of the uterus and vagina, by inflating these: and, on the contrary, these vessels may often be inflated also, by means of air thrown into the vagina and uterus †. The nerves of the womb are from the intercostals, and those of the os sacrum. The vasa lymphatica have long since been discovered in brutes; but, of later years, Morgagni has found them also in human subjects, in the state of pregnancy ‡. The lymphaticks, commonly figured in the womb by authors, are not from nature.

In the cervix, or neck of the womb, there are a number of little openings, with folds or valves between them §. These seem to be ducts, serving

\* See Morgagni, *Advers.* 4. p. 48. and Vater. *de Utero.*

† See Fanton. *Anat. corp. hum.* p. 186. See also Vater.

‡ See his *Adversar.* 4. p. 76.

§ See his *Adversar.* 1. T. 3.



for the secretion of a mucous fluid. There are also sometimes observed in the orifice, and neck of the womb, certain vesicles, or corpora globosa\*: these contain a mucous fluid, and have been taken by many for hydatides†. Some have supposed them glands‡, and that they secrete that mucous fluid, which, in women with child, closes up the mouth of the womb. Others have given them a much nobler office, calling them the new-discovered and true ovaries, and supposing the foetus formed in them§. And some will have them to be the vesiculæ feminales of the female sex||; and that a prolifick semen is discharged from them in the time of coition. These last opinions are evidently farthest of all from truth; but what their real use is, is yet doubtful. They are much more obvious in women with child, in whom they stand very close¶.

237. The ovaria, called, by the earlier writers, Ovaria testes muliebres, are two bodies of a somewhat globose figure, of a smooth surface, and in colour whitish: they are annexed, one on each side, to the fundus of the womb.

They are connected, 1. To the fundus uteri, by means of the ligamentum teres; a ligament of a cylindrick figure, which the earlier writers used

\* See them delineated in the same place.

† See the authors cited by Morgagni, *Advers.* 1. p. 32. And Ruyfch, *Advers. Anat. decad.* p. 5.

‡ See Morgagni in the same place; and Verheyen, 1. c. cap. 32.

§ See Naboth's *Dissertat. de Sterilitate*; and Fred. Hoffman in *Medic. rational.* T. 1. Against the opinion, see Goelick's *Hist. Anat.* p. 183; Etmuller's *Epist. de Ovar.* and Hilfcher's *de Generat.* p. 2.

|| See Letters of Desnoyes, p. 70; and Blegny's *Zodiac*, T. 1. p. 20.

‡ See Heinrich's *Dissert. de Vesic. feminal. mulierum.*

¶ See Santorini, p. 213.



to suppose the vas deferens in women: but there is no passage from it to the womb, so that this opinion is evidently groundless. 2. To the Fallopian tubes, and to the sides of the pelvis, by the ligamenta lata of the uterus, and the alæ vespertilium. And, 3. To many other parts, by means of the spermatick vessels.

Their shape is nearly oval; but gibbous on the upper surface, and flat below.

Their size differs, according to the age and temperament of the subject. They are largest in persons in the vigour of their age, and in such as are addicted to lust: in such subjects they are found of two drams weight, and furnished with a number of prominent vesicles. In old people they scarce weigh so much as half a dram; and are dry, corrugated, and deformed with cicatrices.

The alæ vespertilium are membranes, placed between the tubæ Fallopiæ and the ovaries.

The ovaries are surrounded by a strong white membrane from the peritonæum; and are of a membranaceous substance, fibrous, reticulated, and full of vessels variously interwoven. Among these there are a number of round vesicles, with a yellow substance disposed under them: these are more or fewer in number, according to the age and temperament of the person; and are filled with a substance, much resembling the white of an egg: and this humor acquires also, on boiling, the hardness and consistence of the white of an egg boiled. From this analogy with the eggs of birds, these vesicles were called by Hornius ova\*, or ovula. The largest of them hardly equal a pea in bigness. There are sometimes ten, fifteen, or twenty, or more than that, in one ovary:

\* Epist. de Genitalibus.



sometimes there are only one or two of them. They are supposed to contain the first rudiments of the foetus \*.

There are often hydatides formed also in the ovaries; but these are morbid, and are often the cause of dropsies in women.

The bodies called corpora lutea, are a kind of glandulous substances †, of a yellow colour, contorted in the manner of the small guts ‡, and disposed under the ovula, which are contained, as it were, in their cavities. These bodies may usually be discerned in virgins; but in women with child they are much more obvious. Their use is uncertain §.

238. The Fallopian tubes are two canals, tortuous in their figure, but approaching to a conic form. They are joined to the fundus of the uterus, one on each side. They were discovered by Fallopius, and named tubæ, from their resemblance to some musical wind-instrument of the trumpet kind. The Fallopian tubes.

They are connected closely and continuously to the uterus, and more laxly to the ovaries, by the alæ vesperilionum; and, finally, to the ossa ilei by the ligamenta lata. Their length is different: it is six, seven, or eight fingers breadth; sometimes more. Their thickness, about the middle, is equal to that of one's little finger: their extremities are smaller: that next the uterus is very small: it opens into its cavity, and may be inflated by blowing into the uterus; or a small style may be thrust up into it. This small extremity

\* See Brendell de Embryone; and Vallisneri de Generat.

† According to De Graaf, Malpighi, Brendell, Berger, &c.

‡ See Vallisneri, and Santorini, p. 121.

§ Morgagn. Advers. Anat. 4. p. 51, and 78; and also Vallisneri and Santorini.



is connected to the uterus: the other is free, and fluctuates about in the abdomen. This is larger, and is fimbriated or fringed round the edges; and, when there is occasion, this extremity applies itself to the ovary, embracing it with these muscular segments or fringes. See their figure T. 3. Fig. 10, and 11.

Their substance is membranaceous and cavernous. They are composed of a double membrane: the exterior one seems to be continuous with the peritonæum; the interior, with the interior membrane of the uterus. They are wrinkled on the inner surface, and are imbued with a lubricous humor; but they are not cellulous in the human body, as in beasts.

They are furnished with a great number of vessels, and have a cavernous substance between their membranes, by means of which they are rendered rigid, on their applying their mouths to the ovary. They are also moistened, on their inner surface, by these vessels\*.

Their use in generation is very great. They become erect in the time of the coitus, from the influx of blood and spirits; and at that time, by a natural motion, they apply their loose fringed extremities to the ovaries, which are furrounded and embraced by them: in this state they convey to them the prolifick matter of the male semen, injected into the womb†; and after one of the ovula is thus impregnated, they receive it, and convey it to the womb‡. This is the regular course of nature in the first effects of the coitus;

\* See Drake's Anthropolog. T. 10. fig. 2.

† See Ruyfch's Thes. Anat. 5. T. 5. fig. 1. and his Adv. Anat. dec. 1. p. 3.

‡ Fœtus's are often found in this tube, and elsewhere out of the uterus. See Note 35.



but accidents of a thousand kinds may impede this. The Fallopian tubes are easily discovered in hens, and other birds, and are called oviducts.

239. The use of the uterus is to admit the male semen; and afterwards to receive from the ovary, by means of the Fallopian tube, the ovulum impregnated by it. After this it retains the foetus nine months, affording it nourishment; and, at the end of that time, it, by means of its own muscular force, expels it thro' the os uteri and vagina.

240. After the impregnation there is a new production of parts in the female, which continues as long as the time of going with child. The principal of these is the foetus\*. The others are the membranes it is enveloped in; the placenta, the navel-string, the umbilical vessels, and the pellucid fluid contained in the membranes, in which the foetus swims. All these are secondary to the great cause, and are produced merely for the sake of the foetus.

## CHAP. V.

### *Of a Fœtus, and the parts appertaining to it.*

241: **I**N the examination of the foetus intire, we are to observe the membranes surrounding it in the uterus, as in an egg†. The exterior of these is the chorion: this is thick, spongy, villose, and furnished with a vast apparatus of blood-vessels. It is contiguous to the uterus, and is separable into two parts, or membranes.

\* See small embryo's delineated in Ruysch's Thef. Anat. 6. T. 2. fig. 3.

† See Ruysch's Thef. 10. fig. 3. and T. 6. in this work.



The interior or second membrane is called the amnios, and is very thin and pellucid. It is contiguous to the former; and has either absolutely no vessels, or at the utmost a very few, and those very small ones, are distinguishable in it. A pellucid and somewhat glutinous liquor is contained in this, and in that the foetus. Both these membranes break at the time of delivery, and the liquor they contain flows out.

A third membrane is the allantois, called also by some membrana farciminalis. This is found in some animals, particularly in cows, very perfect, and continuous with the urachus, which is pervious; but it is not found in human subjects. It serves in those animals for collecting the urine\*.

Its length in a cow is near twelve foot, and its diameter, when distended by inflation, is more than a foot; so that it is an amazingly large and stupendous part. Many authors affirm, that it is equally necessary in the human frame as in that of the beasts in which we find it; and hence they would conclude, that it also exists in women, tho' we do not discover it. Some of these authors say it is situated between the chorion and amnios; and others will have it to be within the amnios†. But as the most accurate of the modern anatomists have not been able to find it, and, added to this, as the urachus is not pervious in the human foetus, at least is usually closed, and many other substantial reasons might be alleged why providence should relieve the human female from so vast an additional burthen in child-bearing, there is great reason to suppose, that there is no such membrane, except in quadrupeds.

\* See our author's observations on the allantois, in the Ephemerid. N. C. cent. 6. obs. 24.

† See Phil. Trans. N. 271. p. 835.



Authors in general have declared, that there are no blood-vessels in the allantois of a cow; but our author has discovered an amazing multitude of them\*.

242. After the membranes including the foetus, The pla-  
we are to examine the placenta. This was called centa.  
by the antients, from its resemblance to the liver,  
hepar uterinum, the uterine liver.

The number of placentæ in human subjects answers to that of the foetus's; as these are usually single, the placenta is usually so also: when there are two or more foetus's, there are always as many placentæ; but in this case they often cohere one to another, so as to seem but one substance; but, even in this case, their vessels do not communicate from one to the other.

In quadrupeds, and particularly cows, there are often a great number of placentæ, sometimes not less than a hundred to one foetus. In this case they are called cotyledones. Fabricius ab Aquapendente has treated largely and accurately of them, in his book de Foetu formato.

The figure of the placenta is orbicular; its diameter is eight or nine inches, and its thickness is about an inch. Its convex and spongy part is connected to the uterus, by means of a very thin and fine membrane, which is reticulated, villose, and continuous with the chorion. Its concave part is turned toward the foetus, and shews a multitude of very large vessels: it is joined to the funiculus, or navel-string, and surrounded with a smooth membrane from the chorion and amnios. It has no fixed or certain part of the uterus to adhere to; but it usually is affixed to its fundus or bottom, in which part Ruysch discovered a

\* See them delineated in the Ephem. N. C. just mentioned.



new muscle in pregnant females, composed of a series of spiral fibres \*.

The substance of the placenta, according to most of the later anatomists, is glandulous: they affirm, that it is composed of a multitude of minute glands; but they have not been able to demonstrate them to the sight. It seems more rational therefore to conclude with Ruysch, and with those who follow him, that it is truly vascular, or composed solely and intirely of the umbilical veins and arteries, interwoven with one another in a curious manner †. What use, indeed, could there be for glands in this part? The secretion of all that enters the placenta from the uterus has been already performed.

The use of the placenta is, 1. Together with the chorion, to absorb the nutritious juices from the mother's uterus, as the intestines do the chyle §; and, finally, to transmit it to the foetus, by means of the umbilical vein. And, 2. It probably serves to refund again to the parent the blood and urine of the foetus, by the umbilical arteries.

243. After the placenta, we are to observe the umbilical vessels of the foetus, which, after the birth, degenerate into ligaments, as already mentioned, Chap. 207.

They are two arteries, a vein, and the urachus. The arteries are much smaller than the vein: they usually arise from the iliac arteries on each side, sometimes from the lower part of the aorta. They pass on each side of the bladder to the navel;

\* See Ruysch's *Advers. Anat.* T. 3. Decad. 3.

† See Ruysch's *Thes. Anat.* 5. T. 1.

§ See Ruysch's *Adv.* p. 16. and also *Memoirs of the Paris Academy* 1714.



and hence thro' the navel-string, with several spiral contortions, they run to the placenta, where they are divided and subdivided into a multitude of ramifications; and, finally, terminate and bring the blood from the foetus back to the placenta; and thence, probably, it passes back to the mother again\*.

It may be asked, however, why the arteries are two, and why not one only, as the vein: perhaps this is the care of nature, to prevent a mortal hæmorrhage, if the navel-string should be hurt in the delivery, or else not sufficiently secured by the tying afterwards.

The vein of the funiculus, tho' but single, is twice as large as the arteries. It has its origin in the placenta, from almost innumerable ramifications, uniting into one common trunk: from thence it continues to pass between the arteries, and with the same contortions that they have thro' the funiculus umbilicalis; and thence thro' the navel to the liver of the foetus, where it terminates in a sinus of the vena portæ, into which it discharges the blood and the nutritious juices which it had taken up in the placenta: from hence, thro' a singular canal, called canalis venosus†, which is of a cylindrick figure, and almost opposite to the navel, the greatest part of the blood passes from this sinus of the porta immediately to the vena cava, and so to the heart: the remainder is distributed, by the branches of the porta, thro' the liver.

The urachus in quadrupeds, in general, is a canal of a pyramidal figure, extended immediately from the fundus of the bladder to the navel; and, after passing thro' this, it is by de-

\* See note 35.

† See tab. 3. fig. 2.



grees enlarged, and makes its way into the allantois at right angles each way, or nearly so \*, and conveys the urine from the bladder into the cavity of this membrane †.

In the human foetus the whole urachus is not pervious, or, at the utmost, it is very rarely so: it is usually found solid, and in form of a ligament. It scarce appears probable, therefore, that it serves the office of discharging the urine from the bladder, in this as in the former case; and especially as there is no such membrane as the allantois in the human body, nor any cavity formed for the reception of so great a quantity of a fluid.

244. What is generally called the funiculus umbilicalis, is a part belonging to the foetus, long and contorted, or twisted in the manner of a cord. It is of the thickness of a man's finger, or more; and is, as before observed, composed of two arteries, and a vein called the umbilical vessel, and surrounded with a common membrane, which is thick, but soft and spongy; and is full of cells, filled with a glutinous humour, and is continuous with the amnios.

The origin of the navel-string is in the placenta, from a multitude of ramifications of veins and arteries. Its termination is in the navel of the foetus. Its length is two, three, or four spans, whence the foetus has room to turn itself freely about in the womb, without danger of forcing the placenta from it: and a second good effect of it is, that on the delivery, if the string be not immediately tied up, a mortal hæmorrhage is not a necessary consequence.

\* See Fabricius ab Aquapendente de foetu formato.

† See Ephemerides, N. C. Cent. 6. Obs. 24.

‡ See the same Ephemerides, Cent. 3, and 4. Obs. 194.

§ See Rohault's Dissertation in the Paris Memoirs 1714.



The use of the navel-string has been already explained in that of the umbilical vessels; but its use, as a compound body, is for security, that the vessels, so essential to the life of a foetus, may not be liable to being broken by its motions, as they would have been, if they had made their way out singly; and its strength, in this conjunct state, makes it also of great use in the drawing out the placenta, after the delivery of the foetus.

245. After this consideration of the parts, we are to enquire, as far as we are able, into the manner of nutrition of the foetus, while in the uterus.

This is probably effected during the first months, while the organs of concoction are not yet formed, solely by means of the navel-string. But in the more advanced state of the foetus, in the latter months, there are many reasons for sup-<sup>Of the nutrition of the foetus.</sup> posing that it is also nourished by the mouth, by means of a soft and somewhat glutinous fluid which surrounds it, and which is probably secreted from the amnios. In support of this opinion, we are to observe, 1st, That a fluid, similar to that of the amnios, is found in the mouth, the oesophagus, and the stomach, not only of the human foetus, but in that of quadrupeds. 2. That this fluid is found also in the small guts of the foetus, but altered and digested. 3. That there are found also in the larger intestines real faeces, called meconium: sometimes the whole ileum is full of these. 4. That in the first months there is a great quantity of this fluid surrounding the foetus, but in the latter months there is but very little of it; and the consumption of it is not easily accounted for, any other way than by its being swallowed by the foetus. 5. That the liquid itself is so extremely proper for the nutrition of the



foetus, that a more fit one could not have been formed or desired. 6. That it seems to be continually pressed into the mouth, œsophagus, and stomach of the foetus, by the perpetual renitency of the uterus itself, and by the pressure of the muscles of the abdomen, and of the ambient air. See note 37.

Finally, another use of it seems to be, that the œsophagus, the intestines, the lacteals, and the thoracic duct, may be the better dilated and kept open by it, and by degrees accustom themselves to the offices they are afterwards to serve to.

246. We are next to enquire into the situation of the foetus in the womb. This in the first months, and even in the middle ones, is perfectly uncertain; but in the latter months it is more regular: in these it is usually in a posture like that of sitting, and its head and neck are bent downwards; its knees are raised up toward its cheeks, and its heels drawn back to its buttocks. Its hands are usually hanging down, and embrace the feet\*. A little time before the delivery it usually changes its position, in such a manner, that its head falls toward the mouth of the womb, and its buttocks and feet are turned upwards. Frequently, however, it varies during the whole time of the pregnancy from the common rule; and at the very instant of the delivery, its head does not present itself; but is turned to one side, or to some other part of the womb.

Delivery. 247. Delivery, partus, is the natural exclusion of the perfect foetus from the uterus, thro' the

\* In the year 1722, a body was opened in the seventh month of pregnancy. The woman had been shot: the head of the foetus was in this subject turned to the os uteri, and the nates and feet upward.



vagina, after the rupture of the membranes it was involved in.

The causes ascribed to the bringing on this exclusion of the foetus, are, 1. That the uterus, being so far distended, can suffer no more dilatation. 2. That the meconium and urine of the foetus stimulate so as to excite it. 3. That there is at that time a necessity of air and respiration: but this is all dubious and uncertain.

The ordinary and regular time of partuition is after nine solar months; that is, ten lunar months, or forty weeks. The premature times of delivery are at the end of the seventh or eighth month: the child may live, however, that is born at either of these periods. The earlier exclusion of the foetus is called abortion: this may happen at any time before the seventh month; and at whatever time it happens, the foetus cannot live.

The ordinary or natural manner of delivery is, when the foetus assists its own exclusion, with its head pressing full against the mouth of the womb. When the mouth of the womb naturally opens, the membranes burst, which had before wrapped up the foetus, and the liquor they contained is excluded; and the foetus is finally expelled by the joint contractions of the uterus itself, of the muscles of the abdomen, and of the diaphragm.

All other situations of the foetus, at the time of delivery, are termed unnatural; and they always cause difficulty in the delivery, sometimes an utter impossibility of it, unless the assistance of art be called in.

Those deliveries in which the child presents its buttocks, or its feet, are the nearest to the natural and proper one; and consequently the child may be thus born either entirely without the help of art, or with but a very little assistance from it.



248. We are, finally, in our examinations into the nature of the human foetus, to enquire into the more essential differences between that and an adult; considering the foetus not only as yet inclosed within the womb, but as newly come from it.

In the abdomen, the umbilical vein, and arteries of the navel, and the canalis venosus in the liver, are, in the foetus, open and pervious; in adults, they are contracted and solid.

The liver is very large; the stomach is filled with a glutinous fluid; and the larger intestines, and often the ileum also, with the faeces called meconium.

The vermiform process of the intestinum caecum, is larger than in adults; and is also full of the meconium.

The renes succenturiati are larger in the foetus than in adults.

The kidneys themselves are not smooth and even on the surface, as in adults; but unequal, and in some measure resemble those of a calf.

The urinary bladder is of a longer shape, and extends almost to the navel.

The hymen in a female foetus is very plain and obvious.

In the thorax, beside a peculiar fluid, found as well in this cavity as in the abdomen,

The gland thymus is larger than it is in adults.

The lungs, as they have never yet been inflated by breathing, are collapsed, and of a blackish colour: and if thrown into water, they sink in it, contrary to what is the case in those of adults.

In the heart, the foramen ovale between the left and right auricle, and the canalis arteriosus, between the pulmonary artery and the aorta, are open, to serve for a peculiar circulation in the foetus,



foetus, which has not yet breathed; and there is in the inferior trunk of the vena cava, near the heart, a remarkable valve\*.

In the head, beside its great size, in proportion to the body, we are to observe, that the ossa cranii are in several places distant from one another, especially at the fontanella, and that the futures are wanting. The brain also is softer than in adults.

The teeth are also imperfect, and not rooted in the gums: they lie hid or buried under the gums, to appear at a more advanced period.

The meatus auditorius is not yet perfect in them; and in the foetus, whilst it is in the womb, is entirely closed up by a peculiar membrane, which is continuous with the epidermis, and which naturally disappears after delivery†.

The bones of the whole body, excepting only a very few, are either soft, or yet absolutely imperfect: some of them are merely cartilaginous; and the articulations are not at that time perfected.

## C H A P. VI.

*The contents of the Thorax, the other part of the trunk of the human body.*

249. **T**HE thorax is that large part of the body situated between the abdomen and the neck: it is also called pectus.

\* Winslow has described this in the memoirs of the French Academy 1717; and Cheselden in his Anatomy, Ed. 1. T. 9. fig. 1. calls it valvula nobilis; but in the third edition he has omitted the plate and the description of it.

† See Kerkring's Osteogenia, p. 222. See also Ruysch.



Its parts are of two kinds, the continent or containing, and the contained.

The continent parts, or those which form the cavity, are either common or proper. The common continent parts of the thorax are, the cuticula, the cutis, and pinguedo. These have been considered already in sections 197, 198, and 201.

The continent parts, proper or peculiar to the thorax, are these: the breasts, the pectoral muscles, the intercostals, the diaphragm, the pleura, and, finally, the bones. Of these there are twenty-four ribs, the sternum, and twelve vertebræ: these have also all been described already in their place in the Osteology.

The contents of the cavity formed by these, or the parts contained in the thorax, are the mediastinum, the lungs, the heart and its pericardium, with the large vessels arising from it, particularly the trunks of the aorta and pulmonary artery, of the vena cava and pulmonary vein, the thoracic duct, and, finally, the greater part of the œsophagus.

The uses of the parts of the thorax in general, are their serving to respiration, and the circulation of the blood in both sexes; and in women to the producing milk.

The  
breasts.

250. The breasts, *mammæ*, occur first in our examination of this part of the trunk. In men they are smaller, and serve to no purpose but ornament. In women they are of the utmost importance; and 'tis, therefore, in the female only the anatomist is to employ his researches.

In the human species they are, for many great and obvious reasons, seated on the breast; in animals of all other kinds, they are situated on the abdomen.

In



In the human species they are only two in number; in quadrupeds of different kinds, they are very various in number and structure.

In order to their being ornamental, it is requisite that they be of a moderate size, and stand at a considerable distance; that their skin be white and soft, their substance firm, not flaccid or pendulous, and the nipple red.

Their size is very various and uncertain. In virgins they are usually small: in women who are with child, or who have given suck, they are larger, often very enormous. In very young and very old persons, they are always small; and they differ in bigness also in the several different countries.

The time of the breasts growing full in women, is about the age of fourteen. The time of their decreasing again is various: about the fiftieth year is the most frequent and most natural time; but it happens sometimes later, sometimes sooner.

The nipple of the human breast is a little eminence, nearly of a cylindrick figure, red in colour, and placed in the middle of the breast, and surrounded with a circle.

Its substance is cavernous, almost like that of the human penis; and hence it is capable of being rendered erect and tumid on titillation, and in suckling. It is composed of a multitude of fine nervous fibres, disposed in a reticulated manner, and is therefore of an extremely quick sense; and is furnished with a great number of blood-vessels from the mammary ones. The extremities of the lacteals also are abundant in it, and the epidermis surrounds every part of it. The foraminula, or orifices of the lacteal tubes, are very conspicuous in women who give suck, on their pressing their breasts,



breasts, and forcing out the milk: they are in number from seven to ten.

The circle which surrounds the nipple is beset with small glands \*. In virgins it is usually of a fine bright red colour: in women a little more advanced it is of a dusky red, or sometimes brownish; and in old women it is livid and dull.

The use of the nipple is for the giving suck to the infant, who, without it, could scarce possibly get at it.

The breasts, beside the common integuments of the body, that is, the epidermis, the cutis, and fat, are composed of a singular glandulous matter, of a whitish colour, not unlike that of the substance of the udder in quadrupeds. This forms the inner or central part, to the midst of which the nipple answers; and is surrounded by a larger or smaller quantity of fat, which makes by much the greater part of the breast †. Nuck ‡, Verheyen ||, and their followers, have described what they call globose bodies, corpora globosa, as distinct glands; but there are by no means glands, but merely fat, as Morgagni has since abundantly proved §.

Among the glandulous substance, however, of which the breasts are composed, there are arranged, beside the blood-vessels, a multitude of lactiferous tubules or ducts, which unite by frequent anastomoses: these are large in women who give suck, and are dilated into sinus's in many places, forming a kind of cells, which hold the

\* As to the nature of these, see Morgag. Advers. 1. S. 12. and 4. p. 8.

† See Morgag. Advers. 4. fig. 3.

‡ Adenographia, fig. 2.

|| Anat. Corp. human. T. 18. fig. 2, and 4.

§ Adversar. 2. 92.



secreted milk, and communicate with the veins and arteries. All these parts are to be seen much more distinctly in breasts that are large, and full of milk, than in others: they are, indeed, scarce to be distinguished at all in young women, in such as have little breasts, in such as are emaciated, or in those of very old people.

The arteries and veins of the breasts are called mammary vessels, and are sent from the subclavian and axillary vessels. The former of these are called the internal, and the other the external ones. The nerves are from the dorsal ones of the spinal marrow; and to these Wharton \* adds lymphatics.

The use of the breasts are, 1. To secrete in their glandulous substance the milk from the arterial blood, to collect it in the sinus's and tubuli lactiferi, there to preserve and retain it, and, at a proper time, to afford it to the infant thro' the nipple. 2. To add to the peculiar beauty of the female. 3. To add a stimulus to venery, on both parts, while they are handled and pressed.

251. When the breasts are removed, there occur certain muscles and the pleura. The muscles are, 1. Two called the pectoral muscles: these are large: there is one of them on each side, extending from under the breast to the arm. 2. The intercostal muscles, no fewer in number than twenty-two external ones, and as many internal: these are placed between the ribs, and serve to elevate them, and to assist in respiration; but of these we shall speak more largely in the Myology, 3. The membrane called pleura, is also to be hereafter treated of singly, and at large: this membrane surrounds the whole cavity of the thorax.

\* Adenograph, cap. 36.



252. When we have observed these, the breast is to be opened; and in this are to be observed the cartilaginous parts of the ribs: thro' these, near the bony part, the incision is to be made on each side, and the sternum is to be elevated. As soon as this is done, there occurs first the mediastinum.

253. The mediastinum is a double membrane, continuous to the sternum, situated under it, and adhering firmly to it. It divides the cavity of the thorax longitudinally into two parts. In this we are to observe the cellulous interstice, which is between the two membranes, and is sufficiently observable in that part of the mediastinum which is nearest the diaphragm: in this there are sometimes abscesses and inflammations.

The mediastinum is connected with the sternum pleura, pericardium, and other adjoining parts. Its situation is not exactly under the middle of the sternum, but somewhat to the left side: by this means the right part of the thorax is rendered larger than the left\*.

It receives veins and arteries from the mammary and diaphragmatick vessels, and sometimes has proper and peculiar ones of its own from the aorta and cava: these are then called the mediastinal vessels. Its nerves are small, and are from the diaphragmatics and the par vagum. It has also a number of lymphatics, which run to the ductus thoracicus.

The uses of the mediastinum are two, 1. To divide the breast longitudinally into two parts, for several very great purposes; as, first, that on one of the lobes of the lungs being ulcerated, the

\* See Winslow in the Memoirs of the Paris Academy 1715, p. 309.



other might not be immediately affected. 2. That water, matter, or any thing else contained in one part of the thorax, might not, at the same time, affect both parts of the lungs. 3. That in case of a wound in one side of the thorax, respiration might be continued in the other, and the person not immediately suffocated. The second general use of the mediastinum is to support the heart in its pendulous state, for the benefit of its free motion, especially when we lie on our backs.

254. When the mediastinum is dissected, and the sternum removed, we are to observe the situation of the several parts in the cavity of the thorax. The diaphragm is placed transversely in the lower part of the cavity.

The glandulæ thymi in the upper and middle part.

The lungs on each side.

The heart in the middle, or nearly so, surrounded with its pericardium; but so placed, that its greater part is on the left side.

The œsophagus, or gulæ, in the hinder part, on the left side.

The great vessels, as the vena cava and azygos, in the hinder part, on the right.

And, finally, the thoracick duct in man, between the aorta and the vena azygos.

255. Before we proceed to examine these Pleura. singly and particularly, we are to observe the pleura. This is a smooth, robust, and tense membrane, adhering to the ribs and to the intercostal muscles, and surrounding the whole cavity of the thorax. In this membrane we are to remark the structure, which is as if it were composed of two sacks, one of which surrounds one side of the thorax; the other, the other side; and each of them contains one of the two lobes of the lungs:



lungs: from the conjunction of these two fuculi of the pleura, in the middle of the thorax, is formed the mediastinum.

The pleura is composed of a double membrane, of a very musculous structure. Its vessels are arteries, veins, nerves, and lymphaticks. The arteries arise from the intercostals, the diaphragmatick and the mammary ones, and are very numerous; the veins, from the veins of the same names with those arteries; but all of them discharge themselves into the trunk of the vena azygos, and the upper trunk of the cava. The nerves are from the vertebræ of the thorax, and the diaphragmatick ones. The lymphaticks all run to the ductus thoracicus.

Many of the later anatomical writers have attributed glands also to the pleura; but this is without foundation.

The use of the pleura is to lubricate, and to strengthen the whole cavity of the thorax.

**Thymus.** 256. The thymus is a gland, which, in infants, is very remarkable: it is situated in the upper part of the thorax, immediately under the sternum, and lies upon the pericardium, and on the trunk of the aorta, and of the vena cava.

It extends itself from the pericardium, along the trunk of the aorta, to the beginning of the carotids; sometimes as far as to the thyroide gland. Its figure is irregular and uncertain\*. Its colour in infants is a pale red; in adults it is of a duskyer hue. It is much larger in infants newly born, than in subjects at any more advanced period. Its length is there not less than three fingers breadth, and its diameter two: its thickness is about half a finger. It gradually decreases from

\* See tab. 4. fig. 14, and 15.



this size as the child grows up \*. In adults it is very small, and in old people it almost entirely disappears.

Its substance is glandulous and conglomerate, and it is surrounded by a membrane. It has its blood-vessels sometimes from the subclavians, sometimes from the mammary, and sometimes from the mediastine ones; and, in some subjects, from the carotids and jugulars. Its lymphatics sometimes run to the thoracic duct, sometimes to the subclavian veins, and they have in general no valves. The nerves of the thymus are from the par vagum, or from the intercostals. There is sometimes a milky juice found in this gland in new-born subjects. It has no excretory duct hitherto discovered, and its use is therefore not certainly known.

Possibly, it serves to secrete lymph, which it discharges into the thoracick duct, for the dilution of the blood and of the chyle; as the glands of the mesentery and pancreas do, in regard to the chyle. On this supposition, its use is much greater in the foetus than at any time after the birth, because the want of respiration in that state may well be supposed to subject the blood to be thicker, and to need more dilution than afterwards, nothing tending to attenuate the blood so much as respiration. Bellinger is of opinion, that it prepares a nutritious fluid for the foetus, while in the uterus, and conveys it by particular ducts to its mouth †; but we are to observe, that neither himself, nor any body since, have ever been able to find out these ducts.

\* It has been found indurated by a schirrus, and very large, in a boy of thirteen, who died of a hectick.

† See his Tract. de foetu nutritio, London 1717.



The diaphragm.

257. The diaphragm is a large, robust, muscular skin, placed transversely in the trunk, and dividing the thorax from the abdomen. The Latin writers hence call it *septum transversum*. Its situation is not exactly even, but somewhat oblique, between the abdomen and thorax; so that the anterior part is higher, the posterior lower; and its upper superficies is convex, its lower concave. It is connected with the sternum, the spurious ribs, the pericardium, the mediastinum, and the vertebræ of the loins. Its figure, taken transversely, is somewhat oblong and elliptick. See Fig. 13.

There are in the diaphragm two large foramina. The first is in the left side of it, and gives passage to the gula and the par vagum. The second is in the right side of it, and the lower trunk of the vena cava passes thro' it. There is also an interstice between the two heads of the lower part, thro' which pass the aorta, the vena azygos, and the ductus thoracicus.

The vessels of the diaphragm are called *vasa phrenica*, from *φρυγ*, the Greek name for the diaphragm: they are arteries, veins, nerves, and lymphaticks.

The arteries are, 1st, from the aorta, or from the coeliac: 2dly, from the subclavian, or mammary: and, 3dly, from the intercostal and lumbar ones\*.

The veins are from the cava, the azygos, and the subclavian.

The nerves are, 1st, two great ones, called diaphragmaticks, arising from the vertebral ones of the neck on each side, and almost totally in-

\* See Ruysch, Epist. 9. p. 23.



serted in it \*: 2dly, some branches from the intercostals and par vagum. The lymphaticks go to the jugular vein †.

The diaphragm is covered with a membrane, on the upper part from the pleura, on the lower from the peritonæum. Its substance is muscular. Its upper part, which is large and elliptick, arises from the spurious ribs, the transverse muscles of the abdomen, and the cartilago xiphoides; and, with its tendon, renders the nervous centre of the diaphragm almost triangular. The lower arises from a double base, from the vertebræ of the loins on each side, and is inserted nearly into the centre of the superior ‡.

The uses of the diaphragm are, 1st, to assist in respiration; for, in taking in the breath, it is pressed downwards, and, in expiration, it rises upward into the cavity of the thorax. 2. To assist the necessary motions of the contents of the abdomen, viz. of the stomach, intestines, liver, and spleen; and in the promoting the secretions of chyle, bile, &c. And, lastly, for assisting in the expulsion of the fæces, the urine, the foetus in parturition, and the secundines.

258. The lungs are the largest viscus of the thorax. They are situated in the two sides of the thorax, having the heart, as it were, in the midst of them. They are connected, by means of the mediastinum, with the sternum and vertebræ; with the heart, by means of the pulmonary vessels, and immediately with the aspera arteria. The colour of the lungs, in infants, is a fine florid

\* The left of these is longer than the right. See Winflow in the Paris Memoirs, 1715.

† See Nuck's Adenographia, p. 142.

‡ Cowper has given elegant figures of the diaphragm, T. 34 and 35, of his Myot. nov.



red; in adults, it is darker; and, in old people, livid, or variegated with black and white. In figure, when inflated, they somewhat resemble the hoof of an ox; and are convex on the upper side, and concave underneath.

They are divided into two large lobes, the right and left; the left lobe, which is the smaller, is divided again into two; and the right, which is larger, into three smaller ones; and these into innumerable other still lesser. The membrane, with which the lungs are surrounded, is continuous with the pleura. Their substance is spongy, or vesicular. They seem, indeed, entirely composed of a number of small vesicles, of a fleshy texture, and of a variety of vessels.

The bronchia are, in their origin, formed of imperfect annuli, or rings; and, in their progress, of cartilaginous and membranous frustæ, very variously connected and joined together. These have their origin from the trachea, and are first divided into branches, afterwards subdivided again, and into almost innumerable ramifications: they finally terminate in those small vesicles, which form the greater part of the substance of the lungs. These vesicles have interstices all the way between them, and adhere, as it were, to the branches of the bronchia, in the manner of clusters of grapes.

The pulmonary artery and vein are divided in the same manner as the bronchia, and accompany them all their length, tho' in a various manner in the various parts; and, finally, extending their ultimate ramifications about the vesicles, they form what is called the rete vasculosum of Malpighi: they do not serve, however, as some have supposed,



posed, merely for the nutrition of the parts; but for the circulation of the blood thro' the lungs.

The vessel called the bronchial artery of Ruysch, is allotted to the nutrition of the lungs: it rises sometimes single, sometimes double, sometimes triple from the aorta and intercostals, and adheres every where firmly to the bronchia\*.

The bronchial vein is either from the intercostals, or from the vena azygos.

The nerves arise from the thoracick plexus of the par vagum and the intercostals.

The lymphatics run to the thoracick duct.

The uses of the lungs are, 1st, for the office of respiration, by which the blood is attenuated in the plexus of arteries, called the rete vasculosum. 2. To be assistant to the voice in speaking, and to the sense of smelling. They are also emunctories of the blood, and are of many other important services.

259. The aspera arteria, called also the trachea, <sup>Aspera arteria.</sup> and fistula spiralis, and in English the windpipe, is a tube or canal, extended from the mouth down to the lungs. Its situation is in the middle and anterior part of the neck; and it is connected with the fauces, the lungs, and the oesophagus. Anatomists divide it into two parts; 1st, the larynx; and, 2dly, the aspera arteria, strictly and properly so called.

The larynx is the thick upper part, or head of the tube just mentioned. In this there is an aperture to the lungs, called the glottis: this is of an elliptick figure, and is furnished with cartilages and muscles†; by means of which it is occasionally dilated or straitened, so as to give the

\* See Ruysch valvular. lymphat. dilucid. p. 61. Epist. 6.

† Concerning these, see the Myology, S. 324.



wonderful variety of notes the voice is capable of, in speaking and singing \*.

The larynx is principally composed of five cartilages. The first is the thyroide, or scutiform cartilage: it is of a kind of quadrangular figure, and stands in the anterior part, where the *pomum adami*, as it is usually called, makes its prominence, and is the largest of the five. The second is the cricoide, or annular one: this occupies the lowest part, by way of base to the rest: to the lower part of this, what is properly called the *aspera arteria* adheres. The third and fourth are the two arytænoide ones †: these form, as it were, a kind of basin of a singular figure, which is joined to the posterior and superior parts of the cricoides, by peculiar articulations on each side, that the glottis may be the more readily opened and contracted §. The fifth is the epiglottis: this is often of the shape of a leaf of ivy, and is joined to the superior and anterior part of the thyroides, over which it appears erect, immediately behind the root of the tongue; to which it is also connected by its middle ligament, by two lateral ones to the cornua of the *os hyoides*, and by two posterior ones to the arytænoide cartilages: this, in the act of deglutition, covers the glottis, in the manner of a moveable bridge, to prevent any thing falling on it.

The membrane which invests the larynx is very sensible, and is furnished with a number of oscula or openings, which discharge a lubricating fluid. There are also glands, called *glandulæ arytænoi-*

\* See Dodart in the *Memoirs of the French Acad.* 1700.

† Santorini will have each to consist of a double one; so number seven, p. 97.

§ These four first cartilages often ossify, as has been already observed.



deæ, and glandulæ epiglottidis, extended over each surface of it, which serve for secreting a mucous fluid, for lubricating the whole aspera arteria.

The ventricles, or sinus's of the larynx, are certain hollows, some of them smaller, some larger, on the inside of it, under the glottis, serving for the modulations of the voice\*.

The aspera arteria, or trachea, properly so called, is the remaining part of that cartilaginous canal before described, which is extended from the larynx to the bronchia; and is, in some measure, of a conic figure.

The beginning of this is round, and is so large, that it easily admits of a finger: its end is somewhat narrower. It enters the cavity of the thorax, under the sternum; and there, before it joins the lungs, is divided into two branches, a right and a left, called bronchia; which are afterwards subdivided and distributed thro' the lungs in very minute portions, 'till by degrees they terminate in the vesicles which compose their substance.

It is composed of eighteen or nineteen, sometimes but sixteen, sometimes twenty cartilaginous rings or annuli, and four coats.

The annuli, or rings, are imperfect; for the whole trachea on its hinder part, as also the beginning of the bronchiæ, are membranaceous: this is contrived by nature, partly, that they may not be troublesome to us in swallowing; partly, that they may be subject to dilatation and contraction, to assist in the modulations of the voice, and in the expulsion of the excrementitious matter, which nature has destined the body to be ridded of that way.

\* Of the whole structure of the aspera arteria, see Morgagni Adv. 1. T. 1, and 2.



Of the four tunics, or coats, the exterior is membranaceous ; the second is glandulous \*, the third is muscular, and the several rings are joined together by this, which is formed of transverse fibres, running from the several extremities of one to the other, so as to have a power of contracting them †. The fourth or internal covering is tendinous and robust : this also, by means of its longitudinal fibres, has a power of rendering the trachea and bronchia shorter, and there are several oscula of glands and secondary tunics seen in it §.

The arteries of the aspera arteria are from the external carotids ; the veins from the jugulars : the nerves are from the recurrent ones of the plexus cervicalis.

The uses of the trachea are, to assist in deglutition, and to be assistant to the lungs.

On the exterior part of the aspera arteria, there are certain glands very observable : they serve for the moistening it. They are the thyroide and bronchial.

The thyroide gland is of a very singular figure, resembling that of a new moon. It adheres by its middle part to the upper ring of the trachea, and its points or horns are turned upwards. It adheres on each part to the larynx and œsophagus. But of this we shall have occasion to treat more largely S. 383.

The bronchial glands are of various sizes, some larger, some smaller. They are of a blackish colour, and are connected to the lower part of the trachea, to the divisions of the bronchia, and to the œsophagus. Their use is uncertain ; but we shall have occasion to speak more of them S. 388.

\* See Morgagn. Adv. 1. T. 2. fig. 1. oo.

† See the same, letter P.

§ See the same, table 1.



260. After the lungs we are to examine the <sup>The</sup> heart. <sup>heart.</sup>

The pericardium is a membranaceous bag, loosely including the heart, and situated in the middle and lower part of the thorax, between the two lobes of the lungs. The figure of the pericardium is conic, like that of the heart itself. Its size is such as can conveniently contain the heart, without pressing upon it. It is connected with the mediastinum, with a great part of the diaphragm, and with the large vessels of the heart, which, together with this covering, sustain also the heart itself in its place. In beasts of most kinds, the heart is not at all connected with the diaphragm by its pericardium.

The pericardium is composed of a double membrane: the exterior one is common with the pleura and mediastinum: the interior one is proper, lubricous, and is continuous with the coats of the larger vessels. This membrane, when expanded upon the finger, frequently discovers a great number of foraminula, or little apertures. The arteries and veins of the pericardium are from those of the mediastinum and diaphragm; and its nerves also are from the diaphragmatics. Its lymphatics all run to the thoracic duct.

The uses of the pericardium are, 1st, to support the heart in a pendulous state, especially when we lie down. 2. To defend the heart from the cold air taken into the lungs. 3. To preserve it from being injured by water, by matter, or any other extraneous fluid in the cavity of the thorax. And, 4. To contain the liquor of the pericardium, as it is called, which serves to facilitate the motions of the heart.

The liquor of the pericardium is a fluid, resembling, in appearance, water in which raw flesh had



been washed. This is found in a small quantity in the pericardium, and seems destined for the keeping the surface of the heart moistened, for the rendering its motions, which must necessarily be continual and easy, the more free : much of a fluid is not required to this purpose, but that there should be some is necessary ; and this bag is destined by nature, among other of its uses, for the retaining of it. The anatomical writers in general, deduce this fluid from certain glands, situated either in the pericardium, or in the heart itself : but as these glands are not to be found, it appears more rational to suppose, that it is expressed out from the auricles of the heart in its systole, whence there is necessarily a constant supply, tho' no redundance of it. The observations made by Bartholine on the case of a wound in the pericardium \*, and the experiments of Thebesius †, tend to confirm this : and, in fine, it seems probable, that it is, when redundant, absorbed by the pores of the pericardium, rather than excreted ; tho' many are against this ‡.

The pericardium is found sometimes, in long hecticks, to cohere with the substance of the heart ; and there are accounts of its having been wholly wanting ||.

261. The heart itself is a muscular part, included in the pericardium, and situated nearly in the middle of the breast, between the lobes of the lungs. It is the primary organ of the circulation of the blood, and consequently of life.

Its figure is nearly conic : its larger part is called its base ; its smaller, the apex : its lower

\* See his Anat. Reformat. cap. de Pericardio.

† Dissertat. de Circulat. Sang. in Corde.

‡ See Littre's Experiments in the Paris Memoirs 1711.

|| See the same, 1712.



part is plane; its upper, convex. Its situation is nearly transverse, or horizontal; so that its base is in the right, and its apex, with the greatest part of its bulk, is in the left side of the thorax; and, consequently, it is there that the pulsation of it is felt\*.

The plane surface of the heart lies on the diaphragm; the convex one is turned upwards. The heart is connected, 1<sup>st</sup>, by the intervention of the pericardium with the mediastinum, and with a large part of the middle of the diaphragm: this is contrived by nature, to prevent its being displaced, inverted, or turned too rudely about, in consequence of the various motions of the body. 2. Its base is connected to its common vessels; but its apex is free, and is received into a kind of cavity in the left lobe of the lungs.

The length of the human heart is about six fingers breadth: its breadth, at the base, is about five fingers; and its circumference about thirteen. Its substance is muscular, and it has two large cavities called ventricles; and is surrounded, both externally and internally, with a smooth membrane. There is a quantity of fat about the heart, which covers its base and its apex, and serves for lubricating it, and for facilitating its motions. Its blood-vessels are of two kinds, common and proper. The proper or peculiar vessels of the heart, are the coronary arteries and veins, which are beautifully and elegantly distributed through the heart, and are finely delineated by Ruysch†.

The common vessels of the heart are two veins, called the vena cava, and the vena pulmonalis; and two arteries, the arteria pulmonalis, and the aorta.

\* See its situation finely expressed in Eustachius, T. 9.

† See Epist. Prob. 3. and Thef. Anat. 4. T. 3.



The nerves of the heart are not large; they arise from the par vagum and the intercostals.

The auricles of the heart are two: they are a kind of appendages of the heart at its base, and are distinguished by the names of the right and left. The right auricle is much larger than the left; and this is placed in the hinder, that in the anterior part. They are intended as diverticula for the blood, during the time of the systole. Their substance is muscular, and composed of strong fibres, running into a kind of columns, as it were, with furrows between them for their constriction, and the expulsion of the blood out of them into the heart, when it is in its diastole: their motion therefore is not synchronous with that of the heart, but achronous.

There are also two cavities in the heart, called its ventricles: of these the right is thinner and weaker in its circumference, but usually much more capacious than the left. They receive the blood from the vena cava, and from the right auricle, and deliver it into the pulmonary artery, to be carried to the lungs. The left ventricle is much thicker and stronger in its sides; but it is narrower and smaller than the right; it receives the blood from the pulmonary vein and the left auricle, and extrudes it very forcibly into the aorta. The right ventricle is in the anterior part of the thorax; the left in the hinder part: so that they might be called the anterior and posterior ventricles, much more properly than as they are the right and left.

Between the two ventricles of the heart there is a very robust and strong septum, which is not perforated. In the right auricle there is also a large tubercle in the hearts of quadrupeds, situated between the meeting of the upper and lower cava.



cava. Lower, and his followers, give great uses to this in the human fabrick; but they should have known, that it is not found in the human heart at all.

There are, in the sides of both the ventricles of the heart, and of both its auricles, several columnæ carneæ, or lacertuli, with furrows between them, seeming so many small and distinct muscles; and from the concurrence of the tendinous fibres of these in the heart, there are formed peculiar membranes, or valvulæ, which are situated at the orifices of the auricles of the heart: and there are also other columns of this kind, which run from one side of the ventricles, transversely, to the other: these serve partly to assist the contraction of the heart in its systole, and partly to prevent its too great dilatation in the diastole\*.

The valvulæ of the heart are of three kinds, 1. The tricuspidales: these are three in number, and are situated at the ingress of the vena cava in the right ventricle. 2. The mitrales: these are two, and are situated in the left ventricle at the ingress of the pulmonary vein: these serve to hinder the ingress of the blood from the heart into the veins again, while they are constricted. 3. The semilunar ones: these are three, and are situated at the origin of the aorta and pulmonary artery, and serve to prevent the reflux of the blood from them into the heart: these, for the sake of strength, are furnished with a number of fleshy fibres and spheroid corpuscles†.

The orifices of the veins of Thebesius‡ and Verheyen§, in the hollows of the heart, have

\* See Cowper's Myotom. nov. T. 36. ad 40.

† See Morgagni Advers. 1. T. 4. fig. 3.

‡ Dissert. de Circul. Sang. in Corde.

§ Anatom. cap. de Corde.



been very improperly taken, by Vieussens\* and others, for arteries, excreting the ferment, as they have expressed it, of the heart. Their office is truly to carry back the blood from the substance of the heart to its cavities.

The fibres of the heart are of a muscular substance, and of a most amazing fabrick. They were first explained by Lower†, in a very elegant manner. They are of two kinds: 1. Strait ones in the left ventricle: and, 2d, spiral ones, common to both ventricles, and of two orders. The exterior ones run to the left, from the base of the heart: the interior ones run to the right, and intersect the others; and, when they act, they closely constrict the cavities of the heart, and drive out the blood from them.

According to this fabrick, the heart may be resolved into two muscles, each of which constitutes one of its ventricles §.

The use of the heart, in the œconomy, is for the circulation of the blood. It receives the blood from the veins, running from all parts of the body; and propels it again, by its own motion, to all those parts, thro' the arteries. On this depend life itself, the preservation of the frame, and the motions and actions of all its parts.

This motion of the heart is wonderful: it continues to the utmost period of life, day and night, without a single moment's interruption or intermission; and is performed more than an hundred thousand times every day. Here is, indeed, something like what the mechanists want under the name of a perpetual motion; and the stupendous

\* Nouvelles decouvert de la Cœur.

† Tract. de Corde.

§ Winflow in the Paris Memoirs, 1711.



wisdom of the Creator is in nothing expressed more gloriously \*.

The circulation of the blood in the foetus, while yet inclosed in the womb, as there is a defect of respiration, and the lungs are intirely at rest, is performed necessarily in a very different manner from that in adults, in whom respiration has so great a share in it. The blood in the foetus is not (except a very small quantity) propelled thro' the lungs; but is partly sent thro' the foramen ovale, which is between the right and left auricle, and partly thro' the canalis arteriosus, which is between the aorta and the pulmonary artery, to the left ventricle of the heart and the aorta.

262. The œsophagus, or gula, called by some of the antients the stomachus, is a membranaceous canal, reaching from the fauces to the stomach, and conveying into it the food and drink taken in at the mouth. Its figure is somewhat like that of a funnel; and its upper part is called by anatomists the pharynx. Its situation is almost exactly behind the aspera arteria, and longitudinally with the vertebra of the neck and back; but when it enters the cavity of the thorax, it turns a little to the right, on account of the aorta.

Its substance is membranaceous; and it is composed of five coats: the first or exterior coat is membranaceous, and is continuous with the pleura in the thorax. The second is robust and muscular; and, in the human body, it is composed of a double stratum of fibres: those of one series, longitudinal; those of the other, annular or cir-

\* See Hamberger's Differtat. de Deo in Demonstratione Cordis.



cular \*. In oxen it is composed of two spiral lamellæ, decussating with one another, and serving very advantageously for the constriction of the part. The third coat is cellular, much like that of the intestines. The fourth is nervous, and is divisible into a number of other lamellæ, and furnished with a multitude of glands and vessels: this is hence divided by Verheyen † into two, under the names of a vasculous and a glandulous coat. This is continuous with the interior membrane of the mouth and stomach. The fifth coat is villose, and is called by authors *crusta villosa*: this is always covered with a mucous liquor.

The muscles of the pharynx serve to open or shut the œsophagus: but of these we shall treat more at large in the Myology.

There are a number of glands situated in the upper part of the pharynx; and excretory oscula, or openings, are frequently discovered with them.

The arteries of the œsophagus are from the carotids, the aorta, the intercostals, and the cœliac.

The veins are from the jugulars, the azygos, and the coronary vein of the stomach.

The nerves are from the par vagum. That there are also lymphatics, is probable; but they are, at least, not easily discovered.

There are also certain excretory ducts, called *ductus excretorii novæ Vercelloni* §, which arise from the glands, and convey a saltish liquor into the œsophagus and stomach. The glands, from which these have their origin, are of three kinds:

\* See Cowper's Myotom. in fol. T. 29. fig. 3; Schellhammer's Analect. diss. 8. 54; and Santorini, p. 138. who contended for their being square.

† See Anatom. de Oesophagus.

§ See Dissect. Anat. de Gland. Oesophag.



1. The gastrick glands, which are conglomerate, and are situated near the left orifice of the stomach.
2. The dorsal ones, which are situated near the fifth vertebra of the thorax. And, 3. The bronchial, tracheal, and thyroide, already described.

The use of the œsophagus is for deglutition, and a commixtion of the liquid, serving for digestion.

## C H A P. VII.

*Of the Neck, which is the third part of the trunk.*

263. **T**HE neck, *collum*, is that slender part of the trunk situated between the thorax and the head, and extending from the sternum and clavicles to the head.

It consists of, 1st, The common teguments. 2. The vertebræ, usually seven in number. 3. A number of muscles, serving to move the head, the neck, the larynx, the pharynx, and the os hyoides. 4. A number of very large arteries, as the carotids, internal and external, and the vertebral ones. 5. Of large veins, as the jugular, internal and external, and the vertebral ones. 6. Of large nerves of the par vagum, the intercostals, the recurrent, the diaphragmatics, and the vertebral. 7. Part of the spinal marrow. 8. The aspera arteria, or trachea, particularly the larynx, in which is an eminence called the pomum Adami. 9. The pharynx, with a part of the œsophagus. And, 10. The thyroide, with some other smaller glands.

264. We have already treated of the vertebræ, the aspera arteria, and the œsophagus; and we shall hereafter treat of the spinal marrow, the arteries, the veins, and the nerves, in their places.



All that it was necessary to do here was to enumerate them, not to pass over the neck unregarded, as many of the anatomical writers have done. Tho' its several parts are, according to our own plan, to be treated of severally in other places, yet it is necessary to know them in their situation. The neck contains parts as necessary to life as any division of the body; and hence Aristotle, Ruffus, Oribasius, Coiterus, Riolanus, Ruysch, Morgagni, and others, have agreed in making it a distinct part in the division of the body, as not only a part of the utmost importance, but which could not properly be referred either to the head, or to the thorax.

### C H A P. VIII.

*Of the Head, the fourth part of the trunk.*

265. **B**Y the term *head*, caput, the anatomists understand what they call the fourth part of the trunk, comprehending that portion of the human frame which is placed above the upper vertebra of the neck.

The figure of the head is roundish, but oblong, somewhat approaching to an oval, prominent both before and behind, but flattened at the sides, and that in such a manner, that the anterior part, especially about the forehead, is narrower than the posterior. When the head is of a contrary shape from this, or even when it but recedes considerably from it, it is a deformity, and generally is the occasion as well as indication of a distemperature of the senses.

The size of the head is to be proportioned to that of the body: when either too small or too large for it, the consequence is not only a great impair-



impairing of the symmetry and beauty of the whole, but of the reason.

The head is situated at the top of the body, for the sake of the more commodious lodging of the organs of sensation in it: these serve as a kind of centinels to the soul, and are therefore most conveniently placed in the highest position.

Anatomists divide the superficies of the head into two parts; that which is covered with hair, and that which is not. That part of the head not covered with hair, is called the face; and in it are the organs of the several senses, the eyes, nose, &c. That part which is covered with hair, is called by several names in its several parts: the anterior portion of it is called *sinciput*; the posterior, *occiput*; the upper part, the *bregma* and *vertex*; and the sides, the temples.

The parts of which the head is composed are of two kinds: the continentes, or containing; and the contents, or contained.

266. The continent or containing parts of the hairy portion of the head, are in part common, in part proper. The common are the cuticle, or epidermis; the cutis, which is very thick; and the fat. There is but little of this about the skull; but about the cheeks there is considerably more.

The proper or peculiar continent parts are,  
1. The hairs, of which we have treated already.  
2. The four muscles of the cranium, which are very thin: two in the fore part, and called *frontales*, or *frontal muscles*; and two in the hinder, called *occipitales*, or *occipital muscles*. These cover the upper part of the skull with their tendons, as with a kind of helmet. But of these we are to speak more at large hereafter, in our *Myology*.



3. The pericranium is a membrane immediately investing the cranium, and is thin, but considerably firm and strong. This coheres with the cranium, with the adjoining muscles, and with the dura mater. The pericranium may be divided into two parts, an exterior and an interior membrane; and hence some have divided it into two separate portions, under two distinct names of the pericranium and the periosteum; but this division is not essential or necessary.

It has a very great number of blood-vessels in common with the other parts of the head; and its nerves are from the vertebræ of the neck, and the seventh pair of the brain.

Its uses are, 1. To support the vessels, for the nutrition of the cranium. 2. To occasion sensation in the cranium, which, as a mere bone, would, without this membrane, have been wholly insensible.

The fourth of the proper continent parts of the head is the cranium itself, which is intended for the defence of the brain, and is merely and entirely boney. It is composed of eight robust bones, joined by sutures. Of these we have already treated in our Osteology. In this place we are only to observe, that, in order to the examination of the internal parts of the head, the dissector is to cut the skull transversely, in half, with a saw; and the upper half being then carefully lifted off, there will be observed a number of redish dots, which shew where it has adhered by vessels to the dura mater internally, by which it is nourished.

The parts contained in the head are the brain, &c.

267. In our examination of the brain, which is the primary seat of the soul, we are first to observe its three membranes, which are called meninges



menynges and matres. These are, 1st, The dura mater. This is a robust and thick membrane, composed of tendinous fibres, and situated immediately under the cranium\*. In this we are to observe the red spots, made by the separating the cranium from it, and shewing the places of their adhesion. Its figure and magnitude correspond exactly with those of the brain. It is joined in every part to the skull; only that, in the upper part, it adheres more laxly than elsewhere: in the lower part it is most firmly connected, and it adheres, tho' not very firmly, to the parts placed under it. It has its arteries from the carotids, and they are beautifully ramified in it, in the manner of little shrubs†. Its veins are of two kinds; some, as in the other parts of the body; and others peculiar, of a triangular figure, and robust, and called sinus's.

Many anatomists speak of a great number of these‡; others make them only four, or at least allow only four principal ones. These are, 1st, the sagittal, or longitudinal. This running from the forehead to the occiput, thro' the middle of the brain, terminates, in fine, in two lateral ones, which represent the figure of the Greek circumflex, and empty themselves on each side into the jugular veins: these are to be seen when the brain is taken out. The fourth comes from the part where the pineal gland is situated, and is inserted nearly in the part where the three just described meet§. That part is called the torcular herophili||. The smaller ones are numerous, and

\* See Pacchion. de dura mater.

† See Ruysch's Thef. 5. T. 2. fig. 4.

‡ See Ortlob. Oecon. Animal. fig. 1. and Vieussens in Neurolog.

§ See Ridley's Anat. Cereb. fig. 4.

|| See the same.



are placed within the brain : of these we shall speak hereafter in their place. The insertion of the veins of the brain into these sinus's, is very singular and remarkable.

In our examination of the dura mater, we are also to observe the glandulæ conglobatæ Pacchioni \*, which are small ; and the chordæ transversæ of Willis, which serve to prevent the too great extension of the sinus's.

The use of the sinus's of the dura mater is to carry the blood from the brain, by a very peculiar mechanism.

The dura mater has nerves, for sensation, from the fifth and seventh pair of the brain. It has been asserted by many also, that it has lymphatics in considerable number ; but they have not yet been absolutely demonstrated.

The dura mater has also three processes, 1. The falciform, so called from its figure, resembling that of a reaper's sickle : this is placed between the two hemispheres of the brain. 2. The process between the cerebrum and cerebellum. And, 3. That in the division of the cerebellum, of very important use.

The dura mater has a motion, which Baglivi and Pacchion. will have to be peculiar to itself, and of the muscular kind ; but it appears much more naturally to depend upon the pulsations of the arteries of the brain †.

The uses of the dura mater are, 1. To serve in the place of a periosteum to the internal parts of the skull. 2. To defend the brain. 3. By its processes to prevent the compression, which both the cerebrum and cerebellum would otherwise be

\* See Ridley's Treatise de dura mater.

† See his Account in the Philos. Transf. 1703.



liable to. And, 4. By means of its sinus's, to give warmth to the brain.

268. The arachnoides is the second coat or membrane of the brain. It is extremely thin and delicate, and has its name from the resemblance it has to a spider's web. It is situated immediately under the dura mater, and occupies the space between that and the pia mater. It is connected so closely with the pia mater, in the upper part of the brain, that it cannot be separated without tearing: but in the lower part, and especially about the cerebellum, the medulla oblongata, and sinus's, it is connected so loosely, that it is easily distinguishable without cutting; notwithstanding that some, to this time, doubt, or totally deny, its existence; or agree with Ridley \*, calling it only the exterior lamella of the pia mater. It is extended as far as the dura mater, covering the whole brain, and the spinal marrow intire: it covers the latter, however, only in a very loose manner; and is beautifully and distinctly seen on it, when suspended in a clear glass with spirit of wine.

There are blood-vessels delineated by some authors †, as belonging to the tunica arachnoides; but it is not easy to find them in the membrane itself: it rather looks of the nature of the epidermis, which has no blood-vessels at all.

Santorini has, however, discovered certain glands between this membrane and the dura mater, about the trunks of the vessels, which serve for the secretion of a certain fluid within the cavity, between these membranes ‡.

\* Anatom. cerebri.

† See Bidloo's Anat. corp. hum. T. 8. fig. 5.

‡ Observ. Anat. p. 52.



The use of tunica arachnoides is to serve as a covering to the brain; for it does not appear, that so thin a membrane, and that destitute of vessels, can be of any other use to such important parts as the brain and the spinal marrow. Santorini \* well observes, however, that as the pia mater descends deeply into the cavities between the anfractosities, or windings of the brain, this membrane is always, in that case, so regularly stretched over it, that the vessels, which pass under it, are strengthened by it; and that it connects the sides of these frequent furrows, or sulci, and absolutely prevents the possibility of any thing getting into them, that might possibly be noxious to the brain. This is a very important use of this membrane, tho' merely as a covering of the brain; and the accurate author has made it out very plainly and perfectly.

269. The third tunic, or membrane of the brain, is the pia mater. This is placed immediately under the tunica arachnoides, and is closely and firmly connected to the brain, which it immediately surrounds. The pia mater is not only extended over the whole surface of the brain, but it insinuates itself into all its cavities, and is carried down to the bottom of all its furrows in its anfractuosities. It covers also the spinal marrow, and all the nerves: hence its superficies is much greater than that of any other of the membranes of the brain.

It adheres very firmly to the brain itself, in a healthful state; but, in hydropical cases, it is rendered much looser. It adheres also to the tunica arachnoides very closely and firmly, in the upper

\* Observ. Anat. p. 53.



part of the head ; but much less so below with the dura mater. It has no other connection, except by the veins running to the sinus's.

Its blood-vessels are common to the rest of the brain, and are very numerous ; so that it seems in a manner wholly composed of them, as Ruysch first shewed by his injections. The arteries are from the internal carotids and vertebrals. The veins, some of them, discharge themselves into the sinus's of the dura mater ; others immediately into the jugular and vertebral veins. There are no nerves, yet discovered, entering the substance of this membrane, nor any lymphaticks. Willis and others have attributed glands to the pia mater, and given them the office of secreting a peculiar liquid, destined for the lubricating of the meninges ; but these are, in general, found only about the longitudinal sinus ; or seem to be the same with those mentioned before, S. 268. and which Santorini has ascribed to the tunica arachnoides.

The use of the pia mater is to support the blood-vessels of the brain, which it also serves as a covering to, that they may be the more conveniently distributed, by this means, thro' all the furrows and anfractuosities, for the secreting the proper fluids in the brain, and forming the animal spirits.

270. After the examination of the membranes investing the brain, we come to the consideration of the brain itself. Its figure is roundish ; but with some inequalities and furrows, called anfractus and gyri, which give it somewhat of the appearance of the intestines, as they lie together in their place. It is divided into two hemispheres,



by means of the processus falciformis of the dura mater, already described; and these are again divided into the anterior and posterior lobes.

The human brain is, in general, so large as to weigh about four pounds. It is nearly three times as much in quantity as the brain of an ox.

Its substance, on cutting off a part of it, is found to be of two kinds; an exterior one, called the cineritious or cortical part; and an interior, called the medullary.

The cortical part of the brain is about a sixth of an inch in thickness, and it penetrates in the serpentine mazes and furrows, deep into the brain. Its structure, according to Malpighi, Bidloo, and most of their followers, is declared to be glandulous; but Ruysch, Berger, and Vieussens, have proved, by their injections, that it is almost entirely vascular\*; at least, it does not appear that the glands the former authors speak of, are, or ever have been, fairly demonstrated.

The structure of the interior or medullary part of the brain is fibrous and tubular. It has its origin from the extremely small arteries of the exterior or cortical part, and its termination is the beginning of the nerves. It is somewhat harder than the cortical part.

When the two hemispheres of the brain are drawn back, the corpus callosum comes in view: this is whitish, hard, and joins the two hemispheres. In this part Lancisi and several others have supposed the soul particularly to reside†.

\* See his Epist. 12. and his Thesaur. Anat. in several places. Also Berger in his Physiologia; and Vieussens in his Nov. System. vasorum.

† See Dissertat. de Sede animæ cogitantis. Camerar. in Elect. Med. p. 18.



The ventricles of the brain are certain remarkable cavities. There are usually reckoned four of them: two anterior ones, which are very large, and which shew themselves, when the brain is taken off, down to the corpus callosum, by an horizontal section. In the examination of these we are to observe, 1. The septum lucidum, or pellucid partition, which offers itself to view between these two cavities, as soon as the corpus callosum is raised. This septum is composed of a fine medullary substance, and is formed into two sides, or parietes, with a longitudinal cavity between them. It is covered with the pia mater; and it divides the two ventricles, as the mediastinum does the cavity of the thorax. Galen, and other of the old authors, have called it diaphragma cerebri.

2. The fornix: this is seen under the septum lucidum; and is composed, like it, of a medullary substance. Its anterior part rises with a double base; but the two parts soon unite: the hinder part is, however, again bifid. The bifid part is called, by some, crura fornicis; by others, pedes hippocampi.

3. The plexus choroideus, which is very full of vessels; but has no glands. This is beautifully delineated by Ruysch †.

4. The corpora striata, which are of a greyish colour on the outside, and striated within.

5. The thalami nervorum opticorum. These are white on the outside, and greyish within; and between these and the crura of the medulla oblongata, is situated the third ventricle of the brain ‡. In this, after we have examined part of the plexus

† See his Epist. T. 15.

‡ See T. 4. in this work.



choroides, we are to observe the glandula pinealis, or pineal gland. This is of a greyish colour, and its processes and base are often medullary. This gland has also, by many, been supposed the peculiar seat of the soul.

After this we are to observe the nates and testes; and under these the valvula magna, cerebri, and the aquæduct of Sylvius, the posterior orifice of which is called its anus, and its anterior vulva and rima. This makes a communication between the two anterior ventricles, and the fourth, which is continuous to this: but all these are most conveniently seen when the brain is taken out of the skull. The fourth ventricle is a cavity between the cerebellum and the medulla oblongata. It is conveniently seen when the brain is taken out, and the cerebellum dissected.

271. After examining the cavities or ventricles of the brain, we are to look into the cerebellum. This is situated under the posterior lobes of the brain, and the hinder processes of the dura mater, in the lower part of the cavity of the skull. Its figure approaches to a globular one. Its superficies is less anfractuous, or gyrated, than that of the brain; but it is furrowed: the furrows are deepest and largest in the middle; and from thence they gradually grow smaller every way, in form of so many segments of circles, till by degrees they terminate in what is called the vermiform process.

The substance of the cerebellum, if cut into the right and left parts, appears much the same with that of the brain; but the cortical part is here much more in quantity than the medullary: this, in a very elegant manner, resembles a kind of shrubs, or little trees; the trunks of which form what are called the peduncles of the cerebellum.



bellum. Tho' the brain has its feveral cavities, the cerebellum has none.

The lobuli of the cerebellum adhere in clusters, in the manner of leaves on trees, to the arbusculi medullares, already mentioned: they are very beautifully feen, on dividing the cerebellum; and are furrounded with the pia mater, and compofe the far greater part of the fubftance of the cerebellum\*.

The peduncles of the cerebellum confift of three medullary proceffes. The firft afcends from the cerebellum towards the testes, and forms what is called the valvula magna of the brain. The fecond forms the annular prominence of Willis; and the third defcends to the fpinal marrow.

272. The medulla oblongata is the lower and medullary part of the cerebrum and cerebellum, formed into a kind of tail, and extended to the great foramen or hole in the occipital bone of the cranium, where it gives origin to the fpinal marrow, and to the nerves of the brain†.

In taking the brain carefully out of the fkull, there are diftinguifhed, in the lower part of this, the nerves of the brain, which are ufually called ten pair, but are properly only nine; and are, for the fake of memory, reduced into the form of two Latin verfes:

*Olfaciens, cernens, oculosque movens, patiensque,  
Gustans, abducens, audiensque, vagansque, loquensque.*

At the fame time alfo we are to obferve the ingrefs of the internal carotids into the fkull; the infundibulum, and its infertion into the pitui-

\* See T. 4. in this work.

† Schelhammer, and many others, fuppofe this to be the common fenfory. See Anal. Diff. 13.



tary gland ; and, finally, the acceffory spinal nerve of Willis \*.

After the brain is taken out, we are to observe, in its lower part, the anastomoses of the carotid and vertebral arteries †, and their distribution thro' the brain ‡, the crura of the medulla oblongata of the brain, and the crura or peduncles of the cerebellum, from which arise the medulla oblongata, and the spinal marrow ; the origin of the feveral pairs of nerves of the brain ; the two orbicular protuberances, behind the infundibulum ; the auricular protuberance of Willis, called also the pons varoli, very ill described and delineated by Willis and others, but very well by Ruysch § ; the end of the medulla oblongata, and, in this, the pyramidal and olivary eminences, described by Vieussens || and Ruysch ¶ : and, finally, the tunica arachnoides, which is very finely distinguishable in this part.

In the upper part of the brain, when turned up, we are to observe the fourth ventricle, and the calamus scriptorius, with its crena ; all the other parts, which have been already described as belonging to the third ventricle, and the substance of the medulla oblongata, which is, in its external part, medullary ; and, within, contains somewhat of the cortical or cineritious substance.

The vessels of this part, and of the whole brain, are arteries and veins, very distinguishable and obvious ; and authors have added nerves and lymphaticks ; but these are not so easily distin-

\* See his de Cerebro, fig. 1. M. M.

† See Ridley, l. c. fig. 1.

‡ See Ruysch's Epist. probl. T. 13, and 15.

§ See Ruysch's Epist. probl. 15.

|| See T. 4. R. S.

¶ See Epist. T. 14.

guishable.



guishable. The arteries are from the carotids and vertebrales: the carotids sent branches into the cranium, thro' the singular canals of the os petrosum; the vertebrales thro' the great foramen of the occipital bone: they make several surprising inflexions. The veins scarce penetrate into the internal substance of the brain; but, arising from the cortical part, they are inserted into the sinus's of the dura mater.

The uses of the brain, in general, are, 1st, To be of the utmost importance and assistance to the animal functions. 2. To secrete the animal spirits, and to transmit them to the nerves, for the necessities of sensation and motion.

The cerebrum is supposed to be particularly constructed for the secretion of the animal, the cerebellum for the vital and natural spirits. The peculiar uses, to which the several particular parts of the brain are destined, are wholly unknown.

273. The medulla spinalis, or spinal marrow, is a continuation of the medulla oblongata of the brain, and forms, as it were, a kind of tail to that part. It is included in a kind of boney canal, formed by the vertebræ, and in this is continued, from the head to the extremity of the os sacrum.

Its length is therefore the same with that of the spina dorsi, which is different in persons of different stature. Its thickness, in general, is about equal to that of a finger; but it is not uniformly of the same diameter throughout. Its proper integuments are no less than six: these are, 1. The boney canal, formed by the cavities of twenty-four vertebræ, and the os sacrum. 2. The tunica, which is very strong, and connects the vertebræ within. 3. The cellular or adipose coat, which, in fat persons, always contains more or less fat, and seems destined by na-



ture to serve for the softening the former. 4. The dura mater, which is stronger in the upper part, and finer and weaker in the lower: this loosely encloses the medulla in the spine, and, in its anterior part, is firmly connected with the vertebræ. 5. The tunica arachnoides, which, in its anterior part, adheres very firmly to the pia mater; but in its posterior part is loose and fluctuating. The sixth and last covering of the spinal marrow is the pia mater: this surrounds every part of the spinal marrow, and all the nerves that arise from it, and enters also its longitudinal division.

The division of the spinal marrow is formed by means of a fissure: it is by this separated, according to authors, into a right and left part, or into two columns; but this separation is not continued to the centre.

The arteries and veins of the spinal marrow enter at the apertures of the vertebræ, which give passage out to the nerves: they make a multitude of anastomoses, and are derived from the vertebrals of the neck, the intercostals, and the lumbar.

The nerves of the spine are thirty-one, or, as others count them, thirty-two pair. These are composed each of a multitude of fibres, arising from the anterior and posterior parts of the medulla: these fibres afterwards unite, and are connected by and covered with membranes, and in that state they constitute what we call nerves.

The substance of the medulla spinalis, in the upper part, as far as to the last vertebra of the thorax, is the same with that of the medulla oblongata of the brain; but somewhat tougher and more firm: they are externally of a medullary substance, that the nerves may easily make their way



way out; internally cineritious, and of the same nature with the cineritious or cortical part of the brain: but the lower part of them, from the last vertebra of the thorax to the extremity of the os sacrum, is fibrous and very tenacious, and is called by authors *cauda equina*.

The uses of the spinal marrow are, 1. To give origin to the before mentioned pairs of nerves, which are principally distributed to the limbs and external parts. And, 2. To secrete and prepare a nervous fluid for their purposes.

274. After the taking the brain intirely out of the skull, there yet remain, for our observation, the egress of the nine pair of nerves of the brain, and the ingress of the arteries of the brain, and those of the dura mater; as also the larger sinus's of the dura mater, the second, third, and 4th already mentioned, S. 267.

The inferior sinus of the falx, and the circular one\*; what are called the *receptacula plana*, the pituitary gland by the antients†, and several other smaller ones in the basis of the cranium‡, together with their various ways out of the cranium§, and their ingress, which is partly into the occipital and vertebral veins, but more usually into the jugulars.

We are also to observe the *rete mirabile*, which is a plexus of vessels and membranaceous fibres, in manner of a net, situated on each side, near the pituitary gland, and under the dura mater, where the circular sinus is. This is found to

\* See Ridley, fig. 2.

† See Morgagni, Adv. 6. p. 7.

‡ See Vieussien's Neurograph. T. 17. Ortlobs. Hist. Part. and Morgagni Advers. 6.

§ See Santorini, who describes these under the names of the various emissarii.



be much larger in some quadrupeds than in the human frame ; but its use is hitherto unknown.

After this we are to observe the pituitary gland : this is a small gland, situated in the fella equina, between the duplicature of the dura mater, and has a cavity in it \*.

It has its name from its use, which is the absorbing the pituitary matter of the brain.

It has two membranes, 1. It is surrounded and supported by the dura mater †. 2. By a thin membrane, analagous to the pia mater, and perforated for the infundibulum. Its size and shape are nearly those of a common kidney-bean ; but it has an appendage in its posterior part. It is usually larger in quadrupeds than in the human frame. Its substance is glandulous ; its colour, a pale whitish red : it is usually considerably hard and firm ; but somewhat softer, and of a greyish colour, in the appendage ‡.

It has arteries from the carotids : its veins run to the neighbouring sinus's. Its nerves are from the fifth pair. Its excretory duct is probably the infundibulum already mentioned ; for there does not appear to be any other.

The use generally attributed to this gland is the absorbing the pituita of the ventricles of the brain, and afterwards discharging it §. But there does not seem a sufficient foundation for this supposition ; since, 1. The proper office of a gland is to secrete a fluid, not to receive one already secreted : 2. Because a simple canal would have answered sufficiently to such a purpose, and the

\* See Littre's Account in the Memoirs of the Paris Academy, 1700.

† See the same in the same paper.

‡ See Morgagni, l. c. p. 31.

§ See Brunner de Gland. pituit. &c.



apparatus of a gland had been therefore unnecessary. And, 3. Because its substance is so hard and firm, as to render it very improper for such a use \*.

275. After having gone thro' the examination of thus much of the head, we now are to proceed to the face, or that part of it which is not covered with the common long hair. The parts of the face, that are to come under our consideration, are of two kinds; the continent, or containing, and the contained.

Of the continent parts of the face, some are common, others proper, or peculiar. Of the number of the common ones, are, 1st, The epidermis. 2. The cutis. From the colour and fineness of these two parts arises the principal beauty of the face. 3. The fat, which is in considerable quantity, and in this part is frequently also covered with a panniculus carnosus, adding much to the beauty of the face.

The proper continent parts of the face, are, 1. The muscles, as the frontals, those of the nose, of the lips, of the lower jaw, and the rest; of which we shall treat in the Myology. And, 2. The bones, which we have already described in the Osteology.

The contained parts are, the organs of the five senses: of seeing, tasting, smelling, hearing, and feeling. The last of these, however, more accurately speaking, belongs to the whole surface of the skin.

The organs of sight are the eyes. In these we are to observe their situation, in the upper part of the face, by means of which we are able to see to a greater distance than we otherwise could; their figure, which, excepting for the external

\* See Drake's Anthropol. p. 490.



parts, is globular; and their colour, which, in the human species, is variable; in some black, in others brown or hazel, in some greyish, in some blueish. The parts which are destined for the assistance of seeing, but do not enter into the composition of the eye, are the eyebrows, the eyelids, and the muscles of the eyes.

The eyebrows, supercilia, are two hairy arches, extended over the orbit of the eyes: they are composed of hairs of a peculiar kind, and of a determinate length, all turned toward the temples; and under these, of a thick skin and some fat, by means of which they are raised, and become more eminent. That part of the eyebrows where they approach one another, about the root of the nose, is called their head; the opposite extremity is the tail. Their use is to prevent the sweat, trickling from the forehead, from getting into the eyes, and for moderating the force of the light from overhead.

The eyelids, palpebræ, are the integuments of the eyes: there are two of them to each, an upper and an under; and, at their joining, there are formed two corners, called canthi, an interior and larger, and an exterior and smaller: they are capable of closing and opening at pleasure, by means of muscles.

They are composed of the epidermis, the cutis, which is there very thin, and an arched cartilage, called the tarsus of the eyelid; and are lined, on their inner surface, with a fine and delicate soft membrane, very sensible, and continuous to the periosteum, and to the albuginea of the eye\*.

The eyelashes, cilia, are certain rigid hairs, situated on the arch or tarsus of the eyelids, and bent in a very singular manner. They are destined

\* See Ruysch's Thef. Anat. 10. p. 2.



for the keeping external bodies out of the eye, and for moderating the influx of light.

The muscles we shall speak of, in their proper place, in the Myology.

The glandulæ sebaceæ of Meibom, are situated in the interior surface of the eyelids\*. They serve for the secretion of an oleaginous fluid, which is of great use in preventing the attrition of the eyelids, from their continual motion. After these we are to observe the caruncula lachrymalis, which is situated in the larger angle or canthus; where there are also sometimes some hairs†, and certain little glands; and the semi-lunar membrane§, serving to direct the tears to the puncta lachrymalia.

The glandula lachrymalis is situated in the orbit, above the smaller angle, with its excretory ducts under the upper eyelid‡. These are much more easily demonstrated in the eye of an ox than in a human one.

The puncta lachrymalia are two: they are situated in the larger canthus or angle, at the extremities of the tarsi or cartilages. They terminate in the sacculus lachrymalis, the nasal canal, and in the nose itself||. They were known as early as in the days of Galen.

The use of the eyelids is to cover and defend the eyes, to wipe off foulnesses from the cornea, to moderate the influx of light at pleasure, and, by their frequent motion, to occasion a secretion of a necessary fluid from the glands.

\* See Epist. de vasis palpebr. nov.

† See Morgagni's Advers. 1. S. 22.

§ See the same in the same place.

‡ See Steno de gland. ocul.

|| See Morgagni, T. 4. fig. 1. and Verheyen, T. 28. fig. 9.  
Also Bianchi's Duct. lachrymæ.



The muscles of the eyes, serving to their motions, are, in the human frame, six in number, four strait, viz. The attollens, deprimens, adductor, and abductor; and two oblique, the superior and inferior: but of all these in the Myology.

Between and among these there is a considerable quantity of fat, serving for various very important purposes.

The proper parts of the eye, which form its globe or bulb, are the coats or tunics, the humors, and the vessels.

The coats of the eye are several: 1. The albuginea, adnata, or conjunctiva, which adheres only to the anterior part of the eye: this joins the eye to the orbit, and is extremely full of vessels. 2. The cornea, which is convex, pellucid, and divisible into various lamellæ. 3. The sclerotick, which is hard, opaque, and is extended from the cornea to the optick nerve, in which what are called the aquæducts of Nuck are to be observed; but these are not truly aquæducts, but blood-vessels of the eyes\*. 4. The choroides, placed immediately under the sclerotica, the interior lamella of which is called tunica Ruyschiana: both this and the other are very full of vessels, and coloured black†. 5. The uvea, which is the interior part of the choroides, and is seen thro' the cornea: this is convex, and we are to observe in it,

1. Its anterior coloured surface, called the iris, which is entirely vascular‡, and from which arises the variety of colours in the human eyes. 2. The

\* See the author's Dissertat. de tunic choroid.

† See Ruysch's Epist. 13. T. 16. and Thesaur. Anat. T. 2. fig. 1. and Hovius de circ. ocul.

‡ See the same in the same place.



pupil or foramen, which is round in the human eye, and is nearly in the middle of the iris\*, and is capable of dilatation and contraction. 3. Its posterior surface, which is black; and in which, when this blackness is cleared away, there appear the sphincter of the pupil, formed of circular fibres for contraction; the ciliary fibres or processes for the dilatation of the pupil; the ciliar ligament for the motion of the vitreous and crystalline humors; the arterial and venal circles, from which the vessels are, in a wonderful manner, distributed over the uvea, the choroides, the ligamentum ciliare, and the vitreous and crystalline humors†; the ductus nigri, so called from their black colour, and placed between the processes and the ligamentum ciliare; the space between the uvea and the cornea, called the anterior camera of the eye; and that between the uvea and the crystalline, called its posterior camera, which is either much smaller‡, or entirely wanting§.

Many authors have also attributed glands to the uvea; but this is less certain, whether properly or not, they are so difficult to be distinguished, if there be any.

Finally, we are to mention the retina: this is a very delicate, tender, and, as it were, mucous coat of the eye; or, more properly, it is only an expansion of the optick nerve at the bottom of the eye: it is a primary part of the eye, and the great organ of vision, for the sake of which all the rest were formed.

\* See Winslow in the Memoirs of the Paris Acad. 1721.

† See Ruysch and Hovius, before quoted.

‡ See the author's Dissertation on the Cataract.

§ See Winslow, where quoted above.



The humors of the eye are generally established to be three: their office is to serve for the expansion of the coats, and for the refraction of the rays of light. They are distinguished by the names of the aqueous, vitreous, and crystalline.

The aqueous or albugineous humor fills up both the *cameræ* of the eye, tho' the antients distinguished these *cameræ* by the name of the empty place, or *locus vacuus* of the eye\*. In this the *uvea* fluctuates, as it were, and moves at liberty: this humor, when lost by accident, will be repaired by nature.

The vitreous humor, so called from its resemblance to glass in fusion, is much like a fine clear jelly in its appearance. It consists probably of extremely fine vesicles, containing a limpid and perfectly pellucid humor†. This fills the posterior part of the eye, and is every where contiguous to the hinder part of the retina, which it serves also to expand.

The crystalline humor is nearly of a lentiform figure: it is more firm and solid than the rest, and might be more properly called the crystalline body, or crystalline lens, than the crystalline humor. This is included, by the assistance of an extremely fine tunic or coat, in the fovea of the vitreous humor; and is suspended, by means of the ciliar ligament, between the aqueous and vitreous humour, immediately behind the pupil: in this place it hangs free, and is moveable, by means of the ligament just mentioned. It is composed of a multitude of *lamellæ*, like the coats of an onion;

\* See Celsus, l. 7. c. 7.

† Morgagni, *Advers.* 6. rightly observes, that we only speak of this fabrick from conjecture: Riolanus was the first who spoke of it; and, after him, Hovius treated of it as a certainty,



and these are also pellucid and vasculous \*. Often also there is a small quantity of the aqueous humor contained within or under its coat †.

After these three humors of the eye, we are to observe the tunica arachnoides: this is an extremely thin and fine vasculous membrane, which surrounds the crystalline and the vitreous humor ‡, and by the assistance of which the crystalline lens is lodged in the fovea of the vitreous humor. On the cutting or breaking of this membrane, the crystalline falls out.

The blood-vessels are next to be considered: these are distributed, in an amazing manner, thro' the internal parts of the eye §. Arteries from the external and internal carotids go to the eye in many different parts ||. There are also a number of extremely minute ones, which convey only a fine and subtle lymph thither, by which the tunics and humors of the eye are nourished. The veins partly carry the blood back to the sinus's of the dura mater, and partly to the jugulars.

Beside these vessels, Valsalva assures us, that he discovered a number of true and proper lymphatics in the eye of an ox.

The nerves of the eyes are very numerous. They are, 1. The optick nerve, which, by its expansion, forms the retina of the eye, which is the primary organ of vision: this enters the eye from the side of the nose. Beside this, there are the third and fourth pair of the brain, and a fifth and sixth branch distributed about the muscles,

\* See Hovius, l. c.

† See Morgagni's Advers. 6. p. 90.

‡ See Ruyfch's Thesaur. 2. T. 1. fig. 8.

§ Some anatomical writers have denied the existence of this tunic; but it is easily demonstrated in dissection, &c.

|| Ruyfch and Hovius have demonstrated this.

¶ See our author's Dissertation de tunica choroidea.



membranes, eyelids, and the lachrymal fucculus and gland. But of these we shall have occasion to speak more at large in our Neurology. See S. 299.

The  
tongue.

277. The primary organ of taste and of speech is the tongue, *lingua*. In our consideration of this organ, we are also to take cognizance of the other parts of the mouth placed about it, and assisting in the same offices: these are the salival glands, the os hyoides, the gums, the palate, the lips, the uvula, and tonsils.

278. The glands serving for the secretion of the saliva, are the parotids, the maxillares, the sublinguales, &c.

The parotids are two very remarkable glands, situated, one on each side, between the ear and the angle of the lower jaw, and they often extend themselves over a great part of the masseter: from each of these there runs a very large duct, about three fingers long, and of the thickness of a wheat-straw: it has a great number of roots. Steno has the honour of being the first discoverer of this: he found it, in dissection, in the year 1660\*. It is called by some, from his name, ductus salivalis Stenonius; by others, ductus salivalis superior. It passes over the masseter muscle, thro' the middle of the cheek, and there perforates the buccinator muscle, and the membrane of the mouth, near the second or third of the ductus molares; and at this perforation it discharges a very large quantity of its proper fluid into the mouth.

The maxillary glands are also considerably large ones: they are placed, one on each side, in the interior side of the angle of the lower jaw. These have also each a single duct, formed from the

\* See Steno's Observ. Anat.



conjunction of a great number of roots, which is something slenderer than the ducts of the former, but is usually longer. These are called by some, from their inventer, or supposed inventer, Wharton, ductus Whartonianæ\*; by others, ductus salivales inferiores. These open into the mouth sometimes by a single, sometimes by a double, and sometimes by a triple orifice under the tongue, near the root of the frænulum†.

The sublinguals are also two glands of an oblong form, situated, one on each side, under the tongue; from whence their name. It has been hitherto generally believed, that, in human subjects, these discharge their saliva into the Whartonian ducts, just described.

Rivinus §, however, in the year 1679, first discovered a duct running from each of them, in a calf‡; and afterwards Bartholine made the same discovery in the mouth of a lion||: hence these ducts are indifferently called the Rivinian or the Bartholinian ducts. In human subjects it is otherwise: in these Morgagni first discovered, that they open into the mouth, between the sides of the tongue and the gums, by very small and scarce perceptible apertures¶. Our author, after the information he received of this from Morgagni, found them also, in dissection, opening in this manner; and has given a drawing of them in the seventh Tab. Fig. 33.

After these we are to observe the foramen linguæ, called cœcum by authors, and figured by

\* See Adenograph. cap. 21.

† See Ruysch's Thef. Anat. 1. p. 25.

§ Dissertat. de Dyspenæa.

|| De ductu salivali novo.

¶ Advers. 6. p. 131.



Collins \*, and Morgagni †; as also in our fourth plate, fig. 20. Vater ‡ was the first who supposed this to be a salival duct; and proved, by a number of experiments, that it communicates with the glandulous substance about the root of the tongue: but he did not explain, very clearly, how this communication was effected. Coschwitz §, however, afterwards took considerable pains to shew this, and to explain in what manner it is that several of the ducts run thro' the maxillary and sublinguale glands, and have their various places of excretion in the tongue. The author has taken considerable pains in this attempt; but whether nature varies in this, as in many other circumstances of such kinds, or from whatever other cause it may be, we cannot say that every thing this author has described, appears just as he lays it down in dissections. In human subjects there are sometimes found two remarkable ducts, indeed, terminating in it: these are figured in Tab. 8. Fig. 34 and 35.

After this we are to observe two glands, one on each side, which open into the mouth by several osculæ, near the posterior dentes molares of the upper jaw. These are very obvious in some subjects, but not so in others: these, as found in the same subject, from which the figure of the former was taken, are figured in our Tab. 8. Fig. 36 and 37.

In the same subject there was also discovered a duct, under the anterior apophysis of the os occipitis: it was considerably large, and, on being press'd, it discharged a quantity of a mucous hu-

\* See his Anat. T. 2.

† Advers. 1. T. 1.

‡ Peculiar Dissert. de novo ductu saliv.

§ Diss. de ductu salivali novo.



mour into the fauces. This is also figured T. 8. Fig. 38. It is not so obvious in other subjects; but it is worth searching after with attention, to know whether it be general, or were a particular part there.

Beside the glands already described, there are also certain miliary and lenticular ones, placed in considerable numbers about the membrane of the mouth, particularly about the lips, the palate, the cheeks, and the tongue: these, according to their different situation, may be called *linguales*, *labiales*, *buccales*, *palatinæ*, and *uvulares*; or by other names, from the parts they are formed in.

These are the glands serving to secrete the saliva in the human frame. In dogs there are two other very remarkable ones, called, from their discoverer, *glandulæ Nuckianæ*\*: they are situated, on each side, near the eyes; and they send down their ducts into the mouth, near the last but one of the dentes molares of the upper jaw. Nothing analogous to these is found in man.

279. The *os hyoides*, called also by some *os linguale*, and *os bicornè*, has been already spoken of in the osteological part of this work, S. 106. Its description will be found there; but it is necessary, in regard to its connexion with the tongue, and the use it is of to it, to say something of it here. It coheres with the base of the tongue; so that it is situated between the tongue and larynx, and moves with the tongue. It is connected with the tongue, the larynx, and the styloide processes of the head, by ligaments, and by the intervention of muscles, not only with the parts already mentioned, but also with the jaw, the clavicles, the scapula, and the sternum. It has five pair of muscles, by means of which it is

\* Nuck's Sialograph. p. 15. T. 3. fig. 1 and 2.



variously moved, together with the tongue : these muscles will be hereafter described in our myological part.

The uses of the os hyoides are, 1. To afford a firm and strong base to the tongue, and to be instrumental to its various motions, and to deglutition. And, 2. To give a fixed point to a number of the muscles.

280. The lips next come under consideration : they are two, an upper and an under. They are composed principally of muscles, and are covered externally with the general integuments ; and, internally, with the membrane of the mouth. Under this membrane there are, in both the lips \*, a great † number of miliary and lenticular glands. The prolabia, when the epidermis is taken off, after macerating a sufficient time in water, are found to have also a multitude of nervous papillæ ; and hence it is, that they are so extremely sensible ‡. Each of the lips has its peculiar frænum : the upper one, under the nose § ; the under one, near the roots of the dentes incisores || ; and they are of the utmost service to us in speaking, and eating and drinking.

281. The gums come next to be examined : they consist of the common membrane of the mouth, and the periosteum, of the jaws, to which they adhere very closely and firmly. They are furnished with a vast number of blood-veffels, whence their florid red colour ; and they serve for the covering of the jaws, and the keeping the teeth fast in their sockets.

\* See Cowper's Myotom. reformat. fig. 4.

† See our eighth plate, fig. 36. d d.

‡ See Ruysch's Thesaur. 2. p. 26.

§ See Bidloo, T. 12.

|| See Morgagni, Advers. 5. fig. 1.



282. The palate has much the same structure with the gums; but it has also a very great number of glands, discovered so early as in the time of Fallopius: these are principally situated in its hinder part, near the uvula, where it is pendulous in the manner of a curtain. This part is called the velum or claustrum of the palate. The glands situated particularly in this part, secrete a mucous fluid, serving to lubricate the mouth and throat, and to facilitate deglutition\*: they have a great number of apertures there, for the discharging of this humor into the mouth. The great uses of this membrane are, to defend the bones of the palate from corrupting; and for preventing, by its claustrum or velum, the things to be swallowed, from getting up into the nostrils.

283. The uvula, called by Celsus the uva, and by others columella, is a part of a cylindrick, or rather a somewhat conic figure, hanging pendulous from the velum or claustrum of the palate, above the root of the tongue, between the two arches of the palate, as it were, and the tonsils†. It is, in figure, much like the last joint of a child's finger. Its substance is musculous; its covering is of the glandulous membrane of the mouth. It has muscles, by which it is variously moved, which are described in the Myology. And, finally, it has two membranaceous ligaments, by which it is connected with the bones of the palate.

The use of the uvula is not yet perfectly known: 'tis highly probable, however, that it is of assistance in modulating the voice. It has also a share in preventing the drink, taken in at the

\* See T. 8. fig. 36. b b.

† See Ephem. Nat. Curios. Cent. 3. Also the Memoirs of the Paris Academy, 1718.

mouth,



mouth, from rushing up into the nostrils. It is wanting in all quadrupeds\*.

284. The tonsils, commonly called the almonds of the ears, are two remarkable glands, in some degree resembling almonds in figure, and are situated one on each side of the mouth, near the uvula. They secrete a mucous humor for the lubricating the passages, and discharge it by several irregular but conspicuous foraminæ into the mouth†.

The arteries of all these parts, namely, of the tonsils, uvula, gums, lips, palate, and salival glands, all are derived from the external carotids. The veins are from the jugulars, and the nerves principally from the fifth pair.

285. The tongue itself, the great organ of speech, comes next after these parts to be examined. Its figure approaches, in some degree, to pyramidal. Its anterior part, which is smaller and moveable, is called its apex; and its posterior, which is thicker and more fixed, is called its base or root. It is connected with the os hyoides, the lower jaw, the styloide process, the pharynx, the larynx, and the other adjoining parts, by means of a number of muscles and membranes.

Its ligaments are, 1. The frænulum, placed near its apex on the under part, at the root of which the salival ducts of Wharton empty themselves into the mouth. And, 2. A membranaceous ligament, by which it is connected with the lower jaw, the os hyoides, the larynx, and the epiglottis. In the middle of the tongue there is a longitudinal line, called *linea mediana*, which

\* When the uvula has been eaten off by the lues venerea, the voice has sometimes suffered greatly, sometimes very little from it.

† See Widman's Dissertation, Eph. Nat. Cur. 3.



divides the tongue, as it were, equally into two parts.

The tongue is principally composed of muscles, and of nervous involucra or membranes, and of fat, and some glands, and a number of vessels.

Beside the sublingual glands already mentioned, there are frequently a great number met with on the superior and posterior part of the tongue: these are, in some subjects, as large as a small pea, and shew an evident perforation in their centre \*. The foramen cœcum, as it is called, of the tongue, is situate in the upper and hinder part of the tongue among these glands, and is often very conspicuous, sometimes not so much so. Its use was long unknown; but it is, at this time, found to be a true ductus salivaris †.

The arteries of the tongue are numerous and large: they come from the external carotids §. The veins of the tongue are ramifications of the external jugulars: of these some, which are situated under the apex of the tongue, are called *venæ raninæ*: these are sometimes opened by surgeons for bleeding, particularly in disorders of the fauces.

The nerves of the tongue are very remarkable ones. There are two branches from the fifth pair, which are usually said to serve for tasting; and two others from the ninth pair, which are supposed to assist its motions: but Boerhaave disagrees with the common opinion in this respect, and supposes that the first pair serve to assist the motions of the tongue, and that the others are

\* See Morgagni's *Advers.* 1. T. 1.

† See Collins's *Anatomy*, T. 2. and Morgagni, *Advers.* 1. T. 1. As also our figure, T. 4. fig. 20.

§ See Ruysch's *Thef.* T. 3. fi. 4. p. 45.



for the office of tasting\*. Possibly both pair serve mutually for both purposes.

Coschwitz† and Du Verney‡ figure lymphatics in the tongue also.

There are three involucra, tunics or membranes of the tongue, surrounding its muscular substance. The external one is continuous with the common membrane of the mouth: this forms a number of vaginulæ, or cases, of a pyramidal or of a globose figure: these are porous, and serve for receiving the nervous papillæ of the third membrane §.

The second or middle membrane of the tongue, called the reticular membrane of Malpighi, is composed of a very beautiful reticulation, and lets the nervous papillæ pass thro' its apertures: this is conspicuous only on the upper part; and, even there, is much more difficult to be seen in human subjects than in beasts.

The third tunic is papillary and nervous: it is placed immediately under the reticular one, and is easily seen in the same parts of the tongue in the same subjects. This contains a number of nervous papillæ, which are of two kinds; the first, fungous or capitated, resembling the horns of snails, or the young shoots of mushrooms: these are full of little foramina, and may be thrown out or drawn back at pleasure. The other papillæ are pyramidal in their figure: some of them are larger, some smaller, and most of them crooked ||. Both these kinds of papillæ arise from this inner or third membrane of the tongue, and

\* See Ruysch's Institutes, cap. de Gustu.

† Differt. de Duct. Saliv. nov.

‡ See the same treatise.

§ Ruysch, Thef. 1. T. 4. and Morgagni, T. 1. Adv. 1.

|| See Ruysch, l. c.



from its nerves: they pass thro' the foramina of the reticular or middle tunic, and terminate in the vaginulæ, or cases, formed by the external membrane. These papillæ are the primary organ of taste.

The muscles of the tongue, beside those belonging to the os hyoides, are four pair. Of these we shall speak at large in our Myological part. Over the surfaces of these muscles, however, there also run a multitude of irregular and inextricable fibres\*; and it is by means of these that the tongue is occasionally contracted and expanded, thrust forward, and drawn back again, and performs all its other remarkable motions and changes of figure.

The uses of the tongue are, the being the great organ of tasting and of speech, and the serving to the comminuting, sucking, and swallowing of our food; as also to spitting: but it is not so immediately necessary to all these, as has been supposed†.

286. As the tongue is the primary organ of tasting, that of smelling is the nose. This part varies greatly in size and figure in different subjects: it is high in some, low in others, narrow in some, broad in others, and has a number of other lesser variations. Anatomists divide its parts into the external and internal: its more obvious external parts are, the dorsum or back, the root, the spine, the orbiculus, and the alæ or pinnæ: these need no explication. The septum

\* See Malpighi, de lingua.

† We have a remarkable instance in the Memoirs of the French Academy, 1718, of a girl born without a tongue, yet performing all the functions it is supposed to serve to; and in our own Philosophical Transactions, we have an account of one Margaret Cating, who spoke without a tongue, well explained by Dr. Parsons.



is also of the number of the external parts: this divides the nose into two parts, which are called nares or nostrils. The hairs also are of this number: they are called by some vibrissæ: they serve to hinder the mucus of the nostrils from continually running out; and to prevent insects, and extraneous substances of many kinds, from getting in. We are also to add to these the common teguments, namely, the epidermis, the fat, and the cutis. The upper part of the nose is rigid, and composed of bones: the lower part is soft and flexible, and is composed of a number of cartilages, muscles, and membranes.

The internal parts of the nose are, 1. The bones: there are several of these go to the structure of the nose, as the ossa nasi, the maxillaria, the os cribriforme, the ossa spongiosa, the os frontale, the lachrymalia, the os palati, the vomer, and the os sphenoides.

The cartilages, which form the lower part of the nose, are connected by membranes, that the nose may be flexible in that part: the first of these forms the anterior part of the septum narium: there are two very large and conspicuous ones in each of the alæ; and between these there are placed sometimes two, sometimes three, and sometimes more, smaller ones\*.

The septum narium is cartilaginous in its anterior and lower part: in its posterior and upper it is boney; and these parts are surrounded by robust and strong membranes, which join them firmly together.

There are two passages from the nostrils into the mouth, destined for the passage of air, and of the mucous matter. There are also sinus's in

\* See Ruysch's Epist. 8. fig. 4. and Drake's Anthropol. T. 17.



the mixillary, frontal, and sphenoidal bones; and cellulæ in the os ethmoides, which increase the hollow of the nose; and thus also give way to the greater expansion of the pituitary membrane\*.

There are also certain inequalities and eminences of the ossa turbinata, or ossa spongiosa of the nostrils, which serve partly to the same purposes, and partly to prevent insects, and other extraneous matters, and even the cold air, from getting immediately that way into the mouth.

There is also a soft and vascular membrane to be observed, which invests the nostrils, and all their sinus's and irregularities: this is called the membrana mucosa, and pituitaria of Schneider†; and is the primary organ of smelling, and the place of secretion of the mucus of the nostrils.

We are to remark also the oscula, or openings of the excretory ducts, in this membrane: they are extremely conspicuous in the head of an ox, in this part‡.

There are also a number of little glands under this membrane §, especially about the middle of the septum ||. These are destined to the secretion of a mucous humor, like that of the rest of the glands of this part.

The arteries, which are dispersed in prodigious numbers thro' this membrane, arise from the carotids ¶: these serve also for the secretion of this mucus.

The veins are from the jugulars: by these the abundant blood, not employed for these purposes,

\* Delineated in Palfin's Osteolog. T. 1, and 2. and by Drake, T. 18.

† See Schneider de Catarrhis.

‡ See Ruysch, Epist. 8. T. 9. fig. 7.

§ See Ruysch, where before quoted.

|| See Morgagni, Advers. 6. Santorini, p. 91.

¶ See Ruysch, l. c. fig. 6.



is returned. The nerves dispersed thro' the membrana pituitaria, are, 1. The olfactorii, or olfactory nerves: these are sufficiently observable; but they are less in human subjects than in quadrupeds\*. They are supposed to be of use in smelling. 2. Some branches of the fifth pair, which terminate in the hairs: these constitute the true organ of smelling†.

Under the membrana pituitaria there is also another membrane, very thin, and serving to invest the bones and cartilages‡; and called, where it surrounds the former, periosteum; where the latter, perichondrium.

The foramina to be observed in the nostrils, are, 1. Those at the frontal, the maxillary, and the sphenoidal sinus's, and the cellulæ of the os ethmoides, serving for the communication of these sinus's with the nostrils. 2. The orifices of the lachrymal ducts, which open into the nostrils: these are excellently figured by Morgagni§. And, 3. The ducts from the nose into the mouth: these in a skeleton are open, and are obvious just behind the dentes incisores of the upper jaw; but in dissection of recent bodies, they are not found absolutely to open into the mouth at all; nor, indeed, do they so in living subjects; for they are closed up by the membrane of the palate: the use generally attributed to them, therefore, of transmitting a mucous matter out of the nostrils into the mouth, is very erroneous.

The uses of the nose are, to be of primary use in the sense of smelling; to serve in the great

\* Schlevogtius denies this, and says they are only emissaries of the brain.

† See Santorini, p. 92.

‡ See Ruysch, l. c. fig. 8.

§ See Ruysch's Adversar. 6.



office of respiration, and in the modelling the voice; to receive the abundant humors from the eyes, and to add to the beauty of the face. It is certain, that there is no passage for the air, much less for the powders snuffed up the nostrils, to the brain. Whether there be any passages for the transmitting a mucous humor from the brain, to be discharged at the nostrils, as the antients, and as Schelvogtius, and some other of the moderns, have supposed, is not yet ascertained.

287. The organs of hearing are the ears. Anatomists, in describing these, usually divide them into three parts; an exterior, a middle, and an interior. The exterior part is called simply auricula; but more properly by others, auris externa. In this there are a great many eminences and cavities to be observed; as the pinna and lobule, the helix and anthelix, and the tragus and antitragus; the scapha, which is a cavity between the helix and the anthelix behind; and the concha, which is a larger cavity, situate before the meatus auditorius, or passage into the internal ear: in this we are to observe the glandulæ sebaceæ of Valsalva\*, which are mere cutaneous follicles; their substance is composed of the common integuments, and a cartilage.

The muscles of the external ear are also to be carefully examined: they are in human subjects very small, often scarce conspicuous; sometimes however two, sometimes three, and sometimes more of them, may be distinguished. These may be called, from their situation, the superior, the posterior, and the anterior. Their use in moving the ear, is evidently either none at all, or very inconsiderable: the most probable conjecture, as to their real use, is, that they serve to render the

\* Tract. de Hum. Aure.



ear tense, when we would hear more distinctly. We are also to observe the ligament, by which the posterior part of the ear is connected to the os petrosum\*.

After these we are to examine the meatus auditorius, or auditory passage. The course of this is tortuous and oblique, turning principally toward the anterior parts†. Its substance is partly boney, partly cartilaginous; and it is formed, as it were, of broken cartilages, covered with an elastick membrane: the membrane investing its internal part, is continuous with the cutis.

We are also to observe certain small glands, of a yellow colour, called by Du Verney glandulæ ceruminosæ‡. These are situated in the convex part of this membrane, about the middle of the passage. They serve to secrete the cerumen, which they deposit, for various purposes, in the passage.

We are to observe also the corpus reticulare of Valsalva, in the areolæ or sinus's, of which these ceruminose glands are contained§.

We are also, finally, to observe the hairs in the auditory passage, and their use.

The use of the external ear is to receive and convey sounds, in the manner of an acoustick tube, in order to our hearing them the more distinctly||.

The middle part of the ear, which comes next to be examined, is called the tympanum. In this we are to observe, 1. The membrana tym-

\* See Du Verney de Org. Auditus, T. 3. fig. 11.

† See Valsalva, T. 3. fig. 1, and 3.

‡ See Valsalva, l. c. T. 3. fig. 3.

§ L. c. T. 3. fig. 1, and 3.

|| Schelhammer asserts, that he was the first who demonstrated, that hearing is performed by means of sonorous rays, as seeing is by means of visual ones. l. c. n. 59.



panis, which is situated at the extremity of the auditory passage. Its situation is not perpendicular, but very oblique inwards. Its figure is elliptick; and its surface not plane, but concave. It is connected, in its circumference, with an annulus or ring, of a boney substance in infants, which becomes afterward transformed into the auditory passage; and in the middle it is connected with the little bone, called the malleus. Its substance is membranaceous: it is composed, indeed, of two or three lamellæ; and is furnished with a vast number of blood-vessels, which were first discovered by Ruyfch \*.

A great number of authors have followed Rivinus† in mentioning a natural foramen, or hole, very small, and placed in an oblique direction, penetrating this membrane, and ‡ letting the smoak of tobacco, taken in at the mouth, find a passage thro' it out at the ears.

The boney cavity of the tympanum is to be observed as to its size, which is much smaller in human subjects than in quadrupeds. In this cavity we are to observe, the periosteum, which is very thin, and is furnished with a great number of blood-vessels; the chorda tympani, which is a little nerve, composed, by a combination of ramuli or little branches, of the fifth and seventh pairs: this is extended, in the manner of a cord, under the membrane of the tympanum.

We are also to observe here the three ossicula auditus, covered with the periosteum ||: these are called the malleus, the incus, and the stapes. We

\* See Ruyfch, Epist. 8. p. 12. fig. 9.

† See Welsch. T. Anat. 49.

‡ See Valsalva, l. c. cap. 2. and also Drake's Anthropolog. p. 567.

|| See Ruyfch, T. 8. fig. 1.



have already described them in our Osteology, (S. 68.) But we are to add somewhat in this place, as to their connections, &c. The manubrium, or handle of the malleus, adheres to the membrane of the tympanum; and its head is articulated by ginglymus, with the body of the incus; and, finally, the longer leg of this is articulated by arthrodia, with the head of the stapes: the stapes also, at its base, adheres to the fenestra ovalis, by means of a membrane.

The muscles of the malleus are two, an external, and an internal: the stapes has but one\*.

We are after these to observe the two fenestræ, or openings, distinguished by the names of the oval and the round fenestra. The fenestra ovalis leads to the vestibule, on which stands the stapes. The fenestra rotunda leads to the cochlea, and is closed by a membrane.

Beside these fenestræ, we are also to observe two other foramina. The one of these opens into the tube or duct of Eustachius, and terminates in the mouth, almost immediately behind the tonsils: this duct is partly boney, partly cartilaginous, and partly membranous, and affords a communication between the mouth and the ears†. The other of these foramina goes to the cellulæ of the mastoide processes.

The third division, or, as it is usually called, the inner part of the ear, has, among anatomical writers, the name of the labyrinth.

In this we are to observe the vestibulum, which is a cavity forming the middle part of the labyrinth: the passage into this is the fenestra ovalis.

After this we are to observe the three semicircular canals, distinguished by the names of the

\* See more of these in our Myology.

† See T. 8. fig. 38. c, d, e.

largest,



largest, the middle one, and the least, which open by five orifices into the vestibulum. These are well figured by Du Verney and Valsalva.

After this we are to examine the cochlea of the ear. This is a part placed opposite to these canals, and formed in the manner of a snail-shell, forming in its progress two turns and a half, in a spiral form. In this we are to remark the nucleus, and the canal, which is divided into two by a spiral lamina. The upper of these opens into the vestibulum, and is called *scala vestibuli*; and the lower, which terminates in the hollow of the tympanum, through the *fenestra rotunda*, is called *scala tympani* \*.

We are also carefully to observe the very delicate and fine membrane, which is carried thro' all the cavities of the labyrinth: this is formed of an expansion of the auditory nerve, and is the primary part of the organ of hearing; just as the retina is formed of the expansion of the optick nerve, and is the primary organ of seeing. These expansions of the auditory nerve are called, by Valsalva, *zonæ sonoræ* †. They are much more easily distinguished in the ear of a sheep than in the human ear: and in that of an eagle they have been found to be particularly plain and obvious.

We are next to observe the canal of the auditory canal, which is distinguished into the common and the proper. The common canal is large, and there are foraminula in it, passing into the labyrinth. The proper one is narrower and longer, and is called the *aquæduct of Fallopius*: this terminates partly in the cavity of the cranium, and partly between the *styloide* and *mastoide processes* ‡.

\* See Valsalva de Aure hum.

† Valsalva de Aur. T. 8. fig. 8 and 9.

‡ Valsalva, T. 7. fig. 4.



The nerves of the inner ear, are, 1. From the auditory pair: this consists of two parts or branches, a soft, and a harder: the soft branch or part is distributed through the labyrinth\*; the harder part sends off branches to the dura mater, the tympanum, and the external ear. 2. From the third pair of the vertebrae of the neck; but these are principally sent to the external ear.

The arteries are from the carotids, both the external and internal.

The veins run partly to the jugulars, and partly to the sinus's of the dura mater.

288. The organ of feeling is composed of the cutaneous papillæ: these are the villose extremities of the nerves of the skin, and are situated every where on its superficies, but particularly in the palms of the hands, the soles of the feet, and the extremities of the fingers; in the last of which places they are more numerous than in any other part of the body: they are elevated a little, and are covered with the cuticle. Where they are most numerous, the sensation of feeling is most delicate; as has been already observed, where we treated of the integuments.

It is by means of these papillæ that we are endued with the sense of feeling, from the texture, surfaces, and motions of objects; and the qualities sensible to the touch, such as rough and smooth, dry and moist, hot and cold, hard and soft, are conveyed to us by no other means.

289. The sense of taste agrees extremely well, almost in every particular, with this of feeling. In this the nervous papillæ of the tongue, as they

\* See Valsalva, T. 8. fig. 8, and 9. There is a very singular account of the course of this nerve given by Simoncelius; but we are yet to enquire whether it be conformable to truth.



are differently affected by sapid objects, excite in us the various sensations of sweet and sour, austere and mild, and the like.

It is much in the same manner also, that the nerves distributed in the manner of papillæ thro' the membrana pituitaria, affects us with the sensations we have of various smells: so that, upon the whole, the sense of feeling seems almost a general and universal one; and the others may, perhaps, without impropriety, be called only so many different species of this.

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BOOK IV.  
*Of* ANGIOLOGY.

CHAP. I.

*Of the Arteries.*

290. **A**Ngiology is the doctrine of the blood-vessels; that is, of arteries and veins. The term might be understood in a more comprehensive sense; but as custom has established this more limited one for it in anatomical writings, in this only we shall understand it in this place.

291. An artery is a tube or canal, endued with pulsation, elastick, and branched, and serving to carry the blood from the heart to the several parts of the body.

The arteries of the human body are, properly and strictly speaking, only two, 1. The pulmonary artery; and, 2. The aorta, or arteria magna. All the other arteries of the body, tho' distinguished



guished by particular names, are only branches of these.

The figure of the arteries is conoide: they begin from a larger base, and end in a small point. Toward the extremities, however, they become merely cylindrick tubes of an extreme fineness; and these end in reticular plexus's, in pencils, spirules, and other figures; and, finally, go off into veins, lymphaticks, or excretory ducts. The arteries are of a membranaceous structure: they are composed of five coats; the first is vascular, the second cellular, the third tendinous, the fourth musculous, composed of annular, and, as it were, tendinous fibres; and the fifth is nervous.

292. The pulmonary artery arises from the right ventricle of the heart, and is distributed only thro' the lungs, but that with a vast number of ramifications.

293. The aorta, called also the arteria magna, or great artery, arises, with a single trunk, from the left ventricle of the heart, above its valves, called the semi-lunar ones: it presently gives two arteries, called coronary ones, to the heart itself, and its auricles; and after this its trunk is bent, in the manner of an arch: and from this part it sends, in human subjects, usually three ascending branches; from which are formed the two carotids, called, from their situation, the right and left, each of which, about the larynx, is wonderfully turned and bent in most subjects, and is divided into what are termed the external and the internal carotid.

The external carotid sends branches to the larynx, the pharynx, and the muscles of the os hyoides; the jaws, the tongue, the lips, the mouth, the nose, the eyes, the ears, the temples, and, in fine, to all the external parts of the head.

The



The internal carotid enters into the cavity of the skull, and, after many inflexions, sends branches to the several parts of the brain, the membranes of the brain, the eyes, the nostrils, and the internal ears.

The subclavians are two; and from these arise, on each side, an artery, which is called the vertebral: these run up to the brain, between the foramina of the transverse apophyses of the vertebræ; and, after making many windings, enter the cranium, and are joined to the carotids, forming the cervicalis\*, with the spinal†, and with these are distributed over the whole brain.

From the subclavians also arise the musculares colli, which are uncertain both in their number and situation, and are distributed thro' the muscles of the neck.

The external scapulary artery, which is sent to the external parts of the scapula.

The superior intercostals, which are distributed about the two or three first ribs, and the circumjacent parts.

The mediastinal artery, distributed thro' the mediastinum, thymus, and pericardium.

The superior diaphragmatick artery, which descends to the diaphragm, and frequently gives branches to the parts last mentioned; particularly if the mediastinal artery, as is sometimes the case, is wanting.

The mammary artery, which, running under the sternum, descends quite to the abdomen, and sends branches to the breasts, the muscles of the thorax, and those of the abdomen.

And, finally, the axillary arteries, from which are derived the internal scapular, which goes to

\* See Ridley's Anat. Cerebr. fig. 1. g.

† See the same in the same place.



the parts that lie under the scapula : the thoracick artery, or external mammary artery, which is distributed thro' the external parts of the thorax : and the brachial, which usually descends undivided as far as to the bending of the elbow, only sending off little branches to the arm ; but, from this place downward, it is divided into two branches, the radiæus, and the cubitæus ; and these are divided into a number of branches, which run to the hand, and to the several fingers. Sometimes, however, the brachial artery is in the upper part of the arm, and sometimes in the middle, divided into branches ; and many other variations of nature, from her ordinary course, are met with in different subjects, in regard to this division.

After we have thus traced the ascendent branches of the aorta, we are to examine its trunk, which descends, after an arch-like inflexion, thro' the thorax and the abdomen, down to the os sacrum. This is usually larger in women than in men : and from this arise, in their order,

The bronchial artery of Ruyfch ; tho' this sometimes also rises from the intercostals \*.

The inferior intercostals, which are distributed about all the ribs, except the two or three first ; and send ramifications to the marrow in the spine, and to the muscles of the abdomen.

The œsophagæan arteries, which run to the œsophagus, and have been observed but by few of the anatomical writers.

The inferior diaphragmatics, which sometimes also rise from the cœliac.

The cœliac, which issues from the aorta, just below the diaphragm.

\* See Ruyfch's Dilucidat. Valvul. Lymphat. p. 61. and Epist. 6.



The right branch of this sends out the right gastrick and epiploick, the pancreatick, and the duodenick, the hepatick and the double cystick arteries.

The left branch of it sends off the left gastrick and epiploick arteries, the gastro-epiploick, the great splenick, and also many of the pancreatick arteries.

The superior mesenterick next runs off from the descendent trunk of the aorta: this is distributed to the mesentery, and to the small intestines. After this

The renal or emulgent arteries, which are sometimes single, sometimes double, on each side; with these arise the

Atrabiliariæ, which go to the capsulæ atrabiliariæ; and the adiposæ, which run to the adipose membrane of the kidneys; but these also often arise from the renals.

The spermaticks, which in men run to the testicles, and in women principally to the uterus.

The inferior mesenterick, which goes to the larger intestines; and one branch of which, in particular, going to the intestinum rectum, is called the internal hæmorrhoidal.

The lumbar ones, which are various, and go to the muscles of the loins, and to those of the abdomen, and other of the circumjacent parts.

The sacra, which sometimes descends thro' the middle of the os sacrum to the pelvis; sometimes arises one from each iliac, and sometimes is wanting.

And, finally, the two iliacs, each of which is again divided into two parts, the internal, and the external.

The internal branch of the iliac is commonly called the hypogastrick: this runs to the bladder,  
the



the intestinum rectum, where it is called the external hæmorrhoidal artery; to the parts of generation, the buttocks, and the adjacent parts.

The external branch of the iliac sends out the umbilical artery\*; the epigastrick, which runs thro' the musculus rectus of the abdomen, up to the mammary one; the pudendal, which goes to the cutis of the pudenda; and, finally, the crural, which lies upon the vein†, and is divided into two parts; the external, which is smaller, and is distributed throughout the exterior part of the thigh; and the internal, which is larger, and forms the popliteæ, the furales, and the tibial arteries; and which is afterwards, from the extremities of these, divided into a multitude of branches, to which anatomists have given no names, in the foot.

## CHAP. II.

### *Of the Veins.*

294. **A** Vein is a vessel which carries the blood from the several parts of the body to the heart. The primary veins of the human body are three: 1. The pulmonary vein. 2. The vena cava. And, 3. The vena portæ.

295. The pulmonary vein arises from the left auricle of the heart, where it first forms a sinus; and is, soon after that, divided into four branches, and afterwards into innumerable ones, which are ramified, and distributed thro' the whole substance of the lungs‡.

296. The vena cava arises, with a larger sinus, from the right auricle of the heart: it there sends

\* The origin of this, however, varies greatly.

† See Morgagni's *Adversar.* 2. p. 87.

‡ See Drake's *Anthropolog.* T. 13.



out a vein to the heart itself, called the coronary vein; and is divided into two trunks, a superior, and an inferior.

From the superior trunk of the vena cava there arise the following veins:

The vena azygos\*, from which arise afterwards the intercostal veins, and the œsophageæ.

The bronchial vein, which, in some subjects, indeed, does not rise separate; but comes from the azygos, and sometimes from the intercostals, and is in some subjects wholly wanting.

The mediastinal vein, which accompanies the mediastinal artery.

The superior diaphragmatick, which accompanies, in the same manner, the artery of that name; as the mediastinal does the mediastinal artery. And, finally,

The subclavians; from which arise, on each side,

The external jugular, distributed thro' the external parts of the head; and which, in its several parts, receives different denominations from them; such as the frontal, the temporal, and the occipital, &c.

The internal jugular, which gives ramifications to the larynx, the pharynx, the muscles of the os hyoides, and to the tongue: those which are under its apex, are called raninæ. Beside these branches, sent off from different parts of the internal jugular, its trunk terminates in a diverticulum, called the jugular sack, and brings back the blood from the sinus's of the dura mater, and from the brain.

The vertebral vein, which ascends to the cranium, thro' the transverse apophyses of the vertebræ of the neck, and runs to the lateral sinus.

\* See Lancisi; as also Morgagni, Advers. 5. 73.



The superior intercostals, distributed about the two or three upper ribs.

The mammary veins, which accompany the mammary arteries.

The musculares, which are of two kinds, the superior, and the inferior.

The scapulares, which are also of two kinds, external and internal, and the external thoracick.

And, finally, the axillary; the exterior branch of which is called the cephalick, and is extended along the exterior part of the arm, toward the thumb: and its interior branch, called the basilick; and in the right arm the hepatick; in the left, the splenick. The vena mediana is formed of the concurrence of these, in the flexure of the cubit. And, finally, that which runs over the back of the hand, towards the little finger, is called the salvatella.

The inferior trunk of the vena cava is remarkable for the valves, and from this arise the following veins:

The diaphragmatick, or inferior phrenick veins, running to the diaphragm.

The hepatick, which are large, and have many branches, and are sent to the liver.

The renal veins, from the left of which rises the left spermatick vein.

The atrabiliaræ and adiposæ; but these are often only branches from the renal ones.

The right spermatick vein, and near it several lumbar veins.

The sacra, which sometimes is found double.

And, finally, the iliacs. From these, on each side, arise

The hypogastricks, from which branches run to the intestinum rectum, and to the anus: these are called the external hæmorrhoidal veins: and



others to the bladder, the parts of generation, the buttocks, and the adjoining muscles.

The epigastricks, the pudendal, and the musculares, all which accompany the arteries of the same denomination.

The crural, which run to the feet; and the internal branch of which, toward the internal malleolus, is called the saphæna; and its external, about the knee, the poplitæa: in the intermediate part of the leg it is called furalis; and about the great toe of each foot, the cephalick vein of the foot.

297. The vena portæ has some kind of resemblance to a tree, in its structure\*. Its roots, or inferior branches, are divided into the right and left.

From the right arise all the meseriæc veins of the intestines, the internal hæmorrhoidal, and the right epiploicks.

The left is called the splenic vein; and from this arise

The gastrick veins, which are various, and form the coronary vein of the stomach.

The vasa brevia, the epiploick, and the gastropiploick veins.

The pancreatick, and sometimes also the internal hæmorrhoidal vein.

The trunk of the vena portæ, which goes to the liver, affords the cystick veins, the right gastrick, the duodenal, and this often the pancreatick.

Lastly, we are to observe its branches: where the trunk begins to explicate, it constitutes the sinus portæ in the liver; and from this it is di-

\* This is elegantly and justly figured in Cheselden's Anatomy, T. 16.



vided into innumerable branches, which are dispersed thro' the whole substance of the liver.

298. The veins are composed principally of a membranaceous, a vasculous, and a musculous tunick; but these are vastly thinner than in the arteries. There are, in some of the branches of the vena cava, valves destined to be of service in the circulation of the blood; but there are none in the vena portæ, nor in the pulmonary vein.

### CHAP. III.

#### *Of the Nerves.*

299. **T**HE nerves are cylindrick, whitish Neurology. parts, usually fibrose in their structure, or composed of clusters of filaments, arising from the brain, or rather from its medulla oblongata within the skull, and from the spinal marrow, and running from thence to every part of the body.

The nerves are usually divided into two kinds: those of the brain, and those of the spinal marrow. The nerves of the brain are nine pair:

1. The olfactory, which pass thro' the os cribriforme to the membrane of the nostrils; some account of which has already been given, (S. 287.)

2. The optick, which, by their expansion, form the retina of the eye.

3. The motory pair of the eyes, which are divided, each near the orbit, into six parts or branches: of which, in human subjects, the first branch goes to the elevator palpebræ; the second, to the elevator of the eye; the third, to the depressor; the fourth, to the adducent; the fifth, to the inferior oblique; and the sixth, into the tunics of the eyes; but in beasts they are divided much otherwise.



4. The pathetick of Willis: this pair were known to Eustachius. They are very small, and run to the trochlear muscle of the eye.

5. The gustatory pair: these are very large, and are divided, within the cranium, into three branches, immediately under the dura mater. Of these, the first branch, called the ophthalmick, runs to various parts of and about the eye, the eyelids, the muscles of the forehead and nose, and the teguments of the face.

The second branch may be called the superior maxillary one, since, after it has made its passage out of the cranium by the foramen rotundum, it is distributed thro' all parts of the upper jaw, the lips, nose, palate, uvula, gums, and teeth: a branch of it also runs to the ear, and this, joining with a branch of the seventh pair, forms the chorda tympani, already described in its place. Beside these, it sends off also one or two furculi, or little ramifications, in the cranium; and these, together with a little branch of the sixth pair, sometimes give origin to the intercostal nerve.

The third may be called the maxillaris inferior, since, after passing out at the foramen ovale of the cranium, it is distributed over the several parts of the lower jaw, the tongue, and teeth particularly. It is from the distribution of this part that the whole pair of nerves have obtained the name of par gustatorium, tho' a great part of them serves to very different purposes, and is carried to parts that have nothing to do with tasting.

6. The abducent: this sends out a branch for the formation of the intercostal nerve; but almost the whole of the nerve, except this, is carried to the musculus abducens of the eye, whence the pair are named.

The



The intercostal nerve is formed either of ramifications of the two preceding nerves, or only of those of the sixth pair. It makes its way out of the cranium by the passage of the internal carotid, and descends, near the eighth pair, thro' the neck; and thence thro' the breast and abdomen, even to the pelvis; and, in its way, makes various plexus's and ganglia\*, and sends branches to almost all the parts contained in the breast and abdomen.

7. The auditory pair: these arise with two trunks, the one of which is called the portio dura, or hard portion; the other the portio mollis, or soft one. This last enters the foramen of the os petrosum, and thence, thro' various little apertures, gets into the labyrinth: it is there expanded over all its parts, and constitutes the primary organ of hearing.

The portio dura, or harder portion, passing the aquæduct of Fallopius, turns back one or more branches from the anterior surface of the process of the petrosum into the cavity of the cranium; and these run to the receptacles, &c. under the dura meninx†. It sends off also another branch internally, which, with the branch from the fifth pair, serves for the construction of the chorda tympani: and it also sends off a number of other smaller ramifications, which run to the muscles, and other parts of the tympanum.

The rest of this pair goes off to the external ear, the pericranium, the muscles of the os hyoides, the lips, the eyelids, and the parotids.

8. The par vagum, (with the spinalis accessorius of Willis:) these pass out near the lateral sinus's of the dura mater, and, descending thro'

\* Of the fabrick and resemblance of these, see Morgagni, Adversar. 2.

† See the same, Advers. 6. p. 34.



the neck and thorax to the abdomen, send out branches by the way to the larynx, the pharynx, the heart, the lungs, and more than all to the stomach. It also sends away, from the upper part of the thorax, large branches to the larynx, which, from this odd passage, are called recurren-  
 rents; and, finally, these are variously implicated and entangled in the neck, the thorax, and the abdomen, with the linguals, the cervicals, and the intercostals.

9. The lingual pair go immediately to the tongue, and are called, by some, the motory nerves of the tongue; but by others, with more justice and propriety, gustatoria.

Finally, we are to observe, that the pair of nerves, which the generality of anatomical writers, after Willis, have called the tenth pair of the head, are, for many unanswerable reasons, to be properly called the first pair of nerves of the neck.

300. The nerves of the spinal marrow are those which arise from the medulla, or marrow contained in the spine; not from the brain. Of these there are properly thirty-two pair.

Those of the neck are no less than eight pair, and from these there are innumerable branches distributed thro' the muscles of the head, the neck, the scapula, and the humerus. From the third pair, in particular, there is a branch which runs up to the ear: from the third, fourth, and fifth pair are formed the nerves of the diaphragm, which, passing thro' the neck and the breast, descend to the diaphragm: the sixth, seventh, and eighth pair of these, together with the first pair of those of the back, after they have been joined by various anastomoses, form the six robust nerves  
 of



of the arm, which are dispersed throughout the scapulæ, the arms, the hands, and the fingers.

To this division also is the spinal accessory nerve of Willis to be referred, as a sort of ninth pair of nerves of the neck: this arises from the spinal marrow, about the origin of the third or fourth pair, and passes thro' the great foramen in the os occipitis up into the cranium: it is then joined to the par vagum, and, coming out of the cranium again by the same aperture, it recedes again from the par vagum, and is bent back to the musculus scapulæ cucullaris, or trapezius †.

The nerves of the back are twelve pairs: these, beside the branch which they give to the brachial nerves, run intirely in the same furrow along the course of the ribs, and are dispersed over the pleura, the intercostal, pectoral, and abdominal muscles, the breasts, and other parts of the thorax.

The nerves of the loins are five pair: they are, in general, dispersed over the loins, the peritonæum, and the integuments and muscles of the abdomen: and, beside this, their first pair often gives, on each side, a branch to the diaphragm. The second pair, after inosculating with the branches of the first, third, and fourth pair, forms the crural nerve, which is distributed over the anterior part of the thigh; and in the same manner a branch is formed of the conjunctions of the second, third, and fourth pair, which passes thro' the great foramen of the os pubis to the scrotum, the testicles, and the adjoining parts.

\* Santorini observes, in opposition to Ridley, that "this pair do not arise from the prior but from the posterior ones, and not below the fifth.

† This is finely delineated by Du Verney in his *Tract. de Aure humana*, T. II. fig. 1.



The fourth and fifth pair of the nerves of the loins, joining with the first, second, third, and fourth pairs of the os sacrum, compose the nerve called the ischiatick, or the posterior crural nerve, which is the largest in the human body: from hence it passes out between the musculi glutæi of the pelvis, and descending along the hinder part of the thigh, between the two lower heads of the os femoris, it is divided into branches, which are distributed over the whole leg, the foot, and the toes. Before it goes out of the pelvis, however, it sends off a number of branches to the bladder, the intestinum rectum, the genitals, and many of the adjacent parts.

The nerves of the os sacrum, finally, are five pair, tho' not always determinately and regularly so: they pass thro' the anterior foramina of this bone; and the superior ones of them, as already observed, compose the ischiatick nerve; and what remains is dispersed, in a multitude of ramifications, over the parts contained in the pelvis, the intestinum rectum, the bladder, the parts of generation, and the other adjacent ones.

The posterior foramina of this bone are very large; but thro' these there pass no nerves, tho' many of the anatomical writers have unluckily asserted that there do. The reader, who would enter more deeply into the doctrine and distribution of the nerves, should study Willis's Treatise of the Brain and Nerves, and Vieussien's Neurologia, where they are expressed by large, elegant, and accurate figures.

301. The structure and fabrick of the nerves is pretty easily distinguishable in most of the larger and in some of the smaller ones. Beside the blood-vessels they receive, and the membranes they are surrounded with, they are seen to be composed  
of



of a fibrous matter ; or, as it were, of bundles or clusters of white, cylindrick, and very slender filaments : these filaments, on the strictest examination we are able to make into their nature, appear to be solid, and without any cavity \*. Much less are we to suppose, that any one ever saw a fluid contained in them, as too many authors, and those of reputation, have attempted to persuade the world they had.

Tho' we cannot discover, by our most nice enquiries, that there is any such fluid as the animal spirits contained in the filaments of the nerves, or indeed that they have any cavity for the reception of it ; yet it is very possible, that there may be such cavities, tho' too small for our discovery, and a fluid of a proportionable fineness and subtlety in them : and the following arguments have been urged, with great shew of reason, in support of the opinion that it is so, and that these filaments are all vessels.

1. Because they arise from the brain and the spinal marrow, in exactly the same manner as the other ducts do from the other viscera and glands ; that is, they rise from the extremities of the arteriolæ of the cortical substance of the brain.

2. Because the vast abundance of blood, which is carried up into the head by four very large arteries, when we consider that the liver is nourished by a single one, and that but a small one, cannot be supposed destined to the nutrition of the brain alone, or at all necessary to it ; nor indeed to be directed thither with any visible intent, unless for the secretion of another fluid, and that in very large abundance, to be there made from it.

\* Lewenhoeck indeed affirms, that he had often found a cavity in them ; but he is not free from errors in many of his microscopical observations.



3. Because the nerves continue to grow to be elongated, and to be nourished, from the first period of the formation of the foetus in the uterus to the full growth, and to extremest old age; which seems hardly possible to be explained any way, unless by supposing that there is a subtle fluid contained in them, which distends them, and preserves them vigorous, after they have done growing.

4. Because, on cutting a nerve asunder, the sensation, motion, and nutrition of the part, into which it was inserted, ceases. This seems to set the importance of the nerves much higher than that of any other of the vessels, and to give proof that the influx of some fluid, of the utmost consequence to the part, is prevented by the destroying the communication.

5. It is not only on the cutting a nerve asunder that this happens, but also on the only tying one up; particularly on tying up the nerves of the diaphragm, in a living subject, its motion is always found to cease; and on pressing these nerves below the ligature, towards the diaphragm, there returns some motion in that part: and this seems to plead very strongly in favour of there being some fluid in the cavities of these filaments, and for the motion of the diaphragm depending on it.

6. The business of sleeping and waking seems not to be accountable for on any other plan, than that of allowing a fluid of this kind to the nerves. Certainly nobody yet has so much as tolerably accounted for it otherwise.

7. It is as impossible also to explain why it is, that so surprising a debility, especially in people of not very robust constitutions, succeeds too free



a use of venery, unless by having recourse to these animal spirits.

8. Nor, indeed, has any body yet been able to explain, without having recourse to the same fluid in the nerves, that amazing debility that is the consequence of too intense study; or that which accompanies many diseases, and particularly that surprising loss of strength that is one of the constant symptoms in malignant fevers.

9. The possibility of a cavity in the nerves, and of a fluid being contained in that cavity, tho' we are able to distinguish neither the one nor the other, may also be easily evinced from the observation of the growth and nuturation of fruits. In the stalks of a cherry, for instance, we are only able to discover a set of fibres, which, like the white filaments of which the nerves are composed, appear to be perfectly solid: no cavity, nor any juice, ever was distinguished in any of these filaments; yet it is very evident, that they must have cavities, and those much larger than there is a necessity of supposing those in the nervous filaments; since, unless a juice, and that of a much coarser and thicker nature than we need suppose that of the nerves to be, passed thro' them, it would be impossible for the fruit to increase in size. The very stone, in this case, is formed of particles that have passed thro' cavities, thus imperceptible to us. And after we have been obliged to acknowledge this, surely it can be no great concession to allow a possibility of cavities and a fluid in the nerves; the apparent necessity of which our reason plainly shews, tho' our bodily organs cannot shew its existence.

10. Finally, those who absolutely deny the existence of animal spirits, or of a fluid conveyed thro' the cavities of the nervous filaments, allow  
no



no purpose, or at least but a very inconsiderable one, for which the nerves themselves can have been formed: if they say, that the soul works on the body by a contraction of the nerves, and thus produces motion, it may be answered, that no powers of contraction can be shewn to be in the nerves. And, beside this, the phænomena already mentioned, from the tying up of a nerve, cannot be explicated any other way than by allowing the existence of a fluid, whose course is thus stopt; for the ligature would not be of any force towards the preventing its powers of contraction, as is evident from the consequence of tying a rope round, ever so firmly, in one part, with a thread: the power of contracting will not be prevented by that.

302. The great use of the nerves, therefore, seems to be, tho' we are not able perfectly to demonstrate it, to convey to all parts of the body, nay, by their minute fibrils of the last division, to every point of every part of the body, a fluid of an extremely subtle kind, secreted in the brain and in the spinal marrow, and destined for no less noble a purpose than the sensation, motion, and nutrition of the several parts of the whole human fabrick.

The reader, who would enter farther into this nice and important disquisition, would do well to read Boerhaave's chapter on the brain, in his *Institutes*; and Morgagni's *Adversar.* 2. p. 70. and the two succeeding ones; and the 29th and 30th of his sixth *Advers.* where he treats judiciously and deeply on this subject; and, after these, Burggrave on the Existence of the Animal Spirits.

There are many at this time who absolutely deny the existence both of these spirits, and of the cavities supposed to contain them, because they



can see neither; and some of them have gone so far as to censure, very severely, those who have asserted the existence of them; tho' with no better proof against their existence than this of their not having been able to make them the objects of their senses. But it may be observed, that they reason very erroneously on the subject of this fluid, who suppose, from its offices, that there is any necessity of its being gross enough to be obvious to our senses: on the contrary, its effects seem rather, as Schelhammer has justly observed, to shew that it ought to be as subtile as penetrating, and as swift in its motions as light, and to diffuse itself as universally and instantaneously thro' the places of its destination. Some instances we have given, seem to shew a necessity of all this subtilty in it; and if we will allow it, that it follows evidently enough, that it is more proper to be an object of our reason than of our senses, and to be seen by its effects rather than by its surface. We cannot see, nor ever can expect to see, the vessels thro' which the fluids circulate in the legs of a mite; yet we are very certain, that there are such vessels and such fluids there. The air, and many other existences, might also be mentioned, as things which we never do nor ever can see; yet whose effects very plainly prove to us, that there are such things.

#### A COM-



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A  
**COMPENDIUM**  
 OF  
**ANATOMY.**

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**BOOK V.**  
*Of MYOLOGY.*

**CHAP. I.**

*Of Myology in general.*

303. **M**Yology is the doctrine of the muscles, explaining their fabrick, their origin, insertion, situation and use.

304. A muscle is an instrument of motion: it is a part of the human body destined for the moving some other part, and that in general by a voluntary motion, or such as is dictated by the will. It is composed principally of fleshy and of tendinous fibres, which have also vessels of all kinds, arteries, veins, nerves, and lymphaticks; all which parts are surrounded by or inclosed in one common membrane,

305. A muscle is divided, by anatomists, into the body and the two extremities: the body is called, also the belly of the muscle, venter; and the



the two extremities, if they are white, are called tendons.

That extremity where the muscle arises is called its head, *caput*, or its beginning, its origin, or its fixed point. Its other extremity, or end, is called its tail, its moveable point, and often its tendon; and, finally, this, if it be broad and membranaceous, is called an aponeurosis.

306. The action of a muscle consists properly in the contraction of its belly, after whatever manner that is done: by this means its extremities approach toward one another; and by this means also the part, into which the end of the muscle is inserted, moves as if it were drawn by a cord. Schelhammer\* is of opinion, that this contraction of the belly of a muscle is performed by means of a corrugation of the fibres, in the same manner as we see an earth-worm shorten and contract itself by corrugating its skin, &c. Morgagni†, on the other hand, alleges, that, in order to understand the power of motion in a muscle, we ought to attend to Wallis's experiment; by which it is evidently proved, that the smallest force imaginable of the air, driven thro' a cylindrick tube into a bladder, will, by distending its width, and shortening its length, cause it to raise up, and sustain a weight of sixty or seventy pounds.

Others have demonstrated, by hydrostatical principles, that a very small quantity of a fluid, directed thro' a small cylindrick tube, placed on a vessel of a larger base, and already filled, will be able, in the same manner, to move and raise up a large weight: from which they shew that it follows, that the belly of a muscle swells in the time of its contraction or action; and that this

\* See his *Analect. Anatom. Dissert.* 7.

† See his *Adversaria* 5. p. 112.



intumescence may, nay and must, have very great effects.

On the other hand, there are, among the latest and most celebrated writers, some who affirm, that the belly of a muscle does not swell, or become distended at all, in the time of its contraction: but it would be well, if the asserters of this opinion would, while they forcibly draw up the under-jaw to the upper, lay two or three of their fingers upon either the temporal or masseter muscle; for, in this case, they will have the most evident of all conviction, that, while these muscles act, their bellies are in reality distended, and rendered firmer. Or let them only, when the hand is placed in a proper situation, forcibly draw the thumb toward the first finger, and they may both see and feel, in the most evident manner in the world, that the muscle between the thumb and the index swells, or is distended in its middle, as the action of drawing the thumb toward the finger is performed. A number of other instances of the certainty of this fact might be brought; but this last alone is so obvious and indisputable, that more are not necessary\*.

In many of the muscles both the extremities are moveable: these properly have no fixed point at all; but in these, that part which, of the two, is least moveable, is always called the head, or the fixed point, by the anatomical writers; and the more moveable part, or end, is called the tail, or the punctum mobile. This, however, cannot be done universally, since there are cases in which

\* The reader, who would enter more deeply into this disquisition, may consult Borelli de Motu Animalium; Bernouilli de Motu Muscul. Berger's Physiolog. cap. 22. Boerhaave's Institutes, in his chapter of Muscular Motion; and Mead's Introduction to Cowper's Myographia.



that extremity of a muscle, which was a little before the moveable point, becomes the fixed point; and that which was the fixed, becomes the moveable one. Examples of this we have in the *scaleni*, the *ferrati antici*, and some of the muscles of the abdomen, not to mention any others.

307. Among the muscles there are certain different ones, which conspire in the same action, and so perform the same motions as associates. Such are the flexors or extensors of the arm, and the like: hence these, and such others as conspire in the same manner to the same action, are called by authors *focii* and *congeneres*.

When, on the other hand, we regard the contrary actions of certain muscles, as the extensors of any part which act quite contrarily to the flexors, these are called *antagonist* muscles: in this case, both the kinds acting together, render the limb rigid or immoveable: this action of the muscles is called *motus tonicus*. We are also to observe, on this occasion, that several of the muscles, considered singly and separately, perform other kind of motions than those ascribed to them in regard to the whole part: thus the *maстоide* muscle, the *rectus major capitis*, &c. when they act on both sides, bend the head forwards; but when only on one side, they draw the head obliquely downwards, and to one side. Hence, from the diversity of the muscles, which act either alone or conjunctly with their associates, or with others, there arise several intermediate motions, quite different from the primary ones, and such as have not hitherto been sufficiently observed.

This does not only happen in regard to the muscles of the head, the flexors and extensors, and the like, but to several others; and particu-



larly to those of the eyes, the lips, the jaws, the tongue, the neck, the abdomen, the arm, the carpus, &c. These we are carefully to attend to, and explain to ourselves, by what particular muscles, acting distinctively, they are performed; otherwise we shall never be able to understand the various and wonderful motions of the parts.

Winflow's excellent observations on the actions of the muscles, published in the Memoirs of the Paris Academy for the year 1720, deserve to be carefully read on this occasion. Among other curious things, this author shews, that a great many of the motions of the muscular parts are not owing to the supposed contraction, but to the relaxation of the muscles of the opposite side.

308. The muscular fibres are, according to the action they are intended for, of various directions; some are strait, others oblique, others transverse, others annular, and others spiral.

309. Some of the muscles consist of one simple or uniform series of fibres: these are from this distinguished by the name of simplices. Others are composed of various and often contrary courses of fibres; and these are sometimes so closely and regularly arranged together, that they seem to form several separate lesser muscles, and the large one consequently appears to be composed of a number of others: these are therefore called composit muscles. Steno, Borelli, and Lower, have excellently explained the nature of these kind of muscles. The more of these clusters of fibres, or smaller muscles, there enter into the composition of a larger, the thicker and stronger it is.

310. The motions of the far greater part of the muscles are voluntary, or dependent on our will: those of some others are wholly involuntary. The former are called animal, the other  
natural



natural motions. Finally, the motions of some of the muscles are of a mixed kind, partly animal, and partly natural. Those muscles which perform the voluntary motions, receive nerves from the brain or spinal marrow: those which perform their motions involuntarily, have their's from the cerebellum: those whose motion is partly voluntary, partly involuntary, have their nerves in part from the brain, and in part from the cerebellum. As we find, that a muscle can no longer act, when its nerve is either cut asunder, or tied up; so the same absolute dependance it has on its artery. The experiments of Steno, and others, on living quadrupeds, shew that, on the cutting or tying up the artery, the muscle in the same manner loses its whole power of motion.

311. The muscles generally receive their names from their fixed and their moveable points conjointly; sometimes from the fixed point only, and sometimes only from the moveable one: some of them also are denominated from their uses, and some from their figure, or resemblance to other things: and, finally, some from their place, their size, tuation, or their other qualities; as will appear more at large in our consideration of the muscles separately. The figures of the muscles most to be depended upon are those of Vesalius, Drake, and Cowper in his *Myotomia*.

312. We shall begin to enumerate them from the head, thence descending regularly to the foot. After this, we shall enquire into their number; a thing most writers are strangely disagreed about, and that with very sufficient cause, as nothing absolutely certain can be established about it: they are certainly more than five hundred in the whole body.



## C H A P. II.

*Of the several muscles of the cutis of the head.*

313. **T**HE muscles of the cutis of the cranium are four: two called frontal, and two occipital.

The frontal muscles are very thin: they are situated under the skin of the forehead, and have both their extremities moveable, excepting only for a few fibres, which arise from the inferior edge of the os frontis. They are extended on each side, under the eyelids, from the orbicularis of the eyelids, near the larger canthus of the eye, beyond the middle of the orbit, toward the lesser canthus, and extend somewhat obliquely outwards over the os frontis: after this they expand their tendons over the upper part of the cranium, and seem to be joined with the aponeuroses of the occipitales, which are fixed. By this means they are able to move the skin of the forehead, and the eyebrows. The antagonists to these are the orbiculares palpebrarum, on which they are affixed.

The occipital muscles are also usually very thin: they arise, on each side, from the os occipitis, where it adheres to the temporal bones: they ascend upwards over the ossa bregmatis, and join their aponeuroses with the frontal ones, to which they seem to afford their fixed point. They, together with the frontal ones, cover the head, as it were, with a helmet or cap, and they assist their actions\*. Morgagni has observed, that

\* Cowper is of opinion, that these two frontal muscles may more properly be esteemed one digastrick one. See his Myotom. fol. p. 16.

these



these occipital muscles are sometimes intirely wanting; and at others, when not absolutely deficient, that they are so thin that it is scarce possible to see them: sometimes also they are larger than usual, and are divided, as it were, each into two. It has been from an examination of them in some subject, in which they were of this kind, that Santorini\* makes two occipital muscles of each side.

314. The eyebrow has only one muscle: this is called its corrugator, or depressor. It rises on each side from the root of the nose, and is obliquely inserted into the eyebrow. It moves the eyebrow downward; and when the two belonging to the two eyebrows act together, they draw them toward one another. The frontal muscles, on the other hand, elevate the eyebrows. There seems some reason on the side of those, who suppose this a part of the frontalis. Santorini judges it part of the orbicularis†.

315. The muscles of the eyelids are three: the orbicularis, the elevator, and the depressor. The orbicularis, or constrictor of the eyelid, is single: it rises from the upper apophysis of the maxillary bone, near the larger canthus of the eye, and surrounds the eyelid with a series of orbicular fibres, serving to shut it: in this action also it depresses and draws forward the eyebrow‡, and elevates the lower eyelid§.

The elevator proprius palpebræ superioris, or proper elevator of the upper eyelid, has its origin in the bottom of the orbit, and its insertion in the edge of the upper eyelid, near the cartilage of the tarsus.

\* Pag. 8 and 9.

† Pag. 8 and 9.

‡ See Morgagni, Advers. 2. p. 28.

§ See the same author, Advers. 6. p. 44.



The depressor palpebræ inferioris, or depressor of the lower eyelid, is a series of fleshy fibres, sometimes thinner, sometimes thicker, arising from the cutis of the cheeks, and sometimes from the os jugalis, and is inserted into the lower edge of the orbicularis: by these fibres it is, if we strictly attend to it, that the lower eyelid is drawn downward, when we open the eye.

### CHAP. III.

#### *Of the muscles of the eyes.*

316. **T**HE muscles of the eye are seven in quadrupeds; but in man they are only six\*, and are distinguished into two sets, under the names of recti and obliqui.

The recti are four: they arise near the ambit of the foramen of the optick nerve, in the fundus of the orbit; and are inserted into the sclerotica, not far from the ambit of the cornea†. They are, the superior attollens, called also the superbus, which raises the eye.

The inferior deprimens, called also the humilis, which draws it downward.

The exterior abducens, called also indignatorius, which draws it sideways and outwardly.

The interior adducens, called also bibitorius, which draws it inwardly.

If two of these muscles act conjunctly, the eye has an intermediate or oblique direction.

The oblique of the eye, called also rotatores, are two; a larger, and a smaller.

\* These are finely figured in Eustachius, T. 39.

† Morgagni, Adversar. 6. 98. observes, that they are extended also to the eyelids, especially the lower, and assist in their motions.



The obliquus major, called also obliquus superior, and trochlearis, the greater, upper, or trochlear oblique muscle of the eye, has its origin near the precedent; but it passes thro' a singular trochlea\*, of an almost cartilaginous structure, near the large canthus of the eye: from thence it again turns back, and is inserted into the upper part of the eye, near its middle: hence it obliquely depresses the pupil, and, in some degree, draws it outward.

The obliquus minor, or inferior, the lesser or lower oblique muscle of the eye, arises from the anterior and inner part of the orbit, not far from the nasal canal: it surrounds obliquely the lower part of the bulb, and is inserted into its exterior part, near the middle. Hence it moves the pupil of the eye obliquely upwards, which is very different from what has generally been supposed to be its effect. Both these obliqui acting together, draw the eye forwards; and thus they are the antagonists of the recti which draw it backwards.

The seventh muscle of the eye, which is peculiar to quadrupeds, arises from the bottom of the orbit, from the whole circumference of the optick nerve: it surrounds the whole posterior part of the sclerotica, and seems destined to serve for the protusion of the bulb of the eye.

\* See Morgagni, *Adversar.* 6. 98. See also Winslow's *Memoir* on this subject, in the *Memoirs* of the Paris Academy 1721.



## C H A P. IV.

*Of the muscles of the ear.*

317. **T**HE muscles of the external ear are frequently so very small as scarce to be visible; and sometimes, indeed, they are absolutely wanting: from this, and from their action being scarcely perceptible, Schelhammer has rejected them from among the number of essential or ordinary parts of the human body \*. The antients seem also to have neglected them for the same reason; and Galen, in particular †, esteems them rather the lineaments of muscles than real and perfect ones. Columbus‡ and Fallopius § were the first who described them with any degree of propriety; and they both agree in saying, that they are not found in all subjects. Fallopius in particular says, that he had sometimes found three: the first of these, he says, was situated in the anterior part of the ear, arising from the extremity of the frontal muscle, and thence descending very thin toward the ear, into the superior and anterior part of which it is inserted. The second arises, with a thin and fine beginning, above the mamillary process; and thence descending transversely, it grows a little wider; and after it has divided into three fingers, as it were, it is implanted into the posterior part of the ear. The third is a part of what is called the platysma myoides; from which sometimes there ascends a part, which is inserted into the lower part of the ear.

\* Tract. de Auditu, p. 1. c. 1. n. 7.

† De Ufu Partium, l. 16. c. 6.

‡ De re Anatomica.

§ Observat. Anatom.



Casserius \* and Bidloo †, instead of three, reckon five; but Du Verney ‡ acknowledges only two, a superior, and a posterior: and Cowper § agrees, that this also has been the determination he has fallen into often, on an almost infinite number of examinations. Valsalva || figures them, adding to these two another, under the name of an anterior one. After him, Vieussens describes four, and countenances his determination, by expressly saying, that he had examined the ear a thousand times before he would venture to describe them; and that his figures are so accurate, that nothing farther could be necessary on the occasion ¶.

Santorini, who seems not to have met with this piece of Vieussens's, accuses almost all the authors, who had gone before him, of great errors on this head, and gives a new delineation \*\* of the whole. It is probable enough, that all these authors, tho' they differ so extremely from one another, yet describe what they saw; for the muscles under consideration vary so extremely, that they may have appeared as they all, except Bidloo indeed, describe them, in different subjects: they are scarce alike, in all respects, in any two bodies: usually there are only two of them, the superior and posterior, already described; but these often differ extremely in their figure. Their use seems to be, to give a tension or relaxation to the external ear, according as is necessary for the different degrees of sounds.

\* Tractat. de Auditu.

† Anat. T. 12. fig. 1.

‡ Tractat. de Auditu.

§ Myotomia nova, p. 29.

|| De Aure human.

¶ Traite de l'Oreille; in which also the Paris Censor greatly commends Vieussens's figures.

\*\* Observat. Anatom.



The muscles which Valsalva gives to the tragus and antitragus, and those which Santorini and Douglass\* give to the helix, the concha, and the meatus auditorius, appear also, on a strict examination, to be rather lineaments only of muscles, as Galen calls them, or muscular membranes, than real or true muscles; for there are very rarely any fleshy fibres observed in those parts, nor are there any motions there that should render muscles necessary.

318. The muscles of the internal ear are of two kinds; those of the malleus, and those of the stapes: they are all extremely minute.

The muscles of the malleus, according to Cowper, Douglass, and Valsalva, are three†. They are also found pretty constantly so, on careful dissections. They are distinguished by the names of the externus, obliquus, and internus.

The externus mallei, or external muscle of the malleus, rises with a short belly from the upper edge of the meatus auditorius; and is continued, by a slender tendon, over the superior part of the membrana tympani into the tympanum: and is, finally, inserted into the thicker process of the malleus: it serves to draw the manubrium of the

\* Myograph. p. 29.

† Myotom. nov. fol. p. 33. and T. 23. Du Verney makes them only two; but he describes them under different names. But Vieussens, in his *Traite de l'Oreille*, makes only one muscle of the malleus, which he calls the monogastrick; tho' he says it has a double origin, and a double extremity. He figures it T. 2. fig. 3. Valsalva, in his *Treatise on the Ear*, not only gives other names to these muscles, but he describes them otherwise; nor does he agree with Cowper as to their uses. Boerhaave, in his *Institutes*, differs also from them both. And from these difficulties it is not easy to extricate one's self, as the parts are so minute and variable perhaps in themselves.



malleus outward, and by that means relaxes the membrane of the tympanum.

The obliquus, called also by some the semicircularis, is situated in the external and boney part of the ductus Eustachii; from whence passing a little upwards, and backwards thro' the canal, it is inserted into the longest process of the malleus, and serves to relax or straiten, in various degrees, the membrane of the tympanum.

The internus mallei arises from the cartilaginous part, where the boney part of the ductus Eustachii terminates; and it goes on in the boney part of this canal, in its upper part, almost to the fenestra ovalis in the tympanum; where its tendon, as if it ran over a pulley, is reflected to the malleus, and is inserted into the posterior part of its handle, near its head. It serves to extend the tympanum.

The stapes has but one muscle: this rises in the canal of the os petrosum, almost at the bottom of the tympanum, with a tolerably thick body, which soon sends out a tendon that is slender, and is inserted into the head of the stapes and the bone called os orbicularis. It serves to elevate the stapes.

## C H A P. V.

### *Of the muscles of the lips and nose.*

319. **T**HE muscles of the lips appear, on a careful examination, to be fourteen\*. They serve to form the various motions of the lips, and answer the purposes of the soul there.

\* Santorini makes them more numerous.



The constrictor is single: it is also called the orbicularis. It constitutes the very substance of the lips. Its fibres are frequently of an arched figure \*.

The abductores are two pair; the zygomatick and buccinators. The zygomatick has its origin from the os zygomatic, whence its name: its termination is at the angle of the lips. This, tho' usually single, is sometimes double throughout; at other times it has a double head: sometimes its tail only is bifid, and it is variously interwoven with the adjoining ones.

The origin of the buccinator is partly from the anterior and lower part of the coronoid process of the lower jaw \*, and partly about the roots of the posterior dentes molares of both jaws. Its progress, as the head is held erect, is nearly horizontal; its termination, as that of the former. Its uses are to bring the food into the way of the teeth, and the salival duct of Steno perforates it about the middle.

The elevatores are some of them common to both lips, some peculiar to each. The common ones are only one pair, called the par caninum: these arise from the hollow on each side, under the os jugalis, in the os maxillare, and are inserted into the angle of the lips.

Those peculiar to the separate lips are two pair, the incisarii and elevatores. The incisarius is peculiar to the upper lip: its origin is from the maxillary bone, just under the orbit: it passes the ala of the nose next it, and gives some fibres to it; and is inserted into the orbicularis, near the dentes incisores.

\* See Cant. T. 1. and Santorini, T. 1.

† Santorini denies this; but experience confirms it.



The elevator is proper to the lower lip. Cowper calls it elevator labii inferioris. It rises below the dentes incisores of the lower jaw, under the gums, and descends into the cutis of the chin: hence it may be properly enough called the incisorius inferior, as the other is the incisorius superior.

The depressoress of the lips are three: they are often wonderfully interwoven with some of the beforementioned muscles. They are the triangulares and quadratus.

The triangulares are two: they arise each from the lateral and under-part of the lower jaw, about the middle; from whence they ascend obliquely to the angle of the orbicularis.

The quadratus is single: it is composed of reticulated fibres; and arises, with a broad beginning, from the anterior part of the same jaw, and terminates on the whole lower part of the orbicularis.

320. The muscles of the nose are three pair\*; two of them dilatatores, and one constrictor.

The

\* Santorini gives a great many more muscles than are here described, to the nose, the lips, and other parts of the face, many of which he has the honour of being the first observer of; particularly he has given eight pair to the nose, all which he has figured in his first plate: but, in dissections, very few of these new muscles are to be discovered. What are here described are, in a great measure, certain: such of his as are additional, are often all wanting: sometimes one or two of them, indeed, are found; but they seem rather the sportings of nature than real and determinate conformations: they often have neither the appearance of the fibres or membranes of muscles. We are to add to this, that Cowper, Morgagni, and Cant affirm, with great justice, that the muscles of the face are so various, in different subjects, that, after dissecting a hundred faces, no two of them will be found perfectly alike in this respect; and to this only is it to be attributed, that so great and accurate men as Cowper, Eustachius,



The dilatatores, which serve also to elevate the nose, are very various in different subjects; but, in general, they are however two on each side; tho', even in this, they vary extremely, and sometimes are so thin and fine as scarce to be perceptible. They are called the pyramidalis and myrtiformis.

The pyramidalis arises from the root of the nose, and is usually continuous with the frontalis: it descends along the side of the nose, where it is by degrees a little expanded. It is inserted into the alæ of the nose, and often sends down its fibres as far as to the upper lip\*.

The myrtiformis, or dilatator, strictly so called, arises near the incisivus of the upper lip, of which it frequently is but a part: it is inserted partly in the alæ of the nose, and partly in the upper lip.

The constrictor is but one: it is not orbicular in human subjects, as it is in many of the quadrupeds; but is only a small muscle, first described by Cowper†. Properly there is, in the human frame, no such muscle as the constrictor orbicularis of beasts; but this serves in some degree in its

chius, Cheselden, and Santorini, differ so greatly in their descriptions of the parts. This difference is evidently owing to the variety of the real structure in the several faces they had examined; and upon the whole it is very fairly to be concluded, that little is to be said with certainty, except of those mentioned in our enumeration. What we call *lusus*, or sportings of nature, tho' they are the source of confusion in these examinations, are not without their use, and that of the most important kind: it is to them that the variety of human faces is in a great measure owing. Santorini acknowledges, that several of his new ones were only to be found in robust subjects. Our author acknowledges, that tho' he had sought for them in such, there were many of them which he could never find as real muscles.

\* See Drake's 17th Table; and Cowper, in fol. T. 25.

† See Myotom. in 8vo.



office. It is also figured by Eustachius †. It arises above the dentes incisores of the upper jaw, and terminates in the alæ of the nose. Santorini will have it, that it is double §, which has been also sometimes seen. The orbicularis of the lips assists this very greatly in its action.

## C H A P. VI.

*Of the muscles of the lower jaw.*

321. **T**HE muscles of the lower jaw are six pair, two of depressors, and four of elevators. The depressors of the lower jaw are, first, the platysma myoides; 2dly, the biventer.

The platysma myoides arises near the clavicle, from the pectoral and deltoide muscles; and also, as Galen, and after him Cowper, have observed, from the vertebræ of the neck, and is inserted into the lower jaw; but that in such a manner, that it usually sends out, in its course, fibres to the cheeks and lips, and usually also to the ears; to the motions of all which parts it is also assistant.

The biventer, called also, from the Greek, the digastrick, or two-bellied muscle, has its origin in the incisure that is under the mastoide process. The tendon of it often passes also the stylohyoidæus muscle, and the membranaceous ring affixed to the os hyoides, in the manner of a pulley; and is then inserted, by synchondrosis, into the internal part of the chin. The mouth is opened, by means of this trochlea, in a most wonderful and elegant manner ||.

† Tab. 41. fig. 1.

§ Obs. Anatom. p. 21.

|| See our author's *Dissertatio de Masticatione*.



The four pair of elevatores are, the crotaphites, the masseters, and the internal and external pterygoidæi.

The crotaphites, called also the temporal muscle, has its origin in the whole region of the temples, but more particularly in the ossa frontis, sin-  
cipitis, temporum, and sphenoides. It passes under the jugum, and is inserted into the acute process of the jaw.

The masseter has its origin from the lower and interior part of the jugum, and its end at the external superficies of the angle of the jaw. The ductus Stenonianus, or salival duct of Steno, passes over this muscle.

The pterygoidæus internus, or internal pterygoide muscle, has its origin in the cavity of the pterygoide process, and its termination in the interior and lower superficies of the angle of the jaw.

The pterygoidæus externus has its origin from the exterior lamina of the just mentioned process, and the neighbouring part of the spheroidal bone; and its termination is a little above the insertion of the other\*.

## C H A P. VII.

*Of the muscles of the os hyoides and tongue.*

322. **T**HE muscles of the os hyoides are five pair; the mylo-hyoides, the coracohyoides, the genio-hyoides, the sterno-hyoides, and the stylo-hyoides.

The mylo-hyoides arises, with a large base, from the bottom of the lower jaw, near the chin; and its termination is at the base of the os hyoides.

\* See Cowper's Myotom. nov. fol. T: 31.



The coraco-hyoides has its origin behind the coracoid process, from the upper costa of the scapula. Cowper and Morgagni have accurately figured it; and it is inserted into the basis, and the horn of the os hyoides.

The genio-hyoides arises in the middle of the chin, above the mylo-hyoides, and near the symphysis of the jaw: its termination is in the base of the os hyoides.

The sterno-hyoides arises from the sternum and clavicle usually; sometimes only from the sternum, and sometimes only from the clavicle: it is inserted into the base of the os hyoides, and is the antagonist to the former.

The stylo-hyoides has its origin in the styloid process, and its termination in the horn and the base: this is often perforated by the digastric muscle of the jaw.

The uses of these several muscles will be easily understood from their situation. Cowper has excellent figures of them in his 27th Plate.

323. The muscles of the tongue are four pair, the genio-glossi, stylo-glossi, cerato-glossi, and the basio-glossi.

The genio-glossus has its origin in the chin, above the genio-hyoidæus: it enters the middle of the tongue, and moves it forward.

The stylo-glossus arises from the apex of the styloid process: it descends obliquely to the side and root of the tongue, and moves it sideways backwards and upwards.

The cerato-glossus arises from the horn of the os hyoides, and is inserted into the root of the tongue.

The basio-glossus arises from the base of the os hyoides, and runs along the middle of the tongue toward its apex: it, with the assistance of



the precedent, draws the tongue backward, and makes it shorter.

Some authors add to these the name of a muscle called mylo-glossus; but what they call by this name is only a part of the mylo-hyoidæus, and there is therefore no necessity to increase the number of the muscles by making one of it.

## C H A P. VIII.

*Of the muscles of the larynx, epiglottis, and pharynx.*

324. **T**HE muscles of the larynx are generally accounted seven pair. They have their names from the places of their origin and insertion; and the principal use of all of them is to assist in modulating the voice\*.

Of these seven pair two are common, and have their origin out of the larynx: the other five are proper, and have both their origin and termination in the larynx. The common ones are the sterno-thyroides, and the hyo-thyroides.

The sterno-thyroides draws the larynx downward, and at the same time dilates the glottis†.

The hyo-thyroides elevates the larynx, and constricts the glottis‡.

The five proper muscles of the larynx, arising and terminating in it, are,

1. The crico-thyroides, which serves occasionally either to dilate or constrict it§.

\* Santorini describes several others, and has figured them in his third Plate: he acknowledges, however, that they are only to be found in some particular subjects; and our author acknowledges he never was able to find them at all.

† See Cowper's Myol. nov. p. 45.

‡ See Santorini, p. 103.

§ See the same, p. 102.



2. The crico-arytænoides posticum; and, 3. The lateral crico-arytænoides, which serve to dilate the glottis.

4. The thyro arytænoides, which, together with the following, serves to constrict it.

5. The ary arytænoides: this last arises frequently from one arytænoide cartilage, and is inserted into the other: this and the former mutually intersect one another, and straiten the glottis\*. Often there is only one muscle†, and often it is different from what is here described; for nature varies greatly in it‡.

Anatomists, for a long time, allowed the muscles of the epiglottis only to brutes§, tho' Sylvius had described very punctually two attollents, and as many depriments, in human subjects||; but of late they have been restored to the human frame again. One of the first who has allowed them there is J. G. Paul¶, who declares that himself had found them; and, after him, they were described by several others.

The attollents are two: they are considerably long, and are extended from the base of the os hyoides to the hinder root of the epiglottis: these the author calls hyo-epiglottici.

The depriments are two, and smaller: they extend, from the apices of the arytænoide cartilages, obliquely forwards to the sides of the epiglottis: they are called ary-epiglottici\*\*.

325.

\* See Morgagni's Adversar. T. 1. fig. 2.

† See Cowper, p. 46.

‡ See Morgagni's Advers. 1. and Santorini, p. 104.

§ See Fabricius ab Aquapendente, and Casserius de vocis organ.

|| See his Isagoge Anat. cap. 7. de Musculis.

¶ In his Preface to the Opuscula of Horn

\*\* Monf. Littré, in the Memoirs of the French Academy for the year 1718, describes three muscles of the epiglottis,



325. The muscles of the pharynx \* serve partly to dilate, and partly to contract it. Of those which dilate it, there are six pair: there is only one to contract it.

The six which serve to dilate it are,

1. The stylo-pharyngæus. This arises from the beginning of the styloide process, and is inserted on both sides into this and into the thyroide process. This and the following pair serve as well to elevate as to dilate the pharynx.

2. The cephalo-pharyngæus. This rises from the anterior apophysis of the occipital bone, and terminates in its posterior part †.

3. The ptery-pharyngæus, which arises from the pterygoide processes ‡.

4. The salpingo-pharyngæus, which arises from the Eustachian tube §.

two of them depriments, and one attollent; but he is not punctual as to their origin, insertion, and other particulars. Santorini also describes not only one attollent, (something of which our author discovered afterwards, and which is figured according to that observation in the eighth plate of this work, fig. 34, letter k) but also four depressors, two ary-epiglottidæi, and two larger thyro-epiglottidæi; and even, beside these, he mentions two smaller thyro-epiglottidæi in the middle part of the epiglottis: but these himself confesses are so extremely thin and delicate, especially the last pair, that they are scarce perceptible, unless in subjects of the most robust make. Our author also declares, that he never in any dissection met with any thing more than membranes in the place of them: it does not, however, follow from this, that in some they may not be larger and more distinct. See Santorini, cap. 6. and Morgagni's Advers. 1. N. 28.

\* See Cant's figures, T. 3. and Cowper's Myotom. T. 28 and 29.

† See the same; as also Douglass's Myograph. 41. Santorini calls this pair azygos, p. 121. Valsalva denies this origination of them; but all these authors join in asserting it, and our author's experience confirmed it.

‡ Morgagni's Adversar. 1. p. 4.

§ See Douglass, Cant, and Santorini.



5. The mylo-pharyngæus, which arises from the lower jaw, behind the last of the dentes molares, and surrounds in great part the tonsils \*.

6. The glosso-pharyngæus, which arises from the tongue. This, as well as all the others, terminates in the posterior parts of the tongue, where a tendinous line is often very conspicuous †.

The single muscle, which serves for the constriction of the pharynx, is the œsophagæus, or, as it is otherwise called, the sphincter gula. This rises on each side from the os hyoides and the thyroide, and the cricoide of the larynx, and surrounds the hinder part of the gulæ. Valsalva, on occasion of the multiple origin of these muscles, has divided them into three pair; and Douglass, Cant, and Santorini have made yet more of them, and have given names to their divisions of them, from their origin and termination; as hyo-pharyngæus, thyro-pharyngæus, and crico-pharyngæus: but as the fibres of all these are, in reality, very intimately connected and interwoven together, so that they very rarely can be explicated, and scarce ever in any thing like the regularity and order Valsalva and others have described, it seems best to agree with Cowper not to multiply parts without reason, and to account all these as so many parts only of one whole, which is the muscle, called by the other writers the œsophagæus, or the sphincter gulæ.

The muscle called by Cowper vaginalis gulæ, has been already described in what appears to be its proper place, under the name of tunica musculosa œsophagi. See Section 260.

\* Santorini thought this had not been described; but Cowper has a fine figure of it.

† Some deny the existence of this line; and it sometimes indeed is wanting.



## C H A P. IX.

*Of the muscles of the Uvula.*

326. **T**HE muscles of the uvula, which, together with the velum palatinum already described, is a part of the pharynx, are six pairs, and one single one. These are,

1. The glosso-staphylinus \*, or glosso-palatinus, arising on each side from the root of the tongue, and terminating in the velum palatinum.

2. The pharyngo-staphylinus, which rises on each side from the sides of the pharynx, and terminates also in the velum †.

3. The thyro-staphylinus, which arises from the lateral part of the thyroide cartilage, and, ascending towards the uva, becomes larger; and is inserted, in manner of an arch, in the side of the velum palatinum.

4. The spheno-staphylinus of Cowper, Cant, and others, tho' it might be more properly called the salpingo staphylinus ‡, as the most accurate examinations prove that it has not its origin, or, at the utmost, but in a very small part, from the os sphenoides; but principally from the posterior part of the tube, and indeed partly from its membranaceous part §: it descends from hence obliquely to the uva, and is inserted into its hinder and upper part; and hence, if both these act together, they retract or draw it back ||.

\* Valsalva de Aure hum. c. 2.

† Ibid.

‡ Valsalva, c. 2.

§ Possibly however this origin sometimes varies, as it does in many others.

|| See Cowper, T. 28. fig. 4. and our T. 8. fig. 38.



5. The pterygo-staphylinus\* : this arises from the upper part of the pterygoide process, and the anterior part of the tube, which is near it : it descends between its two lamellæ, and turns back its tendon over the thin apophysis of the interior lamella, as if over a trochlea, to the anterior part of the membrane of the palate, into which it is inserted† : the uvula is therefore moved downwards and forwards by this pair. Valsalva calls this musculus novus tubæ, tho' it had been described long before his time : he supposes that its office is to dilate the tube ; but of this more hereafter ‡.

6. The palato-staphylinus arises on each side from the junction of the bones of the palate : it is broad at its beginning, but it afterwards joins its associate, and becomes then narrower, so as to resemble a triangle, which descends from the place of its origin to the uvula, and is inserted into its upper part : it draws it upward and forward §.

7. The musculus azygos of Morgagni || : this rises tendinous from the juncture of the bones of the palate, and is extended fleshy, thin, and cylindrick along the middle of the uvula ¶. It is placed at the back of the former muscle, and, with the glandules and the membrane of the mouth, constitutes the uvula\*\*.

\* See Cowper, T. 28.

† See Cant, T. 3. fig. 2. and T. 8. fig. 38. of this work.

‡ See his Tract de Aure.

§ Douglass, in his Myographia, claims the honour of discovering this before : the names, indeed, are Douglass's.

|| See Morgagni's Advers. l. n. 8.

¶ See Cant, l. c. and our T. 3. fig. 38.

\*\* See Santorini, c. 7.



## C H A P. X.

*Of the muscles of the head and neck.*

327. **T**HE muscles of the head are ten pair. Three pair of them are called flexors \*, and are,

1. The mastoidæus: this rises from the sternum and clavicle, and terminates in the external surface of the mastoide process.

2. The rectus major anticus: this arises from the transverse apophyses of the five lower vertebræ of the neck; and is inserted into the os occipitis, before the condyloide process.

3. The rectus minor anticus, called by Cowper musculus annuens †: this arises from the anterior surface of the atlas, or first vertebra of the neck; and lies concealed, as it were, under the former, 'till it is at length inserted, a little behind it, into the os occipitis.

The extensors of the head, beside those common to the neck, are five pair:

1. The splenius: this rises from the lower vertebra of the neck and the five upper ones of the back, and is inserted a little above the mastoide process.

2. The complexus: this has its origin from the three upper vertebræ of the back, and the six lower ones of the neck: it runs under the former, and is inserted near it into the os occipitis.

3. The rectus major posticus: this has its origin from the spinose apophysis of the epistrophæus, and is inserted into the os occipitis.

\* Winslow observes, in the Paris Memoirs for the year 1720, that these not only greatly assist the bending of the head; but sometimes, when we are erect, and the rest of the muscles quiet, the first will do it alone.

† See Cowper's Myol. T. 24.



4. The rectus minor posticus : this has its rise from the posterior part of the atlas, and its end under the former.

5. The obliquus minor : this has its origin from the transverse apophysis of the atlas, and its termination a little above that of the rectus major.

The rotatory muscles of the head are only one pair : this is the obliquus major : its origin is in the spinose apophysis of the epistrophæus, or second vertebra ; and, ascending obliquely from thence, it is inserted into the transverse apophysis of the atlas\*.

The muscles bending the head sideways, are only one pair. This is the rectus lateralis† : this has its origin from the upper surface of the transverse apophysis of the atlas : from this it ascends straight, with a short body, but considerably thick ; and is inserted partly into the os occipitis, and partly into the temporal bone, near the incisure of the mastoide process.

328. The muscles of the neck are six pair : two pair are flexors, two are extensors, and two serve to draw the part sideways. The flexors are,

1. The scalenus : this has its origin from the first, the second, and sometimes the third rib ; and is inserted into the transverse apophyses of the vertebræ of the neck. This muscle is referred by Fallopius, and some others, to the number of the elevators of the thorax, and that not without some reason ; for it serves both to that purpose, and to that for which it has its place here. This muscle is frequently divided into three parts,

\* This is not properly a muscle of the head ; for it does not touch any part of it. It is truly a muscle of the atlas : it has its origin from the second vertebra, and is inserted into the first.

† See Cowper, l. c. k.



sometimes more, sometimes less distinctly : from hence some of the anatomical writers have made three muscles of it, under the name of the first, the second, and the third scalenus.

2. The longus : this arises from the bodies of the five upper vertebræ of the back, and is inserted into all the vertebræ of the neck.

The extensors of the neck are the transversales and interspinales :

1. The transversal, called also the spinal muscle\* : it is owing to Cowper† that this pair of muscles is added to the extensors of the neck ; nor must we omit the mentioning and enumerating them among these ; but they are very improperly separated from the common extensor of the back and loins, called longissimus dorsi, of which they are truly no more than a part : but of this more hereafter.

2. The interspinales colli : these are truly five pair, and are situated between the spinose apophyses : they arise from the upper part of the spinose apophyses of the five lower vertebræ of the neck, and each of them is inserted into the lower part of the spinose apophysis of the vertebra next above.

Of the muscles of the neck, serving to bend it to one side, are the intertransversales and intervertebrales :

1. The intertransversales are situated among the transverse apophyses of the vertebræ : they arise from the lower vertebra, and are inserted into that next above ‡.

\* See Cowper's Myotom. fig. 8. i. and k.

† See Cowper's Myotom. nov. T. 44.

‡ See Philos. Transact. vol. 21. p. 132.



2. The intervertebrales Douglassi \*, so called from their discoverer Dr. Douglass, are very small, and their number uncertain: they arise from the lateral part of the body of the vertebra, and ascend obliquely to the posterior part of the vertebra next above.

## C H A P. XI.

### *Of the muscles of the scapula.*

329. **T**HE muscles of the scapula are properly five pair :

1. The elevator, or, as it is called by some, *musculus patientiæ*: this arises from the transverse apophyses of the first, second, third, and fourth vertebra of the neck, and terminates at the superior angle of the scapula.

2. The trapezius, or *cucullaris*: its origin is from the os occipitis, the spinose apophyses of the neck, and of the seventh and eighth of the back †. Its termination is at the spine of the scapula, the acromion, and clavicle. This has the power of several very different motions: the different course of its several fibres enabling it, as they act differently, to move the scapula upwards, downwards, or backwards ‡.

3. The rhomboides: this has its origin from the five lower spinose apophyses of the neck, and the three upper ones of the back, under the precedent muscle: it runs obliquely under it, and

\* See his *Myograph.* p. 85.

† Douglass extends the originations of these even to the tenth vertebra. *Myogr.* p. 69.

‡ Cheselden denies these diversity of actions, and says this muscle only serves to draw the scapulæ backward, or toward one another. Winslow is against this, and says their principal use is to elevate the scapula. *Mem. Paris* 1719.



is inserted into the whole base of the scapula. It serves to move it upwards and backwards.

4. The serratus, or dentatus minor anticus, called also the pectoralis minor: this arises, by dentated origins, from the second, third, and fourth true ribs: it continues its course under the pectoralis magnus, and is inserted into the coracoid process of the scapula.

5. The serratus, or dentatus major anticus: this arises also by dentated origins from the six lower true ribs, and from one, or sometimes two of the upper spurious ones\*; and it terminates in the base of the scapula. These two serve to move the scapula forward and downward: many of the anatomical writers have referred these to the number of the elevators of the ribs. These call that the beginning of the muscle which we here call its end†. It is to be allowed, that they may also serve to the purpose which those authors suppose them intended for, when the scapula is held firm and immovable by the elevator, trapezius, and rhomboides.

## C H A P. XII.

### *Of the muscles serving to respiration.*

330. **O**F the muscles serving to respiration, some of them dilate the thorax, and others contract it. The dilators act conjunctly: they are,

1. The diaphragm, which has been already treated of in its place, (S. 257.)

\* The two or three lower dentated beginnings of these muscles join those of the external obliqui of the abdomen.

† See Douglass's Myograph. p. 73, and 74.



2. The intercostals, which are generally allowed to be forty-four in number: in every interstice of the ribs there are two, an internal, and an external. Their origin is from the lower edge of the superior rib, and their termination at the upper edge of the succeeding rib: the fibres of the external ones run forward, and those of the internal ones obliquely backward. They serve to elevate the ribs for the service of the lungs.

3. The levatores costarum of Steno, and supracostales of Verheyen\*, are of two kinds, distinguished, from their figure, into short and long.

The short ones, breves, are twelve on each side: they have their origin from the transverse processes of eleven vertebræ of the back, and of one that is the lower one of the neck; and they are inserted obliquely into the hinder part of the ribs.

The long ones, longi, are three or four: their origin is the same, from the seventh, eighth, ninth, and tenth vertebræ; and their end in the ninth, tenth, eleventh, and twelfth ribs†.

4. The subclavian: this rises from the lower part of the clavicle, near the acromion; and terminates in the anterior part of the upper rib, and of the sternum.

5. The serratus posticus superior: this arises, with a thin and broad tendon, from the two lower vertebræ of the neck, and the two upper ones of the back; and terminates in the second, the third, and the fourth ribs‡.

\* See Anatom. T. 35. fig. 1. e e, f f. Morgagni, in his Advers. 2. 36. shews that these muscles were well known to Casserius and Steno.

† See Verheyen, ibid. fig. 1. f f.

‡ Possibly this muscle serves also to extend the neck, and serves the muscles of the neck and back in place of a ligament.



6. The *ferratus major anticus*, mentioned under our last division among the muscles of the scapula, is also by most authors referred to this place; but as the scapula is evidently a part susceptible of more and easier motions than the ribs, it is evidently more properly to be numbered among its muscles. It is to be allowed, indeed, that this muscle sometimes may assist in raising the ribs, especially in cases of difficult respiration.

7. The *scalenus colli*, of which we have already treated among the muscles of the neck, which is certainly its more proper place.

The constrictors or depressors, beside the muscles, more properly belonging to the abdomen, tho' assisting in this effect, are these:

1. The *ferratus posticus inferior*: this rises with a broad tendon from the three lower vertebræ of the back, and the two upper ones of the loins: it terminates in the four inferior spurious ribs, and surrounds the extensors of the back, in manner of a vagina, to prevent their fibres from separating one from another, as they might otherwise do in violent motions.

2. The *triangularis sterni*: this rises from the lower and interior part of the sternum, and is inserted on each side into the cartilages of the fourth, fifth, sixth, and seventh true ribs. Verheyen divides this into several muscles, and calls them *sterno-costales* \*. Some authors also deny its existence; but this is a very rash determination, and has no foundation in observation.

3. The *intercostales* of Verheyen. Of these there are found, on drawing away the pleura, six, seven, eight or nine on each side: they have their origin not far from the heads of the ribs, and, ascending obliquely, terminate in a rib above,

\* L. c. fig. 2. a b c d e.



some in that immediately over the other, some in the next but one above \*. Morgagni observes †, that these muscles were known to Eustachius.

4. The extensor lumborum & dorsi communis, to be described more at large in the next section, concurs also to the depressing the ribs on this occasion. It has its origin from the os sacrum, and is inserted by a multiple tendon into the hinder part of the ribs ‡. Morgagni also goes so far as to ascribe tendons to this muscle, by means of which it acts, he says, as an elevator of the ribs.

### C H A P. XIII.

#### *Of the muscles of the back and loins.*

331. **T**HE muscles of the back and loins are for the most part common: there are of the extensors usually reckoned three on each side.

1. The sacro-lumbaris: this has its origin at the os sacrum and posterior spine of the ileum, and its termination in the upper part of the ribs.

2. The longissimus dorsi, which has its origin in the same place, and its termination partly in all the vertebræ of the spina dorsi, particularly in their transverse apophyses, and partly in the ribs ||.

3. The semi-spinosus: this has its origin from the os sacrum and vertebræ of the loins, and its termination at the upper vertebræ of the thorax, especially at their spinose apophyses.

\* Ibid. fig. 3. d d, e e.

† Advers. Anat. 2. p. 36. and Tab. Eustach. 16.

‡ See Verheyen, fig. 1. b b.

§ See Adversar. Anat. 2. p. 38.

|| See Morgagni's Advers. 2. p. 38.



These are the three muscles usually allowed as extensors in this part; but as they cohere in so firm a manner together, that they are scarce to be separated by any act without laceration, and as they all conspire in the performing the same action, perhaps it is more just to call them all together only one common muscle, under the name of the common extensor of the back and loins\*. If these act only on one side, they draw the back obliquely sideways.

The flexors, beside the muscles of the abdomen, which serve to the drawing the parts as well forwards as sideways, are,

1. The quadratus lumborum: this has its origin in the anterior and superior part of the posterior process of the os ilei, and its end at the transverse apophyses of the vertebræ of the loins, the last vertebra of the thorax, and the last rib.

2. The psoas parvus: this arises by a slender tendon from the os pubis, where it is joined to the ileum; and is inserted into the side of the upper vertebra of the loins†.

3. The intertransversales lumborum: these are very small muscles, described by Douglass: they are situated between the transverse apophyses of the loins, arising from the rim or edge of one; and, being inserted into the succeeding one, they assist in the moving the part sideways‡.

\* Cheselden in his Anatomy observes, that these muscles act also alternately when we are walking, elevating the ossa innominata; and that this may be perceived, on laying a hand upon the loins as we walk.

† This muscle is often wanting: when it is found, its office is to assist the quadratus in elevating the ossa innominata, especially when we lie down. Douglass says Riolan was the first who described it, p. 90.

‡ See Douglass's Myogr. p. 90.



## C H A P. XIV.

*Of the muscles of the arm and hand.*

332. **T**HE muscles of the arm, the brachius or humerus, are nine. The elevatores are three\*.

1. The deltoides: this arises from the clavicle, and the acromion and spine of the scapula; and terminates at four fingers breadth below the neck of the humerus.

2. The supraspinatus: this has its origin from a cavity above the spine of the scapula, and its insertion in the neck of the humerus.

3. The coraco-brachialis: this has its origin at the coracoid process of the scapula, and its termination about the middle part of the arm.

The depressors of the arm are three: these are assisted in their action by the weight of the arm itself. They are,

1. The infra-scapularis: this has its origin from the whole internal surface of the scapula, and its termination in the interior part of the head of the humerus.

2. The rotundus, or teres major: this has its origin at the lower angle of the scapula, and its termination three fingers below the head of the humerus.

3. The latissimus dorsi, called also by some aniscliptor: this has its origin at the posterior part of the spina ilei, the upper spine of the os sacrum, and all the spinose apophyses of the loins, and the seven inferior ones of the back: it unites its ten-

\* Winslow, in the Paris Memoirs, shews that the adductores and abductores assist these.



don with the former muscle, and is inserted in the same place.

The adductores are only one pair, the pectoralis major: this has its origin in the clavicle, the sternum, and all the true ribs, and its termination at four fingers breadth below the head of the humerus. The action of this muscle is probably greatly assisted by the action of the coracobrachialis, and that of the deltoides by that of the upper part of this pectoral muscle, which is usually a kind of distinct muscle.

The abductores of the arm are two, the infra-spinatus, and the rotundus, or teres minor:

1. The infra-spinatus has its origin in the cavity below the spine of the scapula.

2. The rotundus, or teres minor, has its origin at the inferior costa of the scapula; and this, with the former, indeed, properly form only one conjunct muscle, forming at the extremity only a single tendon, which is inserted into the posterior part of the neck of the humerus.

333. The muscles of the cubitus are six, two flexors, and three extensors. The flexors are,

1. The brachialis externus: this rises tendinous with two heads: one of them, which is the broader, has its origin from the coracoide process; the other, which is slender and longer, from the acetabulum of the scapula. This descends in the channel of the humerus, under the ligament of the joint; becomes fleshy, and joins with the former: and after this runs near the insertion of the deltoides, in the anterior part of the arm, and ends partly by a round tendon in the tubercle of the radius, a little below its upper head; and partly by a broad tendon in the common membrane, which surrounds all the muscles of the cubitus. This tendon is sometimes

cut



cut in bleeding, and very bad consequences attend the accident\*.

2. The brachialis internus arises just below the end of the deltoide, and is inserted into the tubercle of the ulna, a little below its upper head.

The extensors of the cubitus are four, the longus, brevis, brachialis externus, and anconæus.

1. The longus arises from the inferior costa of the scapula.

2. The brevis arises from the external spine of the humerus.

3. The brachialis externus arises near the former, from the interior spine of the humerus. These three unite their several tendons, and make, as it were, only one triply divided muscle, which is inserted into the hinder part of the olecranon, and may very properly be called the musculus triceps brachialis.

4. The anconæus has its origin in the exterior condyle of the humerus, and its termination a little below the terminations of the others.

334. The muscles of the radius are four; two of them are pronators, two supinators. The pronators are,

1. The rotundus: this rises from the internal condyle of the humerus, and terminates near the middle of the radius.

2. The quadratus, which has its origin in the lower part of the ulna, and its termination opposite in the lower part of the radius.

The supinators are,

\* These are elegantly figured by Cowper, Myotom. nov. T. 50. and described p. 74. Winslow also, in the Paris Memoirs 1720, has treated judiciously of the subject: he shews, that this muscle is properly a supinator of the radius, and an elevator of the arm.



1. The longus, which has its origin from the exterior spine of the humerus, and its termination at the lower head of the radius\*.

2. The brevis, which rises from the upper part of the ulna, and is inserted into the upper part of the radius, which it totally surrounds and incloses.

335. The muscles of the carpus, or hand, are six: three of them are flexors, three extensors. The three flexors all arise from the internal condyle of the humerus: they are,

1. The radiæus internus: this is inserted into the bone of the carpus next the thumb.

2. The ulnaris internus, which terminates in the internal officle of the carpus.

3. The palmaris, which is inserted into the palm of the hand by a broad expanded tendon, and the office of which seems to be the constriction of the palm.

The three extensors all arise from the external condyle of the humerus: they are,

1. The radiæus externus. 2. The longus & brevis, called by others the bicornis. One of these is inserted into the first metacarpal bone, and the other into the second.

3. The ulnaris externus, which terminates in the metacarpal bone that supports the little finger.

If the muscoli radiæi act all together, and at the same time the ulnares are all quiet, the hand is moved outwards: and, on the other hand, when the two ulnares act together, and the radiæi are quiet, the hand is drawn inwards. The muscles are also kept together, and in their places, by a ligament, called, from its shape, the ligamentum annulare: but we are to observe, that

\* This muscle may also be of use in the bending the cubit.



this ligament does not appear annular in dissections, as it is usually figured; but is rather a common membrane, surrounding and including all the muscles which are placed about the cubitus and carpus, and facilitating their motions. In preparations of the parts, this membrane assumes an annular figure, such as it is usually represented of\*.

336. The muscles of the palm of the hand are two, according to the generality of anatomical writers; the palmaris, simply so called, and the palmaris brevis.

The palmaris has been described in the last section, among the flexors of the hand; to which it more properly belongs than immediately to the palm.

The palmaris brevis, called also by some caro quadrata, adheres, in form of a small mass of flesh, to the aponeurosis of the palmaris longus, above the abductor muscle of the little finger: this is said to assist in drawing together the hand: both this and the former, however, are often found to be wanting in dissections.

## C H A P. XV.

### *Of the muscles of the fingers and toes.*

337. **T**HE muscles of the fingers are in part common, and in part proper. The common are the flexors of the first, second, and third phalanx, the extensor and interossei.

1. The flexors of the first phalanx are the four lumbricales: these arise deep and tendinous, and are inserted into the first phalanges on the side next the thumb.

\* See Vesalius's Muscul. T. 1, and 2.



2. The flexors of the second phalanx are the *sublimis*, called also *perforatus*: this arises from the internal condyle of the humerus and the radius, and is divided into four tendons, which are inserted into the second phalanges of the four fingers.

3. The flexors of the third phalanx are the *perforans*, or *profundus*: this has its origin at the upper part of the middle of the ulna, and, dividing into four tendons as the former, it perforates the tendons of that, and is inserted into the beginning of the third phalanx of the four fingers\*.

The extensor of all the three phalanges is called the *extensor communis*: it has its origin at the external condyle of the humerus, and the posterior part of the radius and ulna: it then divides into four tendons, which pass under the ligament of the carpus, and terminate in the posterior surface of all the phalanges of the fingers, which are gibbous on that surface.

The *interossei* are divided by anatomists into the internal and external. The external *interossei* are three: they occupy the interstices between the bones of the metacarpus in the back of the hand. The internal ones are also three, according to the generality of writers; but *Stockhusius* makes them six: they are situated in the palm of the hand, and are more properly placed under the bones of the metacarpus than between them; so that *interossei* is a bad name for these. They all of them arise from that part of the metacarpal bones which is nearest the carpus, and are inserted in various

\* These two muscles pass under the transverse ligament of the carpus; and their tendons, included in a strong membranaceous vagina, are joined to the bones of the fingers, to prevent their receding in the time of flexion.



manners into the sides of the fingers. Their offices are various: they sometimes act singly, sometimes in concert with the other muscles of these parts: they accordingly serve either to draw the fingers together, or to separate them from one another; to divaricate or to contract them, and to extend or bend them.

338. Of the proper muscles of the fingers, those belonging to the thumb are five:

1. Its flexor, which has its origin in the middle part of the radius, and its end in the third phalanx.

2. Its extensor, which is called also bicornis and tricornis: this arises in the posterior and middle part of the ulna and radius, and terminates in two or three tendons in the first, second, and third phalanx.

3. The thenar, or abductor: the origin of this is in the transverse ligament that joins the bones of the carpus, and its termination in the first and second phalanx. The two sesamoide bones of the thumb are usually found lodged in the tendon of this muscle.

4. The hypothenar: this rises, near the precedent, from the same ligament, but somewhat more towards the palm of the hand; and it terminates in the lower head of the first phalanx. This muscle is not mentioned by many authors, and, indeed, there is some reason on the side of esteeming it but a part of the former.

5. The antithenar, or abductor: this rises from the metacarpal bone of the middle finger, and is inserted into the first and second phalanx\*.

339.

\* We are to observe on this head, that there are frequently great variations in the muscles of the thumb, as well as in those of the fingers, in different subjects; so that no description



339. The proper muscles of the index or fore-finger are two, an extensor, and an abductor :

1. The extensor has its origin with the common extensor of the fingers ; and, indeed, there is some reason to acknowledge it but a part or portion of that muscle.

2. The abductor has its origin in the interior bone of the metacarpus, and terminates on the inside of the first phalanx\*.

340. The proper muscles of the auricularis are two :

1. The proper extensor, which seems to be a part of the common extensor, and has its origin with it.

2. The abductor, the origin of which is at the interior bone of the metacarpus, and its insertion at the internal side of the first phalanx.

Many add to these two muscles an adductor ; but this properly draws the internal metacarpal bone towards the thumb †.

341. We are now to return from the arms to the trunk again, to examine the muscles belonging to the abdomen ; and from these we are to proceed to those of the legs.

342. The muscles of the abdomen, and those of the clitoris, have been already described in their proper places, under S. 205, and S. 234.

tion can be given that will suit all subjects. The extensor of the thumb is sometimes bicornate, sometimes tricornate, and in some subjects there are two flexors, as Cowper observes, Myot. p. 216. Variations of the like kind are also found in the muscles of the other fingers. See Morgagni's Advers. 2. 40.

\* A sesamoide bone is sometimes found also in the tendon of this muscle.

† In this also is sometimes found a sesamoide bone. See our plate 1. fig. 5. l. c.

‡ See Winslow's Observ. Memoirs of Paris 1720.

But



But we have still, for the business of this place, the muscles of the testicles, the penis, the urethra, the anus, the urinary bladder, and the vagina, to describe.

## CHAP. XVI.

### *Of the muscles of the parts of generation.*

343. **T**HE muscle of the testicles is called the cremaster or elevator: it is a thin series of muscular fibres, arising sometimes from the oblique ascendens of the abdomen, near the place where that muscle is perforated to give passage to the spermatick vessels. Sometimes it rises from the transversus\*; and, finally, sometimes from the spine of the ileum†. From either of these origins it proceeds, together with the process of the peritonæum, to which it is firmly joined, descending into the scrotum, and there expands itself over the tunica vaginalis, which includes the body of the testicle. When this muscle is contracted, it elevates the testicle: it is frequently so very thin in emaciated subjects, as scarce to be at all discernable.

344. The muscles of the penis are properly only two, called ereectors. These arise on each side from the ossa ischii, between the tubercle of this bone and the beginning of the corpus cavernosum; and each of them is inserted into the corpus cavernosum of its own side‡.

These muscles, when they act together, press the veins of the back of the penis against the ossa pubis, by which they prevent the reflux of blood

\* See Santorini's Observat. cap. 9. 1.

† See it delineated in Cowper's Myotom. nov. T. 17.

‡ See Cowper, T. 17 and 19.

from



from the penis; and consequently when, at the same time, the blood flows impetuously into the part by the arteries, and cannot get back this way, the penis becomes erected \*. The muscles of the penis, described by many authors under the names of acceleratores and transversi, do not so properly belong to the penis in general as to the urethra in particular: we shall, therefore, describe them under the head of the muscles of that part.

345. The muscles of the urethra in men are of two kinds, dilators and constrictors. The dilators are,

1. The transversi †: these arise from the tubercle of the os ischium on each side, and are inserted into the posterior part of the bulb of the urethra: they are not quite determinate and certain, however, either in their origin or insertion; and sometimes they are wholly wanting. When they act, they dilate the urethra in its posterior part ‡.

2. The posterior or triangular dilatator, dilatator posticus: this is often extremely small, and sometimes it is double §. It rises from the anterior part of the sphincter of the anus, and is inserted into the posterior and lower part of the acceleratores, or else into the lower part of the bulb of the urethra. This muscle has been

\* Schelhammer will not allow the erection of the penis to be thus performed, *Diff.* 12. Cheselden doubts it also; but there seems much reason in it.

† See Bartholin. *Anat. L.* 1. c. 24. Bidloo, *T.* 47. Cowper's *Myot. Reformat.* fig. 10 and 12.

‡ These muscles, Morgagni observes, are often wanting; and when they are not so, they vary greatly in their situation: experience confirms the truth of this.

§ See Morgagni's *Adversar.* 4.

taken



taken for a part of the sphincter ani by Riolan \*. He acknowledges that it is extended to the urethra; but he will have it a part of that muscle. Littre † is the first who acknowledged it for a distinct muscle, and described it as such. This muscle seems to be an antagonist as well to the acceleratores as to the erectores penis; for it draws down the penis from the ossa pubis immediately after the ejection of the semen, and thus gives the blood a free passage out of the penis.

The constrictors of the urethra are the muscles commonly called acceleratores urinæ: they arise partly from the precedent muscle, and partly, and indeed principally, from the corpora nervosa of the penis: from hence, proceeding obliquely, they surround the whole bulb, and the inferior spongy part of the urethra; and are, finally, inserted into the line which is formed by the concurrence of these, and adheres to the bulb. Hence, when they act, they constrict the hinder part of the urethra, and by that means serve to expel the urine out of the urethra, but more especially the semen in copulation.

Santorini, beside these, has described certain new muscles of the urethra, called projectores and elevatores; as also some muscles of the prostata ‡: but the most careful dissection will only shew thin membranes in the place of them.

\* Cap. de Muscul. Ani.

† See Memoirs of the Paris Academy 1700. Santorini also agrees with Vesalius in calling this muscle a part of the sphincter ani.

‡ See the same, p. 181.



## C H A P. XVII.

*Of the muscles of the anus and bladder.*

346. **T**HE muscles of the anus are generally said to be three, one sphincter, and two levators\*.

The sphincter of the anus closes the extremity of the intestinum rectum. It has its origin from the bottom of the os coccygis, and the skin that is under this bone; and its fibres, from hence separating every way from one another, and surrounding the anus in every part, ascend afterwards in men into the lower part of the bulb of the urethra, or into the acceleratores muscles which surround this bulb, and are there terminated. In women they are inserted into the lower part of the vagina of the uterus.

Many fibres also descend from the interior and lower part of the os pubis, near the synchondrosis; and forming a body of an oval figure, and of the breadth of a man's thumb, they surround the extremity of the rectum; and, when they act,

\* There are no muscles of the human body in the descriptions of which authors differ so much as those of the anus: this may be seen very evidently, on examining Riolan's Anthropolog. L. 5. c. 40. Cowper's Myotom. nov. p. 13. Douglass's Myograph. p. 66. Morgagni's Adversar. Anat. 3. p. 59. and Santorini's Observations, p. 164. These authors, tho' all accurate and excellent ones, differ widely, not only in regard to the number, but also the origin, progress, figure, and insertion of the several muscles they jointly allow of. Whether this be owing to the real difference of these muscles in different subjects, or to some other cause, is not easy to determine. The expert anatomist, however, will usually find them very regularly in most subjects, as our author here proceeds to lay them down, which he has done, not from the works of any, but from his own observation.

have



have the same effect of drawing it together and closing it : there are, indeed, but few merely circular or annular fibres, such as are usually said to compose the sphincter observed in dissection.

The levatores ani arise on each side, with a broad base, from the internal part of the os pubis, the tunic of the obturator internus, and the internal part of the os ileum, and the acute process of the ischium : from these parts fibres, in the manner of rays, running from a circumference toward a centre, directing their course toward the sphincter ; and, finally, they unite in the hinder part of the intestine which they surround, including at the same time the neck of the urinary bladder, the prostata, and the vesiculæ seminales in men ; and in women the vagina. They are, after this, inserted partly in the upper and hinder part of the sphincter, and partly confound and blend their fibres with those of the oval and annular kind, which form the sphincter ; and from this course of their fibres it is very evident, that they may serve not only for the sustaining and elevating the anus, but to press the vesiculæ seminales and prostatae in the coitus.

Beside these levatores, which Douglass calls, by way of distinction, majores \*, he describes, in much the same manner as Riolan had before done, a pair of smaller levatores : these arise partly tendinous, partly fleshy, from the protuberance of the ischium ; and are thence carried transversely toward the anus, and are inserted into its sphincter, not far from the bulb of the urethra †.

The

\* See his Myograph. p. 68.

† Douglass does not tell us in what manner they are inserted in the female subjects ; but in dissection such muscles are sometimes, tho' not always, met with in women : in this case



The muscles of the os coccygis are also two \*, one on each side, called coccygæus, and seeming destined to be of service to the anus in its necessary motions. They have their origin from the acute posterior apophysis of the ischium, and are implanted on each side into the sides of the os coccygis. These, by pulling against the os coccygis, assist the levatores of the anus; and, when it has been forced too far outward, they reduce it in again into its natural state; and prevent also its too easily changing its natural situation.

347. Authors allow the urinary bladder two muscles, a sphincter and detrusor.

The sphincter we have already had occasion to describe, S. 222; and the detrusor, which is also mentioned in the same place †, is indeed no other than the muscular coat of the bladder, which is an antagonist to the sphincter, and serves to protrude the urine out of the bladder ‡.

case they usually arise from the upper part of the protuberance of the ischium, near the origin of the erectors of the clitoris; and are inserted into the upper part of the sphincter, where they are joined to the vagina. Santorini, p. 206, tells us, that in women there are transverse muscles, which he compares to the transversales of the penis in men, and figures them in tab. 2. letter g g. What are found in dissection by an expert anatomist, will be found to be very like what he there describes. It does not appear that they are always to be met with; and it is also difficult to determine whether we are to agree with Douglass, that they belong to the anus; or with Santorini, that they belong to the vagina.

\* See Douglass's Myograph. p. 143. As also Cheselden's Anatomy, and Morgagni's Adversar. 3. p. 94.

† See figures of these in Cheselden's Lithotomy, and in Cowper's Myograph. nov.

‡ Bianchi, in Magnet's Theatr. Anatom. p. 414. describes certain new muscles of the bladder, which he calls elevators and depressors, and has figured in two plates; but Morgagni and Santorini agree in determining, that there are in reality no such muscles.



348. The sphincter, or constrictor of the vagina, is a series of muscular fibres, which arise from the sphincter of the anus, and surround the orifice of the vagina from each side, and are afterwards inserted into the crura of the clitoris. The opening of the vagina is drawn together, in the time of copulation, round the penis, by the help of this muscle.

Santorini has described several other muscles of the vagina and the urethra in women; but the most accurate dissections do not shew any others that ought to be called by that name, nor is this the only case in which that author has done this\*.

## C H A P. XVIII.

*Of the muscles of the thigh, leg, and foot.*

349. **T**HE muscles of the femur are fourteen: they are of various kinds, and serve to different purposes.

The proper flexors or elevators are three †: the great psoas, the iliacus, and the pectinæus.

The psoas magnus arises from the first, second, third and fourth vertebra of the loins.

The iliacus arises from the internal cavity of the ileum, and the extremity of each is at the little trochanter.

The pectinæus, called also lividus, has its origin at the upper part of the os pubis, and terminates four fingers breadth below the former.

\* L. c. p. 207. and the following.

† There are many of the muscles, however, assistant to these; as the abductor, the triceps, the glutæi, the fascia lata; and, as Winslow justly observes, the rectus tibiæ also.



The extensors of the femur are the three glutæi, distinguished by names from their size, and called maximus, medius, and minimus. They all arise in the external surface of the ileum, ischium, and os sacrum. The termination of the first or greatest is about four fingers breadth from the great trochanter, and the terminations of the two others are in this trochanter.

The abductors are five; the fascia lata, quadratus, pyriformis, and the two gemini.

The fascia lata, called also musculus membranofus, more properly belongs to the tibia; tho', in compliance to the common custom of authors, we name it here: it will be described at large in our next section, among the muscles of that part.

The quadratus has its origin from the tubercle of the ischium, and its termination at an eminence between the two trochanters.

The pyriformis rises thick from the lower part of the os sacrum, where it is joined to the ileum.

The gemini are two, and are distinguished into the superior and inferior.

The superior has its origin from the posterior and inferior spine of the ileum.

The inferior has its origin from the tubercle of the ischium\*.

These two, and the pyriformis, are all inserted into the sinus of the great trochanter.

The abductor of the femur is the triceps. The first and second heads of this muscle arise from the os pubis, near the synchondrosis; the third from the tubercle of the ischium: it is inserted into the whole spine of the os femoris.

\* The two gemini are usually found firmly concreted with the obturator internus; and hence some have described them, not as separate muscles, but as a part of that.



The rotatores, called also obturatores, are two, an internal and an external.

The internal arises from the internal circumference of the great foramen of the os pubis, passes the channel in the ischium, and is inserted into the hollow by the great trochanter.

The external arises from the external circumference of the foramen just mentioned, and is inserted in the same place with the former. These two muscles assist also the abductors.

350. The muscles of the tibia, or leg, are eleven.

1. The abductor, called the fascia lata, and musculus membranofus, arises fleshy from the anterior part of the anterior and superior spine of the ileum: soon after its origin it becomes intirely membranaceous, and closely furrounds the muscles of the thigh; after which it is inserted in the upper part of the tibia, near the head of the fibula; and from thence sends out an aponeurosis almost over the whole tibia\*.

The sartorius is an abductor and elevator: it rises from the internal part of the anterior and superior spine of the ileum, and, descending obliquely, is inserted into the upper and inner part of the tibia: it moves the legs upwards and forwards, determining them towards crossing over one another, as taylors sit with them.

The extensors of the tibia are four: they are situated in the anterior part of the femur. They are,

1. The rectus: this has its origin from the anterior and inferior spine of the ileum†.

\* It serves also to draw back the thigh, and to elevate both this and the leg: this and some other of the adjacent muscles are therefore common to both parts.

† This also assists the elevatores of the femur and the sartorius in their motions; and, together with the pectinæus, psoas, iliacus and glutæi, assists in the motion of seating ourselves. See Winslow's paper in the Paris Memoirs 1720.



2. The cruralis, which is situated under the former, and rises from the whole anterior part of the femur.

3. The vastus internus, which rises from the whole internal side of the femur.

4. The vastus externus, which rises from the whole external side of the femur.

These four muscles together form a very robust and strong tendon just above the knee, to which the patella adheres behind, and which is inserted below the knee at a tubercle of the tibia\*.

The flexors of the tibia are five:

1. The gracilis, which arises near the synchondrosis of the os pubis.

2. The semi-membranosus, which arises above from the tubercle of the ischium.

3. The semi-nervosus, which arises from the same tubercle in its hinder part.

These three are all inserted into the interior and upper part of the tibia.

4. The biceps: the origin of the first head of this is from the tubercle of the ischium: the second rises from the middle part of the femur; and its insertion is in the superior part of the fibula.

5. The poplitæus. This is a small muscle: it arises with a slender rounded tendon from the exterior condyle of the femur; and from hence it passes tendinous under the ham inwards: after this it becomes fleshy, and terminates in the superior and interior part of the tibia.

\* Almost all the muscles of the leg mutually assist one another, as also those of the thigh. There is scarce any one of them, that, beside its primary use, does not also concur in the forming other actions and motions with the others.



351. The muscles of the tarsus, or foot, are seven\*. The flexors are two:

1. The tibialis anticus: this has its origin from the superior and exterior surface of the tibia, and is terminated at the internal os cuneiforme, and the interior part of the internal metatarsal bone.

2. The peronæus anticus: this has its origin from the anterior part of the middle of the fibula, and is terminated at the exterior metatarsal bone.

The extensors of the foot are three:

1. The gastrocnemius: this has its origin from the two condyles of the femur†.

2. The plantaris: this has its origin from the interior part of the external condyle‡.

3. The solaris, which rises from the upper and hinder part of the tibia and fibula.

The bodies of these three muscles join together, and form the sura; and their tendons joining, form an extremely strong one, called the tendo Achillis, or chorda Achillis, which is inserted into the hinder part of the calcaneum.

The adductor is the tibialis posticus: it has its origin in the upper part of the interosseæous

\* These muscles of the tarsus, and some of those of the toes, are in robust subjects kept down by ligaments, especially about the malleoli, to prevent their rising out of their places in the time of their action: these ligaments serve also to direct, in some degree, their motions. See Vesalius, Fig. Musc. 1, and 2. and what he adds in his chapter on ligaments.

† There frequently occur, in dissection, two sesamoide bones in this part. Vesalius, Riolan, and Drake have figured them: they are also figured in this work, T. 1. fig. 2. D. E. Sometimes there is only found one, as Cowper and Fallopius observe.

‡ Cheselden tells us, that he found a sesamoide bone in the origin of this muscle. Morgagni also mentions it; but he says it is sometimes wanting.



ligament, and its termination in the os naviculare \*.

The abductor is the peronæus posticus: it has its origin from the upper part of the fibula; but its tendon is turned back under the tarsus, and is inserted into that bone of the metatarsus which supports the great toe. There is usually, in old subjects, a sesamoide bone in the tendon of this muscle, where it passes under the os cuboides.

## CHAP. XIX.

### *Of the muscles of the toes.*

352. **T**HE muscles of the toes are of two kinds, common and proper. The common are sixteen. The extensors are two, a long and a short one.

1. The extensor longus has its origin in the upper part of the tibia, and in the anterior part of the ligament, between the tibia and fibula. It divides into five tendons, four of which are inserted into the four phalanges of the toes, and the fifth into the outer metatarsal bone †.

2. The extensor brevis has its origin from the superior and anterior part of the calcaneum: it is divided sometimes into four tendons, sometimes only into three, which are inserted into the three toes next the great one, or into all the four.

The flexors of the phalanges of the toes are of three kinds:

\* This muscle often has a double tendon, and is hence bicornate; and sometimes it is almost entirely divided into two muscles. Some authors have hence made two muscoli tibiales postici, a longer and a shorter.

† This fifth part makes the flexor of the tarsus, often forming a separate complete muscle; and sometimes also it runs even to the little toe.



1. The flexors of the first phalanx are the four lumbricales: their origin is from the tendon of the musculus perforans, and from the interior part of the calcaneum: their termination is at the first phalanx of the several toes.

2. The flexor of the second phalanx is the perforatus: this rises from the lower and inner surface of the calcaneum. It is divided into four tendons, which are perforated; and it is terminated in the bones of the second phalanx.

3. The flexor of the third phalanx is the perforans: its origin is from the hinder surface of the upper part of the tibia, towards the middle: it is divided also into four tendons, and these perforate the tendons of the former, and are afterwards terminated in the third phalanx.

The adductores of the toes are the four internal interossei.

The abductores are the four external interossei; and both these are so nearly allied in structure and properties to those of the hand, that there needs no farther description here\*.

The proper muscles of the toes, are those of the great and of the little toe.

353. The proper muscles of the great toe are no fewer than seven:

1. The extensor longus, which has its origin forward from the middle part of the fibula, and of the interosseæus ligament; and its termination in the first and second phalanx.

2. The extensor brevis: its origin is in the upper and anterior part of the calcaneum, and its termination with the former in the first and second phalanx†.

\* Govey will have all these interossei to be properly only one muscle. Verit. Chir. p. 211.

† These two often make but one muscle, which terminates in two tendons.



3. The flexor longus, whose origin is in the posterior part of the fibula, and its termination in the lower part of the last phalanx.

4. The flexor brevis: the origin of this is from the middle os cuneiforme; its termination is at the two sesamoide bones of the great toe, which are joined by ligaments to its first phalanx.

5. The abductor, or thenar: its origin is from the internal side of the calcaneum, and the os naviculare; and its termination at the internal side of the great toe, at the internal sesamoide bone\*.

The adductors, or those which draw the great toe toward the others, are two.

6. The anti-thenar; the origin of which is from the third os cuneiforme, and its termination at the external sesamoide bone.

7. The transversalis: the origin of this is from the fourth bone of the metatarsus, and its termination near that of the former. This muscle seems also to assist in the drawing the several other toes toward one another.

354. The little toe has only one proper muscle, called its abductor proprius. This has its origin from the exterior part of the calcaneum, and the fifth metatarsal bone, which supports the little toe: its termination is in the exterior part of the first phalanx. This muscle, however, is very ill named: the little toe cannot be drawn from the others by it. It indeed performs the office of a flexor, and ought to be called flexor proprius digiti minimi.

\* The internal side is that where the great toe is situated; the external, that which regards the other toes.



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A  
**COMPENDIUM**  
 OF  
**ANATOMY.**

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**BOOK VI.**

*Of* **ADENOLOGY.**

**CHAP. I.**

*Of the glands in general.*

355. **A** Denology is the doctrine of the glands, called by the Greeks ἀδένες. The Latins seem to have given them their name glandulæ, from a resemblance which some of them have to the acorn, or glans of the oak.

356. The parts to which the antients have given the name of glands, tho' they are as different from one another as possible in figure, size, and colour, yet are easily known and distinguished as glands by all the world; tho' it is so difficult a thing to give a definition of what a gland is, or even a general character of them only, which shall include all the true glands, and take in no other



other parts of the body with them, which the antients have distinguished by other names from the glands, that the very best anatomists have chosen to evade the attempting to do it.

357. Many of the anatomical authors of the very first class, and among these some who have written professedly of the glands, and have made it their peculiar business to examine nicely into their nature, and explain their structure; have yet, from the mere difficulty of ascertaining adequate ideas to the term, evaded giving a definition or general description of the glands: and, in consequence of this, numberless errors, and an almost inextricable confusion, has crept into the study of this important part of the human structure.

358. Other authors, who have had more boldness, if not greater abilities, than those who had avoided meddling with definitions of these parts, have ventured to establish what they call so; but these differ so much from one another, in what they would establish as general certainty, and have produced such imperfect and erroneous definitions, that they have all either included parts which themselves will own not to be glands in the definition, or they have limited the term to some particular ones, and excluded what themselves and every body else allow to be glands out of the number. Our author has treated largely on this subject, in a dissertation entitled *De vera Glandulæ Appellatione*.

359. Some set out, in their definitions, with declaring a gland to be a globose part, &c. but these, in their setting out, exclude the pancreas, which tho' not of a globose figure any way approaching to such, yet is truly a gland; and is, indeed, the largest and principal gland of the whole



whole body, and has always been acknowledged a gland by authors of all kinds, from the first establishment of anatomical distinctions to this day. In the same manner also the capsulæ atrabiliariaë, the parotids, and some other glands, truly and unquestionably such, would be excluded from the number of the glands, because they are not round; tho' they really are, and at all times have been acknowledged to be glands.

360. Others have given their definitions of glands, that they are soft, lax, and spongy parts; but this is liable to the same kind of exception with the former. Nothing is more certain, than that we have glands which are neither lax, soft, nor spongy; but, on the contrary, are very hard, firm, and compact: and, on the other hand also, we have many soft, lax, and spongy parts which are not glands, as the lungs, the fat, and the like; which even the authors, who make these characters of glands, will allow to have no title to that name; tho' they must allow, that they are confounded with the glands under such a definition.

361. Some have defined a gland to be a parenchyma, or soft, lax, and fungous kind of flesh; but it is plain enough, from what has been observed above, that this definition is as false and defective as any of the former.

362. Among the later writers we have had some who have thought they had given a true, accurate, and perfect definition of a gland, when they tell us, that it is a congeries of vessels of all kinds, or a part composed of such a congeries of vessels. But when we come to enquire strictly into the structure of the several other parts of the human body, do we not find almost all of them included also in this definition? The membranes,  
the



the muscles, &c. when nicely examined, are found to be congeries of vessels of all kinds, as well as the glands; and, in consequence, this definition does not in reality distinguish the glands from the several other parts of the body.

363. Others have improved on this last definition, and declared the glands to be formed of congeries of such different vessels, all included in one proper membrane; but this also confounds a number of other parts with the glands. The lungs, the heart, the stomach, the muscles, and other parts of the body, as distinct from the glands as from one another, yet are as well characterized by this definition as the glands themselves. What are all these but congeries of vessels, included in their proper membrane? This definition, therefore, is as defective as any of the former.

364. Many writers on these subjects have asserted, that where ever there is secretion of any kind performed, there is a gland; and hence they have attempted to give a definition of a gland, not *a priori*, or from its fabrick; but *a posteriori*, from the use to which that fabrick or structure serves.

But this is as defective as any of the others: the principle on which it is established is not true; for there are many secretions performed in the body, and those even of the largest and most important kind, where yet there are no glands to perform them. The chyle is secreted in the intestines without the assistance of glands: the osculæ of the lacteals, in the tunica villosa of the intestines, absorbing it without any farther assistance, from the matter protruded into them. In the same manner the semen is secreted in the testicles; and the pituita in the pituitary sinus's of the brain,



brain, where yet there are no glands at all. And in the same manner the fat is secreted in the cells of the *membrana adiposa*, which are extremely fine and thin follicles, where there never have been, nor probably ever will be any glands discovered\*.

On the other hand also it is to be observed, that there are glands, received and allowed by all writers as such, which do not appear to perform any secretions at all. Who is it that ever has, or ever will prove, with any degree of certainty, that the *glandula pinealis*, the *pituitaria*, the *capsulæ atrabiliaræ*, the *thymus*, the *thyroides*, the *bronchiales*, and several others that might be instanced, do in reality secrete any thing at all; and yet there never was an author of any age, who did not allow all these to be true and genuine glands.

It is not only that we of the more informed ages in anatomy have found that many of the bodies, allowed to be glands, do not perform any kind of secretion; but the ancients themselves agreed in giving the name of glands to several parts, tho' they were not assured that they secreted any thing at all, nor even in some cases believed that they did. It is evident, therefore, that the ancients did not give the name of glands to bodies which they knew to perform secretions, or even believed to do so; but evidently distinguished them by

\* Schelhammer has very abundantly proved, that all the secretions are not performed by means of glands. *Analect. Anat. Diff.* 3. N<sup>o</sup>. 37. Mery also, in several papers in the *Memoirs of the Paris Academy*, proves the same truth. Littre and others were for making even the menstrual discharges the effects of glandular secretions; but Mery proved that there were no glands in the part to perform this; and that many of the secretions, of most importance to the body, were performed without glands.



other characters, and named them from other qualities. We are to add also, that every beginner in anatomy, at this time, knows a gland to be such, when he sees it, only from its external appearance, and without knowing any thing of its use. There are, therefore, other characters by which a gland may be known, tho' by its office and use it cannot.

365. Some other writers, of the number of whom is the great Malpighi, have been led, by a mistaken observation of morbid viscera, still farther from the truth in this matter than any of these: they have found, on dissecting morbid bodies, such in particular as had died dropfical, or in hecticks, consumptions, and other chronick disorders, certain bodies of a spheroidal form in the liver, the spleen, the peritonæum, the pericardium, &c. and have hence concluded, that these tubercles, because they were of a roundish figure, were true glands; and consequently that these several viscera, in their natural state, were composed wholly of such corpuscles, and of congeries of minute and innumerable glands. But this is fallacious in the highest degree: these tubercles are so far from being real glands, that they are morbid tumors of the atheromatous or steatomatous kind, or congestions of terrestrial and tartareous matter, grandines, and the like things; which are so far from constituting these viscera in a healthful state, that they are not even found in them in such state, but are merely diseases.

366. To the observation that these bodies are not found at all, or, at the utmost, are not common or necessary parts of the viscera in a healthful state, it is to be added, that their formation is easily accounted for, on the principle of sup-  
posing



posing them the effects of a diseased habit; since stagnations of thick, viscid, or terrestrial matter, in the minute vessels of these parts, may easily, nay and must necessarily, form connections of this kind with this roundish figure, and with all the characters of these morbid tumors, tho' with not one of the true or genuine characters of glands.

Whatever is natural, and an effect of the common course of things, is to be sought after in sound bodies, not in morbid ones: when we depart from this natural and necessary rule, we fall into numberless errors. How frequently, in diseased states, do we find the arteries, and several of the membranes, grown cartilaginous, or almost boney? But are we to infer from this, that the natural state of these arteries and membranes is cartilaginous and boney? Certainly no body will pretend to assert it. Beside these spheroidal bodies or tubercles are found, not only in the liver and spleen of a hog, for instance, but frequently also in the lungs of the same animal, and these not only on the surface of the lungs, but throughout the whole inner part: and it is not only in quadrupeds, but in human bodies, where there has been a long continued hectic, the lungs are found full of the very same kind of roundish bodies or tubercles. Malpighi, and others also, who have contended for these tubercles being glands, have observed the same; but surely no one, who understands but a little of the human frame, will declare the lungs, for this reason, to be a glandular part. The same sort of tubercles, or round bodies, are also found in the substance of the uterus; yet surely no body from this will pretend, that the uterus is naturally of a glandular structure. If it appear certain then, as it must do in the eye of reason, that these viscera are not  
of



of a glandulous structure, tho' these kind of tubercles are found in them, when in a morbid state, why are we to suppose, that the other viscera are of that structure, because these tubercles are found in them in the same morbid states? Why, in particular, are we to suppose the spleen a part, in which we know of no secretion being performed, nor any of the actions of a gland executed, to be of a glandulous structure, merely because, in a morbid state, morbid tumors, which have somewhat of the figure of glands, are found in it? All Malpighi's \* experiments and observations have not proved, that these bodies are true glands; or, indeed, that they have any of the properties of glands. They are usually found in the superficial parts of the viscera especially, if not only there; and this is not the place where they might be expected, if destined for the uses of glands: and surely, tho' they are found in the pericardium, no body would suppose that that membrane is glandular.

367. Others, in dissections of particular bodies, have found vesicles in the brain, the liver, the kidneys, and other parts; and hence have declared them also to be glandulous in their structure †: but in this case, as in the others, the bodies dissected were all morbid ones; and as the same vesicles are not found in healthful ones, nor indeed any thing analogous to them, it is a sufficient proof that they are not natural parts of the structure of them.

Malpighi, who is one of the strongest assertors of this doctrine, yet allows that the parts do not appear at all like what they usually do, when they

\* See him where last cited.

† See Malpighi, 16.



have these vesicles. He tells us of one large vesicle \*, often taking up the place of the whole brain: he gives the cause also of the accident; but if he had even omitted that, a state like this could never have been supposed the natural condition of the part.

We are to observe, that the antients never called vesicles by the name of glands, nor ever understood any thing of that kind to be of the nature of glands. Here alone we shall have innumerable errors and confusion about the meaning of words, if, while we pretend to mean by the term gland what the antients meant by it, we express, under the same name also, things so different from every thing they intended by it. If we could, indeed, allow these diseased parts to be in a state of nature, we still ought not to call them glandulous: why not rather vesiculous kidneys, vesiculous livers, and vesiculous brains? The lungs are, indeed, of a vesiculous texture, even in their natural state: they are composed merely of vesicles, yet no body, not even Malpighi himself, ever confounded the ideas of a vesicle and a gland, so far as to call them glandular; but all the writers, of any sort of credit, have continued to call glands *glands*, and vesicles *vesicles*, and to call those parts vascular which are composed of vessels. There are manifest and evident vesicles in the ovaries, in their natural state; yet no body has ever, for this reason, declared the ovaries to be glandular bodies. It is wonderful, therefore, that authors should have made so ready conclusions of this kind, from the merely morbid state of particular parts, when they neither do it themselves, nor find others

\* Epist. de Gland. p. 6.



doing it, in the same condition of healthy ones. Littre, from finding vesicles in the kidneys \* of a distempered subject, declares the kidneys, in their natural state, in all bodies, to be glandular; but Ruysch has proved them to be entirely vasculous, and experiments daily confirm the truth of it. Certainly there being vesicles found accidentally in a pair of kidneys, is of no force to prove all kidneys to be glandular, even if this proof of the contrary had been wanting.

368. It will be answered to our establishing a vasculous structure of these parts, against the supposed glandular one, that vasculous and glandulous parts may be the same; that the terms express no contradiction; for that all glandulous parts are naturally vasculous; and that a vasculous part may, without impropriety, be called glandulous †: but it is to be observed, that this is confounding things which are in themselves sufficiently distinct, even tho', in strictness, the assertion be true. Authors, of any degree of accuracy, have expressed very different things by the terms *vasculous* and *glandulous*; and tho' glands are composed of vessels, yet those vessels, in order to form glands, must be of a particular kind and structure, and particularly arranged: a part may have these vessels, without their being arranged into glands; and is then properly enough distinguished, as to its structure, by the term *vasculous*, as having no right to that of *glandulous*.

All the parts of the body are unquestionably vasculous, and if, for this reason, they were intitled to the name of glandulous, the whole body is to be declared at once to be composed of glands.

\* See Memoirs of the Paris Academy 1705.

† Michelotti, in his Book de Separatione fluid. argues thus.



Every one must see the absurdity of this; and every one must also see, that, in spite of the quibble, as to the definitions, two very different kinds of structure are understood by the terms *vasculous* and *glandulous*; and that it would bring great confusion into the anatomical writings to confound them, or use them synonymously.

369. Malpighi, to whom much of this confusion is owing, asserts, that in every gland, however minute and simple, as well as in all those which he pleads for in the viscera, there must necessarily be a vesicle or follicle placed between the extremities of the arteries, veins, and excretory ducts, by which the secretion of the part is performed; and these natural vesicles of the glands, when dilated and expanded by some distemperature of the part, he says, form what we call vesicles in these viscera. He is not without his followers in this system; but the most accurate anatomical writers declare against it, as a new hypothesis formed in the imagination, and not supported by any facts: they do not allow either, that there are any glands at all in these viscera in their natural state; or that there ever were any such seen, much less that these folliculi in them ever could be seen. But to this we are to add, from frequent observation, that it is not necessary there should be either any glands, or any follicles in glands, from which to form these morbid vesicles; for that the small vessels of these parts may as easily, perhaps more easily, be distended into these kind of little bladders, than even those follicles, if there were any such parts. Ruyfch\* and Rauholt have observed such vesicles in the placenta uterina, which all the world must

\* See Memoirs of the Paris Academy 1714, 1715, 1718.



allow to be a part merely vasculous ; as also in the lungs, in the superficies of the cutis, in the eyes, and in other parts, where there never were any glands found, nor indeed any glands ever supposed to exist. What happens in these parts without the assistance of glands, may also happen in the liver, the kidneys, and the brain, without glands ; and 'till we have better authority for declaring that there are glands naturally in those parts than we have at present, we can have no right to suppose these vesicles to be the effect of glands distempered, according to Malpighi's system. It is not the business of an anatomist to assert, or to suppose, but to demonstrate : he is, therefore, not to take any thing for natural, that does not appear in a natural and healthful state of the body ; for in states out of nature, and the effects of distemperatures, there are so many monstrosities, so many variations of nature from her ordinary course, that nothing but error can be the effect of establishing what is the natural structure of the parts, from what appears in them in these states.

It is to be observed also, that the true and genuine glands, as the salival ones, those of the mesentery, the pancreas, the thymus, &c. are seldom, if ever, found thus transformed into vesicles ; which yet, if it happened so easily as Malpighi makes out, ought to happen very often. From this also it appears, that the parts truly glandulous scarce ever become vesicular ; yet vasculous parts very frequently do do : it is a change that very easily happens in these, tho' very difficultly, or scarce at all, in the others ; and that, tho' these vesicles deceive many with an opinion of their being of glandulous origin, they are truly no more than distended little vessels. It has been  
objected,



objected, that nature still pleads for the ease of the follicles of glands being converted into vesicles, as well as for the difficulty of the ramifications of vessels being so distended; but this is asserting without proof, and taking up our own ideas as certainties: if it were true, the consequence must be, that vesicles must be very frequent in the parts which are truly glandular; and very rare, or scarce ever seen at all, in those which are vascular only: but we see exactly the contrary of this happen, and therefore have great reason to suppose, that the contrary to the assertion is true. It appears, therefore, that there are none of these follicles of Malpighi in the glands of these parts; or else, that the ramifications of vessels are much more easily distended into these vesicles than such follicles are, altho' the reason may not appear to us why it is so. But let us allow the followers of Malpighi, that there are such follicles in some of the glands at least: it does not follow from this, that there are such and so numerous ones, in all the parts which they assert to be glandulous. The Creator of our bodies has not, in any of the other parts, tied himself down to any such fixed laws; but has varied in the several parts, as they were destined for several different purposes. Many of the asserters of Malpighi's doctrine, that they may have the more room for defending the system of glands established by him, understand the term *follicle* in a very lax sense: they affirm, that the long seminal vessels of the testicles, nay and even the whole tract of the intestines, to be each a mere glandulous follicle; but, with the same reason, they might establish the stomach, the pericardium, the tunica vaginalis of the testicles, the peritonæum, the pleura, and whatever parts they please to be follicles; and they may re-



solve all the parts of the body into mere glands. This, however, we are to put them in mind, is running away from an argument, not supporting it: every one, who is unprejudiced, will see how wild a notion this is entertaining of a follicle of a gland.

370. There is nothing that we are more certain of, in regard to the animal œconomy, than that secretions may be and actually are performed in many parts of the body, without the assistance of any of these follicles, though Malpighi has established them as so necessary and essential a part of a gland\*. Not to mention the simple secretions of the chyle, and of the fat, which we have already taken notice of on a former occasion, suppose we would allow such a part as this follicle of Malpighi in a simple gland a vesicle, about which the ultimate ramifications of the vein and artery of the part were disseminated; and in which, as these authors assert, the excretory duct of the gland has its origin! Still allowing even all this, the follicle has nothing to do with the business of secretion performed in the part; but is a mere receptacle to the liquor secreted by the other vessels. The liquor contained in the excretory duct of a gland, or in this follicle, if it communicate with it, as these writers assert, is evidently already secreted; nothing is to be secreted there. Secretions, we very well know, are not made even from the veins, excepting only in the singular instance of the liver, where the vena portæ acts as an artery, and performs the

\* Michelotti, in other parts of his works, departs from this opinion; but he is most in the right, when he maintains it most warmly.

† Malpighi allows the lymph to be a secretion from the arteries. See his *Epist. de Gland.*



offices of one ; for the veins serve only to carry back the blood, after the secretions have been made from it. It is certain, that secretions are performed in the arteries, and particularly in their lateral canals ; which, it is probable, are produced from the sides of the minute ramifications of the arteries, in the very same manner as the chyliferous vessels are propagated from the sides of the intestines ; tho', in the former case, they are too minute to become the objects of our senses \*.

It is in this manner that, we suppose, secretions are performed in the brain, the kidneys, the liver, the testicles, the cutis, the other membranes, and even in the glands themselves. But as nature is usually similar to herself, in the several parts destined to the same purposes ; and as these follicles, so warmly contended for by Malpighi and his followers, either do not exist at all, or, if they do, perform the office of receptacles, not of secretory organs ; it seems much more eligible to take our ideas of the other more abstruse and hidden secretions, from that open and obvious one of the chyle, than to fall into so doubtful and dark a system as this, in which we see no analogy to the other actions of the several parts of our structure, and for which we have no evidence of the very existence of the supposed parts.

371. If therefore we would avoid the equivocations between the words glandulous and vasculous, and consequently avoid the error and confusion that have got into the world from them, we are first to distinguish, that the same thing is not expressed by both these terms ; but that they express parts, which as they differ from one another in external appearance, in shape, and in

\* Michelotti agrees in this opinion, l. c.



their very nature, so they ought to be expressed by words never confounded with one another. The viscera, therefore, which are found, by inspection with the naked eye, by the more minute examination with the microscope, and by injections, to be truly and merely vascular; and in which, in their natural and healthful state, there are no spherical corpuscles found; and which are inclosed in a peculiar and appropriated membrane, are all to be called vascular parts. There is nothing of the appearance or structure of glands in these, and they therefore are not to be called glandular; but that term is to be appropriated to parts truly glands, or in which true and proper glands are found: by this means alone, a multitude of confusion, apparent in the writings of the late writers on these subjects, will be avoided\*.

372. If, after this, it be asked what is truly glandulous, or what is really a gland, it is to be answered, that as the latest and best writers are not agreed in the definition of a gland, we are to enquire what it truly and properly was that the antients understood by this term; and, after this, what was their reason for calling these parts by this name: by this means we shall, at least, keep up to that excellent rule of Morgagni's on this subject, not to change the names by which the old writers have called things, without reason. We find, that they called by this name the pineal and pituitary glands, the parotids, the maxillaries, the jugulars, the thyroide, the thymus, the pancreas, the mesenterick, the axillary, the inguinal, and some other glands†. We are therefore, in

\* Michelotti here departs from his common opinion, and declares vascular and glandulous to be the same thing.

† See Hippocrates, Lib. de Glandulis; and the other antients on the same subjects.



conformity to their methods, to call these, and such other parts as have a like structure, figure, and appearance with these, by the name of glands, even tho' many of them were not known to these writers. This is the way of naming new discovered things after old and known ones.

373. As to the latter part of the question, namely, why it was that they called these parts by the name of glands, we are certain, first, that it was not from their being of a globose or spherical figure; because, if it had been for this reason, they would not have called the pancreas and the thymus by this name: nor was it from their being of a soft, lax, and spongy texture; for then they would have excluded all the more firm, compact, and hard ones from the number, and would have taken into it the lungs, the fat, and all the other parts of the human fabrick which are of that lax and spongy structure: neither, thirdly, did they give the name of glands to these parts, because of their use in the secretion of certain fluids; for it is evident from their writings, that they did not know that any secretion at all was performed in the far greater part of what they called by this name, the discovery of the offices of most of the allowed glands of the antients not having been known 'till within the last century. On the other hand we are also to observe, that tho' they knew very well that secretions, and those very large and important ones, were performed in several of the viscera, as in the liver, the kidneys, and the testicles; yet they never supposed or called these glands: they supposed that the spleen also secreted a black bile from the blood; but tho' this was an established doctrine in their writings, they never called the spleen a gland.

Those



Those writers, therefore, who are for calling all parts in which secretions are performed, and only such parts, by the name of glands, dissent greatly from the opinion of the antients, who did not limit the term to such parts. On this plan a number of parts must be called glands, which the antients not only have not called by that name, but which they have had other determinate names for; as the uterus, the lungs, the cutis, and the intestines; and, on the other hand, a great many parts, which they called glands, must no longer be received as such; because we do not know that they secrete any thing, or that they were not destined by the Creator to answer some other purposes unknown to us, and very different from these; such are the thyroide, the bronchial, the pituitary and the pineal gland, with several others.

374. It is evident, therefore, that the antients called certain parts of the human body glands, and that for no other reason but because they found them composed of a peculiar kind of fleshy substance, of a peculiar habit, or of a peculiar external appearance, without paying any the least regard either to their internal structure, their spherical figure, or their use. Since, therefore, we cannot change the sense and signification of the terms used by the antients, without confounding the things described under them, we are not to do it without a sufficient reason; which reason we can never have, as to the glands, till we are much better acquainted with their true characters, nature, and uses than we can pretend to be at present. We are not to give the antient name gland to parts as different as possible from those to which the antients themselves gave it; nor ought any part, at this time, to be called a gland, unless



unless it has that general external appearance, or peculiar habit, which the other glands, so called by the antients, have; and from which it was that they came to be so called, notwithstanding that they should have a similar internal structure, or even, as appears to us, a similar use with some of the genuine glands. Michelotti is against this system; but his objections to it will be answered hereafter in their place.

375. We shall not, therefore, repeat in this place what a gland properly is, or how it is to be defined: we have already ascertained, on these principles, what parts they are that are truly and properly called by this name (S. 33); and that in such a manner, that tho' there still wants a sufficiently accurate definition of a gland, yet an unprejudiced person will not fail to know, at sight, what he ought to call by that name.

376. It will be asked, perhaps, why, in order to the distinguishing the glands, we have recourse to this peculiar habit and general appearance in them. But we are to answer, that the necessity is evident: there is, in the peculiar appearance of the gland, a distinguishing singularity easily perceived, tho' not easily described; and that as no author has given, or has been able to give, tho' he attempted it, a proper, expressive, and punctual definition of a gland, we are to use this as it is, tho' less determinate than most other characteristics, yet less apt to deceive than many. Tournefort and Ray, when they are describing the different genera of plants, often have recourse to the habit, or peculiar external face of the plant, and find it necessary to make this a distinction; where tho' the plants, they are describing, are evidently of different genera, yet the difference is not easily explained with accuracy. Every body  
will



will allow these plants to be different, though no one should be able to say in what the difference consisted, and tho' only the *facies externa* of the plant could be called in as the characteristick of it \*. As this has been allowed to the botanical writers, why should it not be allowed to the anatomical ones, in a like case, where a perfect definition or description has not, nor can be given: we do not, however, wish to force this determination upon any body; nor shall we be against retracting it, as soon as some authors shall find the way to do what has not been done yet, that is, to give such a definition of a gland, without having recourse to its external habit, as shall include all the glands of the body, nothing but the glands, and shall sufficiently distinguish them from the other parts.

377. If it be asked what this particular habit in the glands is, or how we are to know it, when we meet with it; we are to answer, that the peculiar complication and arrangement of the vessels, from which there arises a form obviously distinguishable at sight from the muscles, the fat, the bones, the membranes, the vessels, and, in fine, from every other part of the human fabrick, which gives a sufficiently certain, determinate,

\* Tho' Ray and Tournefort were reduced to have recourse to this vague method of distinction in some cases, we have since found, that it was not necessary. Nature has impressed characters sufficiently distinctive and certain in the stamina, pistill, and other parts of the fructification of plants, to distinguish all the really distinct genera. It was only during the ignorance of the world, as to the nature of these parts, that such uncertain marks of distinction, as the habit of a plant, were called in. Linnæus has not found it necessary; nor has any author in botany, since his excellent establishment of generical distinctions, ever had recourse to it.

and



and striking notice of it. This habit, arising from the complication just mentioned, will always be known at sight; and tho' it is such as can never be described by any determinate words, yet it will never be mistaken. Ray observes, that it would be very difficult to give such a character or definition of common moss, as should distinguish it from all other plants; and yet that its habit, or facies externa, will always sufficiently and invariably distinguish it to the eye. Neither the skilful nor the unskilful will find it difficult to distinguish it from other plants, tho' they can neither of them express how it differs; and just so every body will, at sight, be able to distinguish the glands from the other parts of the body, tho' they cannot say, in determinate words, what it is that the difference, they so obviously see, consists in\*.

378. Whatever part, therefore, has been called by the antients a gland, or has the external habit and appearance of those parts which the antients have called glands, we are to acknowledge to be such: and whatever part wants or differs from this habit, or general external appearance, ought, to avoid confusion, to be excluded from the number of what we call glands. The antients, we are to observe, not only acknowledged the large glands, which we have occasionally mentioned,

\* If our author's comparison in this case be just, we may hope to have sometime this great anatomical desideratum, a definition of a gland, supplied. That Ray could not distinguish common moss by a sufficiently accurate description, was owing to his not understanding perfectly the characters and fructifications of that plant. Dillenius has since found the way to convey, in sufficiently distinctive and accurate terms, a description of that plant; by which its difference not only from other genera of plants, but from the other species of the same genus, is obvious; tho' even Dillenius was far from knowing all that he might have discovered on this subject.



and others of considerable magnitude for such, but they readily allowed the same name to many very small ones, particularly to those of the mesentery; in which part there are a multitude of minute bodies, which every body who sees them, and who has before seen only a few of the other acknowledged glands, will immediately declare to be glands also. Where ever, therefore, there are found parts, whether larger or smaller, that have this peculiar habit, which is seen in all those parts which the antients called glands, this part is also, without any regard to its size or other qualities, to be called a gland.

379. On this principle we are to exclude from the number of the glands, properly so called, the cortical substance of the brain; since neither the naked eye, nor even the assistance of a microscope, can distinguish in it any thing that has that peculiar habit or appearance, which is the characteristick of the bodies called glands by the antients; and since injections have, on the contrary, shewn us that it is truly vasculous, or a mere congeries of fine and elegant vessels.

Hippocrates, in his book on the glands, says, indeed, that the brain is like a gland; but he does by no means affirm in this, that the brain is a gland; for, surely, what is like another thing, is not therefore to be established as the same.

The same has been said of the liver, the spleen, and the testicles, namely, that they are like glands: but Ruysch, Lewenhoeck, Vieussens, and Berger, have all joined in affirming what experiments have abundantly confirmed since; namely, that these several parts have, in their natural state, nothing that at all resembles the figure or habit of a gland in them: but, on the contrary, that vessels in their usual and natural directions,



directions, are found in vast abundance in every part of them. It is with great reason, therefore, that these parts are established as vascular, instead of being called, as they used to be, glandular; for they are truly vasculous, and the name expresses very properly what we constantly meet with in their structure.

Nothing, however, ought to strike the judicious anatomist with more surprize, on this occasion, than the finding authors declare the spleen to be glandulous; because, in morbid bodies, there have been sometimes found a number of tubercles in it. The spleen, so far as is yet known, secretes no fluid at all, nor is destined to any such uses as these authors themselves are for making a part of the characteristicks of glands; but, in all probability, has an office of an extremely different kind, in the execution of which it can have no necessity for any gland at all, nor for any thing of the peculiar structure of the glands. If the antients had run into the error of calling the spleen a gland, their established opinion, tho' a false one, of the atrabilis being secreted in it, would have excused them; but if they who really supposed a secretion performed in it, yet did not allow it for a glandular part, surely those who do not allow it so much as the office of a gland, are unpardonable in supposing it of the nature of those parts. The most accurate of the modern anatomists agree, that no secretion is performed in the spleen; nay, that it has no excretory duct: to what end, therefore, are they to make it of a glandular structure? Every thing that the spleen has been supposed, by any modern writer, to perform, may be much better performed by means of a vascular structure than by a glandular.

If



If the kidneys of a human subject, a hog, a dog, a calf, or almost any other quadruped, be examined, whether raw or boiled, or macerated in water, their whole outer as well as inner substance is found to be vascular, or composed merely of tubes of different diameters; but as to the round bodies of which those, who plead for their being glandular, pretend that they are composed, the most accurate examination will never shew any thing at all like them in a kidney that is sound, or in its natural state.

Ruyfch is of opinion, indeed, that something like round tubercles had occasionally occurred to him, in the dissections and examinations he had made of these parts; but, most probably, they were merely morbid tubercles, since, if natural, a man of his accuracy would not have found them only in some few subjects, but in all. But even allowing what this author hints at to be natural, so few and so minute glands, even if they were such, could by no means be sufficient to answer the purposes of secreting a fluid, so abundant in quantity as the urine. The testicles, in the same manner, are agreed, by all the accurate writers of this time, to be vascular\*. And in the pleura, the pericardium, the peritonæum, and the tunica vaginalis, there are naturally no bodies that have any thing of the appearance of glands. There are, indeed, of a certainty, no glands there; and as to the tubercles, which have at times been met with in them on dissection, they have been all morbid ones.

380. The differences of the glands among themselves are established by many authors as very numerous. It will not be necessary to run into the whole disquisition: we shall select a few

\* See our figure, T. 6.

which



which are more generally established than the rest, and of more immediate and real use. We shall first divide them into two general kinds, the simple, and the conglomerate.

The simple glands, called also conglobate glands, consist of a single distinct body, of a figure approaching to round, and are inclosed in their proper membrane.

The conglomerate, or, as they are otherwise called, composite glands, consist each of a number of smaller glands, arranged together, as it were, into one mass, and contained in one common tunick.

The glands differ also greatly in regard to their consistence. Some of them are considerably hard and firm, and others of them are extremely soft and tender: of the latter kind, in particular, are the glands situated in the articulations of the bones of the several parts of the body.

They differ also very considerably in colour. Some of them are of a pale whitish red, or fleshy colour; others of a strong, deep red; others yellowish, or brownish; and some evidently blackish.

Their differences in figure are as considerable also as those in colour. Some of them are round, others oval, others oblong, and many others of figures as different as well can be from any one of these regular ones: the pancreas, the thyroide, and the thymus, are instances of this. Some of them have obtained their names from their peculiar figure: of this number are the glandula pinealis, the milliares, and others.

Their uses are also as different as either their colours or figures. Some of them are salival, mucose, and lymphatick: others are mucilaginous, sebaceous, and waxy; others lachrymal, pituitary,



&c. and from these, their several contents or secretions, they are named lachrymal, &c.

Their situation is also another article in which they differ, and from which many of them have their several names; such are the parotides, maxillares, linguales, thyroide, palatine, labial, jugular, cervical, axillary, inguinal, lumbar, intestinal, mesenteric, renal, &c.

And, finally, their size is a thing in which they differ most obviously and essentially.

## CHAP. II.

### *Of the glands in particular.*

381. **A**FTER we have thus been at the pains of distinguishing what parts of the human body properly are, and what, though called so by some, properly are not glands, we are to proceed to describe such as are truly and properly of this denomination.

In the first place, we are to examine what are the glands of the head. If any one is for affirming, on the doctrine already examined, that the whole cerebrum is one gland, because Hippocrates, from some similitude which he thought he saw between the brain and the glands, called it, as before observed, a body resembling a gland \*; we shall not be at any trouble in confuting the opinion, tho' the rest of the antients are all of them against it: but that the cortical part of the brain is, as Bidloo † has figured it, a mere congeries of small glands; or is, in its natural state, composed of innumerable minute globular bodies, we can never agree. Hippocrates himself, tho'

\* Lib. de Glandulis.

† Anatom. T. 10. fig. 2.



he compares the rest of the brain to a gland, is against this; and nothing is more evident, from experiment, than that it is wholly false.

In the sinus's of the dura mater, and out of them at the sides, there are indeed found a number of the small glands described by Pacchonius \*; and there are sometimes others visible in the foveæ of the os frontis, and about the divisions of the vessels, between the dura mater and the arachnoides, as described by Santorini. Something, however, there is in his account of these last, that is perplexing: he says expressly, that they are situated about the trunks of the vessels, between the dura mater and the arachnoides; but as there are no conspicuous vessels in the tunica arachnoides, it is not easy to understand what he means by the place of their situation. We sometimes find some of them about the divisions of the larger vessels of the pia mater; but whether these are the same with those of Santorini, is a point not easily decided: it rather appears, that they are not.

Sometimes also we meet with clusters, as it were, of the same sort of glands, in the hollows of the os sincipitis, which are frequent, not far from the longitudinal sinus; and these, in the same manner as those of Santorini, in the hollows of the os frontis, were not covered; but the dura mater was deficient, and, as it were, perforated in that part.

These glands seem destined for the secreting of a fluid, to moisten the dura mater.

The glandula pinealis, already described in its place, is also to be esteemed a gland of the brain; and the glandula pituitaria is also to be mentioned:

\* De Gland. Conglob. Dur. Matr.



this is placed under the brain in the sella equina, and has also been described in its place.

The uses of these glands are very little known: we have but conjecture for it; and that, in general, but very indifferently agreeing with reason. Not only dissection, with the assistance of microscopes, but even careful and very successful injections, join to shew us that there are no glands; nor, in a natural state, any round bodies in the plexus choroides.

382. In the exterior part of the head, that is, out of the cavity of the skull, we have the parotids, the maxillary glands, the sublinguals, the linguals, the labials, the palatine, and the buccales, which are distributed here and there about the membrane of the mouth, and have been already described in their place. In the orbit also there is the glandula lachrymalis, long called glandula innominata, which we have also already described in the enumeration of those parts. Under the eyelids also there are the glandulæ ceraceæ, or sebaceæ of Meibom; but in the uvea of the eye, where many authors have established them, upon the erroneous principle that there can be no secretion without glands, experience shews that there are none; and that those who have pretended that there were, have only said so, because they thought there must be such; not because they had ever seen any there. The tonsils in the fauces, the mucose glands in the pituitary membrane of the nostrils, and the ceruminose glands of the ears, are also to be mentioned here, tho' all described already in their places.

383. The principal gland of the neck is the thyroides: this is very large, and has been very indifferently figured, and as ill described, by Verheyen. In the seventh century of the German Ephemerides it is described at large, and figured, together



together with the bronchial glands, in its natural size. As much as we could have room for, in a compendium of this kind, has also been said of it in its place, in the course of this work. We may add, in this place, that this gland in human subjects is single, not double: it resembles the figure of a new moon, or crescent, the horns running on each side upwards, not downwards, as Verheyen has figured them, and adhering to the thyroide and cricoide cartilages, as well as to the œsophagus: its middle part, which is called by authors its isthmus, is joined to the upper cartilages of the aspera arteria\*.

384. In the memoir referred to, on the subject of this gland, in the Ephemerides, the new use which Vercellonius† has ascribed to it is considered: he makes it a kind of nidus for what he calls ovula verminosa; and supposes that these ovula, which are generated in this gland, are discharged thro' passages, which however neither himself nor any body else have ever been able to find, into the œsophagus, and thence into the stomach; where their business is, as he expresses it, to impress a vital character on the chyle, and to promote digestion. These ovula, he says, also often, by accident, hatch into a kind of little worms in the substance of the gland itself; but that this is not the natural course.

385. Frequent examinations of this part in human subjects, have not been able to confirm the anatomist in the truth of the assertions on which this strange doctrine of Vercellonius is founded: there are found, indeed, fibres manifest enough, by which it adheres to the œsophagus,

\* See Morgagni's Advers. T. 1. and Cant's Figura Cordis, T. 4. but dissection does not always shew us the figures.

† See his Dissert. de Glandul. Conglomeratis œsophagi.



and the gland is always found hard and firm; but the ovula, that this author describes, were never found by any body else in it, any more than the passages by which they should be conveyed into the œsophagus.

In a dissection of a female subject at Altorff, this gland was once found turgid, and full of a fluid: from this there was a promise of some discovery that might be made, as to its use. The trachea and œsophagus were carefully opened with this intent from behind, that a proper examination might be made of their cavities in the parts concerned: after this the gland was pressed with the hands, at first gently, and afterwards more forcibly, in hope of occasioning some of its contents to be evacuated into the trachea or œsophagus, or both; but all the pressure that could be employed, however varied, was not of power to force one drop of it into either. It is still, therefore, a doubt what the purpose for which this gland is destined is, and into what part it is that it naturally discharges its secretions. On opening the gland, it was found to be full of a clear limpid fluid, in which there swam a great number of yellowish vesicles, or spherules, in manner of drops of oil, on the surface. Whether these were the bodies which Vercelloni had sometime found in the gland in this state, is not easy to determine: they have not the appearance of what he describes under that name, nor indeed are they found once in a thousand dissections.

386. Beside this gland, there are also found in the neck a great number of other lesser ones, distributed here and there among the muscles and fat. Their figure, their number, and their situation, vary in different subjects; but, in general, those in the anterior part of the neck are called  
jugu-



jugulares, and those in the hinder part occipitales and cervicales. The use of these is hitherto as uncertain as that of the gland last described: it is generally supposed, that they are of service to the lymphatick vessels; but what sort of use they can be of to them, does not so easily appear.

Ruyfch and Morgagni have also described and figured glands in the epiglottis; and Morgagni has described others in the other parts of the larynx, particularly about the arytænoide cartilages, as also in the trachea; but these are often so small, that they are scarce discoverable on dissection. From the figures of Morgagni\* it appears, that he had seen them in subjects where they were much larger than they are in the generality of mankind: a curious anatomist, however, will always find the traces at least of them in all subjects.

The œsophagus, especially toward its upper part, has a great number of glands: they have been well figured by Valsalva†. They are in some subjects, however, found much larger than he has figured them; and, in this case, it is frequent to find a little aperture or osculum in the centre of each, which has much the appearance of an excretory duct.

387. In the thorax we first meet with the gland thymus: this has been already described in its place, where we treated of the thorax; and in our fourth plate there are two figures of it, at number 14 and 15. Bidloo and Verheyen have had long controversies on the subject of this gland. Bidloo, in a dissertation expressly on the subject, published at Leyden, very severely attacks the

\* See De Aure human. T. 5. fig. 2.

† See Ephemerides Germ. Cent. 7 and 8, T. 6; but the figures are not well done.



description and figure that Verheyen had given of it. Verheyen has answered him with the same spirit and warmth; and Bidloo replied in another dissertation; which Verheyen attacked, soon after it was published, in the same manner again. Bidloo, at length, fairly quitted the subject of the dispute, and bent the force of his censures against some inaccuracies in Verheyen's Latin; so that very little publick utility was the consequence of this violent paper-war.

388. In the thorax we also meet with the glandulæ bronchiales, described also before in their place. These are very observeable glands, situated externally in the larger divisions of the trachea and bronchia\*. They are of a blackish colour; and their use, like that of many other of the glands of this part of the body, is yet very little known. It had been long supposed that they served to secrete a liquid, which they discharged into the bronchia, for the lubricating and moistening those parts: but Vercellonius will have it, that they secrete a fluid, whose use is to be assistant in the digestion of our food; and that they discharge it into the œsophagus, thro' certain extremely minute ducts. He observes, that the glands are fixed to the œsophagus in a very firm manner, which is true: dissection never fails to shew the fibres by which they adhere; but the ducts, thro' which he supposes the fluid secreted by them to pass into the œsophagus, and so into the stomach, have not yet been discovered: the fibres, tho' not very minute, are however not thick enough to be supposed ducts; nor has any body been able to find cavities in them, or to introduce but the finest hair into them.

\* See Ephem. Germ. Cent. 8.



Stones, equal in size to the last joint of the little finger, have sometimes been found in the largest of these glands; but this is an accident that very rarely happens. Sometimes black glands of this kind are found adhering to the whole posterior surface of the trachea, near the œsophagus, and some of them about its anterior part. They are in size from that of a grain of wheat to that of a kidney-bean, and they usually are affixed loosely to the trachea.

389. About the fifth vertebra of the back there is sometimes found in the thorax a remarkable gland, adhering to the posterior part of the œsophagus. It has been described and figured by Vesalius and others, and is usually called *glandula dorsalis*. It is, in different subjects, of very various sizes: it is often of the size of a kidney-bean, sometimes of that of an almond, and sometimes it considerably exceeds the largest of these standards; at others it is much less than the smaller, and sometimes it is wholly wanting, or at least is so extremely minute and inconsiderable, that the best dissectors are not able to find it. Sometimes also two glands are found in this part, in the place of one: there are not wanting authors who affirm, that it is more frequent to meet with two than with only one; but experience does not warrant this. In the dissection of a man who died, from an inability to swallow any thing, either solid or liquid, this gland was found swelled to the bigness of a hen's egg. The man had complained that the obstruction was in his breast, not in his throat; and it proved, that this swelled gland had pressed one side of the œsophagus so close to the other, that nothing could pass, and in this manner had absolutely starved him. Other instances have been of obstructions of the same kind,



kind, under which people have died; but the want of leave to open the bodies, has prevented the informing the world whether this was or was not the cause; but most probably, in most such obstructions, where the cause is perceived to be deep in the breast, it is. Verheyen gives us an instance of the sides of the œsophagus intirely coalescing, or growing together, from the same cause\*.

390. Vercellonius† is of opinion, that this gland is also placed there for the secretion of a fluid, serving to assist the digestion of our food in the stomach. He says, that there are ducts carrying this fluid from it into the œsophagus; but these ducts do not appear upon dissection, tho' ever so carefully sought after. Fantonus‡, and some others also before Vercellonius, have supposed that these glands discharged a fluid of a mucous nature into the cavity of the œsophagus; and Fantonus goes so far as to say, that he had discovered the ducts thro' which it was discharged, in the dissection of a dog; and even alledges, that he had found the worms, mentioned by some other authors, living within them. Morgagni§ also says, that in dogs these glands are sometimes found tumid, and inhabited by numbers of oblong and slender red worms. Redi|| also, and Clerk¶, affirm the same; and Morgagni adds, that in this case there are also found passages from the glands into the cavity of the œsophagus; but he acknowledges, that while

\* Anat. Cap. de œsophag.

† See the same dissertation.

‡ Anat. Corp. hum. dissert. 3. p. 55.

§ Adversar. Anatom. 3. p. 5.

|| See his De Animal. vivent. in viventib. repertis.

¶ See De lumbrico lato, cap. 13.



the glands themselves are in their natural state, there are no such passages to be discovered in dogs any more than there are in men. Why it is that worms should breed in these glands so frequently, as by the testimonies of these authors they appear to do, is very difficult to account for. What Vercellonius says of a nidus of ovula verminosa in the thyroide gland, seems, at least, as applicable to these.

391. In the abdomen there are very considerable numbers of glands: the largest of them is the pancreas, already described: after this, in size, come the glandulæ renales, or capsulæ atrabiliaræ: after these the meseriacs, and the intestinals of Brunner and of Peyer in the intestines. All these also have been already described.

The glands of the stomach are very easily distinguishable in dogs, and in hogs; but in human subjects it is difficult to find them: many anatomists have doubted them. Morgagni, however, discovered them so fairly in human subjects, and communicated his discoveries so candidly to the other anatomists, that there was no doubt left about them; and frequent observations afterwards confirmed the truth of what he asserted: they are indeed usually small; but some subjects shew them so large and fair, that it is impossible for an experienced anatomist to miss them.

About the vertebra of the loins, near where the receptaculum chyli is situated, and about the os sacrum and the divisions of the iliac vessels, there are many glands of various sizes and figures: they are commonly called lumbares, sacræ, and iliacæ; and they have numerous lymphaticks entering into them, and discharging their contents into the receptaculum chyli.

The



The lumbar glands have been sometimes found swelled to the bigness of a man's fist. Women who have been in an apparent state of health, and young men who have died in atrophies, have furnished instances of this extraordinary growth of these glands.

In the concave part of the liver, about the ingress of the vena portæ, and the neck of the gall-bladder, as also about the spleen, near the ingress of the vessels, there are frequently found conglobate glands, of about the bigness of a kidney-bean: these are called by authors hepatick glands, cystick glands, and by other names formed from the names of the parts they are near, and they seem to serve the lymphatick vessels.

In the liver of an ox there are usually a much greater number of these glands than in that of a human subject: some of them are of the bigness of a nut, some larger, and some of them sometimes are not smaller than a hen's egg.

About the left orifice of the stomach there sometimes also is found, according to Vercellonius, a gland: he has described it as equal to a kidney-bean in size, and says it has ducts opening into the cavity of the stomach\*. In hogs this gland is very conspicuous; but a number of human subjects may be examined before it is found.

Many authors have told us, that in the omentum, in every part where the fat lies, there are a number of glands, whose office it is to secrete it. Dissection shews us a few about that part, where it is joined to the pylorus; and as to the rest, it is not necessary that there should be arte-

\* See the place last quoted.

† Hippocrates says a great deal of the glands of the epiploon in his book of the glands; but he seems to have meant the mesentery by the epiploon.



ries, because there is fat; for that may be, and is indeed, in great abundance, secreted immediately from the arteries.

In the gall-bladders of oxen there are often found a number of small glands, of a yellow colour, and not unlike the ceruminous glands in the auditory passage. In human subjects the same kind of glands also sometimes are found, but not universally\*. The bladder and the ureters have also sometimes a number of small glands; but they are very indeterminate in number and size, and are not always found indeed in the same place, especially about the ureters. Those about the bladder are usually situated towards the neck of it, and are sometimes tolerably conspicuous; but more usually it is much otherwise.

392. In the parts of generation of man there occur, first, the glandulæ Cowperi, already described. 2. The glandulæ Littri. And, 3. The odoriferous glands of Tyson, all described also in their place, with the part they belong to. As to the latter ones, those of them which are situated in the interior part of the prepuce, are much more obvious than those about the corona penis, where it is very difficult to distinguish them from the nervous papillæ of the same part. 4. We meet with the prostatae. 5. The glands of the vesiculæ feminales; but these rarely are seen distinct and fair: sometimes however they are met with, of the size of a grain of mustard-seed, and much of the same shape. Harder† says, that he has sometimes met with them so large, and with an excretory foraminulum so conspicuous in each, that he could introduce a hair into them. He says they are equal, in this state, to the largest

\* See Ephemerid. Germ. Cent. 5 and 6.

† See his Prodrômus Physiologicus.



gland of the intestina crassa, or large guts. Terraneus also describes six small glands in the urethra virilis\*: he says they adhere to different parts of the cavernous part of the urethra, and that they perforate the surface of the urethra, and discharge into it a soft mucous fluid: it is not easy, however, to find any of these in dissection. We may sometimes indeed see, according to the accurate description of Morgagni, certain foraminula in this part, which, from the retention of a fluid in them, will become turgid, and resemble whitish round glands†.

The testicles, with the epididymides, have been by many accounted glands; but, according to the distinctions established in the first part of this Adenology, they are to be wholly excluded from the number of the glands, since they are manifestly vasculous, and want the peculiar habit and external appearance of glands; and the antients have all agreed in excluding them from the number of those parts.

393. In the parts of generation in women we are to refer to the number of the glands: 1. Those which Morgagni discovered in the nymphæ, which he has very accurately described ‡. These have a very near alliance with the glandulæ odoriferæ of the penis in men. We are to observe, however, that these glands are not so large and conspicuous as he has figured them, in all subjects; but this is the less wonderful, as even the nymphæ themselves are very different in their size in different subjects: where the nymphæ are themselves very small, these glands are scarce large enough to be visible; but, on the other hand, in subjects in

\* See his Tract. de Glandulis, p. 32.

† Advers. Anat. prim. §. 10.

‡ Adversar. Anat. 1. T. 3.



which the nymphæ are large, these glands are very large also: in these they are often met with fully as large as Morgagni has figured them in the others: they are so minute, that none but a very good anatomist would be able to discover them. 2. Authors tell us of glands in the female as well as in the male urethra; but the dissector will find only little foramina and ducts in the place of them. 3. About the extremity of the urethra, however, in the vagina, where there are manifest lacunæ, or openings, some of them admitting a hog's bristle, there are sometimes found evident glands, situate beneath them: Morgagni describes and figures one of these very large and fair †. These, as well as the glands of the nymphæ, are often very turgid in the time of parturition, and are easily distinguished by the operator, who is employed in turning the fœtus, or otherwise assisting in cross-deliveries. At this time the copious afflux of blood to these parts distends them, and they are vastly more obvious than in a dead body; so that, in dissections, sometimes not only the glands but the very ducts themselves, are not to be found. 4. The vesicles, sometimes met with near the internal orifice of the uterus, and taken by some for a new ovary, appear also much more plainly in the time of labour than under any other circumstances: they are not however properly glands, tho' some people have been very positive that they were such. They have nothing of the habit and peculiar appearance of glands; and, as they are truly vesicles, the allowing them to be glands would not only be improper in itself, but

\* See Bidloo's Anat. T. 51. fig. 3. and Terraneus de gland. p. 44.

† See Morgagni's Advers. 1.



would be the occasion of confounding two so very different things as vesicles and glands. These different parts were always distinguished under different names by the antients, and they are not at this time to be confounded together; otherwise the ovaries, and other vesiculose parts, will have the same right to be transformed into glands, in our accounts of them. 5. Some have established it also, that there are glands in the uterus, by which the menstrual discharges are secreted. Littri has taken great pains to prove this, in the Memoirs of the Paris Academy: but this has not arisen from his seeing any such glands; for there are none such; neither has he attempted to describe their shape, structure, or appearance: he only argues from the false hypothesis, that where there are no glands there can be no secretion; and therefore declares, that there are glands in the uterus, because it appears necessary to him that there should be such.

394. Many authors have also asserted, that there are glands in the placenta: it seems to have been from the same source of false reasoning with the former, that this was first asserted; and many at present, not knowing why it was first asserted, continue, tho' the error in the argument is exploded, to believe that the glands are there. No author whatever has ever so much as attempted to demonstrate these glands, or even to describe their size, figure, or situation. On the contrary, Ruysch, who has treated of the placenta in many of his writings, and Rauholt\*, who has published largely upon it in the Memoirs of the Paris Academy, mention nothing of glands in it; nor have the most accurate examinations of the part been

\* See the Memoirs of the Paris Academy 1714, 1715, and 1718.



able to shew any; but the concurrent testimony of all the anatomists of note in this present age, as well as in the last, prove that this part is composed merely of blood-vessels.

395. Among the glands which belong to the articulations, and the extremities, we are to mention, 1. The axillary ones: these are situated under the alæ, and are enveloped in fat, and lie close by the axillary vessels. 2. The inguinal glands: these are situated on each side in the groin, near the crural vessels: these, in various diseases, are apt to become tumid and inflamed. Abscesses are often formed in them, and sometimes they become schirrous and incurable. Their use in the body is not easily understood. 3. The glands, called, from their discoverer, glandulæ Haverianæ \*, in the articulations: these are also called, from the matter they secrete, glandulæ mucosæ. These are observed in the articulations of the bones; but no where so distinctly as in those of the femur, as well where it is joined to the acetabulum of the ossa innominata, as where it is articulated with the tibia. The same kind of glands are, indeed, found in the other articulations; but they are greatly smaller in them all than in those.

These are the softest of all the glands in the body: they secrete a mucous soft fluid, which serves to lubricate the joints, and render their motions easy, and to prevent their growing dry and cohering together. These glands greatly approach to the nature of a certain soft kind of fat, such as is found in the interstices of some of the muscles, and in the cavities of the spine about the marrow; so that there, in many cases, appears reason to doubt whether what we call glands, in

\* These are described in Havers's Osteology.



this case, are truly such; or whether what we take for such is not a more lax and subtile pinguedo, or fatty matter, than is met with in many other parts.

About the scapula, the flexure of the elbow, the hand, the knee, and the foot, there are also found here and there some small glands, as also in some places between and among the muscles: but as their number and situation, as well as their size and figure, are very uncertain and variable, it is not necessary to recount them in a work of this kind.

396. We are, however, yet to speak of the cutaneous glands. Verheyen tells us, that Steno had discovered that there was a gland situated under every distinct pore of the skin; from whence there arose a vessel for the conveyance of the matter of sweat, which terminated at the surface of the cutis: and hence Verheyen, tho' he does not say that he had ever seen any of these glands himself, ventures to give them a place among the parts he describes, and calls them sub-cutaneous glands. The pores of the skin are so extremely numerous, that if, according to these authors, there were a gland belonging to every one of them, they must be almost infinite also in number. But in dissection, when the cutis has been carefully cleared from the fat that is under it, it is certain, that no glands are seen either in the separated fat, or on the lower surface of the cutis: there are, indeed, always found little portions of the fat here and there, insinuating themselves into the little foveolæ, or holes in the cutis: these have imposed upon many young anatomists, and been taken for glands; and, indeed, some professors have shewn them in their lectures under the name of glands: but pieces of fat will always be distinguished



tinguished from glands, with very little difficulty, by an experienced anatomist. From this and from innumerable searches after these glands, made without any success, it appears, that there are indeed no such glands as those called subcutaneous by these authors, that is, glands, one of which is situated under every pore of the skin; and, in all probability, the supposed existence of them arise merely from the erroneous opinion before exploded, that where there is a secretion, there must be a gland. Thus, while Steno and others were very sensible that there was a secretion made at every pore of the skin, it was easy for them, while they believed the principle just cited to be a true one, to take it for granted that there must also be a gland under every pore.

In the cutis itself, and sometimes in its exterior superficies, under the epidermis, there are, in several parts of the body, found a kind of spheroidal corpuscles, each with its excretory duct: these are particularly frequent in the nose, the eyebrows, the ears, the nipples, under the armpits, and in the cutis of the penis, the scrotum, the pudenda of women, and about the anus. These are bodies of a peculiar kind; but, if they are to be established on the footing of glands, they are by no means what these authors mean by their descriptions; neither are they to be called subcutaneous glands, as theirs are named, since it is evident that they are not situated under the cutis, but in it.

397. It may be proper, however, to consider these bodies a little more nicely. We are to observe, that they are very indeterminate in their number and size, being in some subjects, much larger, in others much smaller, in some very numerous, in others few. The nose and the eye-



lids in some persons are full of them, and have them of the size of millet-seeds: in this case the parts are rendered quite rough and scabrous with them, and they occasion a very great deformity in the face: in others they are very few, and so minute as to be scarce visible. The cutis of the penis, and scrotum, in the same manner in some abounds with vast numbers of them: in some other persons the same parts have scarce one, or not one of any size on them. We seldom also find them of any considerable bigness in the areolæ of the breasts\*: but Morgagni has figured them large there, and an author of his accuracy is not to be suspected of having given them otherwise than as he found them. From this it appears, that they vary extremely in different subjects, in the same parts of the body.

There appears also great reason to doubt whether these bodies are really and truly glands, or whether they are not more properly no other than certain excretory ducts from the arteries of the skin, which, either from the density of the cuticle in those parts, or from the thickness of the matter contained in them, become obstructed, and are so formed into these large tubercles. Ruyfch and Boerhaave† are clearly of this opinion in regard to them, and therefore call them not glands, but crypta, folliculi, and receptacula cutanea. Vercellonius is also of the same opinion, as appears from his saying‡ that the sebaceous glands, for that is the name given by the modern anatomists to these tubercles, are no other than the mere extremities of the arteriolæ of the cutis, expanded into a kind of follicles, or little bags. Bianchus

\* Adversar. Anat. prim. T. 4. fig. 2.

† Ruyfch's Advers. Anat. Dec. 1. p. 9.

‡ Dissert. de Gland. conglomerat. œsophag. p. 150.



is clearly of the same opinion also, and asserts, that the cutaneous glands of many authors are parts which do not exist, nor are at all necessary to the secretions performed in that part\*.

Reason joins with these authorities in declaring, that these globose particles are not truly glands, because, first, they are wholly wanting, in many subjects, in the places where in others they are so extremely numerous. 2. Because, when the stagnant, viscid, or sebaceous matter contained in them is pressed out, as is easily done between the fingers, the whole tubercle disappears, and the part is lost to the senses; which could not happen, if the tubercle were a real gland, or congeries of vessels arranged in their determinate manner, and inclosed in their proper membrane: tho', if all the contents of the gland were to be squeezed out, in this case the vessels and the membrane would certainly remain, and the part would continue visible. Upon the whole, the doctrine of the glands seems hitherto established upon the least firm and certain footing of that of any of the parts of the body; and it is much to be wished, that the present set of anatomists, than whom there perhaps never was a better, would set themselves heartily to work to establish a better system, and better distinctions of these parts, than are to be found at present.

398. The doctrine of the glands established in this work, as it is clear and perspicuous, and is consonant to the opinions of the antients, and not disagreeing with the common received opinion, as to the nature and structure of the glands, has been very well received by many of the modern anatomists in the former editions of this work; and a French physician, in particular, has thought so

\* In Hepatis Historia.



well of it as to translate it *verbatim* into his own language, and make it a part of his system of anatomy \*: nor indeed has any body stood up against it, except Michelotti in his treatise of the separation of the fluids in animal bodies. This author says, he does not know what is meant by that peculiar habit and appearance of a gland, which is laid down in this place as one of the great characteristicks of those bodies. But not only people, who have not studied anatomy certainly, do know a gland, when they see it, by its external peculiar appearance and habit, without having been obliged to books, definitions, and descriptions for their knowledge; but even Michelotti himself plainly enough declares, that he was not blind to this peculiar habit of the glands, when he tells us, that he shall readily agree in regard to the larger glands, and to some indeed of the smaller also, that they may be known by their peculiar appearance, or external habit. This, surely, does not accuse the description given of a gland, in this work, of quite so much obscurity, as his not understanding what was meant by our term *peculiar habit* did before.

He agrees also with the doctrines established here in this, that he allows all the secretions or separations of fluids in an animal body, are not performed by means of glands, with vesicles or follicles in them, as the more rigid followers of Malpighi pretend: he expressly says; “ I agree  
 “ with Heister, that the separations of fluids in  
 “ animal bodies may be and are, in many of the  
 “ parts, actually made without the intervention  
 “ of follicles or vesicles;” but he proceeds to affirm, that the essential and peculiar secret structure of the glands, and particularly of the more

\* Noguez Anatom. de Corps humaine, Paris 1723.



minute ones, is not to be distinguished by any peculiar external appearance or habit, but by their peculiar vascular structure and compages, which is contrived in a singular manner, appropriated to their necessary offices: and from hence he concludes, that the cortical substance of the brain, and the ultimate vasculous parts of the liver, the spleen, and the testicles, ought to be referred to the number of what are properly called glands.

This, however specious it may appear, we cannot but observe has been already fairly answered in the course of this part of this compendium, where it has been shewn, that an inexplicable confusion of the different parts of the body would be the consequence of the taking away that long established distinction between the vasculous and the glandulous parts, which has existed so many ages, served to so many distinctions with sufficient accuracy, and is obvious to the very senses in the inspection of the parts. Every part of the body may be called a gland, if so large and vague a characteristick of glands be established: while we would speak intelligibly and distinctly, we must call every thing by its distinctive name.

Michelotti, from his idea of a gland, which he makes to consist in the being merely a vascular part, does not blame those who assert, that wherever there is a secretion performed, there must be a gland: but this, beside being in itself a perfectly erroneous assertion, leads, and has at all times led, the asserters of it into such a series of errors, that it is not easy to say what could be a more unlucky maxim in anatomy. The chyle is evidently secreted in the intestines, without the assistance of glands. The fat is also secreted without them; and so is as evidently the mucus in the pituitary sinus's, the semen in the vasculous compages of



the testicles, and the menstrual blood in the uterus. All the membranes, nay, in short, every part almost of the body, would be intitled to the name of a gland upon this plan; which can neither agree with the sense of the antients, with the structure of the parts, or with the opinion that the generality of the world, as well those who have studied anatomy as those who have not, have established within themselves of what a gland really is. All the world agrees in certain general ideas of what a gland, what a muscle, what a membrane, what a vessel, what fat, or what an intestine is, and by these ideas they can distinguish these parts when they see them; but all this means of distinction would be taken away, by thus confounding vascular and glandular parts. The ten Latin lines made occasionally in honour of a young physician sustaining a thesis on this subject, some time ago, are yet too justly applicable to the subject:

*Dicere difficile est medicis, quæ glandula pars sit ;  
 Nondum doctores haud docuere satis.  
 Corporis hinc omnes mire confundere partes  
 Cæperunt, & pars glandula quævis erat.  
 Nunc quivis plexus vasorum glandula dictus ;  
 Nunc membrana omnis glandula facta fuit.  
 Mox cerebrum, splen, pulmo, jecur, renesq; vocati  
 Glandulæ ; nunc quævis bullula talis erat.  
 Ast qui distinguit partes, quas visus & usus  
 Distinguunt priscus, rectius ille docet.*

Wherefore, tho' it is established in the doctrine of a gland here delivered, that its inmost structure is truly vascular; yet as there are a multitude of parts that are truly vascular, which cannot be called glands, without making too free with the distinc-



distinctions nature has herself established, and mankind in general, 'till the time of Malpighi, had acquiesced in; it has been a principal point established here, that for a part to be vesiculose and vascular does not constitute it a gland: and as neither the office of secretion, nor any other character hitherto discovered, is sufficient to distinguish accurately, and with certainty, those parts which the antients called glands, and which the generality of writers since their time have also agreed in calling so, it appears necessary, as well as proper, 'till sufficient distinctions of a more accurate kind can be established, to call in, as is here done, that peculiar external appearance and habit of a gland, which has always hitherto served to distinguish them from other parts. And upon these principles it probably is that Nicolai, in his dissertation *De Directione Vasorum*, has ventured to assert, that Michelotti's hypothesis of the glands is precarious.

399. Boerhaave, in a long epistle to Ruysch, has said a great deal in favour of the Malpighian system of the glands, and which consequently makes against what is advanced on the subject in this work; but even the name of Boerhaave cannot, in justice, be supposed to overthrow reasons, 'till better reasons are established in the place of them. Ruysch and Boerhaave had many arguments on the subject of the glands, managed with a friendly moderation, and yet carried to the exactest scrutiny: Ruysch was positive in his own opinions, Boerhaave favoured those of Malpighi; and it was, in fine, agreed between them, that this epistle of Boerhaave's should contain all that its author had to urge in favour of the Malpighian system; and that, after this, Ruysch was to publish his reasons against it, to urge all that he could



could to overthrow the system, and to support his own. Both these treatises were afterwards published under the title of an *Opusculum Anatomicum de fabrica glandularum in Corpore humano* \*. In the first, Boerhaave, with all that strength of reasoning he was master of, produced all the arguments that could be alledged in favour of the Malpighian system; tho', as himself candidly confesses, he, in many things, differs much less in his real sentiments from Ruysch than the necessary form of argument makes his words seem to import. Ruysch has answered all these arguments in a nervous and strong manner; but as it appears, that, beside all that Ruysch has advanced, there are still many arguments behind, that greatly make against the Malpighian system, it is not proper they should be passed over in silence. What Ruysch, therefore, from his great age, his many avocations, and a thousand other reasons, omitted, we shall, with all due deference to so honoured and so truly honourable a name as that of Boerhaave, (not for the sake of dispute or cavil, but in the honest pursuit of truth) venture to give here.

Malpighi and his followers, not excepting even Michelotti, have established it as a standing maxim, that every gland has a follicle or vesicle within it: but Boerhaave, who has attempted, with more labour and strength of genius than any other author ever did, or probably ever will do, to support the Malpighian hypothesis, if supportable, seems in this essential point to disagree with the author of the system, and with all his followers; for he defines a gland to be a very simple part, which properly forms an involucrum, or case, with the simple apparatus of a membrane,

\* Published at Leyden in 1722, in 4to.



within which a peculiar liquor is secreted. An involucrum or case is, as all the world must agree, nothing more than a covering; and it must be as readily allowed, that the integument of a part is not the part itself, as the integument or involucrum of the liver is not the liver itself; and, in the same manner, the involucrum of a gland is not that gland itself; nor can this involucrum or integument, forming the case of a gland, be supposed or understood as the thing itself, without manifest confusion.

If it be alledged, that Boerhaave in this place uses the word involucrum in a new and appropriated sense, and means by it to express the vesicle or follicle of the Malpighians, we are only to observe, that the using the word involucrum as synonymous with vesicula or folliculus; and as the term to express a gland is giving a sense to it, different from that under which it has been received at all times by the antients, and by the moderns, and indeed giving it a wholly unknown signification, by means of which great confusion must be brought into all writings in which it is necessary to use the terms.

We would be glad to know, what antient Greek or Latin writers, or indeed what author of any age or nation before Malpighi, ever took a vesicle or a follicle for a gland, or ever called such a part by such a name? It is evident, that no one ever did; nor is it less evident, that this sort of innovation, in regard to the sense of words, cannot be brought into use without the utmost confusion among the things before understood by those words. This is evidently a new way of understanding the two words vesicula and glandula, which is not only incongruous to the ideas before affixed to them, but also quite unnecessary.



cessary. We are ready to agree with these great authors, that there are vesiculæ or folliculi in several parts of the human body, within the cavities of which fluids of various kinds are secreted, contained, retained, changed, and, in fine, from out of the cavity, of which they are discharged by a proper passage; but there is no reason for calling these parts glands. The urinary bladder, the gall-bladder, the vesiculæ feminales, and the vesiculæ in the sinus's of the bones of the skull, are indisputably hollow parts, within which peculiar liquors are secreted, contained, retained, and changed, and from which they are afterwards excreted; and they have, therefore, all the requisites for the establishing them glands, according to even Boerhaave's definition: but no author of any time, new or old, antient or modern, ever supposed these several parts to be glands, or ever called or desired others to call them so; but at all times they have been called by their proper, expressive, and distinct names of vesicæ, or vesiculæ.

From this therefore it is evident, that tho' vesiculæ be clearly demonstrated to exist in certain parts of the body, whether they are necessarily and naturally there, as in the cutis; or whether they are found only under certain circumstances, and appear rather to be the effect of distemperatures of the part, not of its natural state: and tho' in these several vesiculæ a peculiar appropriated fluid be proved to be secreted there, retained, changed, and finally excreted; yet surely it is not proved from all this, that these vesiculæ are glands, or that there are any glands in the part where they are found; and therefore the parts where they are found should not be called, as they usually are, glandulous parts, but vesiculous parts. These vesiculæ are not, nor do they indeed at all resemble



femle glands; but they are perfectly like the vesiculæ, or vesicæ, already mentioned, as always called by that name; and therefore they ought always to be called by the same name, unless we are desirous of introducing into medical writings endless confusion and disputes about words, which will always lead into errors about things, according to the Latin adage,

*Errorum genitrix est æquivocatio semper.*

Where therefore only vessels are found, let those parts be called vascular; where only vesicæ or vesiculæ are found, let those parts be called vesicular: but where glands are found, let those be called glandular, or glands. Thus, in various parts of the skin, there are found folliculi or vesiculæ, in which an unctuous liquid is formed, which is always either viscous or sebaceous, particularly in the nose, the ears, &c. as before observed: these vesiculæ or folliculi are truly vesiculæ, and have no appearance of the nature, structure, or peculiar habit of a gland; they are therefore very improperly called by the name of glands: they may be much more properly called folliculi receptacula, or crypta, as some have called them, and most properly of all vesiculæ cutaneæ. They have all the requisites of the vesicæ before mentioned, and indeed scarce differ at all from them, except in bigness.

Why, therefore, Malpighi and his followers should deny the name of vesicles to these, and should impose on them another new, improper, and foreign one, not expressing their nature, but occasioning endless confusion, by joining them to another set of bodies of a different structure, does not appear.

We



We have already observed, that if there were, in reality, vesicles found in the brain, liver, kidneys, &c. in their natural and healthful state, which yet is a thing much to be disputed, it would not follow, that these viscera were to be called glandulous in their structure, but vesiculous or vesicular.

Where, indeed, such vesicles are surrounded by or inclosed in a quantity of a glandulous flesh, or of such a substance as the bodies allowed by all people of all ages to be glands are composed of, and which, at first sight, shews that peculiar face and habit which characterises a gland; in that case, as this is the case in regard to the glands of the lips\*, those of the aspera arteria†, and those of the palate, the pharynx, the intestines, and particularly of the duodenum and rectum, then these bodies, tho' vesicular, are to be acknowledged to be true and proper glands. But they are not charactered as glands by the vesicæ within, as the Malpighians assert, much less by the involucrum, but by their peculiar fleshy matter surrounding the vesicles; for it was from this peculiar fleshy matter alone, not for any other causes, as has been evinced in the preceding parts of this work, that the antients called certain parts of the body glands, or glandular parts. Their names of parts ought by no means to be changed by us, unless with very sufficient reason; and consequently 'till absolute and distinctive characters of what a gland is shall be established, and shall be found to exclude some of these bodies universally received as glands, or to take in some others not so received. These parts, and no other parts but these, ought to have the name of glands with

\* See T. 8. fig. 36. d d.

† Morgagni, Advers. 1. T. 2. o o.



us: otherwise, as has been abundantly proved already, equivocations, and from them confusions of the several parts, will be let in upon us, and numberless errors are the necessary consequence; all which will be avoided in this case, if we will only agree with the antients in calling the bodies which they called glands, and those only, by that name.

400. Finally, we are to add, that those tumors which Boerhaave and Malpighi have declared to be situated in the follicles or vesicles of the cutis, as the atheromata, steatomata, *talpæ*, and the like, do not, in our opinion, arise in the cutis, but under the cutis: for, in the extirpation of these tumors, they do not only appear very evidently, before the operation, to lie under the cutis; but, in the operation itself, the cutis must always be cut quite thro' before the tumor or its follicle can be got at. Nay, the same appears evidently even from the very accounts these authors themselves give of these tumors, which had fallen under their own observation.

It will appear to every one, from this, how very little all that has been alledged, in regard to these encysted tumors, proves in favour of the doctrine of the cutaneous glands; and how equally little all the other morbid cases they have recited on this occasion, tend to prove that there are, in the parts where they have been produced, any such glands as the authors have brought them to shew that there were there. In all these cases, the parts have receded too much from their natural structure, to give any grounds for forming a judgment of what is that structure from them: and this argument is also of infinitely the less weight, toward the proving what these authors intended to prove by it, as the true  
2 and



and genuine glands are scarce ever changed into hydatides or vesiculæ; but, on the other hand, the vasculous parts are extremely subject to such changes.

Nothing can be a stronger instance of the truth of this observation than that singular case, recited in another part of this work, of the whole liver being transformed into a multitude of hydatides, in such a manner, that there remained not the least vestige of the vena portæ, or vena cava. A very striking instance of how great changes may be made in the parts by distemperatures!

### SCHOLI ON.

It seems very evident, that Hippocrates \* principally had regard to the general habit of the glands, so strongly insisted upon in this treatise as their great and obvious characteristick, in his descriptions of them; since he says, their structure is spongy; that they are lax in their texture and fatty; that they are not composed of a flesh, like that of the rest of the body; nor have, indeed, in them any thing like any other part of the body, but a friable matter, full of a multitude of vessels.

\* See his Liber de Glandulis.

### NOTES.



A D D I T I O N A L  
N O T E S.

N O T E 76.

**T**HE epidermis, or cuticula, is formed merely by the production of the integuments which are under it. The cutis has a number of wrinkles and furrows, furnished with their secretory and excretory vessels, and with clusters of nerves. These three productions, as they dry, form a kind of scales or squammæ, and are lodged one upon another. The fluid matter, which exhales by means of the heat from them, then leaves them harder, dryer, and more rigid than they were before; and, under this transformation, they make what we call the epidermis.

This system of the origin of the cuticle is perfectly analogous to what the microscope shews us in it; for whatever part of it we examine, with the assistance of that instrument, we find it composed of these squammæ or scales; or whatever part of the surface of the body be examined, in its healthful state, it is always found thus covered. When any violent attack is made upon the surface of the body, these squammæ are the first thing that feel it; and, if not too severe, often they are the only part affected by it. Their softer part, which remains yet attached to the under integuments, looses its connection, and the whole series of squammæ come off together, in form of a thin skin, which is properly the epidermis. As soon as this outer integument is off, the furrows and excretory vessels of the cutis appear: they immediately protrude themselves again at their extremities, and form a new series of these squammæ; that is, they constitute a new covering for themselves, a fresh epidermis, like the first. If this new-formed epidermis be separated again from the under



integuments, a third will be formed in its place, and so on, almost without end.

From this account of the formation of the cuticle, we may understand the nature and origin of callosities; which are, in reality, no more than a number of series of these scales, or several distinct epidermis's, laid one upon another. In order to the formation of these callosities it is not necessary, however, that the epidermis separate itself entirely from the skin; for, in this case, the effect would be different, and the matter of transpiration or sweat would raise it into blisters, as we see in burns: in which case the action of the fire hardens the epidermis, and separates it entirely from the skin, after which the matter of perspiration not being able to make its way thro' its altered substance, and at the same time nothing fixing it down to the skin, the fluid, which should have been exhaled, is collected in drops, and raises the cuticle, lodging itself between it and the cutis, and forms the blisters, which are the consequences of such accidents.

The vesicles which are formed in exanthemata, without the assistance of external agents, may also be accounted for on the same principle. That part of the epidermis, which is naturally immersed in the larger cavities of the cutis, separates itself from the internal sides of these cavities which it before covered, and raises itself outward, as the fluids from within press it that way. As it does not give passage so readily to these fluids as their excretion requires, they cannot but be retained under it, or between it and the cutis, and they must there form a kind of blisters or elevations, which must rise above the level of the surface of the skin; and when the blood is urged, by the nature of the disorder, into these cavities of the cutis, these elevations must appear red.

Immediately under this membrane, called the cuticula and epidermis, lies the corpus reticulare. To form to ourselves an idea of the nature and origin of this, we are to remember, that under the skin, and on the surface of the membrana adiposa, there are certain series of nerves which form a kind of membrane, accompanied with arteries, veins, and lymphatics. These nerves



elevate themselves in form of pyramids, and with their heads pierce thro' the cutis; and, when they are arrived at the epidermis, they put off the membrane with which they were before covered: this membrane, or covering of the extremities of the nervous pyramids, when separated from them, divides into a number of lobes, which apply themselves to the cutis; and there uniting with those others, which are thrown off from the other clusters of nerves, by this union of the lobes, formed by these different separations, there is formed this membrane, called the corpus reticulare. The clusters of nerves pass thro' the apertures of this membrane, and run to the two sides of every one of the furrows of the cutis, where they are arranged into parallel series, in a longitudinal direction, and are the organs of sensation; which is more or less strong, according to the more or less strong motion that is excited in these clusters of nerves. The soul, which is present in every part, feels the slightest signal from them; and her sensations are more or less strong and lively, as the motion given to these nerves is more or less violent; and in consequence, if any part of this structure is hardened by external accidents, or otherwise, she has no more communication or connection with that part, because there cannot any longer be any sensations excited in those clusters of nerves.

Beside this reticular substance there is another, which may be called properly enough the rete cutaneum, or rete of the cutis. This is formed by the vessels which are dispersed all over the skin: these vessels receive, in general, no other fluid but lymph; and to this it is owing, that the whole surface of the body with us is white. It has been supposed, that in negroes this reticular substance was formed of larger tubes; and from hence authors have argued, that in consequence of their larger size, these vessels may have received blood into them in those subjects; and that this blood, divested of its lymph and other aqueous matter by transpiration, became black in them, and was the occasion of their black colour. This has a shew of reason; but we are at present very well assured, that the black colour of these people is solely and entirely owing to a black mat-



ter, of a peculiar kind, lodged in the corpus reticulare, tho' we are not acquainted with its origin.

There are people always of a florid red colour, from the blood in the vessels of the skin not being divested of its lymph; and in general, according to the nature of the blood and other liquors which enter these vessels, the skin is differently coloured. We are not to suppose it wonderful, that the vessels of the skin are not exactly of the same size in all people; for we find that they vary extremely, in this particular, in the different parts of the body in the same person. In the cheeks they are naturally very large, whence there is in general a florid colour there; and the blood being capable of rushing more forcibly into them on any occasion, it is in them that flushings of red are first seen from exercise, or a thousand other occasions. In many of our passions the nervous fluid being forced violently along its passages, they press upon the arteries, and force the blood into the lateral tubercles which form this reticular substance: hence it is, that we grow red with these passions. If the passion be more violent still, and the nervous fluid urged on with greater force, the arteries may be so pressed upon as to prevent the blood's passing at all along its own little channels; and to this it is owing that we turn pale with extreme anger, and with many other very violent passions.

The same consequence will happen also, tho' on another principle, if, on the contrary, the nervous fluid is not propelled at all, for want of force in the nerves: in this case the heart will not send the blood at all into these minute vessels, and consequently we become pale, as in the other case. This is the origin of that paleness which seizes us in terror.

Under the squammæ, or scales of the epidermis, we discover, by means of the microscope, a vast number of holes or apertures: Lewenhoeck tells us, that he reckoned not less than a hundred and twenty-five thousand of these, within the space that a grain of sand would have covered. He supposed these to be the excretory apertures destined for perspiration; but, on the nicest view, it is hard to determine whether what he called holes and apertures were all truly such, and whether



whether many of them were not extremities of vessels. We see clearly and distinctly enough, however, a number of tubercles on the surface, which are of considerable size, and which we can distinguish to come from certain glandulous bodies, situated on the internal surface of the cutis. When we examine these tubercles on the extremities of the fingers, with the assistance of good glasses, we discover that their inner surface is punctulated all over with little dots, which are the apertures of other small tubercles. All these little apertures, doubtless, discharge their contents into the general tubercle: these contents are the matter of perspiration and sweat; and what we had been used to esteem the excretory ducts for it, and think very small ones too, appear truly to be only the reservoirs of it, running from millions of others still more minute.

#### NOTE 77.

Gagliardi observes that the bones, beside their hard matter, have a spongy, and, as he expresses it, a reticular substance: there is a membrane also, which forms the vesicles in their interstices, as we shall see more at large below.

The hard matter of the bones is composed of a multitude of lamellæ, or flakes, laid in several series over one another; and, in the long bones, the external series of these lamellæ separates itself from the others at their extremities: the next series also separates itself in the same manner; but it is shorter than the former; and the same is to be observed in succession of all the rest.

The heads of these bones, when cut longitudinally, resemble a battledore. We see by this structure easily and naturally, what it is that occasions the protuberance of the heads of the bones.

The spongy substance of the bones is only an assemblage of a multitude of boney lamellæ, which are not disposed evenly over one another, as those of the hard parts, but cross and intersect one another at various angles, and have spaces or cellules between them. It is evidently no other than the hard lamellæ, which, by their different position and distance, form the spongy matter; and hence it is, that we find it in the heads of the long bones.



The reticulation, or reticular part, is composed of fibres, which cross and intersect one another: these fibres or filaments proceed from the spongy substance among which they are intermingled: they are placed in the cavities of many of the bones, to support the medullary matter in its place.

The interstices, which are found between the fibres of these reticulations, are lined with a membrane which forms vesicles; and it is within these vesicles, which in many of the bones resemble clusters of grapes in form, that the blood-vessels deposite that fatty or oleaginous substance, which we call marrow.

In the long bones we meet with the three substances just mentioned, the hard, the spongy, and the reticular; but in the flat ones we meet with only the two first, a hard external matter, and a spongy one between: this spongy substance, in the cranium, is what we call the diploë.

There is not, in reality, any of that great difference that there appears at sight to be, between the hard and the spongy substance of the bones; for, on calcining the very firmest bones, we find that their hardest and most solid parts are, in reality, no more than an arrangement of cellules: the whole difference between them therefore is, that in the hard parts an indurated or solid matter fills up the cellules; and in the spongy parts a softer matter is deposited, which leaves the cavities distinctly visible. The same fatty substance, which occupies the interstices of the reticular part of the bones, is also lodged in the cells of the spongy part.

#### NOTE 78.

Malpighi has very accurately explained the structure of the teeth in those of oxen; but we are not so well informed of the structure of those of the human body. They have externally a white matter, harder than the rest, which is composed of perpendicular fibres, raised from the surface of the internal substance. This is only a series of little vessels, in which there is lodged a firm white matter: these hardened vessels are sometimes continued into the internal substance of the tooth, which seems to be an arrangement of cells, in which the blood, which is sent from  
the



the root of the tooth, circulates: it is easy to see from this, that the teeth must become black, when robbed of this white matter; and they may be divested of this either by external accidents or force, or by the stagnation of the blood which ought to circulate within, which, after this stagnation, grows corrupt, and corrodes the enamel of the teeth. The part of the tooth, which forms what we call the root, is truly boney, according to the observations of Dr. Havers: it is composed of lamellæ of a boney matter, in the manner of the other bones; and it was also necessary, for the use of the teeth in the comminuting our food, that the enamel or external covering of them should be harder than the rest.

The teeth have a membrane covering their roots: this is produced from the membrane which covers the gums, and lines the inside of the mouth. We also sometimes find at the root of a tooth a fleshy matter, like that of the gums, which serves to keep it firmly in its place.

The periosteum, which covers the maxillary bones, runs down into the alveoli, or sockets of the teeth; and on one side it adheres to the bone of the alveolus, on the other to the root of the tooth: when there is no fleshy matter in the way, it joins itself in so firm and perfect a manner to the membrane that covers the roots of the teeth, that it concretes, as it were, into one substance with it.

The nerves which enter the jaws send ramifications also to the teeth, in the same manner as the blood-vessels of the same bones do. The aperture in which these enter is often visible in the tooth, without the help of the microscope; but it is not always in the same part of it. Sometimes it is at the very point of the root, sometimes on one side of it. It is evident from this, that the teeth are capable of pain; and that odd sensation, expressed by us by the phrase *setting the teeth on edge*, by biting certain substances, is also easily explained by understanding the communication we have mentioned, between the membrane of the gums, the periosteum of the maxillæ, and the roots of the teeth.



The microscope discovers pores of two kinds in the bones, longitudinal and transverse ones. These are not intended to give passage to blood-vessels; but, according to Dr. Havers, the transverse ones are destined for the primary reception of the medullary juice, and for the distributing it to the longitudinal ones.

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## NOTE I.

Dr. Trew of Nuremberg, who had attended the author's courses of anatomy, and dissected with him for four or five years, desired him to communicate to the authors of the German Ephemerides some anatomical observations, which stand in the publications of that body for the year 1717, on the subject of some sesamoide bones, which he had discovered by his own indefatigable observations in bodies dissected by the author, in the anatomy-school at Altorff. These bones are described and delineated as new-discovered ones in the account, and the author had communicated them as the discovery of Dr. Trew, and sent them in his name. The publishers of those works, however, without his knowledge, printed the paper, with some few alterations, in his name, not in Dr. Trew's: the author of this treatise thinks it incumbent on him to take this publick opportunity of setting this matter right, that neither Dr. Trew nor his friends may suppose him guilty of any attempt to take any thing from the merit of so ingenious a man, or of intending to do himself honour from the discoveries of another: and to give the praise where it is due, he here declares, that every thing contained in that account does of right belong to Dr. Trew.

He confesses also, that he did not know of these bones 'till they were shewn him by Trew, especially those of the ossa femorum, and then considered them as new-discovered ones. Ravius, who had been long preceptor to our author in anatomy, and especially in the osteological part, had never, as he observes, mentioned them in his lectures; but absolutely declared, in his manuscript-osteology, which his pupils had the advantage of looking into, that there were no such bones: he expressly says in that treatise, we are to take care not to add improperly to the number of the bones, by  
counting



counting more than ten of the sesamoide ones. There are two of them at the second joint of the thumbs and great toes, and one in each tendon of the musculus tibialis posticus\*. The articulations of the fingers never have any of them, and it is but very rarely that the tendon just mentioned has. It is evident, from this passage, that Ravius not only says nothing of the sesamoide bones of the thigh, and of the little finger; but absolutely denies the existence of all the other sesamoide bones, as they are called, except the ten he particularises.

Hornius also, in his *Microcosmus*, and his Commentators, who have, in general, been men of great knowledge, and many others of the more eminent writers on these subjects, have omitted the mention of them: Verheyen†, who does mention those in the thigh, yet does not speak upon his own knowledge, but quotes the authority of Bartholine for them. And, finally, Marchettus‡, a very accurate and diligent dissector, declares, that he never could find these sesamoidæ of the femur, tho' he had, from finding them described by some writers, frequently looked carefully after them. From all this, and from the vain attempts that had been often made by the author himself to find them, he wholly gave into the opinion of Ravius, that there were none such: but he was afterwards perfectly convinced by Trew, that there did such bones exist; and that several other ossa sesamoidea also were to be found, which were not described, nay, were excepted against by Ravius.

After this, however, looking into a great number of the anatomical writers of most credit, on occasion of these bones; and finding, in consequence of this, that not only one but two sesamoide bones had been sometimes met with, in old subjects, in that part of the femur where the gastrocnemii have their origin, parti-

\* Probably Ravius intended in this place not the tibialis posticus, but the recondens posticus; for the author, as well as Vesalius and others, have found this bone in that, not in the other.

† See his *Anatomy*, cap. de Off. Sesamoid.

‡ See his *Anatomy*, cap. 19. de Musc. Gastrocnemiis.



cularly by Vesalius §, Riolanus ||, who ascribes the honour of the first discovery of them to Vesalius, and also by Bartholine\*, Munnick †, Drake ‡, and others; and that Fallopius ¶ and Cowper mention only one to be found there, which probably was the one which Dr. Trew afterwards found. It is with the assent of Dr. Trew that he here declares, that these sesamoide bones, of which Trew writes, are not new and undescribed ones, as they had appeared to himself as well as to that writer; but that, as they were known long before, yet sunk into oblivion at that time, as they had not of a great while been written of by any anatomist, nor shewn in any course of lectures: it cannot but be judged much to the honour of Dr. Trew, that he first at this time discovered one, and to our author that he afterwards shewed another in the femur, and they described and delineated them in their natural size, and with accuracy, that will leave no room for farther doubt about them. See T. I. Fig. 2, 3, 4. It is a very great service that the figures of parts, not before perfectly known, are of to anatomy.

## NOTE 2.

Morgagni, when he speaks of the generation and regeneration of the epidermis, says that he is of opinion, that the epidermis is nothing else but the upper superficies of the cutis itself, which grows hard, and, as it were, in some degree callous, by the external compression; and thence grows to be insensible, and, as it were, dead. But it is to be answered to this, that the epidermis is perfectly formed in the foetus, while in the uterus, when there have not been these causes of induration: where the whole surface of the body has been surrounded by the liquor amnii, which is soft and mucilaginous, and by no means capable of making such a compression as is necessary, according to this author's system, for the formation of this part; nor

§ Anatom. Corp. hum. l. 1. c. 28,

|| Anthropolog. l. 5. c. 43.

\* See his Anat. c. 14.

† De Re Anatomica, S. 65.

‡ Anthropolog. p. 729.

¶ Observat. Anatom. p. 441.



could give it that hardness, dryness, and callosity which this author allows in it.

Beside Ruysch teaches us, in his *Adversaria*, a way to prepare, in a beautiful manner, the cuticle and corpus reticulare of Malpighi; and in that place very severely censures St. Andre, who had not only ascribed vessels to the cuticle, but asserted, that he was able to fill these vessels with a red injection, in such a manner, that they should become turgid, and very beautifully visible to the naked eye, in great numbers.

### NOTE 3.

Many of the modern anatomists describe glands, which they call glandulæ sebaceæ; and tell us are situated here and there in the cutis, especially in the ears, the eyelids, the nose, the areolæ or circles round the nipples, the scrotum, the skin of the penis, the prepuce, the nymphæ and labia pudendorum, the anus, the axillæ, and several other parts: from these they tell us, that a sebaceous matter, thick and fatty, may frequently be expressed; but Berger and Vercellonius contend, that these imaginary glands are in reality no other than the extremities of the arteries, dilated into a kind of vesicles.

Finally, Boerhaave informs us, that those corpuscles which are called sebaceous glands, and which have a small aperture which is their emissory, and which perforates the epidermis, are rather to be esteemed receptacles of an oleaginous or fatty humour, than glands formed for the secreting of it. To which this author adds, that this humour, supposed by others to be so secreted in these parts, is more rationally to be supposed deposited in them from the mouths of the minute arteries of the cutis; and that, while in the act of secretion, it was not thus thick, but fine, subtile, and thin; that, during its stay in those receptacles, its thinner part has been exhaled; and the remainder, by that exhalation, reduced to the thick and sebaceous consistence in which we see it; and that this matter, thus become thick, may very easily be supposed to distend, fill up, and render its receptacles visible, and give them much the appearance of glands. These tubercles are frequent in the face, especially about the nose; and this



this seems a much more rational account of them than the supposing them glands.

It is these tubercles which have been mistaken for living animals by many, and called worms of the skin: their extremities often appear in form of black specks on the surface of the skin; and, on pressing them forcibly, a white, thick, fatty or sebaceous matter may be squeezed out of them. It is natural for a tough matter, thus forced out at a narrow orifice, to represent the figure of a worm, and hence has arisen the error.

Boerhaave carries this doctrine much farther, and with great reason; and propriety deduces the origin of the other pustules, called atheromata and melicerides, from the same cause; and our author always gave into the same opinion, and publicly taught this doctrine, of what had been by so many called sebaceous glands: of this more will be said in its place, in the Adenologia: from the whole, however, it must needs be allowed, that cutaneous glands, properly so called, are not so numerous as many have supposed them; nor that there is one of them under every pore of the skin, destined for insensible perspiration, as Steno and many others, since his time, have imagined, and have indeed publicly taught.

Boerhaave himself, however, in his epistle to Ruysch, seemed inclined to take these folliculi for glands; but Ruysch, in his answer, convinced him perfectly of the error. Our author's farther opinion on this subject, see S. 399.

#### NOTE 4.

The ligament, called ligamentum Poupartii \*, is said to be a robust ligament, extended from the anterior spine of the os ilei to the upper part of the os pubis; and it is asserted, that, by means of it, the connivance of the muscles of the abdomen, where the process of the peritonæum and the spermatick vessels in men pass out, is greatly assisted; and that the intestines are by this prevented from falling thro' so easily, and forming hernias. But Morgagni † more judiciously denies the existence of this ligament, as a distinct and separate

\* See Memoirs of the Paris Academy 1705.

† See Advers. Anat. 3, p. 2.



thing; and asserts, that it is no more than the lower rim or verge of the tendon of the musculus oblique descendens. Our author was always of the same opinion; and therefore, not to multiply parts unnecessarily, had wholly left out the very mention of this nominal ligament in the first edition of this work.

Cowper is also evidently of this opinion. It is not to be denied, indeed, that this part of the tendon of this muscle does perform the office of a ligament, and even does the service that is attributed to it by these authors, in preventing the occasions of ruptures; but this is no new discovery. Vesalius plainly shews, that he was acquainted with it in his account of the parts.

## NOT E 5.

The celebrated Tournefort was very firm in the opinion, at one time, that the effect of vomiting was solely owing to the action of the muscles of the abdomen, and he taught this publicly; but Schelhammer rejected the opinion a great while since. After this Chirac, and after him Du Verney, asserted that vomiting was the effect of the joint force of the diaphragm and of the muscles of the abdomen. And, finally, after all these, Littre proved, by very cogent reasons, that the stomach also concurred in the producing this motion; tho' the authors before mentioned had wholly excluded it from any part or share in it\*.

## NOT E 6.

Many of the anatomical writers have averred, that they have observed certain spheroid little bodies, which they will have to be glands, in the peritonæum, the pleura, and the pericardium. But we are to remark, that all the observations of this kind have been made upon morbid bodies; and that no such spheroidal substances are to be seen in the dissection of persons who have been taken off in a state of health: it is hence very obvious, that these bodies, supposed to be glands by the authors who observed them, are, in reality, tubercles of a morbid kind, and the mere effect of the disease of which the subject they were found in died; and, probably, have owed their origin to a stagnation of humors in the small arteries of these parts. This

\* See Memoirs of the Paris Academy 1700.



kind of error of mistaking morbid tubercles for natural glands, has gone very far among our anatomists; and has given occasion to the descriptions of a great many glands, which are not to be found in sound bodies, and which thence alone are sufficiently proved not to be glands at all.

Chefelden \* tells us, that he found in a woman, who had died dropfical, the peritonæum three inches thick, and glands in it visible to the naked eye. But it is very rational to suppose, from the state of this morbid and monstrous peritonæum, that these bodies, supposed by this author to be glands, were not truly such; but were, in reality, morbid tumors of the part. As, from the same cause, we sometimes meet with calculous concretions, nay, boney and cartilaginous ones; atheromata and steatomata, and other unusual and unnatural productions, in different diseased parts of the body.

Nay, we meet with accounts of the parts themselves frequently concreted into a boney, sometimes also into a kind of stoney substance, from the same cause †; yet we imagine no body would refer to such accidental and unnatural changes, for the explication of a system of the natural parts.

In the same manner the judicious anatomist will avoid referring to things which appear in morbid subjects for the explanation of the parts; nor is it easy to conceive that it ever can be proved, that bodies of this kind, found only in a preternatural state of the parts, do really exist at all in them in a natural one, much less that they are glands.

Many of the most pompous discoveries of the later anatomists are to be referred, we are afraid, to the same cause. The author has spoken with an honest freedom in the *Adenologia*; but those who have written since have not paid so much respect, as it would have been to their credit to have done, to what he has said.

#### NOTE 7.

Winslow, a very justly celebrated anatomist of Paris, first observed and described a peculiar natural aperture or foramen into the cavity of the omen-

\* See Chefelden's *Anatomy*, Ed. 1. p. 96.

† See *Memoirs of the Paris Academy* 1700.



tum, by means of which that part might be conveniently distended by inflation, for the observation of its structure and parts.

This aperture is to be sought under the great lobe of the liver, near a certain membranaceous ligament, which joins the beginning of the duodenum and the neck of the gall-bladder to the liver, on the side of the eminence, which is the root of the little lobe of Spiegelius, and between that and another ligament, which connects the colon to the pancreas.

These two ligaments, where they unite, leave between them a certain interspace or aperture, as this author says, of four or five lines in diameter, in a child of four years old, thro' which aperture the eminence just mentioned pass. If a large tube is let in at this aperture, and the rest of it closed by the fingers, all the cavity of the omentum may be inflated by a moderate blast; and in this state the part represents a kind of sack or bag, but of an unequal and irregular figure. The same author observes, however, that this cavity, into which the air is by this means introduced, is not formed solely by the omentum; but by the upper superficies of the meso-colon, with part of the superficies of the colon itself, and of the stomach: and, finally, that membrane, which the space between the two orifices of the stomach, and which he calls the lesser omentum, all concur to the making up the bag thus formed by inflation at this aperture.

The use of this aperture he supposes to be, that, if any humors chance to be collected in the cavity of the omentum, they may have a way out by means of it, especially when the person lies on his back.

#### NOTE 8.

Malpighi himself, in his posthumous works, acknowledges that he doubts whether these ductus adiposi are truly distinct vessels. And Morgagni, in his *Adversaria*, has very justly hinted, that they are not necessary as such; since it appears, that the secretion of the fat may as well be performed in this part as in any other, immediately from the arteries into the adipose cells; and that it may also be again occasionally absorbed by the veins, without the necessity of imagin-

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ing a third sort of Vessels, which Malpighi found it necessary, according to his system, to suppose there should be. Rivinus also, in his dissertation on the omentum, absolutely denies the existence of such ducts.

## NOTE 9.

As to the fleshy fibres of the stomach, Morgagni, speaking of them, very justly observes, that Fallopius delivered a great deal as to the structure of the stomach, and particularly as to what related to its orders of fleshy fibres, which Willis afterwards claimed as his own. Helvetius describes a very different situation of its muscular fibres, with their courses and divisions, and that in a very elegant manner: his figures are also greatly superior to those of any other; but whether what he has laid down as their course be certainly, uniformly, and regularly so, is matter of doubt. Our author observes, that in dissections he had frequently found them otherwise; and that in prepared and inflated stomachs, which he preserved by him, this was evidently not the direction of them.

It should seem most probable, from this, that the fibres of the stomach run variously in different people. Santorini alledges, that the fleshy fibres of the stomach are not annular, but spiral; and that they are most conveniently seen, in robust bodies, about the pylorus. Our author, tho' he searched carefully for them in such subjects, acknowledges that he did not find what Santorini had said, perfectly answered. It should seem pretty evident, upon the whole, that anatomists are often to be understood as speaking only of some one or two particular subjects of their dissections, when they seem to be speaking of the human structure in general. This is not the only instance in which two authors differ greatly in their descriptions of the same part, tho' both of them have written from their own absolute observations. In the minuciæ of the human frame there are variations, in the particular subjects; nor are we to suppose them as invariable as the more essential particulars.

## NOTE 9.

Malpighi will not allow, that there is any such distinct coat of the stomach as that described by authors under the name of the villose one: his reason  
for



for this is, that it cannot be separated from the nervous one; and, in consequence, he allows of only three coats of the stomach, instead of four. He does not deny, however, that there are villi and papillæ in the stomach; but tho' he allows these, there are others who either absolutely deny or at least greatly doubt their existence: but this is a doubt founded only on want of due observation. Ruysch and Santorini have instructed us how to make them appear in the human stomach, by macerating it in warm water; and they are still infinitely more obvious in the stomachs of sheep, oxen, and many other quadrupeds. Morgagni adds, that he has observed in some human stomachs evident excretory passages, or oscula opening into the stomach, which plainly also belonged to its glands: these, he tells us, he principally saw near the antrum pylori. Santorini also observes, that he had found in the same part of the stomach certain oscula, or apertures, which he has given under the name of siphuncles.

## NOTE 10.

The glandulæ Brunneri are very large and conspicuous in the duodenum, in infants that have died with a diarrhæa or dysentery upon them: but when these are to be sought in other subjects, this intestine is to be boiled so long in water as till it sinks to the bottom. After this the internal coat is to be separated from the inner surface of the gut with proper care, and they are then to be sought for: they will generally be seen very plainly in this manner, and especially in that part of the intestine which is nearest the stomach.

## NOTE 11.

Albinus, in an inaugural dissertation published in the year 1722 at Leyden, in which he exhibits a new description of the small guts, teaches a way, in which, by turning one of the small intestines inside out, and afterwards immediately inflating it, and then drying it, the nervous coat may be converted into an elegant and new cellulous one, different from that of Ruysch; and his experiment will always succeed, if set about with the necessary cautions. The same author has given, in his dissertation, many other observations



and remarks, on other parts of the intestines, worthy observation: he alledges, that the tunica cellulosa of Ruysch is situated between the external membranaceous common and muscular coat; and that it does not surround the whole intestinal canal, but is wanting in that part which is against the mediastinum, and is in reality propagated from the mediastinum: but his new cellulous coat is situated between the villose and muscular ones, and forms what is called the nervous coat, surrounding the whole cavity of the intestines\*.

Finally, that the fleshy longitudinal fibres are only placed in the part which is opposite to the mesentery, and are not like so many threads extended along the whole intestines; but are interrupted, as it were, in the manner of the muscoli recti of the abdomen.

He observes also, that the annular fibres are not inserted into the mesentery, as Willis declares; but that their contractions are toward the mesentery; that, by inflation, all the rugæ or wrinkles of the nervous coat, or of his new cellulous coat, and the valvulæ of these intestines, disappear immediately; and that, by this method, the villous coat is easily separated from the nervous, which otherwise is not so easy.

He adds, that the villi on the tunica villosa, by means of a slight maceration in warm water, and frequent changing and washing with it, may be rendered distinctly and elegantly visible, when a piece of the gut, inverted and cleared from its lubricous mucus, is suspended in a clear fluid; and that these villi will be rendered yet thicker, and more obvious, especially such of them as communicate with the veins, if they are first distended by a wax injection. Finally, he adds, that the veins of the intestines may be conveniently and elegantly filled with such an injection, by means of the arteries, and the arteries thro' the veins; and that the

\* Helvetius, in the Memoirs of the Paris Academy 1721, tells us, that he had found two new cellulous coats in the intestines: the one of these he places between the muscular and nervous coat; the other between the nervous and villose, which undoubtedly is the same as Albinus's. But he observes, that he had not sufficiently examined these.

† Helvetius maintains the contrary, and says the longitudinal fibres are strongest near the mesentery, p. 397.



matter of the injection may, from either, be forced into the cavity of the intestine; and that, in this case, when the gut is carefully laid open and examined, the injected matter will be found adhering to the villi of the inner coat, in the form of little worms.

## NOTE 12.

The inner coat of the intestines is commonly called the villose one, by anatomists, from there being a multitude of fine and thin villi, resembling the nap of velvet, upon it\*. This villose matter is most obviously seen in the intestines of a dog, a hog, or some other quadruped, after macerating a part of them for two or three days in warm water, often changing the water, and finally stirring the intestine well about in it.

Ruyfch has observed, that there are not only these villi, but a number of papillæ also, observable in this coat of the intestines, which he therefore calls the villo-papillose one §: but, on the other hand, Helvetius absolutely denies the existence of those villi, which are said to be like so many hairs, in this coat: he asserts, that it consists solely and entirely of mere papillæ, which are spongy, fat, of an irregular figure, and have their extremities pierced with innumerable little holes. He has figured these as they appear before the microscope; and for this reason he calls this coat by a new name, *membrana papillaris*; and he asserts, that the foramina of these papillæ absorb the chyle, and carry it to the lacteals: this is distinguishing very nicely, however, and perhaps not with so absolute a certainty as the author supposes. These papillæ are only discoverable by the assistance of very powerful microscopes: they appear like villi to the naked eye; and indeed, by the same microscopes, villi are perceived in different places among them: so that, upon the whole, it seems more advisable to keep the old name, *tunica villosa*, than to change it.

\* See Bartholin. Anat. 9. renovat. p. 297. fig. 1. Magnet. Theatr. T. 69; and Pechlin. de Purg. T. 2. fig. 3.

§ See Advers. Anat. 1. p. 25.

† See Memoirs of the Paris Academy 1721, p. 35, Memoir 392.



The uses of this coat of the intestines are elegantly explained by Albinus and Helvetius; and what has been before observed, added to the matter of this note, tends not a little to elucidate their doctrine on this subject.

Helvetius, in the same place, speaking of these fibres of the intestines, which authors in general declare to be spiral or annular, does not allow that they are either; but figures and describes them as perfectly irregular, and as a kind of rude segments of circles, collected into fasciculi.

## NOTE 13.

Beside the authors commemorated in this place, as the observers of the lacteals, Rolfinch, in his *Dissert. Anat.* l. 5. c. 22. p. 906. produces some other authors, who, he says, he is of opinion had seen these vessels; and even goes so far as to put Hippocrates and the Arabians into his List. Among the more modern ones he mentions Vesalius, Fallopius, and Varolius, whose words he severally brings to prove it. See also, on this subject, the *Inventa Nov-antiqua* of Almeloven, S. 23.

## NOTE 14.

In the year 1717, a youth of a robust constitution, who had been feasting and drinking plentifully at a neighbouring fair, was suffocated in a ditch, into which he fell by accident, on his attempting to return home. The day afterwards the body was committed to this author for dissection, by the curators of the Altorff academy: he was at that time engaged in the course of his reading, in the demonstration of the common teguments and muscles of the abdomen. On the day following, when he came to examine the intestines before his numerous auditory, tho' this was the third day after the death of the person, there appeared such a vast number of the lacteals under the membrane of the mesentery, and upon its fat, that the intestines and mesentery seemed covered, as it were, with them; and they were, at this time, full of a white milky fluid. The quantity and plainness of these vessels, in this accidental subject, were vastly greater than they ever are in dogs, or other quadrupeds, fed and prepared on purpose for this examination. In these last subjects they are usually



usually only follow the course of the vessels of the mesentery; but in this man they extended themselves promiscuously over the whole mesentery, and had a multitude of inosculations: some of them also evidently entered the glands about the intestines, and others were in part buried in the fat of the mesentery, so that their progress could not be distinguished; and, finally, a part of them went away to the more remote glands, as those figured at the end of this work, Tab. 2. Fig. 8. which were in the subject itself so elegant and fine, that neither the drawer nor the engraver have been able to come up to nature.

After this, in the year 1718, the author, before a numerous audience also, on the 18th of April, demonstrating on the body of a young person, who had died in a consumption, observed the lacteals very numerous, and disposed in the same manner as in the former subject, and this twenty-four hours after the person's death. In this subject also, and in another soon after, the author and his pupils evidently distinguished them coming out of the duodenum itself.

In the year 1719, he also observed a very large lacteal in the duodenum, near the pylorus; and from that time he occasionally observed, and shewed to his auditors, lacteals in different number and condition in several of the bodies he demonstrated on, tho' it has seldom happened to him to find them so obvious and so turgid as in the cases just mentioned. As they are, however, very rarely seen in human subjects at all, and scarce ever in such abundance and fullness; and as the figures given of them by the anatomists in general, are from quadrupeds, it appeared very proper, when such an opportunity offered, to have them delineated from a human subject, and to express the difference between their course and figure in the human frame and in quadrupeds. Nuck, in his *Adenographia*, Fig. 9. has given a delineation of the lacteals, as he says, from a human subject; but he gives so few of them in the quantity of the intestine he exhibits, that they appear much more probably to have been the vessels of a dog; for in both the human subjects, in which they appeared so beautifully to our author, they were, at least, ten



times as numerous as in this figure of Nuck's. The valves, which he has delineated so large and fair in them, do not appear in those of human subjects as they occur to us in dissections: their figure is truly such as represented in our figures; but when their dissection is made in a quadruped, prepared for it, and just killed, and the vessels are tied, there the valves and tubercles appear, and not otherwise.

In the first subject dissected by our author, in which they appeared so fair and numerous, the person was young: he had been eating heartily, and he was instantaneously suffocated, and consequently the motion of the chyle in the vessels was stopped just at a time when they were filled to the utmost: hence it was, that these vessels were so elegantly seen in this subject. But in the other body, the person having been consumptive, jellies, broaths, emulsions, and other strengthening things, had been given him, almost to the time of his last breath; and to this it was owing, that they were so well filled, and so beautifully conspicuous in him.

These were opportunities in which it was natural to expect to find the lacteals filled and visible; but as they are occasions which occur but very seldom, it is not a wonder that anatomists so rarely meet with a view of the lacteals, in human bodies, in any great degree of perfection.

Morgagni, however, has been so fortunate as to meet with much such another view of them, as he informs us in his *Advers. Anat.* 2. p. 92. and in his *Advers.* 3. p. 31. he describes them also as he saw them in the duodenum, a little below the pylorus. Musgrave gives a very elegant method of filling the lacteals in a dog, with a fluid tinged with stone-blue, in the *Philosophical Transactions*, N<sup>o</sup>. 275.

#### NOTE 15.

There have been, among the anatomical writers, many who have denied the existence of the receptaculum chyli in human subjects: some have asserted, that the lumbar glands performed the office of such a receptacle; but experience is against this. Not only our author has sometimes filled this receptacle, along with the thoracic duct, with quicksilver, and that in a very  
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elegant manner, in human subjects; in which case it appears a fine thin membranaceous sack, sometimes single, sometimes double; but many other anatomical writers, whose own credit is sufficient to support the assertion, and whose attestations are confirmed by this experiment, have elegantly and justly figured this with the thoracic duct in the human frame. Cowper in his *Anatomy*, Bidloo in his *Dissertation de Organ. Chylif.* Drake in his *Anthropologia*, Salzman and Wius in particular dissertations, and Henninger in the *German Ephemerides*, Cent. 3. as well as Cant, T. 6. have all justly delineated and described it.

## NOTE 16.

The use of the semilunar valve in the subclavian vein, at the insertion of the thoracic duct, is to this time generally understood to be for the closing that duct, that the blood from the subclavian may not rush into it. But Jo. Adolph. Wedelius dissents from this: he will by no means allow, that it was formed with this intent; and demonstrates, that no blood from the subclavian could ever enter the thoracic duct, if no such valve as this existed. The valves in the thoracic duct alone, and especially with the assistance of the fluid contained in that duct, would always be able to resist the impulse of the blood attempting to force its way into it, as he abundantly proves. He adds also, that the position of this valve is such, that it is by no means calculated for the preventing the ingress of the blood into this duct, if the nature and constitution of that duct permitted it. He goes on to shew, that this valve, together with a similar one on the opposite side, does the same office in this as the other valves do in the other veins; that is to say, they serve to prevent the blood going this way back again from the vena cava in the contraction of the heart.

## NOTE 17.

We have very few of the lymphaticks truly delineated from human subjects; and even Nuck's in his *Adenographia*, which have been generally allowed to be taken from human subjects, on a stricter enquiry, as observed in another place, prove to be either from quadrupeds, or, what is worse still, from imagination. His



figures of the heart, the kidneys, and some other parts, give sufficient ground for this conclusion, as the experienced dissector will easily discover. Those which he adds to the human uterus were certainly never seen by him, but contrived by his own fancy, in consequence of that analogy he observes between the lymphatics of brutes and those of the human species. For since these vessels can scarce possibly be seen, except in living subjects, and since women are not to be dissected alive, for the looking after them, it appears sufficiently that there is no room to suppose them real. But tho' we can by no means allow these to be just figures of the lacteals of the human uterus, we are far from declaring that there are none there. On some very fortunate dissections they have been found; but they are usually few in number, and what there are, are very small.

## NOTE 18.

Our author has, in two papers published in the German Ephemerides, Cent. 5 and 6. described two human gall-bladders, in the cystick duct of each of which he discovered certain beautiful and surprising valves of a spiral figure; and, as they have not been mentioned by any other author, they are figured again in this work, Tab. 3. Fig. 9. where there is also added a third and new delineation of the cystick duct of a woman, dissected by the author, after the publication of the others; in which also he observed a number of membranes, some in a transverse, some in an oblique situation, which divided the duct, as it were, into a number of cells. These, however, did not entirely close the duct in any part, but were disposed much as the *valvulæ conniventes* in the *jejunum* and *colon*.

Glisson says, indeed \*, that certain anatomists had framed, from their own imagination, valves in the *ductus cysticus*; but that he is of opinion, that what led them into the error was the fibrous annulus of the *cystis*; for that he never was able to find a real valve there.

Bianchus § also, in the same manner, roundly asserts, that the valves, spoken of in the neck and the *cystis*

\* See Tract. de Hepate, c. 14.

§ See Hist. Hep. Ed. prim.



fellea, are imaginary: but the author of these observations, who has found the parts already mentioned not only once, or in one subject, but many times, and in many, is not afraid to appeal to the publick, whether they are or are not valves. Their use also, is a subject very worthy to be inquired into. We are not to omit to take notice, however, that Bianchus, in a succeeding edition of his work, has recalled his words, and even acknowledged, that demonstration had taught him to own that they were not imaginary, but real.

Bauhine\*, Bidloo†, and Vestus‡, however, have mentioned in their time certain valves in this part: and Schelhammer§ has gone so far toward it as to allow, that the cystick duct will not admit a style either from the part next the duodenum, or from that next the cystis; but that it very readily admits of inflation either way. It is probable, that this author, in the subject which he is describing, really met with a cystick duct with some of these valves in it; tho' he refers to another cause, what was evidently an effect of their being there. Finally, it is to be remembered that Plancus found, as himself says, valves in this place; and those, as it appears, such as those described from one of our author's subjects: his description of them is, that they perfectly resembled the turn of a snail-snell||.

## NOTE 18.

It has been to this time much disputed, whether there are or are not ducts, which immediately, or without the intervention of any other duct, do convey the bile from the liver into the gall-bladder.

Bohnius gives some very remarkable experiments¶, by which it appears that there are evidently such ducts in men: and adds; that Glisson and Blasius had mentioned them before him: from this he concludes, that such ducts are necessary also in the human frame, and consequently that there are such there. But, on the

\* See Theat. Anat. p. 156.

† See Anat. T. 38. fig. 3.

‡ See Obs. in Cramer. Colleg. Chym.

§ See Analect. Anat. Differt. 11. N. 23.

|| See Epist. ad Jos. Pozzum, p. 20.

¶ See Acta Eruditor. Leipf. 1722.



other hand, the anatomical writers of most reputation, tho' they allow that in many quadrupeds there are such ducts, yet absolutely deny that there are any such in the human frame; and our author joins his testimony to theirs, that there have not been any such found.

Chefelden, in the first edition of his *Anatomy*, mentions a case, in which he says, he found these ducts in a human subject; but he adds, that they were extremely minute: the subject was a person who had died in a jaundice. He gives a figure of the gall-bladder in his 18th Plate. But, in his third edition of the same work, he recalls his assertion, and allows that he had advanced it like a young anatomist; and acknowledges, that he never afterwards could find these ducts, tho' he had searched after them with the utmost attention and care.

After all this, Bianchus, in his history of the liver, takes infinite pains to establish the doctrine of these ducts again: he alledges many reasons why they should be found, and brings many experiments and observations to prove the truth of what he asserts. He even distinguishes the ducts he found into two kinds, the hepatico-cystick, and the cystico-hepatick; and has given very pompous figures of them: how the succeeding anatomists will find them, time will shew us. Added to the weight of his own observations, he brings the testimony of Cajetanus Taconis, a physician and philosopher of Bononia, who, in a letter to him, accompanied with some figures, takes a great deal of pains to prove the existence of such ducts, running from the liver to the gall-bladder; and gives the conformation of the parts, and course of these ducts, as he says he observed them in a morbid subject. Soon after the publication of this, however, there appeared a letter of J. Pozzus, professor of anatomy at Bononia, to Plancus: this was published in 1726; and in this letter, and Plancus's answer, the matter is set in a new light. All Taconis's observations are said to be erroneous and false; and it is asserted, that he was deceived by taking the arteriolæ of the cystis for such ducts as all this pains had been taken to establish.



Our author, who never omitted the utmost pains in his dissections, to enquire into the truth of a subject so much in dispute, tells us, that, after all these altercations about it, he at length thought he had found it to be a truth, that there were such ducts. He discovered, before a numerous assembly, what appeared to be a duct of this kind, or a true hepatico-cystick duct. Its size was such as might countenance the opinion; its colour yellow, and its situation was near the hinder part of the neck of the cystis, or gall-bladder: but others should be informed, from his conduct, how to treat what appear to them in the light of new discoveries. He examined this vessel along its progress; and, finally, making a small aperture in it, and inflating it, he found it was distributed over the cystis in the manner of the ramifications of a shrub, or little tree; and, in fine, that its trunk was a blood-vessel of the cystis, and these its ramifications; tho' its colour and situation, which was much the same with that of some of the hepatico-cystick ducts in oxen, would have led many people to have asserted, with great boldness, that it was truly such a duct as we know there is in that animal, and as had been so long sought in man in vain.

Upon the whole it appears, that it is easy to be deceived unto an opinion of these ducts being found where they are not; and that, from the ill success of the generality of anatomists in their searches after them, it appears, that if there are such in human subjects, as some anatomists who seem to be worthy credit, affirm, that they are not universal, but are very rare.

## NOTE 19.

Those authors, who have said that the substance of the liver is glandulous, have been led to it principally from the observation, that in morbid subjects, particularly in such as have died in dropsies and atrophies, there have been a multitude of spheroidal bodies found in it: but, as it appears by repeated and continual observation that no such things are found in the livers of persons who die without these diseases, it is to be inferred that they are, when found, not glands, but morbid tumors and tubercles.

If



If the liver of a horse or ox are examined, tho' they are very large, and all the parts are very visible and distinct in them; yet the nicest enquiry will not be able to discover in them any peculiar and distinct bodies wrapped up in their membranes: and, on the contrary, if the tubercles that are found in the livers of morbid persons be strictly examined, they will not be difficultly found to be morbid, and quite out of the course of nature. Our author mentions an instance of what would have deceived many people, of sanguine imaginations, into an opinion of their having found these glands, tho' without any real foundation. This was in a body he opened, in company with Boyer: in this the surface of the liver shewed a prodigious number of round white bodies of various sizes, which appeared perfectly like what many have described as glands: the subject was a woman, who had died dropfical; and when these tubercles were opened, and their contents examined, it was found that they were filled with a matter as different as well could be from that of the liver, and much like that contained sometimes in the harder encysted tumors, like suet or fat.

The liver, in this subject, was grown to twice its natural dimensions; and, on opening it, a multitude of the same tubercles were found in its substance: some of these were as big as an egg, others smaller; many of the size of a nutmeg. The colour and whole appearance of all these was like that of those on the surface, very different from that of the liver; and it easily appeared that these tubercles, tho' they were of a roundish figure, were not glands, but morbid tumors, which accidentally resembled the figure of glands.

After this he proceeded to examine carefully the like bodies, which he found emulating the appearance of glands in the livers of distempered human subjects, as well as quadrupeds, and he always found them of the nature of encysted tumors; which kind of tumors will rise in the internal as well as on the external parts, and in both have so much of the appearance of glands, that it is easy for the unwary to be deceived by them.

There have not been wanting others, who, having found morbid vesicles in the liver, have supposed them

to



to be glands; but we shall have occasion to speak at large on a subject of this kind hereafter, see Note 75, and need therefore only observe here, that this opinion is equally erroneous with the other.

## NOTE 19.

Palfinus, in his Anatomy, p. 184, blames our author for having asserted the ingress and egress of the bile, contrary to the opinion of Verheyen: its ingress, thro' the cystick duct into the cystis; and its egress, thro' the same duct into the ductus cholidocus. He calls in, to the support of his censure, the names of a great many very eminent anatomists who utterly reject this supposition, and agree with Verheyen; who declares it as his opinion, that it is impossible that the bile should, by the same duct, run into the cystis, and run out of it again. But Bohn\* and Ortlobius† have advanced this opinion, and that on the testimony of infallible experiments, which experiments our author has repeated, and found to be just, and the conclusion certain. Cole‡ also, and Maur. Hoffman§, and a multitude of others, join in our author's opinion; and Bianchus|| has abundantly confirmed the truth and certainty of it. It is to be added also, that whatever may be said by some, as to the improbability of it, we have all the reason in the world to believe it may be; since we see the very same thing evidently happen in the vesiculæ feminales.

## NOTE 20.

As many have found round bodies in the liver, which they have supposed to be glands; so some also have met with such in the spleen, and have in the same manner supposed those to be glands also: but as, in regard to those imaginary glands of the liver, it appears that they have always been found in morbid bodies; so also, these of the spleen have been found in such only. Whatever has been said against the opinion of these tubercles in the liver being real glands, is of equal force here:

\* See Act. Erudit. Leipf. 1682 and 1683.

† See Hist. Part. p. 135.

‡ See De Secret. Animal. p. 133.

§ See Idea Machin. Corp. hum. p. 55.

|| See Hist. Hepat. c. 13.



may, these round bodies in this part have still less title to be supposed glands, than they might appear to have in the liver, since there is no secretion performed in the liver, nor has it any excretory duct; so that there cannot appear so much as a reason why nature should have placed glands there. There can, indeed, be no use of glands where there is no secretion; and nothing is a more certain truth, than that nature never made any thing in vain. To this it may be added, that Ruysch, in several of his works, has proved, to demonstration, that these viscera are of a vascular structure, and that there are no true glands in them: and Schelhammer \* has proved, that what Malpighi has figured and described as the glands of the spleen, hanging together like clusters of grapes, is a mere fiction. See the *Adenologia*, S. 365.

## NOTE 21.

There is no one of the viscera the use of which is so obscure as that of the spleen, and, consequently, there is none which has given rise to so many different opinions of authors on the occasion. Many, who have found that it may be taken out from a living animal, without its receiving any hurt by the loss of it, have joined with Erasistratus † in supposing it a perfectly useless and superfluous part of the frame, and have even accused nature of an error in putting it there. Others suppose that it is placed, as we see it, to keep up the equilibrium of the body, and with no other intent or purpose. Some have joined in the old opinion of Hippocrates and Aristotle, that it served to draw off the watery matter from the stomach ‡: but the greater part of the antients have been of the opinion of Galen, that it was destined as the receptacle of the humour they called *atra bilis*, or melancholy. Some have supposed that a kind of ferment or menstruum, necessary for the operations of the stomach in digestion, was secreted in the spleen, and thence conveyed into the

\* See *Analect. Anat. Dissert.* 10. No. 22.

† See Galen. de *Usu* Part. 1. 4. c. 15.

‡ See Casp. Hoffman de *Usu Lienis*.

stomach.



stomach. Some have supposed it the origin of laughter, according to the old Latin adage :

*Splen ridere faciat, cogit amare hepar.*

Others have advanced that its use is to inspissate the blood : Havers \* was of opinion, that its office was the preparation of that mucus which is secreted in the mucous glands of the articulations. Schelhammer †, and with him Lister ‡, and some of the late English anatomists beside, as Purcell §, &c. suppose it to be a kind of diverticulum for the blood in the more violent commotions : and to this Purcell adds, that it inspissates the blood ; and, by means of an acid of some kind or other, produces a precipitation, which serves for the better secretion of the bile. Others have found out other imaginary uses for it ; an enumeration of which would take up more room than the reader would think it worth. The opinion of our author is, that its office is to supply a particularly thin and fluid blood to the liver ; by means of which the other thicker blood conveyed to it from the other parts, and from which a secretion of so much importance as that of the bile, is to be formed in this dense viscus, is rendered more fluid ; and by this means the secretion of the bile is greatly promoted, and at the same time the obstructions in the liver, which would otherwise probably be very frequent, and must be of bad consequence, are prevented.

In confirmation of this opinion, if the splenic vein be opened in a dog, or other living animal, a thin and florid blood always runs out of it ; not a thicker than that of the other veins, as the asserters of the opinions most received, as to the use of this viscus, would infer.

N O T E 22.

As the liver and spleen have been declared by many to be glandular in their structure, so the kidneys also have been judged to be so, and that from the same erroneous observations. Tubercles, which have the appearance of glands, are sometimes found in the kid-

\* See his Osteologia.

† Analect. Differt. Anat. 10. S. 40.

‡ Tract. de Humoribus.

§ Tract. de Cholica.



neys; and thence, as in regard to the two other viscera, the whole substance of the kidneys has been judged to be glandulous. The bodies supposed to be glands in the kidneys, are not universal, or found in all; and where they are found, they are always mere morbid tumors. Sometimes vesicles also are found in the kidneys, and from these also they have been supposed to be of a glandular structure: but what is truly the state, in regard to these, will be explained hereafter in note 75.

## NOTE 23.

Scarce any thing has been more obscure and uncertain than the use of these glands. The academy of Bourdeaux very laudably proposed their prize to the person who should discover what was their true use; but, unfortunately, there appeared no body to claim the reward. Some time after this, however, Valsalva\*, a very eminent anatomist of Bononia, wrote to many people, that he had found their real use, and had discovered certain ducts passing from them, in men, to the epididymides; and, in women, to the ovaria. He took care to have the notice of this discovery printed, and promised a distinct treatise on the subject; but, tho' the author lived some years after this promise, the treatise never appeared: and we are to add to this, that no man since has ever been able to find the ducts he speaks of. There appears sufficient reason, from this, to doubt the reality of these ducts; and adding to this, that these glands are very large in the foetus, and gradually become smaller, as the child grows towards maturity, there appears very little reason to suppose them of use in generation. Malpighi has given an accurate and elegant account of their structure.

## NOTE 24.

Authors, in general, say there are only three tunics or coats to the urinary bladder; but as Wharton mentions a tunica cellulosa in the mesentery, and Ruysch and others describe a cellulous one also in the intestines, we are to allow the same reasons of force, and even greater, are to be urged for the establishing the doctrine of a cellulous coat in the bladder. It is evident, that be-

\* See Vallisneri's *Hist. Generat.* p. 353.



tween the outer and muscular coat there is usually, if not universally, a quantity of fat, and that often pretty considerable; and that this is secreted in peculiar adipose cells, and properly collected and preserved in them, as in the other allowed membranes of this kind; so that, properly, we are to allow four membranes to the bladder.

In dogs, and some other quadrupeds, indeed, this cellular membrane scarce comes in sight at all; but in the human bladder it is often considerable enough to be very obvious. Its use seems to be to defend the bladder itself from the acrimony of the fluid contained in it.

## NOTE 25.

Many things more there are to be pointed out, in regard to the testicles: tho' they would swell the enumeration of their parts too much to be inserted in the text, we may have permission to mention them here.

Morgagni observes, that the first among the earlier writers, who discovered the substance of the testicles to be truly vascular, were Arantius, Cabrolus, and the accurate and discerning Riolanus; but that De Graaf first demonstrated the connections and uses of these vessels. The vascular substance is extreme clearly distinguishable in the testicles of the tortoise\*, the boar†, the ram‡, and the dormouse§.

We are to observe also, that the spermatick arteries do not always arise from the aorta; but the left sometimes from the emulgent, and not unfrequently both from the hypogastricks||. This seems not to have been discovered by those who tell us, that the spermatick arteries have been found wholly wanting in some subjects. De Graaf justly calls these triflers on such subjects¶. Lealis and Schrader\*\* also are of opinion, that the spermatick arteries, before they reach the tes-

\* See Ruyfch's *Advers. Anat.* 4.

† See Schelhammer's *Analect. Diss.* 12.

‡ See Lealis de *Part. Generat.*

§ See De Graaf and Cheselden.

|| See Nicolaus's *Direct. Vasa.*

¶ See De Viror. *Org. Generat.*

\*\* See *Observ. Anat.*



ticles, communicate by anastomoses; but no body, beside themselves, have been able to make this out\*.

The first description of these arteries we seem to owe to Andromachus †. Morgagni observes, that the tunica albuginea of the testicles may be easily separated into two; and Teichmeir declares, that it truly consists of three, namely, a tendinous one, a vascular one, and a nervous one ‡.

## NOTE 26.

The disposition of the testicles and epididymides is not always regular or certain. Our author observed a very peculiar manner of it, in a subject publicly dissected at Helmstadt: in this subject the left testicle was not in the scrotum, but in the abdomen; but that not in the pelvis at the side of the bladder, where other anatomists have usually found it on this occasion, but in that part where, in other subjects, the spermatick vessels pass out of the abdomen. It was also much smaller than the other, and had no epididymis. See its figure in Tab. 6. Fig. 25. m. The epididymis made its way thro' the muscles of the abdomen, where the spermatick vessels usually pass out toward the scrotum, and extended itself thro' the left groin, as far as to the upper part of the scrotum. From the end of the epididymis the vas deferens was again turned upwards, and entered the belly near the epididymis, passing thro' the groin, and then thro' the muscles of the abdomen, whence it passed in the usual way to the left vesiculæ feminales. This disposition of the parts, and the singular division of the vessels, are carefully expressed in the figure.

## NOTE 27.

Lealis has figured the vesiculæ feminales as terminating in the urethra, by one common duct; and Boerhaave takes this upon credit from him §: and some of the French anatomists have done the same, observing in their writings, that the vesiculæ have more frequently only one such passage than two. But our author, on

\* See Heucher's Dissertat.

† See Institut. Anatom. p. 37.

‡ See Anthropology, p. 171.

§ See Institut. Med. Ed. alter. S. 148.



the contrary, asserts, that in all the bodies he dissected, he always found them two. He kept by him several preparations also, some injected and dried, and others preserved in spirits, of the parts in their utmost perfection; in all which the ducts into the urethra were two: and his auditors, to whom he always demonstrated these ducts as two, found it ever so, and saw the two orifices which he pointed out to them.

The anatomists, in general, also are of this opinion; so that all that can be properly asserted from Lealis's account is, that tho' these ducts are naturally and generally two, yet it is possible such a variation from the ordinary course of nature may happen, as that there may be but one; and that the particular subject, from which he made his observations, had it so. Those who have adopted his opinion, should however have examined a variety of subjects themselves, which would have prevented their delivering it so freely in his words. It is very easy to suppose that people, not much used to dissection, might be able to find but one; but an accustomed eye will almost always see more.

## NOTE 28.

Our author, in the preface to the second edition of this work, observes, that in the very last subject that had at that time fallen under his examination, he had found; on dissecting the parts of generation, beside the ligamentum suspensorium of the penis, two other lateral ligaments, very like the suspensorium in all respects: these arose, on each side, from the ossa pubis, a little above the origin of the muscoli erectores penis; and were inserted into the sides of the corpora cavernosa of the penis, above the place of the insertion of the same muscles. A multitude of subsequent dissections, however, in which the author carefully searched after these ligaments, gave him no more than two farther opportunities of seeing them; and in both these they were much smaller and weaker, than in the subject in which they were first observed. From this, therefore, it appears, that they are not general or universal parts; but rather accidental ones, appearing but now and then, as is the case in many of the minutiae of anatomy, established too freely as general by authors.



## NOTE 29.

Cheselden, in the first edition of his *Anatomy*, p. 160. much doubts the existence of the glandulæ Cowperi, affirming, very frankly, that, in all his dissections, he had never been able to find them. He adds, that unless these glands were a mere invention of Cowper's, it appears probable, that what Cowper saw was only some little glandulæ, distended by the morbid state of the subject; or that they were a mere *lusus naturæ*, in some one body which Cowper happened to examine; as such *lusus*, he observes, are more common in regard to the glands than to any other part of the body.

Such is the censure on Cowper in his pupil's first edition; but in his third edition of the same work we find all this omitted. One might have expected from this to have been informed, that he had since found these glands, which he at that time so much doubted the existence of in some other bodies; but this does not appear. He does not say he had seen any thing more of them then, than when he wrote so freely against them: he only says, in this edition, that Cowper describes three such glands, p. 294. It is reasonable, therefore, to suppose, that tho' he does not chuse so flatly to deny their existence any longer, he had not, however, at that time seen them. Morgagni, however, affirms, that he had found them in a number of bodies; and that they were sometimes of the size of a kidney-bean, or larger, sometimes smaller: but he acknowledges also, that he very frequently could not find them in his dissections, tho' he took the utmost pains in searching for them\*.

## NOTE 30.

The existence of the membrane called hymen in women, has been greatly disputed by the medical writers of almost all times, since the first mention of it. There were many who, very early in the discovery, denied that there was any such part; and there are many who continue to do so at this time; and many others who, tho' they will not deny but that the authors

\* See his *Advers. Anat.* 4. p. 25.



of reputation, who declare they have found it, have really seen a membrane in this part, assert that it is not universal, but was a mere accidental thing in those particular subjects. It should appear, however, to every practised anatomist, that all these, as well the doubters of the existence of the hymen, as the absolute deniers of it, have only been present at the dissections of females who had had commerce with men; for had they examined the parts in young girls, and such as had not been lain with, they could not have missed finding it. Our author, whose fidelity is no more to be questioned than his accuracy, declares, that in the course of his dissections he had opened many young female subjects; and that in all these, whether just born, a few weeks old, a few months, or even as far as to those of six years, always, and usually as far as to fourteen, he found it. He has given descriptions and figures of the part in the German Ephemerides, 7 and 8; and the world has received what he has delivered on the subject as it ought. In females of these ages he alledges, that he always has found a membranous body, serving to render the orifice of the vagina narrower; and that it was sometimes annular, and sometimes semi circular or semi-lunar: so that it is by no means to be supposed a *lusus naturæ*, or an accident from a morbid state in the bodies it is found in.

It is to be acknowledged, that it is rarely met with in women at the age of maturity; and there are several very obvious reasons why it is not. Among the authors who have always positively asserted the existence of this membrane, we are to reckon Wier\*, Riolan, De Graaf, Swammerdam, Morgagni, and Santorini; and to these, and a long list that might be added, we are to join Vesalius, as more than a common evidence: this author had a long time denied its existence; but after he had examined some younger subjects, and women who were truly virgins, he acknowledged it.

\* See his Obs. Med. p. 95, and 99; and his book De Præstigi. Dæm. l. 3. c. 19.



## NOTE 31.

The thickness of the womb, in women big with child, has been a subject of much dispute. Many of the medical writers, in particular Mauriceau \* and Dionis †, have asserted, that the substance of the uterus is thinner in women who are big, than in such as are not so; declaring it impossible that the uterus should be so amazingly distended as it is, toward the end of the time, without a diminution of its thickness. But, on the other hand, Daventer has bestowed a whole chapter to prove the falsity of that opinion ‡: and our author, after a careful dissection and strict examination of several women, who had died in different stages of pregnancy, and after opening the uterus in women who had died in parturition, and others who had died soon after, does assert also, that in these several observations he never had found the uterus at all thinner than in its common state, but very often considerably thicker. Our author was particularly strong in this opinion, after the publicly opening three bodies at Helmstadt, in the compass of one year, all in a situation to determine it; two of them having died in labour, and the third from a wound in the head, near the time §.

It was objected to him, however, by a person of erudition, that, in regard to these cases, possibly there might have been an uncommon quantity of blood directed toward the uterus about the time of parturition, by which it might be at that time swelled to the thickness, which he found equal to its natural one, out of a state of pregnancy; but that, at other times of the period, this might not be the case, but the uterus might be thinner than usual, as others had asserted. This doubt was, however, soon after cleared up by the dissection of a woman, who had died by a shot in the eighth month; so that the time of her labour was not near. She had been in perfect health before, and had died instantly of the wound: in this subject, therefore, there could have been nothing of this particular deriva-

\* *Traité des Maladies des Femmes grosses.*

† See his *Surgery*, and his book *De Arte Obstetric.*

‡ See his *Operat. Chirurg.* c. 8.

§ See *Act. Nat. Curios.* vol. 1. p. 406.



tion of blood to the uterus ; yet in her the substance of the womb was as thick as in others in the different periods of pregnancy, or at the time of delivery.

Beside the authors cited by Daventer, in countenance of this opinion, and those mentioned by our author in the *Acta Curioforum*, where he treats of this subject, Morgagni, Littre, Voglius, Santorini, Vaterus, and a number of others, join in it.

We are to add also on this occasion, that Ruysch has discovered and figured certain series of spiral or orbicular fleshy fibres in the fundus of the uterus of child-bearing women, to which he has given the name of a new orbicular muscle of the uterus \*. He declares the use of this muscle to be for the expulsion of the placenta, after the child is born. He adds, on this occasion, that the placenta should never be torn away by force ; but that, if it does not follow on a slight pull, it is to be left 'till it is protruded in a great measure by the force of this new muscle. In this, however, our author is of opinion, that it is greatly assisted by the general structure and action of the whole uterus.

#### NOTE 32.

The medical writers are by no means agreed as to the origin and source of the menstrual discharges, some asserting that they are from the womb, others that they are only from the vagina. Morgagni † recites a long catalogue of authors of each of the two opinions : he adds, from his own observations, that all the blood thus evacuated is often immediately from the fundus of the uterus, but that it never is from the vagina. Our author joins also in his opinion, and observes, that, in two subjects he had dissected at a proper time for this observation, he saw that the blood came only from the bottom of the uterus ; and, by a gentle pressure, could force out a few drops of it from the same foraminula, which were still unclosed, and sufficiently conspicuous. Littre also, by very circumstantial observations, proves the flowing of this blood from the uterus ; as do also Grassius and Santorini. Of the

\* See *Advers. Anat.* Dec. 3 ; as also his peculiar treatise on this subject, published in Holland ; and Vater's epistle to Ruysch.

† See *Advers. Anat.* 1. p. 45.



modern writers of reputation, there is only \* one who advances that this blood is discharged from the vagina alone, not from the uterus. He adds, that he has evidently seen this to be the case in several dissections. From the observations of this author, however, which seem such as may be depended upon, and for some other pretty obvious reasons, it appears to our author, that nature does not limit herself to either of these sources singly and invariably; but that, in some cases, the discharge is from the vagina alone, in most from the uterus alone, and in some from both jointly. In this opinion also are Friend, Morgagni, and Vater.

## NOTE 33.

The greater number of anatomical and medical writers have joined with Hornius, De Graaf, Steno, Kerkring, and others, in the opinion that the little vesicles, observed in the ovaries of women, are real and proper ova, or eggs, in which the first rudiments of the foetus are delineated: but a great many of the more eminent ones, as Morgagni, Vallisneri, Santorini, Paiton, and Malpighi, not only make a doubt whether these vesicles are real eggs, but attempt to prove that the true and real ovula are extremely minute, and are contained in the substance of those yellow glandiform bodies, and grow so as to become by degrees visible, after impregnation: whereas these vesiculæ, tho' usually esteemed eggs, in reality decrease, not increase, after impregnation; serving for the nutrition of the real foetus, or real ovulum, and promoting its expansion, its accretion, and its separation. This is a subject worthy of the most careful enquiry. Notwithstanding, however, that most of the modern anatomists and physiologists have subscribed to the doctrine of the generation of man from an egg, there are not wanting, beside Diemerbroek, Lamy, and Du Verney, several who are absolutely against the system. Vidussius † and Voglius ‡, of the Italians, and La Motte § among the French, declare against it; but they have been elaborate-

\* Govey's Veritable Chirurg. p. 398.

† See his Motiv. de Dub. Veneze.

‡ See his Anthropogenia.

§ See Dissertation sur la Generat. Paris.



ly answered by Morgagni \*, Santorini †, and Nigrisoli ‡, who has wrote professedly and largely on generation; as also by Vallisneri §, Paiton ||, and others, who are equally against the system established by Lewenhoeck, in consequence of his microscopical discoveries of the generation of the human frame being from the animalcules, which are found living in the semen masculinum of animals. To this we are to add also, that a very late writer, Mr. Needham, deservedly famous for his microscopical discoveries, by several experiments made in concert with Mr. De Buffon of Paris, as well as several others of his own attempts, has endeavoured to prove the impossibility of the generation of the human frame from these animalcules, by proving that they do not exist as animalcules in the semen, while in the vessels of the male, or in the due course of impregnation; but that they are produced in that fluid, in consequence of its being exposed to the air, losing its texture, and undergoing the same sort of alteration that happens in the infusions of seeds and plants, in which animalcules of the same kind with those in the semen masculinum of animals are afterwards found. He observes, that the production of these animalcules in the male semen is very sudden, and in these infusions is longer about; but that the animals exist in neither before the exposure to the air, and the alteration of their texture. This account is published in a late number of the Philosophical Transactions: its author establishes a very extensive system, a point which does not at all fall under our consideration here; but if there be certainty in the fact which he asserts, it evidently serves the purpose of this quotation, that is, to prove that the animalculæ in the semen do not become the foetus afterwards.

## NOTES 34.

Drake's figure of the Fallopian tube is taken into our Plate 3. Fig. 10. But as our author in the year 1719, in a publick dissection of a female subject, after

\* See Advers. Anat. variis in locis.

† See Observ. Anatom.

‡ See his Consider. intern. della Generat.

§ See l'Hist. de Generat.

|| See Discor. della Generat.

having



having thrown some crude mercury into the right spermatick vein, the lower part of the Fallopian tube, with the ligamentum latum, being tied, to prevent the mercury making its way into the other vessels of the uterus, found, and demonstrated to his audience, a multitude of vessels, elegantly and distinctly pursuing very different courses from those laid down by authors; a figure of the whole part, as seen on this occasion, is also given in the same Plate, Fig. 11. It was observable, that after the mercury had, in this beautiful manner, filled the vessels which thus beautifully and copiously surrounded the Fallopian tube, it made its way into the cavity of the tube itself; whence it is evident, that these vessels communicate with the cavity of the tube, and are destined to secrete a liquor for the lubricating its inner surface.

## NOTE 35.

The uterus is the part destined by nature for the reception of the foetus, and in which it is to take its growth and nourishment, 'till the time of its birth; but there have been many instances of foetus's receiving nourishment and growth out of the uterus: these are unquestionable; and one first thing that is evinced by them is the absurdity of the old doctrine, that the child was formed in the womb of a mixture of the male and female seminal fluids made there. This was an opinion originally of the antients; but too many of the moderns had given into it, till observations like these, and other such reasons convinced them. Voglius, in his Anthropogenia, is of opinion, that the foetus is formed of the very substance of the womb, by a kind of elongation: this is also equally refuted by the same observation; and it is sufficiently and plainly proved that the true beginning of the formation of the foetus is in the ovary; that it is there impregnated by the more fine or volatile part of the semen masculinum; and that, after this, its natural course is down into the uterus, which is the place allotted for its reception and nutrition; but that, from different causes, it may happen, and sometimes does, so that the impregnated embryo stays in its place, or stops in its passage to the uterus: in this case the foetus sometimes cannot extricate



cate itself out of the ovary ; but sometimes, and that more frequently, it stops in the Fallopian tube, where it receives nutrition, and grows to its due period, or nearly so : but, in this case, it is impossible it should be born in the natural way. Magnetus \* has given histories of cases of both these kinds ; and as to the foetus's found in the Fallopian tube, Dionis † and Anellus ‡ give several cases of them : and experience is continually furnishing us with more cases, in which the foetus has been retained in the ovary. We have the same also, in Vieussens §, Littri ||, and others ; and Straussius ¶, Bayle \*\*, Saviard ††, Courtial ‡‡, Bianchus §§, and Calvus |||, give instances of the foetus's in the cavity of the abdomen, as well from themselves as from the writings of others ; but, in most of these, there is some mistake to be suspected. The French also have published some cases of this kind in the year 1722. To the list of those who mention foetus's receiving their growth in the Fallopian tubes, we are to add Riolarus ¶¶, Elsholtz \*†, Buffiere \*‡, Littre \*§, Du Verney \*||, and Cyprianus \*¶ ; and a famous example of it also from Santorini \*, and another from Paiton. Most of the extra-uterine foetus's are, indeed, lodged in the Fallopian tube ; and it is highly probable, that Camerarius's story of a foetus retained forty-six years in the mother, and a multitude of others of a like kind, all have this accident for their origin. The fact is indisputable, that the foetus may, and frequently does, receive its growth and nourishment out of the womb. Vallisneri has written a treatise on generation in the Italian, that is very worthy the careful perusal of every body who would enquire into this subject.

\* Theatr. Anat. T. 2. p. 140. and Bibl. Chirurg. T. 2. p. 131. where the whole is repeated.

† Dissertation sur la Generation de l'Homme.

‡ Suite de la nouvelle Method de guerir fistules lachrymal.

§ Dissert. de Struct. & usu uteri.

|| Memoirs, Paris 1701.

\*\* Hist. Anat. Gravid.

†† Obs. Anat.

‡‡ Anel. loco citato.

\*† De Conceptu tubario.

\*§ Paris Memoirs, 1702.

\*¶ Observ. Anat.

¶ Hist. Foetus Muss.

†† Observ. Chirurg.

§§ Theatr. Anat.

¶¶ Anthropol. graph.

\*† See Philos. Transf. 1694.

\*|| Epist. de Foetu.

\* Disc. della Gener.



## NOTE 36.

It is a question much disputed among the anatomical writers, whether there be a reciprocal circulation of the blood between the mother and the fœtus. Most of them either deny, or at least doubt it: but it is to be observed, that Cowper, after injecting crude mercury\* into the umbilical arteries of the fœtus, saw it enter into the veins of the uterus of the mother. And Vieussens, on the other hand, found the mercury, which he had thrown into the carotid arteries of a bitch big with puppies, not only made its way into all the limbs, and all the viscera of the creature, but reached to the puppies in her uterus; and that all their internal as well as external parts, and even the very cutis itself, shewed, in a very beautiful manner, the mercury thrown into the vessels of the parent animal †. Mery also confirms this reciprocal circulation, by a very singular instance in the human frame: it is of a woman who was instantaneously killed by a fall, in the last month of her time. In the dissection of the body, the cavity of the abdomen was found full of blood; and the blood-vessels, as well those belonging to the woman as those of the fœtus, which was dead also, were all empty. The placenta, all this while, was whole and unhurt, and adhered to the uterus; and there was not the least effusion of blood in the cavity of the uterus ‡. It were much to be wished, that the author of this singular history had told us what vessels they were in the abdomen that were broken, and made the effusion of the blood.

To all this we are to add an observation of our author's own, which tends not a little to the setting this in a proper light. In a dissection of a body in publick, before Dr. Wagner and the rest of the college at Helmstadt, which was of a woman, who had been big with two children: one of these had been brought forth

\* Anatomy of the Human Body, T. 54. See also Act. Erudit. Lips. 1699.

† Manget's Theatr. Anat. T. 2. p. 139. The author gives no reason for his chusing to throw in the mercury at the carotids.

‡ See Memoirs of the Paris Acad. 1708. See also Mery's account of a fœtus without a heart, 1720.

alive;



alive; but a violent hæmorrhage of the uterus coming on, the woman had died in a quarter of an hour, not delivered of the other. On the opening the body, at the distance of a few hours from the death, the blood-vessels were found empty; and, on opening the womb, the placenta, which had belonged to the child that was born, was found in great part loosened from the uterus; but that of the other fœtus, yet in the womb, fast and uninjured: from the separation of the former had doubtless proceeded the hæmorrhage, which had killed the woman. After examination of the tunics, or membranes of the fœtus left in the womb, which were yet whole and unhurt, our author proceeded to open the fœtus, to shew to his audience the parts different in that state from what they are in an adult; and on opening it, he found no blood in it, either in the heart, or in the larger vessels: whence he urges, that the blood of this fœtus had passed thro' the umbilical vessels to the placenta and uterus of the parent, and had been evacuated, together with the mother's blood, from the uterus. *Rauholt*\* and *Morgagni*† are also on the side of this reciprocal circulation of the blood, between the mother and the fœtus. It appears highly probable, that, in cases of twins, the vessels of the placenta do not communicate with one another; tho' the placenta are grown into one, as is often the case. Our author prepared two of these placenta, thus growing together, into the vessels of one of which he had thrown a wax injection: these were perfectly filled by it; but no part of it had made its way into the vessels of the other placenta.

## NOTE 37.

That the fœtus, while in the womb, does really receive nutrition by the mouth, is evident from an observation made twice successively in the publick schools at *Altorff*. The author had received a perfect fœtus, taken from a cow in the winter-season: the membranes were unhurt, and the uterus of the cow was brought with it. The liquor amnii all about the fœtus was frozen; and the same liquor, in the same congealed or frozen state, was

\* See *Memoirs of the Paris Academy*, 1714.

† See *Advers. Anat.* 4. p. 82.



found also in the mouth, the œsophagus, and the stomach of the calf, forming one continued quantity of ice with that formed of the circumambient fluid, and was about the thickness of a finger in the œsophagus. The same observation he also made publick another winter on another foetus, brought to him at the same period, with its membranes and the uterus about it. In this also the congealed fluid made one continued body; from the external mass to the stomach of the creature; so that there remains no doubt of the liquor, found in the stomach of a foetus about its full period, being the same with the liquor amnii; but it is evident that there is communication between them. Nor is it, indeed, probable, that so large a quantity of this liquor, as is usually found in the stomach of a foetus at its full time, should be secreted in that part, as most authors for a long time supposed. It appears much more probable; even to reason alone, that it must have been brought from elsewhere; and it is evident from this singular observation, from whence it is brought; as indeed might, without this circumstance, have been guessed from the similarity of that found in the stomach with the rest, which surrounds the foetus, all the qualities of which it evidently has.

Fred. Hoffman, in his *Dissertation de Pinguedine*, has also an observation that joins strongly with this of our author's, in evincing this truth. He tells us of a child born at its full time, and in perfect health, the funiculus umbilicalis of which was wholly corrupted and putrid: it is very evident from this, that the foetus could not have continued alive, if, as is by the generality of writers supposed, it had received or could receive no nourishment, except by the funiculus or navel-string.

Petit also has an observation of a child born perfect, and in health, tho' there was a knot in the navel-string, very close, and which had evidently been there long before the delivery. This would have prevented nourishment, as usually, to flow to the child thro' this part; and it is plain, that unless it had received, as well as the foetus in the former instance, nutrition by the mouth, it could not have been kept alive. The method



Bellinger has laid down for the nutrition of the foetus this way, by the assistance of the gland thymus, we have already mentioned; and there are some observations on the subject worthy notice, in the *Acta Eruditorum* of the year 1718.

## NOTE 38.

The use of the foramen ovale in the foetus has been a subject of very great and very warm debate among the anatomical writers, particularly between Mery, who, against the common opinion, asserts that the blood passes thro' it from the left auricle of the heart to the right, and Du Verney, Sauvius, Buffiere, Sylvester, Lister, and Verheyen, who all establish the contrary, and adhere to the received opinion. The *Memoirs of the French Academy* for the year 1699, give the arguments on both sides much at large, and tend mostly in favour of the received opinion; but in the same works, in the year 1717, we find Winslow bearing strongly toward the opinion of Mery.

## NOTE 39.

Many anatomical writers of great credit absolutely deny that there is any such interstice of the mediastinum as this: they declare it imaginary, and assert, that, if any such is seen, it can only arise from a violent elevation of the sternum. But our author does not give up the subject: he asserts, that he always finds this interstice, in his dissections, in the part near the diaphragm; and that tho' the sternum be elevated as gently, and as little as possible only, so as to separate the diaphragm from it, by such a gentle elevation as will answer this purpose, he is clear that no change is or can be made in the parts, nor any thing new, or that was not in the parts before, can be produced in them. It is to be added, that a great many authors of the first credit give us instances of matter and abscesses form'd there; and Maier affirms, that he has frequently found a ferous humor in it\*.

## NOTE 40.

Maier, an author quoted in the last note, produces, from Muraltus's experiments, an observation, that he had found in the thymus a great number of crystalline

\* See his *Colleg. Anat. Pract.* 4to. p. 29.



vascula, running to the mediastinum, and to the pericardium; and also a duct running from it to the tonsils, of a membranaceous structure, and naturally hard \*. But it does not appear that there is any such observation as this in Muraltus: whether Maier mistook his quotation, or purposely deceives his readers, is not so easy to determine. There is an appearance of candour in his manner, which would induce one to give it on the more favourable side.

## NOTE 41.

It has been a matter of much enquiry why the pulmonary artery should be larger than the pulmonary vein, whereas, in all the other parts, the veins are larger than the arteries. Some have supposed that this is on occasion of the blood's being more dissolved in the artery; and that, as it is condensed again by the effect of respiration, it requires a less space, in proportion, to return by, than the blood of any other vessel of the body: but this is but a loose and vague way of reasoning. It seems rather, that the artery is larger than might be expected here, because the blood, brought back to the heart, finds it difficult, from its thickness, to make its way thro' the fine reticulations of the vessels of the lungs; and the retardation or resistance in this part, may naturally occasion the trunk of the artery to become distended. On the other hand, the blood in the pulmonary vein has no obstacle, in a manner, to resist or impede its motion, but flows freely and easily to the heart; whence a narrower vessel may serve for the passage of it, and that vessel will be in scarce any danger of being distended beyond its natural dimensions †.

## NOTE 42.

Our author acknowledges, that he had very often sought in vain for the bronchial veins in human subjects; but that he, at length, saw them clearly and distinctly in a female subject: in this he found several branches running from the intercostals to the bronchia, three of

\* See Colleg. Anat. Pract. p. 109.

† See Memoirs of the French Academy, 1718. See also Michellottus and Santorini.



which were particularly observable, and were of the thickness of a straw. In many other subjects, in which he afterwards sought carefully after them, he did not find them; and observes upon the whole, that they do not occur in all, nor are at all determinate in their situation when they do. Cowper observes, that he had frequently met with one or more of them, running to the subclavians\*.

## NOTE 43.

The auricles and ventricles of the heart have not always the same size and capacity; the different ages, stature, and other circumstances in the person, making a very considerable difference. The right auricle and right ventricle are however, in general, larger than the left; as is confirmed by numerous observations of Helvetius, Salzman, Michelotti, and Morgagni. Nicolaus has carefully collected the facts from these authors; and Santorini has since added several observations on this subject, all which join with the others in establishing this as a general truth.

## NOTE 44.

Lower is the first author who has described this tubercle: it is easily seen in the hearts of oxen and calves, in form of a fleshy mass or eminence; but in the human heart it is not found. Our author, at the same time that he acknowledges, however, that he never could find it there, gives a very good account of its having been pretended to be found by others, who would not be supposed to miss any thing, whether it existed or not. He tells us of a demonstrator, to whom, in his younger days, he had been pupil; who, having searched the proper part of the heart of his subject for it, and opened the vena cava, when he found no protuberance where he expected it, took hold of the part where it should have stood, and, pulling it up with his forceps, called out to his audience, "Behold, here is the tuberculum cordis of Lower." Our author declares, that, tho' he strictly examined the heart, he was not able to find any tubercle, or the least eminence, either before his pulling up the part, or afterwards; and that afterwards, having sought carefully after it in

\* See Anat. of Human Bodies.



a great number of hearts, it was never his fortune to find it. Possibly, like to this may be the history of many parts discovered by particular anatomists, which, tho' demonstrated to their audiences, no body was ever able to find afterwards. Nicolaus, indeed, very boldly asserts, that this eminence or tubercle is larger in man than in the quadrupeds; but there appears nothing to countenance this, on examination. Our author kept many human hearts preserved in spirits purposely, to shew the place allotted to this tubercle; in all which it was evident, that there never was any such part. To which we are to add, that there is no figure of it in Cowper's elegant and accurate tables of the heart; but, on the contrary, the concurrence of the ascendant and descendent vein is made plain there, as it is indeed always found on dissection in human subjects. The author, with sufficient reason, from all this, omitted the mention of this part, as of one that had no existence, in the first editions of this work: he seems to have added it in this, by way of shewing that it was not thro' inaccuracy that he omitted it before; but he very justly does not let it pass as a reality, notwithstanding all the great names which appear in support of its existence.

## NOTE 45.

Lower, in his account of the structure of the heart, describes a series of strait muscular fibres, which involve the others under them. Nothing is so evident as that there are such in quadrupeds; but there are not wanting anatomists, of the very first rank, who deny their existence in the human heart. Our author takes a middle course: he acknowledges, in consequence of a multitude of experiments, that they are not nearly so numerous in the human heart as in that of many of the quadruped kind; but he declares, that he has always found some, and was always ready to shew them in his lectures, and that particularly on the surface of the left ventricle. To this purpose, he had a way of macerating a human heart in water, so long as till the external membrane was easily separated; after which the fibres, so much in dispute, appear very obviously and evidently. A heart thus prepared, he always kept also in spirits,



spirits, to shew them at all times to such as doubted their existence.

## NOTE 46.

Anatomists are by no means agreed about the situation of the *œsophagus*, in respect to the *aspera arteria*. Most of the writers on the subject have said that it runs strait behind it, between it and the *vertebræ* of the neck. Morgagni has figured it as inclining a little to the right of the *trachea*; and, on the other hand, Winslow will have it situated to the left of it. Cant accuses Vesalius of an error, in having placed the *gula* behind the *trachea*; and, at the same time, falls upon Morgagni, for having made the *œsophagus* incline to the right of the *aspera arteria*, and refers to the plates of Eustachius. Our author finds an easy way of reconciling these jarring authors, by observing, that every one of them may have fairly described what himself saw, in some particular dissection made for that purpose; but that nature varies in the situation of this part, in regard to the *aspera arteria*, and that it is by no means the same in all subjects. He asserts, that in some bodies, publicly dissected in the schools, he has shewn it immediately under the other; in others inclining to the right, as Morgagni has figured it; and in others inclining to the left, instead of the right. Cant, tho' he refers to the tables of Eustachius, has not mentioned either the number or figure; but whoever will examine them, will find that Eustachius has placed the *œsophagus* behind the *trachea*: for in T. 41. Fig. 8 and 9. where he has given the *trachea*, with the *gula* lying on the right side. The *gula* can scarce any otherwise appear than as if it inclined to the left, tho' placed behind the *trachea*. But in his 42d Tab. Fig. 4 and 6. the *gula* and *trachea* are figured lying, as plainly as possible, on one another.

## NOTE 47.

Vercellonius, in his book intituled *A Medico-anatomical Dissertation on the Conglomerate Glands of the Oesophagus*, describes some new excretory ducts, terminating in the *œsophagus*: they are numerous, and, according to his account of them, not very difficult to be discovered, on a proper examination. He asserts, in



this treatise, that the business of digestion had never yet been truly explained or understood by the medical writers; and that, because they never had found out the true digesting fluid; and this, he asserts, is poured into the stomach and the œsophagus by a multitude of very fine ducts: 1st, from conglomerate glands, situated on the left of the stomach; 2d, from the dorsal; and, 3d, from the bronchial and tracheal. But from the thyroide gland, which is to be supposed a nidus of the ova verminosa, he alleges these ovula verminosa are transmitted to the stomach and œsophagus, and give a vital power and character to the chyle. Of all this the author of this work treats at large in the *Adenologia*. It may be sufficient to mention it here.

## NOTE 48.

The author has already observed, that nature varies greatly in the sinus's of the dura mater, and that the fourth is often wanting. It is to be observed also, that the left lateral sinus, according to the observations of Morgagni, frequently begins from the right, not from the longitudinal one, as is usually supposed\*. The sinus falcis, which is by many called the inferior sinus, appears to have the least of all the title to the name of a sinus: its coats are thin as those of the other veins, and its figure is not angular as that of the other is. Morgagni has observed also, that he had found the lateral sinus's communicating with one another by means of a transverse canal†. Our author joins in the assertion, and observes, that himself had found such a canal of communication; and it is figured here in Tab. 7. Fig. 32.

Rivinus also, in his treatise on the defects of hearing, mentions a transverse sinus, which is evidently the same with this of Morgagni and our author.

## NOTE 49.

There are not wanting authors who deny the existence of the rete mirabile in the human frame: Nicolaus has collected their sentiments‡. But nothing of this kind is more wonderful than that Ruysch, who had ad

\* *Adversar. Anat.* 6. p. 2.

† *Advers. Anat.* 6. p. 3.

‡ *Dissertat. de Direct. Vas.*



before found described, and even figured this \*, should, in his later writings, treat it as an imaginary part †. Our author is confident, from repeated experiments, that if the dura mater be carefully opened with a scalpel each way, near the pituitary gland, the rete mirabile, however much its existence may be doubted by very great men, will appear obviously and evidently enough to every body.

## NOTE 50.

The old writers have given it as their opinion, that the crystalline humor of the eye was the primary organ of vision; but of later times the nervous tunic, called the retina, has been universally allowed to be so. This opinion agrees perfectly with all the optical experiments, advanced as the test of truth in this disquisition; and most of the medical as well as mathematical writers, after the days of Des Cartes, have agreed to it. Marriot, however, a very celebrated mathematician, dissents from this universally received opinion; and will have the choroides to be the primary and principal organ of this sense ‡: he brings a multitude of experiments in support of his opinion, and argues with great regularity and exactness from them. Mery falls into this opinion also, and has brought a number of additional experiments to the support of it §: and with him also De Mayran ||, and Mr. de St. Yves ¶, a celebrated oculist, add their testimonies of facts, and their reasons in support of the new doctrine.

But, in opposition to all this, it is to be urged, that in all the other senses the primary organ of perception is a nerve; nor does there appear any reason why nature should depart from her course in this, which is the most delicate of all the senses. Now the retina is merely an expansion of the optick nerve in the eye; and it seems something rash to thrust this part, so well calculated for the purpose, out of its office; and to give

\* Epist. Problem. 12. T. 13.

† Adversar. Anatom. 2. p. 45.

‡ Nouvelle Decouvertes touchant la Vue.

§ Memoirs of the Paris Academy, 1704.

|| Dissertat. de Causa lucis Phosphor.

¶ Traité des Maladies des Yeux.



so great a power to membranes, much less likely to be endued with the exquisite sense necessary on such an occasion.

## NOTE 51.

Our author has been attacked on account of his doctrine of the eye, and particularly on his opinions as to the glaucoma and cataract by several of his contemporaries. The grand point to be determined was, whether there is more of the aqueous humor in the anterior or in the posterior part of the camera; that is, whether there be a greater quantity of the aqueous humour between the cornea and uvea, or between the uvea and crystalline lens. The people who were against our author's system, advanced that there was more of it in the hinder part; but the author, that there is more in the anterior camera. It appears, on a candid and impartial enquiry into the case, that the principal of our author's adversaries had taken up his notions of the eye, not from dissection and observation, but from the figures in books; and, indeed, to the support of such an hypothesis, such a conduct was necessary enough: but it is to be observed, in regard to this, that most of the anatomical as well as of the optical writers, have made the space between the uvea and crystalline much larger than it is in nature. They have often figured it larger than that which is between the uvea and cornea; and very few of them, indeed, have made it less \* than equal to it in magnitude. But our author, whose great character it is to have been determined by his own observations, not by the writings of any body, tho' he had long before assured himself by a great number of experiments and observations, that there was a larger quantity of the aqueous humour in the anterior than in the posterior camera; yet, on the occasion of this dispute, determined to enter a-new on the disquisition, and to make dissections with the utmost precision; and to have draughts taken from them, which should be more to be depended on than

\* See Stephanus's *Dissect. Part. Corp. Hum.* p. 303. Des Cartes in his *Dioptricks*; Scheiner in his *Fund. Optic.* Newton's *Opticks*; Hartseker's *Dioptricks*; and Verheyen, T. 27. fig. 5. See also Rohault's *Physicks*.

such



such as were already extant, and had evidently led people into errors ; and this he judged the more necessary, as not only tending to put a final end to the controversy he was engaged in, but to establish the truth in a point where it was much wanted, as few authors had come near the giving the true situation, proportion, &c. of the humors of the eye\*.

But as in recent, and not congelated eyes, the efflux of the aqueous humor in the dissecting, and the consequent collapshon of the coats or tunics, render the situation of the humors impossible to be accurately seen, and make it impossible therefore to form an accurate judgment of them, he thought it a necessary precaution to expose the eyes, to be dissected, first to the cold air of winter's nights, that they might be frozen. In eyes thus prepared for opening, on going carefully and regularly thro' the dissection, the parts will all be found in their just and natural situation, and dimensions.

The author began his own experiments, which were very numerous on this occasion, on the eyes of quadrupeds ; and engaged correspondents at Nuremberg, Altorff, and other places, to dissect the same parts with the same cautions, in concert with him. In all the eyes they experimented upon, after cutting them thro' the axis, the crystalline was found to come very near the uvea, and a very small and scarce perceptible quantity of the aqueous humor was found between the crystalline and uvea : but, on the other hand, there was always found, between the uvea and cornea, a much larger quantity of the aqueous humor ; in general, at least four times as much as in the other cavity. This was generally the case in all the experiments made on this occasion. The figure in T. 4. Fig. 18. is from the eye of a hog : it shews the real situation of the parts, and evidently enough proves the truth of this doctrine.

Our author was very intent upon examining the human eye, under the same circumstances ; but not having the opportunity of a subject, during the short time of the frost of the winter, when he had intended

\* See Fabricius ab Aquapendente de Visus Organo, c. 8. See also Mariot's de Visu, fig. 3 ; and Bidloo de Oculis & Visu, p. 3.



it, he wrote to Morgagni, who had always bodies at command, and requested him to experiment, and to give him the result of his observations, and a figure of the parts as he found them. Morgagni's answer was, that he always, without one exception, had found a much greater quantity of the aqueous humor between the cornea and the iris, than between that and the crystalline. The draught he made of the parts, as he found them in a frozen human eye, is given in our 4th Plate, Fig. 19.

After this our author had himself an opportunity of exposing to the frosty air an eye of a human subject, who had died a violent death. On dissecting this afterwards in the publick schools, he demonstrated, to a large audience, that there was scarce any of the aqueous humor between the iris and crystalline, tho' there was a considerable quantity of it between the iris and the cornea. The dissection of this eye agreed in all respects with the account and the figure sent by Morgagni; and after this, both the author and others taking the opportunity of frosty weather, when they had human subjects before them, demonstrated the same thing many times to different audiences. Figures were taken from the author's dissections of these eyes; but he prudently chuses to preserve, in this work, those he was favoured with by Morgagni, as a person, at once, of unquestioned judgment, and not engaged in any dispute on the subject. What our author has said farther on the subject, is to be seen in the *Ephemerides*, Cent. 7 & 8.

Evident as what has been delivered on this subject appeared, however, to the candid world, Wolhusius, in a very severe and harsh manner, has raised objections against it in several of his writings; and has not even spared ill language, when his reasonings are not of force enough. Our author has not omitted to answer his objections, and, in that answer, occasionally to charge him with errors and plagiarisms, in such a manner as he was notable to acquit himself of: nor, indeed, were the world inclined to think well of him, from the coarse and abusive manner in which he attacked both this author, and many others of established reputation\*. Our

\* See *Memoir*, Trevolt, 1725.



author's apology is a sufficient answer to every objection such a writing as this could be able to start; nor, indeed, was it worth his while farther to attack an adversary of this stamp, while Winslow, Morgagni, Petit, Renaume, St. Yves, Morand, and Senac, who translated this author's work into French, and commented largely upon it, all join in his opinion. It may not be improper, however, to give a specimen or two of the manner of reasoning of this wild author. His first and great argument is, That the globe of the eye increases in bulk, all the way from the convex part of the cornea to the centre of the eye; and that, therefore, the posterior camera of the eye must be larger than the anterior. But all that the judicious reader will be able to make out by this is, that the person who says it is but very ill informed of the structure of the eye. The argument would indeed be true, if the eye were a hollow sphere, filled only with a fluid; or, if the ciliary ligament were longer, or more remote from the cornea: but as, in reality, this, with the crystalline, is placed as a wall or inclosure, and allows but a very little room to the posterior camera, as is evident from Morgagni's figure given here, T. 4. Fig. 19. it is clear enough, that this argument does not prove all that its author would have it; but, on the contrary, it appears from the knowledge of this true situation of the uvea, the ciliary ligament, the crystalline, and the vitrous humor, that the posterior camera is not augmented in size, nor does become larger than the anterior, altho' the eye do increase in its dimensions toward the centre.

He attempts to strengthen his argument by the observation of the quantity of matter, which is sometimes found behind the uvea in a hypopion; but this is of all arguments the most fallacious and uncertain. Every body knows how much a part, in a distempered state, may differ from the same part in its natural one; and add to this, that there is no distempered state which will alter and distend the parts it affects so much as a lodgment of matter in them. This, indeed, the objector is, in another place, obliged to acknowledge himself; and from this, and some other such instances, which might be quoted, it appears plainly enough, what credit



credit ought to be given to the observations on the structure of the eye made in morbid cases, and in consequence of chirurgical operations. It would be as easy to answer all the other arguments of this author, and most of them in the very manner of this, but it is not our business here to enter into the dispute. Thus much it was not improper to say, in regard to so heavy and at the same time so unreasonable an attack upon the author's reputation. After this the decision may be left to the reader's judgment; or, if he want farther argument in favour of our side of the question, he may turn to a paper of Winslow's on the subject, in the Memoirs of the Paris Academy for the Year 1721.

#### NOTE 52.

How, in his treatise on the circular motion of the fluids of the eye, has described, under the new name of *nervo-lymphatica*, certain very small blood-vessels in the eye, which do not carry a red but a lymphatick blood, and which Ruyfch has long since also described and delineated. But where is the necessity of a new name for these vessels was, is not easy to discover, any more than, if it had been judged necessary, why the term *nerve* should be used in the formation of it; since nothing is more evident, than that these vessels are all produced from veins and arteries, and have been called accordingly by others lymphatick arteries and lymphatick veins, or arterioso-lymphatick vessels. Our author, very judiciously, excepts against the name, as one that would be apt to give very wrong ideas, particularly to people just entering on their studies: nor is it proper, after having mentioned this author, to leave his work without some more animadversions. He says, 1st, That the tunica choroides is divisible into five distinct tunics or coats; but we are very apt to question whether this be a fact, in regard to the human eye, especially as it is evident, from his own words, that, on account of the difficulty of obtaining human subjects, the greater part of his experiments were made on the eyes of brutes. 2. He denies that there are any muscular fibres in the ciliary processes and ciliary ligament: he thinks what are usually esteemed such, are vessels; but to this we are to answer, that the greatest anatomists of this time are



are all agreed, that all muscular fibres are hollow or vascular; so that, by the same argument, he may prove that there are no muscular fibres in the whole body, which, we are apt to believe even himself will allow, would be somewhat absurd. The natural structure of a muscle does not argue at all against this vascular structure: the great use is in contraction and dilatation. The actions of contraction and dilatation are evident in the pupil; and nothing is more certain, than that we see in the ciliary processes fibres, in all respects agreeing with muscular ones, which have lost the office of vessels as well as the habit and appearance of them; and there can be no doubt, therefore, that these truly and properly are and ought to be esteemed muscular fibres. In another place the author calls the substance of the uvea musculo-membranaceous; and afterwards he asserts, that the vasa adducentia of the eyes come from one and the same origin, namely, from a branch of the internal carotid; but that not admitted into the cranium, as Nuck asserts, but bestowed on the orbit of the eye. To this we are to answer, that in human subjects these vessels do really and truly run out of the cranium to the eye. He afterwards asserts, that the ductus arteriosus of Nuck, coming out of the cranium, is not the source of the aqueous ducts; for that it is too small. To which we are to answer, that it is not, indeed, the only source of them; for that it communicates by anastomosis with other of the branches that run to the eye.

He agrees with Mariott and others, that the tunica choroides is produced from the pia mater; but he does not prove this: and, on the contrary side, it may be alledged, that this tunic is of a colour, figure, consistence, and nature wholly different from that membrane; and that nothing is more evident, than that the other membranes of the body were formed at the same time with the pia mater, but do not owe their origin to it.

He afterwards says, that the crystalline consists of pellucid nerves; but, in regard to this assertion, one would ask, why he may not as well join with other writers in saying that it is composed of pellucid vessels?

In



In another place he tells us, that the gluten in the blood cannot be restored without the assistance of a new acid, and that this necessary acid is only secreted in the glands; but this is a bare assertion: he has done nothing towards proving it; nor probably had he attempted to prove it, would he have found it in his power. He afterwards observes, that the conglomerate glands have no inferent vessels: but this is an assertion that flies in the face of all reason, and all experience; for nothing is more certain than that there are inferent vessels to them; and it is equally certain, that, if there were not, nothing could be secreted in them. In another place he tells us, that the circulus venosus is six or seven lines distant from the ciliary ligament: but, unluckily for this assertion, the whole body of the eye is but about seven lines in diameter; and this circulus is as near as is well possible to the ligamentum ciliare. He has expressed himself, as he thinks, very circumstantially, by adding the epithet *mathematical* to his term *line*. If he means by the word that part of an inch which mathematicians mean, when they use the term *line* as a denotive of measure, which is as we have understood it, it is certain that he knew nothing of the situation of the parts: if he means by it the mathematical definition of a line, which has neither breadth nor thickness, it is not easy to understand what he could intend by expressing the distance of two bodies by measures which are of no diameter, nor express any measure at all. It is most probable, that he did not understand what a line was.

He, in many places, affects to call the arteries fontes oculi; but what necessity could there appear to him for a new name on this occasion? Or, to what purpose is it to multiply things, when there is not a distinction to be preserved by it? He, in another place, calls the internal angle of the eye the canthus minor, or lesser canthus; which is at once contrary to fact and reason, and to the joint consent of all the authors that ever wrote upon the subject.

So much notice would not have been taken here of the errors of an author of this stamp, were it not a kind of debt to so eminent a writer as Ruysch. This author has written very severely against Ruysch, at the same time



time that he has borrowed, or, to speak more justly, stolen what is of value in his book principally from him; and, according to the custom of the authors of this stamp, he very modestly tells us, that he had never read his works. How much probability there is in this, when the author himself is a Dutchman, and his work evidently founded on that of Ruysch, every reader will determine for himself.

## NOT E 53.

In regard to the insertion of the optick nerve, it may be proper to observe, that tho', to a person who cursorily views the eye taken out of its orbit, and cleared from the muscles and fat, it appears as if inserted directly into the middle or centre of the posterior part of the eye; yet it does not enter the eye, as Briggs asserts in his *Ophthalmographia*, directly opposite to the pupil, but on each side, nearer the nose: and this is a very obvious precaution of nature, or otherwise the rays of light would, in their passage from the objects, fall immediately upon the nerves, with which the arteries are joined. The pupils of the two eyes are, in general, nearly three inches distant from one another; but the foramina of the cranium, thro' which the nerves pass to the orbits, are scarce so much as one inch distant\*. The part of the eye where the optick nerve enters is perfectly dark and blind, as Mariott has very evidently proved by experiment†: and it is an evident consequence of this, that if the nerve entered the eye directly opposite to the pupil, at which the rays from illuminated objects enter, many of those objects would fall immediately on it, and consequently would not be seen; but the precaution of inserting the nerve rather laterally toward the nose, wholly prevents that defect.

## NOT E 54.

There are sufficiently numerous proofs, from surgical observations, that a very large quantity of saliva

\* See Boerhaave's *Institut. cap. de Visu*. Also Winslow, in the *Memoirs of the French Academy*, 1721.

† See *Nouv. Decouvert. touchant la Vue*. See also De la Hire, Boerhaave, and Stancarius, who all confirm what this author advances. Our author also tried the experiment, he tells us, in the night with a candle, and found the place, when the candle itself disappeared,



is discharged from this duct, and that particularly during the time of chewing. Fabricius ab Aquapendente observed, first, that in wounds of the cheek, toward the ear, there appeared a little aperture, scarce distinguishable to the naked eye; out at which, especially while the patient was eating, there issued a great quantity of a limpid fluid, in the manner of tears: but he acknowledges, that what it is, or how or whence it flows, he is ignorant; nor is this wonderful, as the salival ducts were not discovered in his time.

Helvetius afterwards affirms, that the quantity of this fluid secreted in this gland is so great, that a soldier having received a wound in his cheek, in which the salival duct was cut, he for a long time wetted several cloaths, at every meal, with the quantity that was discharged from it while he was eating †.

Our author tells us, that himself had also met with several of the like cases, as have also many others; in all which, if this duct have been cut thro', the consequence has been the same. It appears from this, how erroneously they talk who deny that the motion of the jaw, in chewing, has any effect in the secretion and discharge of the saliva; and would give all the merit of that necessary supply to what they describe under the name of the anima. It is surely much more philosophical, as well as anatomical, to find out the material causes of the effects we see produced, where that may be done.

#### NOTE 55.

Steno † was the first author who discovered that the glandulæ sublinguales had, on each side of the tongue, excretory vessels, very short and very slender, placed parallel to one another, and scarce distinguishable, unless they were pressed or squeezed: he observed them in quadrupeds. After him Verheyen § took the liberty of using the very words of Steno on the same occasion, describing the same vessels, but without mentioning Steno's name. Our author, who had followed some of

\* See his Chirurg. de Genarum Vulner.

† See Memoirs of the Paris Academy, 1719.

‡ See his Obs. Anat. de Gland. oris.

§ Anat. Tract. 4. c. 20.



the greatest men in this way in his studies, and had seen them search after these excretory vessels in vain, and who had afterwards sought after them in vain also in human subjects, had at one time persuaded himself that they were peculiar to quadrupeds, and were indeed not to be met with in the human frame at all; but he was afterwards convinced, that they are really to be found in the human tongue, by Morgagni, who not only wrote to him on the subject, but afterwards printed his discovery of them, asserting, that there are, in reality, a great number of these vessels on each side, which arise from the exterior sides of the sublingual glands, and do not bend their course forward, but transversely toward the gums; and that, at a small distance from the glands, they have little oscula or openings of a peculiar form, some of them large enough to admit a fine bristle into them. Our author, who is never above owning that he has been mistaken, and has amended of it, adds, that, after this clear and accurate description, he sought for them again in human subjects, and, after some difficulty, found them.

In the mean time also Walther, physician to his Polish majesty, and a professor of anatomy at Leipfick \*, wrote a treatise expressly on the subject of these ducts, in which he describes them at large, and figures them from a human subject: he is the first author that has done so. He mentions eight of them.

It is not in all subjects that these minute objects of the anatomists researches are equally to be found: in some they are scarce possible to be discovered, in others it is hardly possible to miss them. Our author, who had so long been searching in vain for them, when he found them, examined many subjects afterwards, in which it was difficult to trace them; but, at length, he met with a subject, in which they were much larger and more numerous than he had ever before seen them. He made a careful preparation of the part, and caused a figure to be engraved of them, exhibiting those of one side perfect, with the tongue yet cohering with the lower jaw. See Tab. 7. Fig. 33.

\* Exercitat. de Lingua, Lips. 1724.



## N O T E 56.

The foramen cœcum of the tongue, which is usually small, is subject to great variation in its size. Our author, in the same subject in which he found the ducts mentioned in the former note so very obvious, found also this foramen so large and deep, that he, without difficulty, introduced into it a tube so large, that he had been used to press it into the ureters, for the inflation of them, and even for the inflation of the bladder. On blowing into the tube, when introduced into the foramen, in order to discover the duct mentioned by Vater, he found that the posterior part of the tongue was very remarkably distended by it. Not succeeding so well in this, however, as he had expected, he threw in an injection of a waxy matter, coloured red, in order to see its true situation, form, and course. This succeeded so well, that afterwards, on opening the foramen cœcum in the tongue, see Tab. 8. Fig. 34. he immediately discovered the beginnings of two very remarkable ducts, not described by any writer: these continued their course about a line depth, under the teguments of the tongue. After carefully removing these teguments, he found these ducts continued, one on the right side, and the other on the left, running on, as expressed in the figure. The left duct, marked by the letter *b* in that figure, continued its course to the tubercle *c c*, which was a pellucid vesicle full of a clear liquor, looking like the saliva. Our author judges, with great probability, that this liquor was protruded into the vesicle by the force of the matter of the injection; and that the vesicle is not a natural appearance in the part, but was merely the end of the duct, forcibly distended by the liquor thus protruded, which, having no way out, and being thus pushed into it with a force it could not resist, dilated its sides, and formed the posterior part into the appearance of a distended bladder. In the other duct there was only a little of the injection found, in the beginning; but on taking this out, and introducing a pipe, and blowing into it, the inflation reached as far as the part marked with the letter *e* in the figure: so that, from the letter *d* to *e*, the duct shewed itself to be of the same nature and substance with the ductus salivaris

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Whartonianus; and at the end of this there was no vesicle, like that of the other side; which tends also greatly to corroborate the opinion, that the vesicle there was not natural, but formed as already suggested. These ducts therefore in this tongue, in which they were so particularly distinct and obvious, appeared evidently to be salival ducts. But as, beside these ducts, there were very evidently distinguishable three little apertures or oscula in this foramen, expressed by the letters *g g*, whose cavity ran downwards, and did not admit the small style introduced into them much more than a line deep, he also readily agrees with Morgagni, Vater, and others, that this foramen is either an excretory duct of the lingual glands, or a place of concurrence of a great number of glands, which discharge the saliva into the mouth from the glandulous substance of the tongue. But these ducts, if the large foramen happens to be wanting, as is indeed very frequently the case, open themselves a passage into the mouth, by a number of lesser distinct apertures; and it appears, from repeated examination, that nature varies extremely in this circumstance. What is farther observable in the figure mentioned in this note, will be pointed out in the annexed Explication. Our author is of opinion, from repeated experiments, that the ducts described by Coschwitz, under the name of new salival ones, and figured as such by this author, and by Kulm \*, Du Verney †, and others, are in reality no other than veins.

## NOTE 57.

The same subject, which gave the author an opportunity of expressing the parts treated of in the two preceding notes in so happy a light, furnished him also with another observation: he found, near the hinder dentes molares of the upper jaw, between the musculus buccinator and the masseter, two remarkable conglomerate glands, one on each side, of the size and figure represented at the letters *ffff* in fig. 36. These, from their situation, he calls the glandulæ molares. In each of these he discovered two large oscula or apertures, of twice the size of the punctula lachrymalia,

\* Tab. Anat. Germanice Edit. Gedani 1725, T. 12. b.

† See his Disquisit. Anatom. de Duct. Saliv. Tubing. 1725.



and easily admitting the thick bristles figured at *g g g g*, and even the styles used in the fistula lachrymalis: they admitted these to about two lines.

Beside these larger oscula, there were also, on the left side of each gland, two or three other smaller foraminula; tho' these were not so minute as the apertures of many other of the parts of this kind: all these pierced the membrane of the mouth, and the buccinator muscle; and, on pressing the gland gently, each of them discharged at its orifice a drop of clear saliva. The 37th figure gives a view of the external part of the gland of the left side, which is seen by it to be composed of a number of smaller ones; and hence, in some degree, to resemble the shape of a mulberry: from this it is evident, that it is of the number of the conglomerate glands. It adhered to the substance of the palate, where the last of the dentes molares terminated.

Such is our author's description of these two remarkable glands, as he found them in this subject. Whether they are universal, or are found in the same figure and situation, and with their apertures or foramina in the same size, number, and situation in other subjects, he does not determine.

#### NOTE 58.

As the author was employed about the same fortunate subject, in examining the tubæ Eustachii, and musculi Columellæ, he chanced to press with his finger on the upper part of the pharynx, and on the part of the thick membrane marked with the letter *b* in our 38th figure, which, in that part, invests the lower extremity of the great apophysis of the os occipitis; where, from the part marked with the letter *a*, near the upper part of the vomer, he observed a mucous but not pellucid liquor ouze out. As he afterwards purposely pressed that and the neighbouring parts, he always found the same humor flow out. Determined to examine what aperture of a duct into the mouth this was, he first attempted to introduce a small style anteriorly and sideways; but in both attempts he failed of success: but afterwards making the same attempt toward the hinder part, in a direction to the great foramen of the occiput, he succeeded so far as to introduce it with great ease to  
the



the depth of a finger's breadth; that is, as far as to the part marked in our figure *b*. Finding afterwards that the passage was wide enough to admit a larger style, he introduced such a one as is figured at the letter *f*, and this penetrated as easily as the other to the same depth: after this he inflated it by means of a tube; but its substance was so dense and firm, that he was able to dilate it but very little by this means. But, from time to time, he found himself able to express a very considerable quantity of the mucous liquor beforementioned thro' it. After these observations he opened the passage, and found that it ran from its aperture expressed at *a*, to the depth at *b*, amidst a dense glandular substance, every way surrounding it toward the great foramen of the os occipitis, under the apophysis.

He at first suspected that it might be a morbid opening in this subject, or an ulcer in the part, and wholly preternatural; and he was the more inclined to this suspicion, from the circumstances under which the patient died: for, beside the other symptoms of the disease that carried him off, he had, toward the end, an inflammation of the fauces. This circumstance pleaded much against the author's supposing what he had discovered a real and natural aperture, especially as he candidly acknowledges, that at that time he had not met with an account of any such part, in any writer on the subject. Afterwards, however, turning over Santorini \*, he found a passage where that author is speaking of the fornix of the pharynx, under which term he includes the part which is represented in our figure, between the posterior extremities of the nostrils, the Eustachian tubes, and the great foramen of the os occipitis; concerning which he says, that it is covered with a dense and thick membrane, full of a number of glands, from which a thick mucous matter is discharged. These, he says, he sometimes found opening themselves into shallow cavities, which were, in some subjects, arranged in a kind of regular order; in others they were distinct and separate: sometimes he found inordinate and quite irregular loculi; sometimes the whole cavernous, as it were, full of conspicuous apertures and

\* Observat. Anatom. p. 137.



deep sinus's, so as to emulate in some degree the tonsils; and that it was easy to press out a mucous liquor from these. From this account of Santorini it is evident, that what our author observed in this subject was not a morbid state of the parts; but that such a mucous matter is always naturally thus secreted and discharged in this part. Whether it is protruded out at several apertures, or only at one, as in the subject in which our author observed it, which seemed a common canal, into which the glandulous circumjacent substance pour'd the matter of its secretion: its office is evidently to lubricate the fauces, to make the food pass down the gula with more ease, and to assist in forming the sweetness of the voice. It is also highly probable, that Santorini is in the right in judging that in a morbid state, when this mucous matter is secreted in too great abundance, the great quantity of such matter that the patient thinks distils from his head, and which he so freely voids in spitting, is really the produce of these glands.

## NOTE 59.

Our author in his last dissections, before the publication of his last edition of this Compendium, took very considerable pains to search after the duct named from Steno, and running from the nostrils into the palate, behind the dentes incisores; but tho' this must be acknowledged to be very manifest in the head of a skeleton, it is certainly very obscure in dissection of the fresh body. There are always found, indeed, behind the dentes incisores, a number of rugæ and foveolæ, or depressions; but the author asserts, that, in all his attempts, he never was able to make out any duct or canal running thence to the nose, either by means of a bristle, or of the finest styles, tho' he used such of the latter in the attempt as easily passed into the punctula lachrymalia. After cutting thro' the rugose membrane of the palate, indeed, in this place, he found he could introduce the style into a boney canal, near the membrane which runs thro' this canal; but that this only penetrated a little way, and could by no means be continued to the nose. And, on the other hand, on trying to find a passage thro' from the nose into the mouth, the attempt was as fruitless; not even the finest style,



style, or the smallest bristle, being able to make its way. From all this our author suspects, that this membrane, which is a very strong one, is in reality a ligament, serving to connect and strengthen the membrane of the palate, that it may not be subject to be separated from the bones of the palate by any hard parts of our food, or by other accidents; since, in that case, it would be an inconvenience from which many bad symptoms would rise, and which, tho' it might easily have happened without this defence or prevention, is very well secured from it by such a connection.

## NOTE 60.

Rivinus has described this foramen, which has been since called after his name. The hiatus Rivini is situated in that part of the tympanum, where the cord is, and where the handle of the malleolus is joined to its head. Thus it is that Rivinus has described and figured the place where it is situated; and Teichmeyer, who formerly had been a pupil of Rivinus's, agrees in this: but others describe it in a different manner, and its situation different. Among the latest of the writers of note, who are for the latter side of the question, we are to mention Mr. Cheselden, who affirms, that the membrana tympani, in that place where the boney circle, to which this membrane of the tympanum grows in infants, is not intire; but that it is open, in proportion as this circle is deficient. This is his account in his first edition of his Anatomy; but in the third he says, there is only a little aperture in this place, and that it is covered with a valve. He acknowledges, however, in the first, that this aperture is different in different people; and that in some it is so large, that it will let air enough thro' to put out a candle, on pressing the air from the mouth, when shut, thro' the Eustachian tube and external ear. And adds, that he had met with a man who would smoak a whole pipe of tobacco, without discharging any of the smoak out at his mouth, throwing it all out thro' his ears; and that this man had his sense of hearing very quick. He tells us also, that he once, in a dissection, found this membrane open in half its diameter, and yet that the person was not deaf. He finally tells us, from the authority of



St. Andre, of a man in whom the whole membrana tympani was destroyed by an ulcer, and the officula auditus thrown out; and yet, that the man did not lose his hearing by it.

It is easy to conceive, that, if this accident had happened to one of the person's ears only, he might continue to hear with the other; and, by the account, we are not informed whether it was to one or to both ears that it had happened. Our author asserts exactly the contrary of what this instance is cited by Mr. Cheselden to prove; and declares, from his own knowledge, a case, in which a person having lost these bones or officles absolutely and entirely, lost his hearing with them. We are to add, that Munnicks, in his *Liber de re Anatomica*, and Valsalva in his *Account of the human Ear*, assert, that they have sometimes met with the foramen Rivini; but the latter of them assigns it a different place from that given it by Rivinus.

Our author, whose care and accuracy are not to be questioned, is not ashamed to confess, that tho' he had often sought for this foramen, he never could certainly say that he had found it, either in the human ear, or in that of any quadruped, tho' he had searched after it in both with the utmost diligence and care. He kept among his preparations several of these membranes, taken intire from the human ear, and in their natural situation; but all these, he assures us, were perfectly intire; nor was there the least appearance of an aperture in any of them, either in the place assigned to this foramen by Ravinus, or that by Cheselden. He also adds, that he was well assured that Ruysch, and some others of the most eminent anatomists of his time, had sought for this foramen with no better success than he had done, nor had at all a better opinion of its existence.

Our author, as well as Mr. Cheselden, had met with a man who could discharge, out at his ears, the smoak of tobacco taken in at his mouth; but the man was deaf, and had received that injury by blows given him when young: and it was very reasonable to suppose, that both the deafness, and the power of discharging the tobacco-smoak this way, were owing to the membranes  
having



having been absolutely broken by these violences. He says, that he never had met with, or fairly heard of a person who could do this, and who enjoyed his hearing in any degree of perfection; and that he had many among his pupils who smoked much, and who had attempted to do this often, but without the least appearance of succeeding in it. From all this it is to be concluded, that this foramen, if it be found sometimes, as Rivinus and others describe it, yet is not natural or universal, but that the generality of men and of quadrupeds have it not. The effects related in consequence of there being such a meatus or aperture, can indeed only be accounted for, by allowing that there is such a one; so that our author recommends it to all future anatomists to search carefully after it, and by their joint observations to convince the world whether, and whether more or less frequently, it be found in human and in quadruped subjects.

Rivinus's pupils, with several of whom our author had been acquainted, all joined in telling him, that Rivinus used to demonstrate this foramen in his dissections, by placing a bristle on the part of the membrane where he says it is situated, and, in their presence, letting it thro'; but that he did not pretend to be able always to expose it to the eye. Our author tells us, that he tried this method, and that he could make the bristle pass; but he always has had a suspicion that the bristle makes its own way by forcing a hole in this tender membrane, rather than finds a natural aperture to pass thro' at. The experiment never succeeded with him, unless he thrust the bristle forward with some force; and he observes, that the same degree of force would make it pierce this tender and fine membrane in any other place as well as in this.

Waltherus, in his *Dissertation on the Membrana Tympani* \*, after a multitude of experiments made for this purpose, declares himself of our author's opinion, that there is naturally no such aperture as this described by Rivinus, Cheselden, and others. On the contrary, Teichmeyer not only asserts that this aperture is constant and universal in the membrane in the ears of all

\* Published at Leipfick in 1725, 4to.



creatures, but he gives a method of finding it with great ease and certainty in the ear of a calf. He has described his method at large, and has not omitted the assistance of figures to express it \*. Our author, after carefully perusing him, declares that he never could be so happy, in repeating his experiments, as to pass the style thro' this aperture with that ease and readiness that he did, or asserts that he did : and he observes, somewhat unluckily for Teichmyer too, that the place he has assigned this aperture is not the same that Rivinus has described it in. The figure which he has given of it in his *Anthropologia*, agrees very well with Rivinus's, as the opening is represented in what is called the greater area of the tympanum ; but in his seventh figure, given in the works just alluded to, it is placed in the smaller area of the tympanum. Now if there were such an aperture always, or but frequently in this part in men, it is impossible to say why we do not meet with numerous instances of men, who can discharge the smoak of tobacco at their ears : or how it happens that the instances of people who can do this are so few, as the thing must be easy on this principle. There are many other obvious arguments against the existence, or at least the universal existence, of this aperture in this membrane ; but these are sufficient.

## NOTE 61.

In regard to the number of the *officula auditus*, it may be proper to observe here, that Teichmyer, in his *Anthropologia*, enumerates six of them in each ear ; and, beside those four usually reckoned, describes and figures two new ones, which he had discovered in the ear of a calf. The first of these, which he calls *os lenticulare*, he tells us is placed between the *malleus* and *incus*, in the manner of a *sesamoide* bone ; and that it is joined to them both by ligaments, and serves to strengthen the articulation, in the manner of a *patella*. The other, or sixth bone of the ear, he tells us, adheres to the extremity of the tendon of the *musculus stapedis* : and he adds, that this muscle is not inserted into the head of the *stapes*, as has been usually supposed ; but is inserted into this bone, which is of an

\* *Vindiciæ quorundam inventorum suorum*, *Lonæ* 1727.



oval figure, and is connected laterally to the stapes. And, finally, he adds, that this bone had been observed before by Vesslingius; but that the other had never been discovered by any body.

That which adheres to the side of the stapes is very easily found in the ears of calves, and Cowper has figured it; and our author never omitted, in his courses, to shew it to his auditors: but in this work he omitted the mention of it, because, tho' so general in the calf, he had never met with it in an human subject. Schellhammer tells us, that he had found such bones in the ears of quadrupeds; but he adds also, that he never had met with any of them in the human ear. As to the other bone, called by this author the fourth, we have already declared our opinion of it; for if the epiphyses of the bones are to be enumerated as so many distinct bones, it will be easy to add to the number in other parts as well as this. The os femoris, at this rate, is not to be called one bone, but five.

The author who had added this, is not however content with what he did at first, but has of late added a seventh to the number of the ossicula auditus, which, from its figure, he calls os triangulare. This also, he tells us, he met with in the ears of calves; and adds, that it stands on the paries of the sinuosity of the os mastoidæus, on which the thicker and shorter leg of the incus is placed, as on a base. He adds, that this bone is very difficult to be found, and indeed scarce at all so, unless after the organs of hearing have been boiled. Finally, Dr. Douglass mentions yet another ossiculum auditus†, which has been observed in the tendon of the muscle of the malleus, called the internal one of Eustachius: but himself supposes this not a natural and universally separate part, but to be found by a breaking of another part, and therefore not to be universally found.

#### NOTE 62.

The work in which this very singular course of the auditory nerve is described, is not frequent in this part of the world; nor indeed any where, except in Italy:

\* See his *Vindiciæ* before quoted, p. 22.

† See his *Myograph.* p. 27.



Magnet has even omitted to mention it in his *Theatrum Anatomicum*. Our author has, therefore, been at the pains of translating the passage, in which it is described at length, from the author; and of giving a copy of his figure in a vacant corner of one of the plates of this work. See Tab. 2. Fig. 21.

The title of the book is Letters of Desnoyes, professor of anatomy and surgery at the academy at Bologna, and of Mr. Gulielmini, professor of medicine and mathematicks at Padua, and of other eminent persons, on the subject of certain new discoveries. In this work we have a description of the auditory nerve, in the following manner, given by Mastichelli, a physician at Rome.

The pair of auditory nerves coming from the medulla oblongata, enter the foramen of the os petrosum; and after the harder portion is separated from the softer, this last passes thro' a small foramen, which forms the central line of the cochlea, and thence goes out at a little aperture, which, from a strait base, runs directly upwards. Afterwards, in the upper part, there are discovered not only those little and scarce visible foramina, which Valsalva has described, but beside these another meatus, into which a bristle may be introduced: thro' this there is a free passage to the softer portion of the nerve, which has now the form of a simple filament, and which is increased in its beginning as its centre, and is elongated in its progress, and bends itself about, so as to run thro' the cavities which form spirales in the cochlea. After it has descended by the end of the base, it passes thro' a small foramen into the vestibulum. In this place, this soft and nervous part is covered, as it were, with a kind of mucous humour; and hence it is carried gradually, by divers inflexions, to the very arcus of the labyrinth; when, assuming again the form of a soft and nervous filament, it enters again the narrow cavity of a very small canal; and passing thro' its cavity, returns again thro' the proper orifice of the small canal; and after it has passed thro' this cavity, comes out at the large orifice of the arch: hence it enters the proper orifice of the small canal, and passes out again at the common orifice of this arch, thro' which  
it



it finally enters into the great canal, and thence again passes out at its proper orifice; and, finally, passes out of the os petrosum by one of those foramina, which open transversely into the vestibulum; and returning into the inner cavity of the skull again, insinuates itself into the substance of the brain, where, as it makes its way in, it becomes divided into a number of branches, and joins itself to several of the little branches, in the manner that the little ramifications of the veins and arteries do in other places in the dura mater, in the superior surface of the brain, and about the pineal gland.

That the intricate circuit of this nerve may be the better understood, we are to refer to the figure, which exhibits it separated from the bones, that it may be seen in what manner it is that it makes its way thro' these several passages.

This is the wonderful course of this nerve, which Maftichelli, who relates it, tells us was discovered by Simoncellus, a surgeon and anatomist at Rome. What he would principally attempt to demonstrate from it is, that the soft portion of the auditory nerve does not make its way thro' the cavities of the cochlea and labyrinth in form of a membrane, as has been the common opinion; nor in form of zones, as Valsalva would have it, but in the form of a soft and delicate nervous filament, which, after all this circuit, makes its way back to the brain again. He tells us also, that the discoverer Simoncellus intended, in a short time, to publish this and a number of other curious observations in a treatise, with the advantage of a number of very accurate figures. Our author has taken, as himself professes, a great deal of pains to render the description of the course of this nerve intelligible, in his translation from the original; nor have we been careless in the rendering it into English; yet we join with him in opinion, that it will appear obscure to the generality, at least, of readers. Our author pleads for himself, that it is so obscure in the original, that scarce any body could be expected perfectly to understand the author's meaning. It was not proper to omit what has the appearance, at least, of so very remarkable a discovery in anatomy; but we are to observe, that Camerarius, in  
his



his tenth dissertation, has taken some pains to refute this system of Simoncellius's; nor do we find that any body has been since able to follow the nerve thro' all the meanders, thro' which he has traced it in this description.

## NOTE 63.

In the first editions of this book the author mentions only three coats of the arteries, as it had been the custom to allow no more; but he afterwards found, by more strict examination, that the coats of the arteries are in reality five in number; and that, in the larger arteries, they are evident enough, and may easily be distinguished in the order in which he has mentioned them here. In the outer membrane there are a great number of blood-vessels. The second is formed of reticular plexus's, and may be divided into lamellæ or flakes. The third is a membrane, firm, tough, and approaching to the nature of the tendons in its substance: when this is taken off, there appears a thick dense coat, formed of a great number of evident muscular fibres, which surround the artery in manner of circles or rings; and this tunic also is easily divisible into several lamellæ. Finally, the fifth or inner tunic, which is placed within the fleshy annular fibre, is called the nervous one.

In regard to the muscular tunic, there have not been wanting authors who have denied that there properly was any such. In a work published at Hall in Saxony, under the name of *Bibliotheca Miscellanea*, in the German language, our author's *Compendium* being mentioned, the author denies the existence of a muscular coat of the arteries, partly on the authority of Pechlin and Schelhammer, and partly from observation that there were not what could properly be called muscles there, and that the arteries sometimes ossified, which they declare to be quite contrary to the nature of any thing muscular. The author adds also, that Schelhammer has asserted that the arteries were not constricted by any external force, or by means of any muscular structure; but that this change happened in them by mere subsidence.

But



But as it is evident, that in the intestines, and several other parts, fibres much smaller and finer than these do compose a muscular tunic; and the motion and constriction of the intestines is universally agreed, by the anatomists of all times since its discovery, to be owing to this tunic, it is somewhat unreasonable that it should be denied that this coat of the arteries is muscular, or that it serves for their constriction; since the fibres of it are much larger, and more conspicuous, and, in their annular or circular course round the vessels, form a multitude of evidently fleshy pale red lamellæ, which are so obvious and distinct, that there is no missing them on dissection: and as to the use of them, the constriction and motion in propelling the blood is vastly greater than in the other cases in which they are allowed. The requisites of a muscle are a manifest fibrous substance, and a power of constriction and motion: these are properties of this coat of the arteries; and it is hard, that with these, and every other character of what distinguishes muscles in other parts of the body, they should be denied to be muscles here.

As to the objection raised against the opinion of this coat being truly muscular, from the arteries sometimes ossifying, we are to answer, that the assertion that muscles are not capable of ossification, is not true. The ossa sesamoidea, which are found here and there in the extremities of several of the muscles, are a proof that it is possible; and the dura mater, which, by the common consent of anatomists, is muscular; nay, and the intestines themselves, in the substance of which there are sometimes found ossifications, abundantly evince, that an ossification, where there is true and proper muscular matter, is not impossible, tho' uncommon.

As to the authority of Pechlin and Schelhammer, we may oppose to it that of Morgagni: many others might be brought in on the occasion, but this name alone is sufficient. This author, in his *Advers. 2. Animadv. 38.* not only declares that the arteries have a muscular coat or tunic, but enters so far into the disquisition as to establish the doctrine of the fibres of it being annular, against Magnet's opinion of their being spiral.



A multitude of other authorities might be produced to support this system; but the greatest support it can have is observation, and an examination of the parts themselves. Whoever will enquire into the merits of the dispute in this way, will allow, that the arteries have certainly a muscular coat.

## NOTE 64.

The greater number of the anatomical and physiological writers divide the great artery, into what they call its ascendent and descendent trunk, in the same manner as the vena cava is divided. But this artery, in human subjects, runs in a manner that might have given origin to a better division\*; for after it has arisen with a single trunk about three fingers breadth, it becomes inflected or bent in the manner of an arch, and takes its course thro' the thorax into the abdomen. This arch, as it descends from the basis of the heart, according to the observations of Morgagni †, is about seven fingers breadth long; and is called, from the place of its inflexion toward the lower parts of the body, the *truncus aortæ descendens*, or the descendent trunk of the aorta; and from this part of it are derived all the arteries of the lower parts of the body.

From the upper part of the arch there are usually, in human subjects, three remarkable branches running upwards: of these the right branch, sometimes nearer the trunk, sometimes more remote from it, becomes divided into two parts, which are called the right subclavian and the right carotid arteries. The middle branch is the left carotid, and the other or left branch is the left subclavian: there are afterwards distributed throughout the head and the arms.

Our author observes, that he has sometimes, tho' rarely, found in female subjects four ascendent branches. Of these the two outer ones have furnished the two subclavians, and the two middle ones the two carotids ‡. A heart of this kind, with the arteries injected, the author always kept in his museum, among his nume-

\* See an excellent figure of it in Drake's *Anthropolog.* T. 20.

† See Michelotti de *Separat. Fluid.* p. 104.

‡ Berger has figured and described four branches, *Act. Erudit.* 1689; but they differ from those of our author.



rous preparations. It is but very rarely, if ever, that in human subjects there are only two ascendent branches; much less are we to expect ever to find but one: whence it is very evident, that the aorta ought by no means to be divided, as it usually is, into the ascendent and descendent trunk; terms that may easily give very wrong ideas of this vessel to those who have only read anatomy, without seeing dissections. Comparative anatomy seems to have given origin to this error. When human subjects were less frequently dissected than at present, and most of the figures and descriptions of the parts were taken from those of quadrupeds, it is not so wonderful that the terms of ascendent and descendent trunk of the aorta were introduced; since, in quadrupeds in general, there is usually only one large ascendent branch, dividing afterwards into the vessels of the head, fore-legs, &c. But in most quadrupeds this ascendent branch, tho' it appears single, is not truly so; but there usually is another smaller one very near it.

The new delineations of these vessels by Cant \*, do not at all agree with the usual and ordinary state of them. He gives, as it were, only two ascendent branches: the one larger than ordinary; from which afterwards proceed the right subclavian, and the two carotids; and the other at a great distance from it, from which rises the left subclavian. Our author asserts, that among the great numbers of bodies he had publicly and privately dissected, and examined with due care, as to the formation of these parts, he never met with one in which the vessels answered to this description, or to the figures given by this author. The branch which forms the left carotid, usually begins from a very distinct part from the other two, nearly in the middle, between them; so that it is but justice to allow the figures of Ruysch, Verheyen, and Drake, to be more accurate than these new ones. Drake, indeed, has figured the division of the subclavian and right carotid somewhat too near the trunk; but otherwise his figures are excellent. Nicolai says, that he has given four branches; but this is not just: he has really given only three; for it is evident, both from Drake's

\* See Impet. Anatom. T. 4.



figure and explication, that he makes the right carotid arise from the subclavian.

## NOTE 65.

The author just mentioned, Cant, in his first plate and second figure, has given new draughts of the divisions of the carotids; and, in his explanation of it, he falls foul upon all the writers who had gone before him, as to this matter. He declares all their accounts of these divisions of these vessels to be imperfect, and gives his new system, which he seems to have supposed perfect, in their place: but persons, who have been accustomed to examine these vessels, after injection with a coloured waxy matter, will very easily discover that this gentleman's plan of them is not quite perfect neither. He has given them terminations which they have not; and every one, who has but seen the experiment of injecting them, must recollect that their branches run much farther in the face, and about the temples, than these imaginary terminations allow. The temporal ramifications in particular, instead of terminating where he would make them, run all over the upper part of the head in various ramifications, which form a kind of reticular plexus, and are connected on each part by anastomoses with the arteries of the other side. In the same manner the artery which runs up to the cheek, and is figured by this author as if terminating about its middle in small ramifications, does in reality not terminate there, or in that manner; but its principal branch runs over the cheek obliquely toward the larger canthus of the eye: it partly enters the orbit, where it divides into a multitude of ramifications, and partly runs up to the forehead in numerous others.

Another considerably large branch of this artery also, after a sub-division near the lips, runs into each of them, and has many anastomoses also with the artery of the other side; and these are the vessels which bleed so largely under the operation for the hare-lip, or other occasions, in which it is necessary to make an incision there. It is to be remarked, that this author, with all his pompous pretences to perfection and accuracy, has allowed no arteries to the lips at all, in his figure.

It



It would be easy to point out, to the judicious observer, a great many other defects of this kind in his figure, particularly in regard to the variations of the first division of the carotids; but it is not necessary: the observer will find them, on comparison, very obviously. The author, indeed, seems to have been but very little a master of the art of filling the vessels by solid injections: if he had, he would have been able to have thrown his injection much farther, and filled the vessels of the face much more perfectly; and if he had examined the carotids in a variety of subjects, he would not so positively have asserted that their flexions and situation were always exactly as he has given them, perhaps from only a single subject. We find them, on dissection, sometimes indeed nearly as this author has figured them; sometimes also nearly as Drake has given them, and sometimes their flexions are quite different from what are laid down by either. All this will appear, very familiarly and obviously, to any one who will take the pains to inject them often, with good matter and good syringes.

## NOTE 66.

The anatomical writers, almost without one exception, tell us, that the vertebral arteries, arising from the subclavians, ascend up to the cranium, thro' the foramina formed by nature for that purpose, in the apophyses of the vertebræ of the neck; and by this seem to lay it down as a fact, that these arteries pass thro' these foramina in all the vertebræ of the neck. Our author observes, that in a number of observations which he had made on them, in different subjects, by injection, he has constantly found that these arteries do not enter these foramina in the seventh or lowest vertebra, but in the lowest except one, that is, the sixth. This is an observation not made by any body before him; tho' it might have been made out by the observing that the vertebral veins, in reality, pass thro' the foramina of the seventh and lowest vertebra. The intent of nature in not suffering the arteries which pass thro' these narrow passages in the others, to go thro' those in particular where the veins must pass, seems to be to prevent the arteries, in their dilatation, from compressing



those veins, and thus preventing the free passage of the blood. It seems to be for the same reason also, that in the cranium the veins and arteries do not pass thro' the same, but thro' different foramina.

## NOTE 67.

Our author has observed before, that the arteries of the œsophagus have been described but by few writers. Nicolai \* quotes only Drake and Ruysch, on the occasion of them; and the latter of these only knew of a few passing to the gula from the aorta: but in many dissections he has observed, he tells us, two or three such arteries, arising by distinct beginnings from the aorta. He used to shew these to his pupils, and has been so lucky as to succeed to admiration in his injections of them, with a waxy matter coloured.

## NOTE 68.

Nicolai, mentioned in the last and some of our preceding notes, sustains it, with Willis and Fallopius, against Vesalius, Ridley, and our author, that the vertebral veins do not go up into the cranium, nor reach the lateral sinus's †. It is to be allowed, that this is always the case in those peculiar subjects, in which those foramina or canals behind the condyloide apophyses of the os occipitis are obliterated or closed, as is frequently the case: but as in many bodies we find these foramina open, and manifestly terminating in the lateral sinus's, in these nature is to be supposed to perform her more regular course, and these are therefore to be looked on as the standards of truth. In these, if the other sinus's of the dura mater be injected with a waxy matter, thro' the longitudinal one, and the veins arising from them filled at the same time, it will be very obvious, that the vertebral veins enter the cranium by these foramina, and insert themselves into the lateral sinus's, near their exit out of the cranium. Our author often found it very fairly made out by this method of injection, and makes no doubt but whoever shall find a subject so formed, and go to work upon it in that manner, will succeed in the discovery. It may not be improper also to ask of those authors, who deny the communication

\* See his Dissertat. de Direct. Vasor. p. 64.

† See the same work, p. 4.



of the vertebral veins with the lateral sinus's, by means of these foramina in the cranium, to what purpose they suppose these foramina to have been formed?

## NOTE 69.

Mr. Cheselden, in the first edition of his Anatomy, published in the year 1713, first mentioned the remarkable valve in the inferior trunk of the vena cava, near the heart, called the *valvula Eustachii*; and in his ninth plate in that edition gave a figure of it, tho' not so perfect a one as might have been wished: he ascribes the discovery of it to Dr. Douglass, and calls it the *valvula nobilis cavæ ascendensis*, by which name he means the inferior trunk of the cava; but in the third edition of his book, he has left out the plate in which this figure stands. It is probable, that the sixth figure in the eighth plate of Eustachius, in his *Opuscula Anatomica*, first published at Venice in 1564, and afterwards at Leyden, under the care of Boerhaave, in 1707, gave Douglass the hint for this. But Eustachius does not call it a valve, but a membrane of a wonderful structure, which is placed before the foramen of the vena cava, ascending from the liver, as soon as it degenerates into the right auricle; occupying its anterior half, and then forming a kind of reticulation\*. Such are the express words of Eustachius; and, as to its use, he does not so much as give his opinion†. But Lancisi, in the late published plates of Eustachius, which were supposed to have been lost, particularly in his explication of the third figure of the sixteenth plate, calls this a valve; and tells us, that he is of opinion that it prevents the blood, descending from the jugulars thro' the upper trunk of the cava, from meeting with too much violence, with the blood ascending by the lower trunk of that vein. But Winslow is the author who has best of all described this valve, and explained its nature: he calls it the reticulated valve of Eustachius‡.

\* In his book on the *Vena sine pari*, he has given a fuller description of this valve.

† Bauhine, in his Appendix to the *Theatrum Anatomicum*, T. 8. fig. 1. gives the same figure from Eustachius; but he says nothing of the use of the membrane, nor indeed does he call it a valve.

‡ See Memoirs of the Paris Academy, 1717.



He has given an elegant figure of it, lunated and reticulated; and has described its situation and connections much more accurately than any body who had gone before him. He observes, that its hollow part is turned upward, and its convex part downward; and has observed, that, in looking for it, in dissections, the posterior part of the cava, not the anterior, is to be opened, otherwise that it will hardly be found. He observes also, that in adults, in whom the foramen ovale of the heart is closed, this valve is often wholly wanting; but that in new-born infants, or in any subject in which the foramen ovale is open, it may be easily found, especially on first plunging the vein under water for some time. After many other judicious remarks he adds, that, beside the use which Lancisi ascribes to it, it is evidently of great service in those young subjects in which it is most obvious and remarkable, in preventing the blood from making its way from the right auricle, or from the upper trunk of the cava, into the lower. Winslow's whole dissertation on this subject is worthy the author, and especially worthy a careful reading: he speaks very judiciously in it of the nature and use of the foramen ovale; and maintains, against the common opinion, with Meyer, that the membrane placed opposite to it is not a valve.

## NOTE 70.

Anatomists agree, that the nerves arise from the medulla oblongata of the brain, or from the spinal marrow; but they do not at all agree about what particular parts of the medulla they arise from. Whoever examines Willis and Vieussens on the subject of the nerves, Du Verney on the organ of hearing, T. II. Ridley on the brain, and after these Morgagni and Santorini in various places, will see this. Others also, who have absolutely written from their own observation, differ as greatly from these, as they from one another.

It is easy to see where an author's candour and accuracy are to be depended upon, and where not. We find these differences in the description of the places of the origin of the nerves in authors, all of whom are to be so depended upon; and we are to determine, in consequence, that it is not only one of them, but perhaps every



every one that is in the right; and that nature herself varies, in this particular, as much as their descriptions do. Morgagni has observed, that in the origin, and even in the distribution and plexus's of the nerves, the anatomist will find great differences, in regard to the same pair, in different subjects; and he argues very justly from it, that nature does not tie herself down to those strict laws, in this particular, that she does in many other cases, but is very uncertain and various\*. Santorini also, who had bestowed more time and pains than any man ever did, or probably ever will, in tracing the nerves from their origin; yet confesses, after all his attempts, that it is impossible to arrive at any degree of certainty in laying down the places of them; for that the origin of the nerves of the brain are not constant, but vary greatly †.

To descend more to particulars, there is scarce any thing about which the accurate anatomists of late have so much differed as about the true origin of the intercostal nerve. Most of the late writers agree with Willis, that it arises from both the fifth and sixth pair; and some ascribe some certain branches, others different ones to it. Eustachius, as appears evidently from his tables, deduces it wholly from the sixth pair; and Morgagni in general agrees with him: he says, that he has often found it taking its origin from one, sometimes from two, sometimes from three branches of the sixth; but that he never was able to find it fairly and clearly arising in any part from the fifth ‡.

Lancisi differs from all these: he will not have it deduced either from the fifth or sixth pair; but gives it a peculiar and distinct origin from the protuberances of the brain, where they are connected with the peduncles of the glandulæ pinealis §. Cowper will affirm nothing as to the certain and constant origin of this nerve, but leaves it variable and uncertain ||. And, finally, Santo-

\* Adversar. Anat. 2. p. 75 and 76, and Advers. 6. in various places.

† Observat. Anatom. p. 63 to 67.

‡ Advers. Anat. 6. p. 30.

§ Morgagni, Advers. 5. p. 105.

|| As Morgagni observes, p. 30. Advers. 6.



rini agrees with Vieussens and Ridley, and gives its origin conjunctly from the fifth and sixth pairs, declaring that he has seen it so \*. Our author, whose accuracy is by no means to be questioned, reconciles all this variety of opinions, by observing, that, in different subjects, he has seen it sometimes rising conjunctly from the fifth and sixth pair, sometimes from the sixth pair only. From this our first assertion is very evidently proved, that nature is herself various and uncertain in this matter; and nothing is more certain, than that not only these but other of the nerves vary extremely in the places of their origin. And we are to add to this, that accurate observations are very difficultly made on this subject; for that the extreme smallness and softness of the nerves, about their origin, renders them liable to so many injuries, on taking out the brain, and making other necessary preparations for their observation, that it is easy they should be displaced, injured, or even destroyed in this part, in the very attempt to examine them.

## NOTE 71.

All the medical and anatomical writers, almost without exception, have followed Willis in allowing ten pair of nerves to the brain; but our author is of opinion, that the tenth or last pair of these is very improperly added to the number of the nerves of the brain. It has not its origin from the brain, or the medulla oblongata, but from the spinal marrow; which reason alone, if there were no other, one would think, might determine in favour of his opinion, that this pair is not to be called a pair of nerves of the brain; but that they ought to be referred for the future to the nerves of the spinal marrow, of which they are the genuine and proper offspring: but this is not all that pleads against it. We are to observe, that this pair of nerves does not pass thro' any foramen in the cranium, as all the pairs of nerves of the brain do; nor, indeed, does it come so near this as to pass between the cranium and first vertebra of the neck, tho' Willis has affirmed this, and people have followed him in it: but, in reality, it passes between the first and second vertebræ of the neck.

† See Advers. Anat. 6. p. 39 and 40.



This is an observation which our author has the honour of being the first person who made ; but it has been confirmed by the most accurate anatomists since. This author very positively asserts, that he never, in any one dissection, found any nerve passing between the cranium and the first vertebra of the neck : and it is plain, from the words of Willis himself, on whom all the rest who affirm it depend, as their authority, that he was in doubt about it. He does not speak with that air of certainty, on this subject, that is usual with him on many occasions ; but leaves us room to suspect, from his very manner of delivering it, that he rather conjectured than ever fairly or clearly saw what he describes. According to our author's more certain observations, this pair of nerves are by no means to be said to belong to the brain. They have their origin and egress both quite out of the limits of the cranium, and are evidently to be referred to the nerves of the spinal marrow, and are properly the first pair of those. Morgagni readily agrees with our author's sentiments, as to this pair of nerves not arising from the brain or medulla oblongata, nor passing thro' any foramen of the cranium\* : but he observes, with Ridley, that they differ from all the other nerves of the spinal marrow, in that they do not, like them, arise from an anterior and posterior origin ; and therefore he is not for allowing them to be properly one pair of that series, all of which beside agree in a character in which they differ from these. But in answer to this, we are to observe, that Santorini agrees wholly with our author in opinion † ; and has shewn, by an uncommon accuracy in researches to this purpose, that this pair, as well as the others of the spinal marrow, do actually take their origin both from the anterior and the posterior surface of the spinal marrow. No one will call in question the authority of so judicious and accurate a writer as Santorini, on this subject ; and it follows, therefore, that as this pair of nerves have all the properties, and all the characters, of the nerves of the spinal marrow, and not of those of the brain, they are, from the time of these discoveries, to be added to the number of the spinal nerves, of which

\* Observ. Anatom. p. 66.



they are the first pair; and that, agreeing with Willis's account in other respects, we are to allow only nine pair of nerves to the brain.

## NOTE 72.

While our author was employed in observing, under several subsequent dissections, the uvula and its muscles, he often observed, from the root of the small apophysis of the pterygoide processes, which Santorini, not improperly, calls the horn of these processes, a series of fleshy fibres, very conspicuous in their origin there; which, afterwards joining, form a very minute muscle, whose tendinous expansion terminates in the velum palatinum, toward the upper part of the uvula, which part, by the assistance of other muscles also, it draws upward. This little muscle our author has given the name of *cerato-staphylinus* to; and the reader will find a figure of it in our eighth plate, figure 38, Letters *ll*. That it is a muscular part is evident, beyond a doubt; as also, that it serves in the office of a muscle, with others. It is small, indeed; but it is separate from the others, and has as good a title to be allowed a distinct muscle as many of the others of the same part.

## NOTE 73.

Schelhammer accuses the generality of writers on anatomical subjects, of his time, for allowing, with Drelincourt, forty-four intercostal muscles. He adds, that the intercostal fibres are not so disposed as that they can separately form muscles; but that they are mixed together, that they may decussate with one another in their course. He says, that one order of them runs obliquely from the inferior external part of the upper rib to the superior and internal part of the lower; and another series or order, on the contrary, runs from the inferior internal part of the upper rib to the superior and external part of the inferior rib, and that in the same oblique direction. The reason of this fabrick, he says, is, that the ribs may be liable to be moved, not only upwards, but outwards; by which the cavity of the thorax might be the more enlarged: and, on this plan, he says, the thorax forms a kind of bellows, such as never have been, or probably ever will be, made by any artificer.

In



In consequence of this system, Schelhammer allows the intercostal muscles to be only twenty-two, or half the number received by authors; and to these twenty-two alone, with the assistance of the subclavians, he attributes the elevation of the thorax. Govey goes much farther in the reduction of the number of these muscles than this author: he says, that all the intercostals together form only one muscle, which is divided into several bellies\*. He uses a very singular experiment to prove this; which is, he takes one whole side of the thorax of a human subject, or of a quadruped, and boils it in water 'till the flesh be ready to separate from the bones: after this, on carefully separating and extending the fleshy matter, it is all found to be continuous, and not formed of a number of different parts. This is an experiment that will not fail to please those who are not fond of multiplying the number of the muscles.

## NOTE 74.

It is not without sufficient reason that Winslow observes, that even the most careful of the anatomical writers had not, with a proper accuracy, given accounts of the interosseous muscles: he gives a very natural reason for the neglect, by observing, that they are the last that are demonstrated in the course of Myology; and the anatomist, by that time he comes to them, is tired and fatigued, and longs to get to an end of his business. It is hence, he observes, that these muscles have seldom been so thoroughly examined as they ought, but are generally mentioned in a transitory manner. Even Cowper, he observes justly enough, tho' a very diligent enquirer into the nature of the other muscles, has described these but very imperfectly. Winslow, for this reason, determined to give a better and more accurate description of them: he continues the old division of them into the internal and the external; and he agrees, that their number is, as authors have laid it down, six; but he does not at all agree with the others as to their insertions, or their uses. Some of the writers before him, he observes, have determined all the exter-

\* See his *Veritable Chirurgie*, p. 189.

† See *Memoirs of the Paris Acad.* 1702. p. 114.



nal ones to perfect the office of abductors, and all the internal ones of adductors; and that others of them have established exactly the contrary. Winslow agrees with neither; but establishes it, that the two prior of the external ones, that is, the two which are nearest to the index, are inserted only into the middle finger, on each side; and that they serve as adductors and abductors to that finger only: the third, he says, belongs to the *digitus annularis*, and is an abductor; and by numerous observations he thus proves, that the external *interossei*, tho' appropriated by others to such different purposes, do really belong only to two of the fingers, the middle and the annular.

The first of the internal ones, he shews, belongs to the index; the second, to the annular; and the third, to the little finger, acting as an abducent muscle to that finger: and thus he proves that the internal *interossei* have nothing to do with the middle finger, but belong to the other three. But, with all due deference to the character of so excellent a writer, we may observe, that it is not easy to conceive how the internal *interosseus*, which he says is an abducent to the little finger, if we consider its situation, what anatomists mean by abducents of the fingers, are such muscles as separate them farther from the thumb; but how a muscle thus situated can perform this, is a thing not so easily understood as Mr. Winslow would have it.

Dr. James Douglass, in his *Myographia*, describes these six muscles in much the same manner as Winslow has done in this Memoir; but he is more prolix. It is but justice to this excellent anatomist to acknowledge, that no man appears to have understood the muscles better; and to add, that his *Myographia* was published in 1707, Mr. Winslow's Paper not till 1720.

Winslow, who is a very candid writer, and has too much merit of his own to be in any necessity of borrowing praise at the expence of another, seems not to have met with this excellent work of Douglass's. This author agrees to the division of these muscles into internal and external: the external ones, he observes, fill the whole space between the bones of the *metacarpus*, on the back of the hand; these he therefore al-  
lows



lows are very properly called *interossei*: but the internal ones, he observes, have less title to that name, as they arise from the anterior part of the bones of the metacarpus, toward the palm of the hand, and are visible only in the palm of the hand, not at all on the back of it; whereas the external ones appear on both sides.

The first of the internal *interossei*, he says, arises partly tendinous, partly fleshy, from the whole anterior part of the metacarpus bone of the index, between the head and the condyle; as also from the superior part of the metacarpal bone of the middle finger, and is inserted into that side of the fore finger which is next to the middle finger.

The second of the *interossei*, which is the first of the external ones, arises from the greatest part of the external side of the metacarpal bone, which supports the middle finger; and, in some degree, tendinous from its inner part, nearly under its head; and thence extends itself along the side of the middle finger which is nearest the index\*.

The third of the *interossei*, which is the second of the external ones, according to the general division, is extended along the other side of the middle finger, and fills all that space which is between the metacarpal bones of this and of the annular finger, from which it has its origin.

The fourth *interosseus*, which is the second of the internal ones, runs along that side of the annular finger which is next to the middle one: it arises from the whole anterior face of that bone of the metacarpus, to which the annular finger is affixed.

The fifth, which is the third of the external ones, runs along the other side of this finger, and fills up the whole interstice between the metacarpal bones of the annular and little finger, from which it has its origin.

The sixth of the *interossei*, which is the third of the internal ones, is extended along that side of the little finger which is next to the annular one; and has its

\* The author's method would have been less obscure, if he had first described all the external, and afterwards all the internal ones; but we have no right to change it.



origin, partly tendinous, and partly fleshy, from the whole anterior face of that metacarpal bone.

All these muscles, both the internal and external, pass under a certain transverse cartilaginous ligament; and, after this, each forms two tendons; the one of which is presently inserted into the upper and lateral part of the first internodium; and the other expands itself so much as to cover the greater part of the first juncture, to which the tendon of the extensor adheres: after this it becomes somewhat narrower again, as it approaches the second internodium, where the last named muscle is terminated; and runs obliquely along this bone, and there is terminated itself in the upper part of the last joint, after it has joined the fellow of it on the other side.

As to the use of these muscles, Dr. Douglass gives it as his opinion, that when the long tendons act, the last joint of the finger is extended; and that they thus supply the place of an extensor magnus, which is wanting in this part; but that, when the short ones act, the fingers are moved sideways: that is, they either are drawn towards the thumb, or are separated farther from it. Such is the opinion of Douglass, as to the nature and use of these muscles. Winslow, who certainly had not met with his work, agrees in every material point with him; and our author, who took no common pains in following them in their observations, in a number of dissections, agrees also perfectly with them in all the essential matters.

As perfectly established, however, as the doctrine of these muscles might seem from such concurrent testimonies, Dr. Stockhusius, a physician of Magdeburg, who had formerly been a pupil of our author's, and who had acquitted himself so well in his studies as to leave no common reputation behind him when he left the schools; after all these discoveries and observations, undertook to examine these muscles himself, in a more than ordinarily accurate manner; and, in consequence of his observations, finished drawings of them with his own hand; which, with a new description of them, formed on the same subjects, he communicated first to his old master, and afterwards to the Academy of Berlin;



lin; and explained the whole by a human hand, prepared for the purpose, and exhibited with his paper before the Academy of Berlin.

This author sets out with declaring, that the inter-ossei, tho' generally said to be only six, are in reality nine, six of which are internal ones: and he adds, that they are to be distinguished, without difficulty, in all subjects, as he has figured them. Every one of the three inter-ossei of authors, he says, is distinguished into two, in a very evident manner, by a division in its middle, by a quantity of fat, and a white line; and even has two separate bellies, which may be very easily parted from one another; and, which sets the matter beyond all dispute, each of these bellies has its separate and proper tendon, and each of these is inserted in a peculiar part, nay, in a peculiar finger. This he alledges as the strongest of all proofs of their being each really two distinct and perfect muscles; and, in consequence, that, instead of three, the usual number allowed, the internal inter-ossei are truly and properly six. The originations of these muscles the author has not thought it necessary to enter into the description of: his figure shews, that he agrees with Dr. Douglass in this, and his descriptions therefore need not to be added to or altered; but, in regard to their extremities, he differs extremely both from Douglass and all the other writers; and has very elegantly figured, and very punctually described them. The first of them, he says, which is nearest the index or fore finger, applies its tendon to the internal side of that finger. The third is affixed by it to the external side of the middle finger, that is, to that side of it which is nearest the index. The third is fixed to the internal side of the same middle finger; the fourth, to the external side of the annular finger; the fifth, to the internal side of the same finger; and, finally, the sixth and last, to the internal side of the little finger. He is of opinion, that those, the tendons of which are inserted into the insides of the fingers, serve to draw the fingers back from the thumb; and that those, whose tendons are affixed to the external sides of the fingers, serve to draw those fingers toward the thumb; and consequently that, as only the one, or only the others act,

the



the fingers are drawn towards the thumb, or are separated from it; but that, when they all act together, they serve to draw the fingers close to one another; and that, additionally to all this, they are of use in the bending of the fingers.

This author agrees with the rest of the world, indeed, that the external interossei are three in number; but he observes, that they are of a different structure from what had usually been supposed. He says, that they are all bicipitous, or double, at their origin; and that one of their heads arises from one bone of the metacarpus, the other from another; and that these two bones are always those, between which the muscle lies: from this part, on each side, he says, there run muscular fibres, arising from the bones, which descend obliquely toward the fingers; and that they join, and form, as it were, a body like a feather, (whence he declares them to belong to the penniform muscles) about the middle of the interspace between the two bones, and afterwards form a single tendon each; the first of which, that which lies between the metacarpal bones of the fore and middle finger, is inserted into the internal side of the index\*; that which lies between the bones of the middle and annular finger, to the internal side of the middle one; and that which lies between the middle and annular finger, to the internal side of the annular finger.

From this it appears, that, according to Stockhufius's opinion, the little finger has no assistance from the external interossei; and that these interossei serve for the drawing away the three other fingers, viz. the fore finger, the middle, and the annular finger, from the thumb; and consequently that all the external interossei are abductors. The author concludes with great modesty, not desiring this system of his to be received as certain from his own observations, but submitting it to the examination of other anatomists. We are apt to believe there is great truth and accuracy in his figures and descriptions; but we are to observe, with

\* In this particular the author differs both from Winslow and Douglass, who both say that this tendon is inserted into the exterior side of the middle finger.



Morgagni \*, that there is so much variation in nature, in the construction of the muscles of the fingers, that it is impossible to give any certain and constant description of them, which shall suit what is met with in every subject.

## NOTE 75.

Littre, in the Memoirs of the Paris Academy for the year 1705, has given an account of a dissection of a foetus, in which the kidneys appeared to be of a vesiculous structure: from this single instance many have inferred, that the natural state of the kidneys is vesiculous; but this is arguing much too hastily.

We are to observe, in the first place, that these kidneys were, according to the author's own account, in a kind of monstrous state, very different from their natural one in a healthful and properly formed subject. This is evident from the state of the ureters, which he describes to us: these were, for near an inch from the kidneys, not only solid, or closed up, but the very sides of the pelvis were found also concreted, or grown together: nothing can be more evident than that they were, therefore, in a distempered or unnatural state; and therefore no general conclusion, as to the structure of the parts, could properly be made from them.

We are to observe also, that tho' the author deduces, from this structure of the kidneys of this particular foetus, no less than eight conclusive arguments, as he esteems them, for proving the substance of the kidneys, in general, to be glandulous; he has omitted one observation, and that the very capital one of all that might have fallen in his way; and which, however fairly the rest are deducible from the case, very certainly and obviously is so; which is, that the human foetus is not in absolute necessity of having a secretion of urine, while in the uterus; and consequently is not under a necessity of having the tunica allantoides, which quadrupeds have, and which many have supposed of absolute necessity to the human foetus also, tho' they have not been so lucky to find it.

This foetus of Mr. Littre's was at its full period of nine months, and was killed in the birth; so that it is

\* See his *Advers. Anat.* 2. p. 40.



plain it had lived to that period without any secretion of urine; and, as the foetus had lived so, it is evident that others may, as well as rational to suppose that all others do. The author expressly tells us, that the ureters and pelvis were so perfectly coalesced, that not a drop of the subtlest fluid could be insinuated between them; nor even air be forced in by inflation; much less was it possible, that so thick a fluid as the urine ever had made its way between them. It is evident, therefore, that no urine in this subject could have been conveyed from these ureters and kidneys to the bladder, to be thence sent to the urachus and allantois.

Littre is so far from having fallen upon this important observation, however, that he concludes, from the vesicles of these kidneys being filled with a liquor resembling urine, that therefore there is always a secretion of urine in the foetus, during the time of its being retained in the womb; and consequently that the foetus must either discharge this urine by the common passages, or by the urachus into an allantois. It does not appear, however, that either of these propositions are fairly deducible from the facts. It is very necessary to be allowed, that there is some secretion performed in the kidneys of the foetus; but it has never yet been proved, that the urine thus secreted is so considerable in quantity that it cannot be contained in the bladder, kidneys, and ureters, without a necessity of a discharge of any of it, till after the birth.

If we examine the condition of the kidneys in this foetus of Littre's, it will appear, that all the liquor contained in the whole series of the vesicles, was not so much as an ounce, tho' the foetus was at its full period for exclusion. And it is evident, that no larger a quantity of this fluid could have been, during the whole time of gestation, secreted in this foetus; because the ureters and kidneys were closed up, and no urine could have been sent from them into the bladder for exclusion. As it appears very evident, that a human foetus, in the ordinary course of nature, has the bladder considerably large, in proportion to its bulk; and may have, in that and in the ureters, and in the pelvis of the kidneys, a vastly larger quantity of fluid than that found in this



foetus's vesiculous kidneys, without any necessity of exclusion: and as this foetus, otherwise well formed and healthy to all appearance, had only so small a quantity as about an ounce of it secreted, it appears that there could have been no more necessity of emptying this little quantity into an allantois, than there was possibility of doing it; and hence, if the impossibility of thus discharging urine in this foetus was attended with no ill consequence to its health, it was not necessary to it; and if not necessary to it, it is not necessary in any.

Upon the whole, therefore, 'till the urachus in the human foetus shall be found to be much more frequently pervious than it is, and 'till the allantois has been much plainer demonstrated to exist than has been done at present, we are not rationally to suppose it a necessary or ordinary part.

If it be necessary to suppose that a much greater quantity of urine than can be conveniently contained in the bladder, kidneys, and ureters, must be secreted in the foetus; it follows therefore, that there must have been also such a quantity secreted in this of Mr. Littre's. It evidently appears, that but a small quantity was found in this foetus; and therefore, if there had been a larger, some of it must have been discharged. This discharge could not have been made in the ordinary way, as established by authors, thro' the urethra, or the urachus, into the allantois, since the passages to these parts were wholly stopt up; and if it be allowed that there must have been other passages for the discharging it in this foetus, it follows that there are such other passages also in other foetus's; and, consequently, that an allantois, and the apparatus for the discharge of the urine into it, is not necessary in a human foetus.

The quantity of urine voided by the foetus's of many quadrupeds, during gestation, particularly in cows, is vastly great. A woman, who stands only on two legs, could not walk with such a load, without continually falling, tho' a quadruped may: nature seems, therefore, to have provided against it, by conveying out the urine of the foetus, together with the blood, thro' the umbilical arteries, to the blood of the parent, to be voided with her urine in the ordinary way; and this



seems evinced, not only by the foregoing reasons, but by the very coalition of the ureters, &c. in this foetus\*.

Finally, we are to observe, that the peculiar state of the kidneys in this foetus did not appear, in all the particulars, so plain as the author's description would lead us to believe. Fontenelle, the secretary of the Academy, tells us†, that tho' the kidneys, which he described, were indeed very tumid, yet he was not able to discover, without the assistance of a microscope, the greater part of the singular circumstances which he mentions of them. He quotes, however, in confirmation of this structure in the foetus's kidneys, an observation from Mayer, of the whole substance of the kidneys being found vesiculous in an adult.

\* See Molinett's Differt. Anatom. Patholog. lib. 6. c. 7. p. 304.

† See Hist. Acad. Reg. Scient. Anno 1705, p. 58. Ed. Amstelod.

‡ Colleg. Anat. 173.



## NOTE 79.

**A**FTER the most perfect acquaintance with the bones, as preserved and exhibited in the skeleton, there is still something wanting to a perfect knowledge of the osteology of the human frame.

The bones, in order to their being arranged into a skeleton, in a firm manner, clean and dry, lose many parts which they had, while in the body, especially at their extremities; which parts it is of the utmost importance to us to know that they have, while in the body. These are only to be seen by laying bare and examining the bones in a dead subject, while quite fresh; for, in the natural drying of them only, many would be lost and obliterated in the boiling, in order to the forming into that artificial compages which we call a skeleton. Most of these parts are dissolved, and leave no vestige of themselves on the parts of the bones where they were situated. In the dried skeleton, the utmost we can see of the bones is their figure, their situation in the body, and the parts at which they are connected to one another: but how, or by what means, that connection is performed in the body, we can only learn by examining them in their connected state, while the body is yet in the condition (life alone excepted) in which it was while they were used. In this state only it is, that we can perfectly understand the nature of their articulations: their connections at these parts, by means of cartilages and ligaments, shew us what is truly their state in nature; and we find that, in the dried skeleton, these very articulations often wear a very different face from what they do in this state, which is the only state in which we have any real concern with them, or with accidents happening to them in the body.

Several of the cotyloide cavities, which are demonstrated to us in the dried bones, are not hollowed in this manner in the natural state in the body, but are glenoide: their cavities naturally are filled up with firm cartilages; but these are dissolved and disappear in boil-



ing. Other of the cavities, on the contrary, appear much deeper in the natural state of the bones than in the skeleton. These are only glenoid in the dried bones; and their cavity, in the bony matter, has never been any deeper: but, while in their natural state, they have been surrounded with cartilages, forming a kind of rising rim about their edges, and making the cavity in the whole much greater.

The boiling necessary to the reducing the bones to the state in which they are preserved in the skeleton, divests them also of many other of their essential parts. Their periosteum, for instance, the mucilaginous substance of the joints, and the marrow, all which have their several qualities and properties necessary to be known, in order to the making anatomy of its due use, and bringing it to the service of the parts when distempered. The business of the surgeon, in reducing fractures, and luxations also, is eminently assisted by this knowledge of the bones in the state of nature, or in that in which only they become the subjects of his profession. Every anatomist, in his courses, ought therefore to demonstrate, beside the bones of the skeleton, those of the recent body, cleaned from the muscles and other parts that surround them. Riolan has the honour to be the first anatomist who saw the utility, not to say the necessity, of this double course of Osteology. He always used it in his courses; but the trouble and difficulty of obtaining bodies rendered it neglected after his time; nobody, after him, having been at the pains of doing it, 'till the accurate and indefatigable Winslow. Riolan, who recounts the advantages of it, before remarked, always went carefully thro' it at the end of his course: Winslow, still more judicious, used to make the demonstration of the recent bones the article that immediately followed his common osteology, by the skeleton: by this means his pupils, immediately after they had obtained a general knowledge of the names, terms, and situations of the bones out of the body, were acquainted with their true state and situation in it; and the remembrance of what they had heard before, was by this rooted in them, and served as the basis of the



the whole superstructure, the muscles being afterwards vastly better understood in their situations.

## NOTE 80.

What it is that determines the efforts of the foetus, toward its delivery, from the prison of the womb, which it had before so long patiently suffered, at the period of nine months, is a question that has perplexed people in all ages. One of the first assertions, in regard to it, was, that the foetus found a want of food: this, as wild and extravagant as it is, has no less a name than that of Hippocrates as its establisher and defender. It is not easy to see, however, how the foetus should either want nourishment at this particular period, or should be actuated by such a sense, if it were true that it had it to attempt making its way out. The mother, we find, is very well able to afford nourishment to two foetus's: how then are we to suppose she can, just at this period, become wanting in regard to one? We find most women of robust habits, after delivery, having milk enough for the nourishment of two children: why then should the same woman be supposed, just at the period of nine months, to want nourishment for one?

Others have advanced, that the foetus separates itself from the womb, at its due period, in the same manner that fruits do from the tree, when ripe: this might sound prettily enough from a poet; but, from the mouth of an anatomist, it is not quite so creditable. Fruits, when ripe, are arrived at their perfection and utmost period of growth; but this is not the case in the foetus. Beside, to make out any analogy in the circumstances, these authors should find a parity of reason for the dropping off of both. The reason why fruits, when thoroughly ripe, fall from the tree, is, that their stalk, having now done its full office, dries up and withers, and consequently no more juices are conveyed to the fruit thro' it: but, on the contrary, the placenta continues to be fully and perfectly supplied with blood and juices to the last; and is indeed affixed as firmly, and in a state to perform all its offices as perfectly, at the very period of delivery as at any other time.



Others have said, that the great increase of the liquor amnii makes the foetus uneasy, and is the occasion of its moving about, and endeavouring to escape : but, before people build reasonings on things, they should be assured that they are facts. Now the truth is, that there is not any such peculiar increase of these waters at this time ; and that, if there were, there could be no reason for supposing that the foetus would be incommoded in this manner by them. The foetus, having not yet breathed would be no more disturbed by an increase of these fluids, than a fish, by being put out of a small quantity of water into a larger : and as to their quality, there is no change in that to occasion any uneasiness in it ; for, to the last, they are insipid to the taste.

The apparent insufficiency of all these reasons has put many people, since the time when they were advanced, upon finding a better. An author of very considerable fame, lays the whole force upon the urine and excrements : these, he says, increase by degrees, 'till, toward the time of the delivery, they form a quantity that is troublesome to the foetus, both in regard to its bulk and its weight : this makes it restless, and it begins to move about, its strength at this time enabling it. In its motions its head naturally gets downward, and falls against the orifice of the uterus, with its face towards the coccygis : in this situation of the foetus, its urine and excrements become more troublesome to it than they were before. This occasions more and more motions in it ; and, in consequence of these, it gets lower and lower. In this situation it brings on a tenesmus in the mother : the muscles of the abdomen are put in motion by this, and the effect of their motion is the forcing the foetus still lower down : this increases the tenesmus in the mother, and consequently the muscles of the abdomen are still more and more forcibly put in action. The consequence of this additional pressure upon the foetus, and of it against the orifice of the womb, is, that it opens, and the membranes are pressed upon 'till they break ; the liquid contained in them is let out, and it serves to lubricate the parts, and dispose them to distend and give way the more readily. In fine, the head of the foetus presents itself at the orifice



of the uterus: the action of the mother's muscles, and her efforts, press it downward into the vagina, which has not only been moistened by the liquors from the membranes of the foetus, but its own lacunæ and sebaceous glands continually, on this occasion, discharge their lubricating contents; and it is by this means rendered capable of distention, and the foetus comes forth! After it the navel-string, the membranes, and the placenta follow, and the whole is succeeded by a greater or lesser hæmorrhage.

Courvée, among the French, was the author of this system; and Drelincourt and some others have been at great pains to support it. Drelincourt, in particular, observes, that, at the period of nine months, the intestines are naturally full of the meconium; and that, in consequence of this, the stomach begins to retain some of it, and would fill with it also, but that the first attempts toward this bring on a kind of cholicky or griping pains in the foetus; and that these pains are what disturb it, and give rise to the motions that are the means of its being discharged out of the uterus.

Pechlin and Bohn declared themselves dissatisfied, however, with this account. They have attempted to prove, that it is not in consequence of the foetus's feeling pain that it is thrown into efforts, the consequence of which is delivery; but that it is an attempt to respire that directs its head, at length, toward the orifice of the uterus. But it remains upon the favourers of this opinion to prove, that the foetus is in this trouble and distress about breathing; which is not so easy to conceive, when we consider that it has no occasion for it.

Berger advances yet another opinion, which is, that the posture the foetus is placed in, during the whole time of gestation, is a very uneasy one; that, as it grows larger and more vigorous, it is more sensible of this; and that, in fine, when strong enough to move freely, it makes efforts to put itself out of so confined a situation; and that, at length, it succeeds in these; the consequence of this is its getting into that posture, by means of which it assists itself in the exclusion.



The foetus, while acquiring its growth in the uterus, is placed in such a situation as to take up the least possible room. It is contracted into a close form: its head is placed upwards, and its back against the lumbar vertebræ of the mother: its knees touch its face, and the hands are placed upon them, with the nose between them. This curled state tho' it suffers, while very small, yet, as it grows larger and stronger, it tries to alter it; and, in its attempts of this kind, its head gets downward, and presents itself at the orifice of the womb for delivery. This has a face of reason: but if the author were to be asked, why it is that the foetus grows so particularly uneasy at its curled situation, just at the end of nine months, and succeeds just at that time so happily in the freeing itself from it, he would find it very difficult to give any solid answer to it.

Another system, which gained great ground at one time in France, was, that the menstrual discharges, and the changes in the course of nature, in regard to them in pregnancy, did the whole. The menses, he says, flow monthly at their period, merely from plenitude: as soon as a woman is with child, these cease; because the matter of this plenitude is taken off in affording nourishment to the foetus. There is, however, still a little of the blood, that would otherwise have been thus discharged, directed toward those vessels at which it used to be discharged: this becomes accumulated there, and distends them, tho' it is not able to force its way out.

The roots of the placenta stop up the orifices at which it should be discharged, and its small quantity is not able to overcome the resistance: this quantity is, however, always increasing; and by degrees it becomes so considerable, that, at the period of nine months, there is enough of it to force its way out by the vessels of the uterus; but this can only be done by dislodging the roots of the placenta. The efforts toward this, he says, give many motions to the uterus, and these are communicated to the foetus: it begins to move itself forcibly, and, in consequence of it, changes situation, and its head falls against the orifice of the uterus: the consequence of this situation of the head of the foetus



is a tenesmus in the mother ; and the consequence of that is a motion of the abdominal muscles, greatly assisting the exclusion of the foetus, as already observed. At the same time also the mother feels pains in her loins, about the rectum, and about the bladder, occasioned by the compression of the parts by the uterus ; and the stools and urine are not evacuated but with difficulty. The motions of the foetus, which are at this period very strong, serve to burst the membranes it is inclosed in, and the waters are then discharged out of them : the orifice of the womb opens ; a glutinous humor, which had closed it, is the first thing discharged ; and after this the liquors of the membranes, and the parts are lubricated by this ; and the uterus, being at the same time irritated by it, presses forward its contents. The motions of the foetus, which finds itself much less at ease after the discharge of the waters than before, occasion motions in the uterus also, and these more and more enlarge the orifice of the uterus ; and the head of the foetus pressing all this time against it, by degrees it opens to a due degree for the giving passage, on a strong pressure, to the head of the infant. This pressure is given by the diaphragm and muscles of the abdomen of the mother, and by the contracting power of the uterus itself ; and, in consequence, the foetus assisting by its own motions, it is excluded.

There is an appearance of great sagacity and subtilty in this ; but, when examined seriously, it will be found to want weight. The accumulation of the menstrual blood is not to be allowed in the sense this author mentions it in ; and, as this is the basis of the whole, the superstructure must needs fall with it.

Such have been the various judgments of philosophical and anatomical genius's, as to the occasion of our first being thrown into this breathing world. They have been puzzled to find the cause that, at the end of nine months, delivers us out of the prison nature had inclosed us in at our first existence ; but it should first have been proved, that this exact period of nine months is the time allotted for it. This has been established by every body as a principle to reason from ; but this is not true, in fact. It is often impossible to determine, with any degree



degree of certainty, the real time of impregnation; and instances, in sufficient number, prove to us, that this is so far from being the punctual and exact period, that delivery happens at all the intermediate times between seven months and eleven. It is evident, from a great number of instances, that women do fall in labour at different periods between these; and at the end of the tenth month, in particular, seems to be a critical period, as well as the end of the ninth, tho' not so frequently.

We are therefore, in the eye of reason, to see many causes operating at once toward this important end; not one principal only, as these several authors have set out with supposing, the rest seeming to them but as collateral and accidental assistances to it. The growth or increase of bulk in the infant, the fecal matter, or meconium contained in the intestines, the size of the body, grown over-proportioned to the cavity it is lodged in, and the more than usually violent and continued motions; all these may conspire toward the great end, the exclusion; all may tend to determine the uterus to open its orifice: and to all these we are to add, the effect of the new muscle of Ruysch, and of the other muscular fibres of the uterus, or perhaps of the whole uterus itself, considered as a single muscle; and we shall have a great number of co-efficient causes, all powerful, all directed to the same end.

The muscular fibres are stretched and forced out of their natural situation by the dilatation of the fundus of the uterus; for it is the fundus that almost alone dilates above the ligaments: when this dilatation of the uterus is pushed to a certain point, we may consider the muscles and muscular fibres as now at a period, beyond which they cannot be dilated, and as hurt by it in such a manner, that they naturally are to contract. The period of the contracting of these muscles is, that when they can bear no farther dilatation, and when that which they have borne has become painful and irritating to them: but this is a time not so exactly regulated as should seem from what these authors have advanced; but it varies in regard to the state of the fibres themselves, which differ in different subjects; and in regard  
to



to the bulk of the child, which also is different in different women, and in the same at different gestations. Thus, in some, these muscles are dilated to their utmost pitch in the eighth month; and in some, this does not happen 'till the tenth: whenever it does happen, labour comes on, and the foetus is protruded. The intermediate period between the two extremes is that of nine months: it is not wonderful, therefore, that this is the most usual time. On this then depends delivery, and this is the true system of it, and occasion that brings it on. The Creator has made the muscular fibres of the uterus of such a kind, that they can bear distention up to a certain point, but no farther: when they are thus far distended, they will have a re-action; and the consequence will be an expulsive power, tending to discharge the thing that distends them. In this system there is no occasion for supposing such great effects to be produced by the infants changing its posture: nothing is more certain than that, during the time of gestation, it is changing its posture continually at times, without any symptoms of labour being brought on by it; and, even in the time of labour, it is not always found in this particular situation, with its head at the orifice of the uterus: but labours are too common, in which its being in other very different postures is of great difficulty to the hand employed, and pain and danger to the patient.

Harvey is of opinion, that the membranes ought not to burst in a kindly labour; nor does he allow any to be natural, unless the membranes come forth whole and intire with the foetus, and with their liquors in them. When the membranes have been broken, and their contents discharged, it appears to him that things have gone contrary to the intent of nature; but we are to observe, that, if this be the case, there are but very few deliveries that are in this course of nature; the bursting of the membranes, and the discharge of the fluids contained in them, almost always preceding the birth of the child. On the contrary, nature seems never to have meant any other than what we usually see; and we are to admire her contrivance, in that she makes the same thing serve at different periods to different purposes.



poses. The liquor amnii, which at one time served for the nutrition of the foetus, when that intent is over, and the foetus is to be excluded, serves to relax and lubricate the parts which are to be so wonderfully distended, in order to give way for its birth.

NOTE 81.

This assertion is not singular in our author: he is supported in it by several of the most eminent anatomists, both before his writing, and by the opinions of others at this time; yet it seems still very questionable, whether it really is the case. Paree is the first author we meet with affirming it; but he speaks it rather of his opinion than his knowledge. The great thing urged in favour of it by others is, that there is in some women so large a cavity in the place, that a finger will sink into it; but this may be a mere depression of that part of the bone, not a separation. That it is possible such an accident as an actual separation may happen, we do not deny; but that it very rarely does happen, seems also certain.

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EXPLA-



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# EXPLANATION OF THE FIGURES.

**I**T has been judged proper to add to this Compendium of Anatomy some figures, exhibiting a number of new discoveries in this branch of knowledge.

Two of them only are borrowed from the works of other writers on these subjects, as has been observed in their proper places: the rest are from observations made in publick dissections, and had not appeared in any other work at the time of their being first published in this; tho' they have since been confirmed by the observations of many of the greatest anatomists of the present age.

## *Explanation of the Figures in the First Plate.*

Fig. 1. The malleus, one of the ossicula auditus, drawn, for the sake of perspicuity, a little larger than it is in nature. It is from a human subject, and shews the apophysis or process, commonly called the processus Ravianus.

*a*, The head of the malleus.

*b*, The manubrium.

*c*, The smaller apophysis.

*d*, The long apophysis, or processus Ravianus.

The figure annexed is of the same malleus, drawn from a microscopick view of it, for the sake of exhibiting its parts the more distinctly. In this figure the capitals



capitals *A, B, C, D*, indicate the same parts as the smaller letters of the same denomination in the other figure.

It may not be improper to remark in this place, that this apophysis, or processus Ravianus, has often been found, in dissection, in such a condition as to render it suspected of not being a real bone. It is often flexible and elastick, in the manner of the lesser bones of fishes; and, if pressed any way upon the head, it will bend or give way a little; and, on the removing the pressure, or leaving it to itself, it will recover its true form again.

This flexible and elastick quality is not found, however, in any of the other genuine bones, if we except the ribs. It may also in its recent state, or even after it is a little indurated, be divided by means of a needle, or any other pointed instrument, at its top, into a multitude of fibrillæ, or capillary parts, as if it were indeed no more than an indurated tendon. Ruysch was the first anatomist in whose lectures this singular texture of this part was demonstrated. It appears from the experiment to be rather of the nature of the spines of fishes, or to be the indurated tendon of the muscle, which is inserted in that part, than a real and genuine bone.

Some other processes of the same nature, examined by the microscope, and situated about the angle marked by the letter *E*, are perfectly cartilaginous; but the rest, from this angle *E* to the part marked *D*, is found, on a nice examination, to be much more bony in its nature, and indeed to be a kind of peculiar bone, or epiphysis; and from thence it probably is, that this part is so easily broken, in the taking out the malleus: which is, indeed, so general a case, that the very accuratest anatomists of some years ago, and particularly those who had professedly treated of the human ear, as Du Verney, Schelhammer, Valsalva, Vieussens, and even Mangestus in his *Theatrum Anatomicum*, have omitted this apophysis, or epiphysis, by which ever of those names it may be most proper to call it, in their figures. This, however, is the more observable; since not only Cœcilius Folius, in his *Schedisma*, entitled, *Nova Auris internæ delineatio*, published at Venice in 1645, (a work that



that fell into our hands since the first edition of this Compendium) describes and figures it, tho' not with the most perfect accuracy; but even Bartholine gives it in his *Anatomia Reformata*, p. 713.

As the first figures of this bone are, however, given at Tab. 1. Fig. 1. larger than the life, it has been judged not improper to add another figure of a malleus, with this process, taken from the ear of an infant newly born, in its natural size, as at that period of life. This is figured in two views, and shews some variation in this processus Folianus.

Fig. 2. Represents the lower part of the os femoris, with two sesamoide bones, not described by other authors.

*A*, The os femoris.

*B*, The internal condyle.

*C*, The external condyle.

*D*, The larger of the two new sesamoide bones, situated in a considerable cavity in the external condyle. This, however, in some subjects, is much larger than it is represented here.

*E*, The lesser of the two new sesamoide bones, situated in the internal condyle. This is but very seldom met with in dissection, most subjects wanting it; but the other is seldom wanting.

Fig. 3. Represents the larger of these two sesamoide bones, separated from the cavity in the external condyle, in which it is naturally lodged.

Fig. 4. Shews the lesser sesamoide bone, of the internal condyle, separate.

Fig. 5. Shews the bones of the little finger.

*A*, The metacarpal bone, to which the little finger is annexed.

*B*, The first phalanx of the finger.

*C*, A sesamoide bone, which is frequently met with between the juncture of the metacarpal bone and the end of this finger, which is annexed to it. This bone is not unfrequently found larger than it is here represented,



sented, and affixed to the tendon of the abductor muscle of this finger.

Fig. 6. Represents the right side of a human stomach, extended by inflation, and dried, with its valve, or the large circular membrane, which is found in its right orifice, called the pylorus.

*A, A, A,* The right side of the ventricle, inflated and dried.

*B, B, B,* Part of the duodenum, opened and reclinate.

*C, D,* The valve of the pylorus, or the circular membrane, which internally surrounds the pylorus in its natural situation, as found in the subject from which this drawing was taken, in whom it was larger than it is in many others.

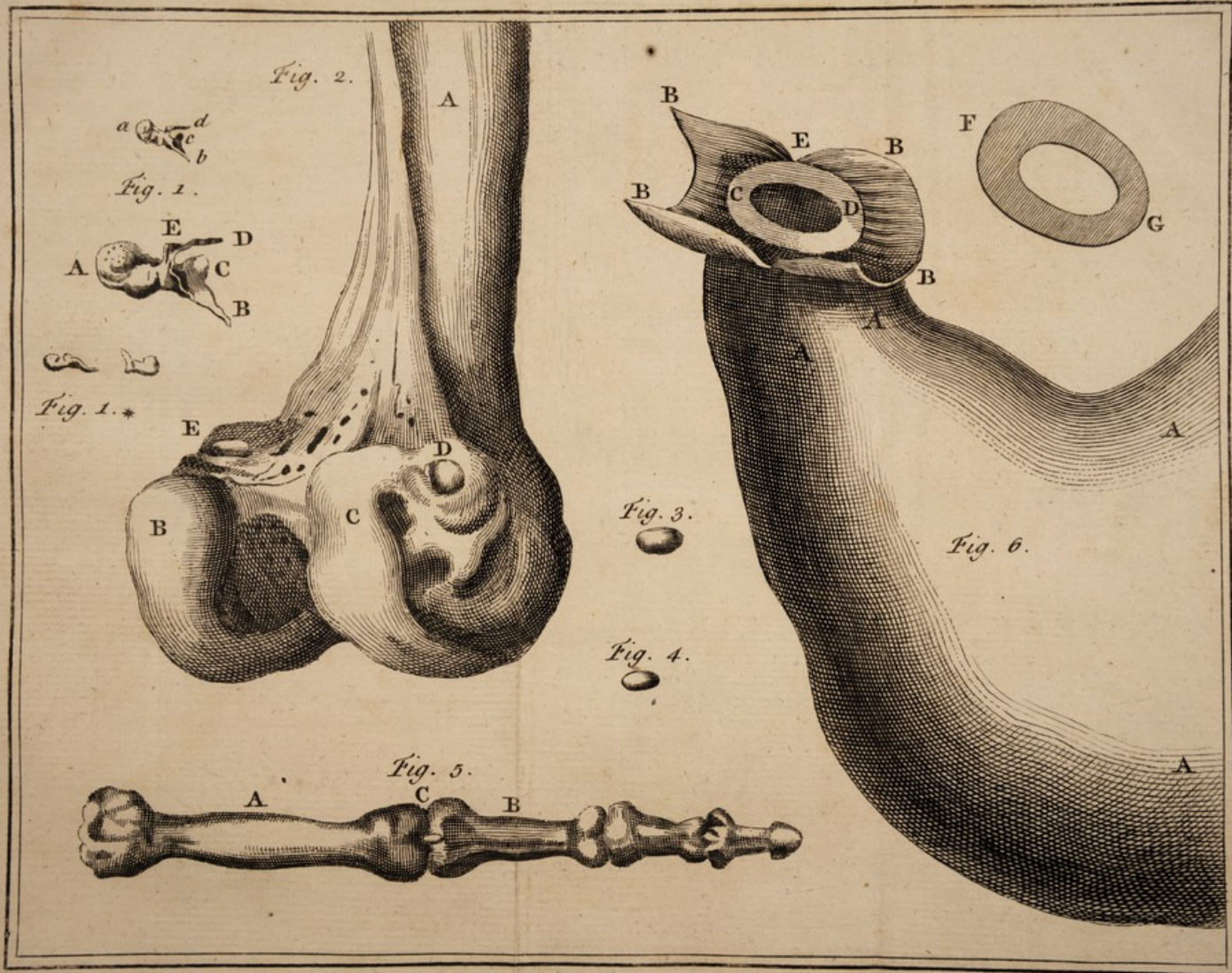
*E,* The aperture into the stomach.

From this figure it appears, first, that the pylorus is not situated horizontally, as Willis in his *Pharmac. Rationalis*, Verheyen in his *Anatomy*, and others, have represented it, but obliquely: it is indeed so situated, that it descends or declines from the right side *C*, obliquely all the way toward the left side *D*. And, beside this, we see by it that the pylorus does not consist merely of a series of circular fibres, surrounding this orifice of the stomach, as has been generally asserted; but usually of a considerably large membrane, which is sometimes two or three lines broad; so that this orifice is well filled by it, and the egress of coarser matter out of the stomach is retarded.

We are to observe, that this membrane of the pylorus, however, is not so large in all subjects: sometimes it is scarce more than one line broad; but in some it is also much larger than here represented. The letters *F* and *G* shew this membrane in its natural size, in another human stomach: in this the part *G* is narrower than the rest; but the part *F*, which is the upper part, is very broad. A figure of this part, communicated to the German *Ephemerides*, and published in the fifth century, is unluckily inverted by the error of the engraver.

*Expla-*











Explanation of the Second Plate.

Fig. 7. Represents a part of the ileum, cœcum, and colon, with the valve called valvula coli Bauhini. In a dissertation of our author's, expressly on the subject of this valve, there are several different figures of it; particularly two singular varieties of it are exhibited in the second Tab. Fig. 1 and 2; the one, in which all these parts are very large; the other, in which they are very narrow. In this plate there is given a figure, expressing it in a middle state, and as it is most frequently met with: by this and the others it will appear, that notwithstanding all these, and a number of other variations, there still is, in reality, a valve, such as is called by Bauhine valvula coli, situated at the end of the ileum; and that it is not a feigned or imaginary part, as Bianchus would persuade the world to believe, in Mangetus's Theatrum Anatomicum.

*A, A*, The ileum, ascending obliquely, as is its usual and natural course, to the larger intestine; and insinuating itself into its left side.

*B*, The intestinum cœcum.

*C*, The vermiform, or worm-like process of the cœcum, turned upwards.

*DDDD*, Part of the cœcum, and of the colon, laid open, that the interior surface may be seen.

*E*, The aperture of the valve, or of the ileum, into the larger intestines.

*F*, The upper part of the valve.

*G*, The lower part of the valve.

*HH*, Membranes supporting this valve; or, more properly speaking, these valves on each side, which may be called the ligaments or frænula belonging to it.

*III*, Several connivent valves of the colon.

Fig. 8. Shews the lacteals, as found in two dissections of human subjects, mentioned in the note on that subject.

*AAA*, Part of the jejunum, with its rugæ or plicæ, which are slightly transparent.

*H h*

*BBBB*,



*B B B B*, A vast number of roots of the lacteals. These were greatly more numerous in the subject than the person employed to engrave them could express, and made a multitude of anastomoses with one another: they are much more numerous in human subjects than in dogs, from which they have usually been figured.

*C C C C*, Their various ramifications, and spreading on the mesentery; which was also, in nature, vastly more than the nicest hand could express in a figure: they communicated here also with one another, by frequent anastomoses; and partly insinuated themselves into the glands of the mesentery, partly passed over them.

*D D D*, Some of the larger glands of the mesentery: beside these, there appeared in the subject itself a multitude of other smaller.

Fig. 21. Tho' not properly belonging to this plate, is added, because there was room for it. It exhibits the distribution of the auditory nerve thro' the labyrinth of the ear, as it is described in Novesius's Epistles.

*A*, The auditory nerve.

*B*, Its distribution thro' the cochlea, in form of a filament.

*C*, Its progress thro' the vestibulum.

*D*, Its windings thro' the three semicircular canals.

*F*, Its extremity returning to the brain, and dispersed thro' it in a multitude of branches.

### *Explanation of the Third Plate.*

Fig. 9. Exhibits three views of the tortuous course, and the valves of the ductus biliaris cysticus, with part of the gall-bladder, as these parts appear in most subjects.

*A A*, Part of the vesicula fellis, or gall-bladder, opened.

*B*, Its exit into the cystick duct, which is very tortuous.

*C*, The cystick duct, which is twisted in the manner of a rope, and has within it a number of spiral valves.

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*Fig. 7.*







Fig. 9. *D*, Exhibits another gall-bladder of this kind.

*E*, Is its exit, and inflexion, as it were, in the form of the Greek *Sigma*.

*FF*, The cystick duct opened, and shewing the spiral valves, formed in a different manner from those expressed in the former figure.

Fig. 9. *G*, Exhibits another gall-bladder, which has within it various cellules and membranes, some transverse, some strait, and some oblique; but all of them perforated, for the passage of the bile and patent: these would not admit a style, indeed, into the cavity; but they easily and readily suffered the wind to pass, in inflation.

These valves have been disregarded by most of the anatomical writers to this time; but, on a careful search, they are usually to be found. Something of valves is to be met with, in almost every subject; but the disposition is very different: every anatomist, who will seek after them, will find this. Bianchi, at one time, denied the existence of any such parts; but he afterwards owned, that they were almost always to be found, tho' in very different forms.

Fig. 10. Exhibits one of the tubæ Fallopianæ of the uterus, from Drake's Anthropologia, with its vessels filled with crude mercury, and by inflation, in order to shew their course in one of the alæ vespertilionum; together with the reticular distribution of the veins on the sides of the tubæ, and its expansions or fimbriæ: by means of these, these parts in the orgasmus of the cavity are distended, erected, and rendered fit for the embracing the ovary of that side; as well for the conveying the semen from the uterus to the ovary, as for the receiving the ovum impregnated by it, and conveying it into the uterus.

*A*, The part of the tube that is next to the uterus.

*B*, Its other extremity, which is somewhat narrower again than the middle, before it expands into the fimbriæ at its mouth.



*C C*, The fimbriæ, or membranaceous expansions of the tube, distended.

*D*, The orifice of this end of the tube distended.

*E*, The vespertilionis ala of that side.

*F*, Its veins and arteries coming from the hypogastricks.

*G*, The vessels, forming a wonderful reticular or cavernous body in the sides of the tubæ.

Fig. 11. Another view of a Fallopian tube, with its vessels filled with mercury, as exhibited in a publick dissection, by the author. In this the distribution of the vessels appear very different from Drake's representation, copied in the former figure, and much more beautiful.

*A*, The part of the tube which is nearest the uterus, tied with a thread: otherwise the mercury, thrown into the vessels, will make its way into the uterus and the hypogastrick vessels, and the vessels of the tube will not be thoroughly filled.

*B*, The other extremity of the tube in this.

*C C*, Are the fimbriæ, or membranaceous expansions, which are extremely full of vessels, tho' very minute ones, to their very utmost verge. No hand is fine enough to express, in engraving, the multitude of these visible in the subject.

*D*, The opening of this extremity.

*E*, The ala vespertilionis, or the ligament between the tube and the ovary. This, when the mercury was first thrown in, was very full of it; but the mercury made its way soon out at an aperture scarce perceptible, and in a great measure emptied it again.

*F*, The vein, at which the mercury was injected, arising from the spermatick of the uterus.

*G*, Its larger divisions.

*H H*, A remarkable branch of it, running parallel, as it were, with the tube, nearly as the veins of the intestines do in the mesentery. From this parallel branch there proceed

*I I*, A multitude of lesser branches, which spread themselves upon the tube, nearly as the vessels in the intestines; and fill it afterwards with such innumerable



ramifications, that the whole substance of the tube appears nothing but a congeries of them. The vessels of the Fallopian tubes are, indeed, to the full as numerous as those of the pia mater, the heart, or any of the other parts, according to Ruysch's figures; and yet it has happened, that authors in general have described and figured them as if they had no vessels at all. It is not a wonder, therefore, that these parts are capable of erection in the coitus, since the copious flow of blood into these numerous vessels at that time cannot but occasion it: we see that it may indeed be done, in some degree, by inflation.

Fig. 12. Exhibits the liver of a new-born foetus.

*AAA*, The circumference of the liver.

*BBB*, The lower part of the liver, in which there are several inequalities.

*C*, The gall-bladder.

*D*, The umbilical vein, running with a single trunk from the navel to the liver.

*EE*, The sinus's of the vena portæ, into which alone the umbilical vein inserts itself, with a single trunk, tho' Verheyen has described it much otherwise.

*F*, The trunk of the vena portæ cut off.

*G*, The principal branches of the sinus of the vena portæ distributed thro' the liver. These become conspicuous when a small part of the superficies of the liver is abraded off.

*H*, The trunk of the vena cava.

*II*, The canalis venosus, or ductus venosus, arising from the sinus of the vena portæ, over against the ingress of the umbilical vein, and inserting itself into the vena cava: this in the uterus carries a great part, probably indeed the greater part of the blood carried, thro' the umbilical vein to the liver of the foetus, by a large passage to the vena cava and the heart; but this, after the birth of the foetus, gradually grows narrower, and closes.

*K*, The place of the entrance of the umbilical vein into the sinus of the vena portæ alone, with one single extremity, not two, as Verheyen and several other writers have improperly described it.



**Fig. 13.** The diaphragm, viewed from the lower part, or in the natural position in which it is placed in the body. In the former editions of this Compendium the figure was less correct; and it is to be observed, that the figures of Verheyen and Mangetus represent it inverted also, or seen from the upper part. The young student in anatomy may easily be perplexed with such a view; this figure is therefore done from the part in situ, in a human subject.

*AAAA*, The upper muscle of the diaphragm, arising by fleshy fibres, considerably robust and thick, from the sternum and the cartilages of the ribs. These fibres all run toward the tendinous part, like rays from a centre.

*BB*, The lower muscle, which is, as it were, double.

*C*, Its right tendon, which is the longer.

*D*, Its left tendon, which is the shorter.

*EE*, The tendinous part, or centrum tendineum, to the upper part of which the pericardium adheres, in which there are tendinous fibres, which, as Santorini observes, are wonderfully interwoven with one another, for the sake of strength.

*F*, A transverse foramen, or hole in the tendinous part, of an elliptick figure, thro' which the vena cava passes.

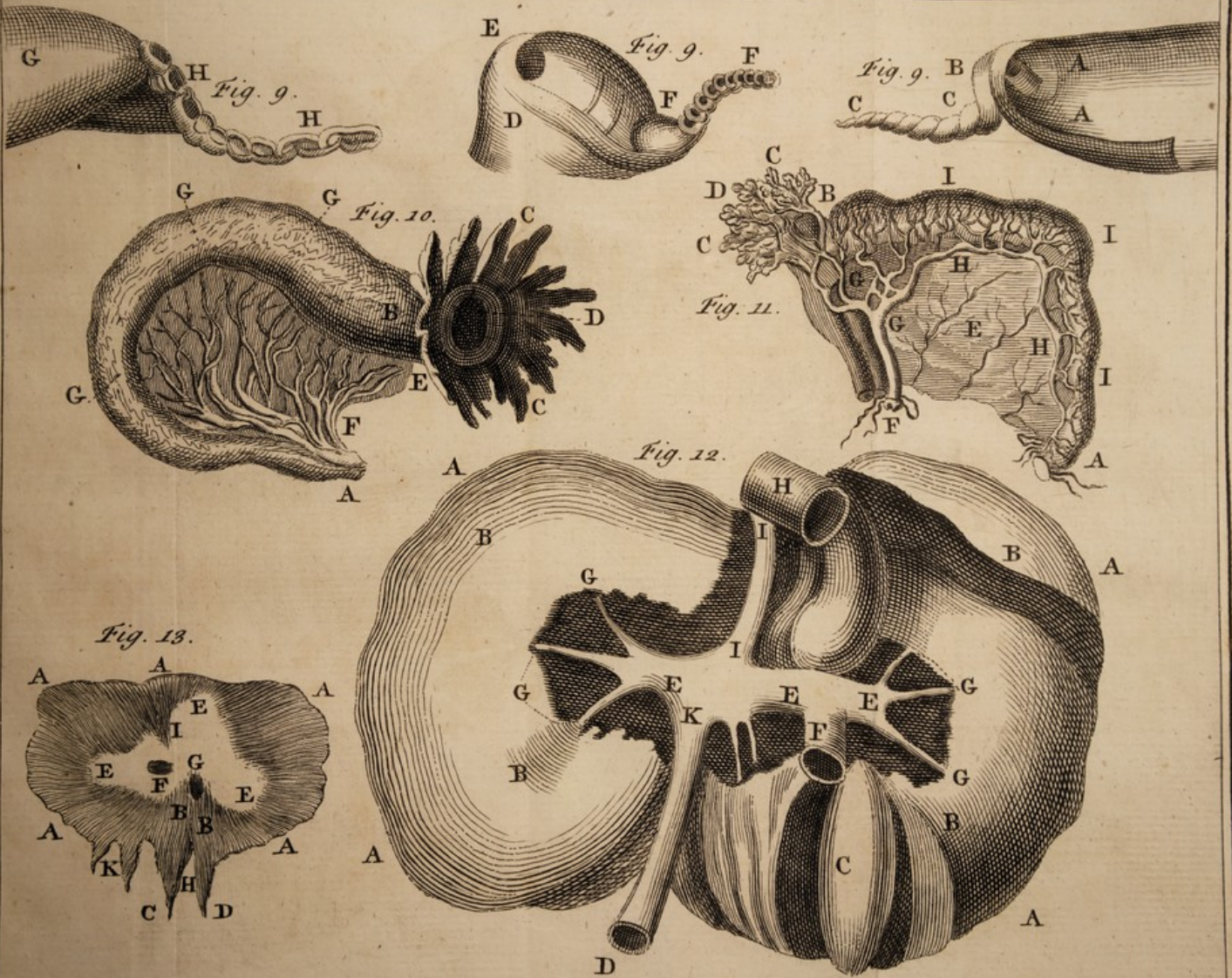
*G*, A foramen of an oblong shape in the fleshy part, thro' which the œsophagus makes its way to the stomach.

*H*, The interstice, a place between the two heads of the lower muscle, where the aorta descends from the thorax into the abdomen; and thro' this passage also the ductus thoracicus, and the vena azygos, often ascend out of the abdomen up into the thorax.

*I*, A fleshy part of the diaphragm, which, in some subjects, is tendinous.

*K*, Two muscular appendages, which are of very various shape in different subjects; and in some are absolutely wanting, in others very conspicuous.











*Explanation of the Fourth Plate.*

Fig. 14. Represents the gland thymus, taken from a foetus just born.

*AA*, The heart, wrapped in its pericardium, to which the thymus in great part adheres.

*BB*, The thymus, as it appeared in this foetus, bifid, as it were, in its lower, and trifid in its upper part: the lower parts, marked *aa*, adhere to the upper part of the pericardium; the middle part, marked *bb*, to the trunk of the aorta; and the upper parts, *ccc*, lie upon the beginnings of the ascending branches of the aorta.

*CCC*, The three ascending branches of the aorta.

Fig. 15. Exhibits the same gland taken from another foetus, and differing from the former in many particulars. This gland is, indeed, extremely subject to vary; and is scarce found of the same size, or any thing exactly of the same shape, in any two foetus's.

*AA*, The upper part of the heart, surrounded with its pericardium.

*BB*, The gland thymus, divided in the upper part into two portions, *aa*; and in the lower part only lightly sinuated, not divided to any depth, *b*.

*CCC*, The three ascendent branches of the aorta, as in the preceding figure.

Fig. 16. Represents the human cerebellum, exhibiting its division into lobes; a circumstance which the anatomists have been used to overlook.

*aaaa*, The human cerebellum, divided perpendicularly, and into equal parts, in the middle.

*BBB*, The interior cortical and medullary part.

*ccc*, The medullary tracts, not so thick or short as they are usually represented by authors.

*ddd*, The divisions of the cortical substance, first, into larger lobes; and from these, into others much smaller; and, finally, into a great number of very minute lobuli, beautifully disposed in such a manner,



that every larger lobe has its own proper medullary branch; and every smaller, nay, every minute lobulæ of the last division, has its own little branch of the medullary substance, every one distinct and separate from all the rest; but all of them at length uniting near the medulla oblongata, and forming one trunk. It would not be easy to mark all these lobes and divisions by letters in the figure; but the drawing is so distinct, that they will be easily understood by it.

*ee*, The medulla oblongata.

*ff*, The beginning of the spinal marrow.

In the fifth century of the German Ephemerides there is a method laid down of preparing this part, and keeping it in spirits, so that all the structure and fabrick of it may be plainly seen.

Fig. 17. Represents the cerebellum of a calf. This is also vertically divided in the middle, with some of the parts annexed, that a comparative view may be given of the lobuli of the cerebellum in this animal.

*aaaaaa*, Shew the larger or principal lobules of the cerebellum of this animal.

*bbbbbb*, Exhibit the principal divisions of the lobules of the cerebellum, which have been generally supposed to form only one continued substance.

*cc*, The principal medullary tracts; from which the smaller ones are propagated, and divaricated in the manner of the branches from the trunk of a tree.

*dd*, The crura of the cerebrum cut off.

*e*, A fissure or chink at the infundibulum.

*f*, The glandula pinealis.

*gg*, The nates.

*hh*, The testes.

*ii*, The fourth ventricle of the brain, or calamus scriptorius, in the middle of which there is a dent or depression in the upper part.

*k*, The anus, or the orifice at the aquæduct of Sylvius.

Fig. 18. Exhibits a recent eye of a hog, which has been exposed to the winter's air, and frozen, in order



to keep the humors in their proper situation. It is vertically cut thro', to shew the situation of what are called the three humors of the eye, and of the uvea.

*a a*, The cornea.

*b b b*, The circumference of the sclerotica, and of the choroides and retina underneath it.

*c*, The uvea, in the centre of which is the pupil.

*d d*, The ciliary ligament, inserted near the crystalline humor.

*e e e*, The vitreous humor, occupying the hinder part of the eye.

*f*, The crystalline humor lodged in the sinus of the vitreous one, included in a membrane, and, as it were, suspended by the ciliary ligament.

*g*, The aqueous humor, situated between the cornea and the crystalline; where it is evident that the quantity of the aqueous humor between the cornea and the uvea, that is, in the anterior camera, is much greater than that in the posterior camera, or between the uvea and crystalline, where indeed there is but a very small portion, and, as it were, at their flake only visible.

Fig. 19. Exhibits a like view of a human eye, frozen, and laid open in the same manner: in this the quantity of the aqueous humor, lodged behind the uvea, is still less, in proportion to the large portion of it that is before the uvea, than in the former subject. There is, beside this, no other difference very observable, except that the crystalline *f* is much smaller in human subjects than in hogs, dogs, calves, sheep, and other quadrupeds in general, as appears from a dissection of a great number of eyes of different species of them.

Fig. 20. Exhibits the human tongue, with its three teguments, which the anatomists in general have omitted to remark. Bourdon, indeed, has figured them, but thicker than the life.

*A A A*, The upper superficies of the tongue, on which there are visible, in every part, a multitude of papillary and pyramidal eminences.

*B,*



*B*, A piece of the exterior tunic, or coat of the tongue, separated from the rest, and reclined. In this an innumerable multitude of nervous papillæ come in view, adhering to its interior surface.

*CC*, The second tunic, or coat of the tongue, called the corpus reticulare of Malpighi: thro' the foramina of this coat the nervous papillæ, rising from the third or inner one, make their way to the first or outer one.

*D*, The corpus reticulare, separated from the third involucrum, which is under it, and reclinate.

*EE*, The membrane, or corpus papillare nervosum; in which there stand numerous eminences, which pass from this body thro' the corpus reticulare to the outer membrane.

*FF*, The glands of the tongue, glandulæ linguales: these, as well as the papillæ, are much larger and more distinguishable in the hinder than in the anterior part of the tongue. They are in some subjects much more numerous than in others.

*G*, The foramen, usually found in the hinder part of the tongue. Its figure is uncertain; sometimes round, sometimes oval, sometimes nearly triangular.

Fig. 21. Has already been explained in the account of the second plate, in which it stands.

*Explanation of the Fifth Plate.*

Fig. 22. Shews the human penis, on its upper part; with its veins, and the cavernous substance, injected with crude quicksilver.

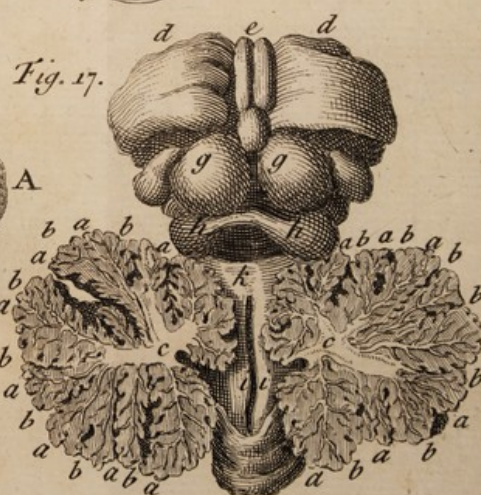
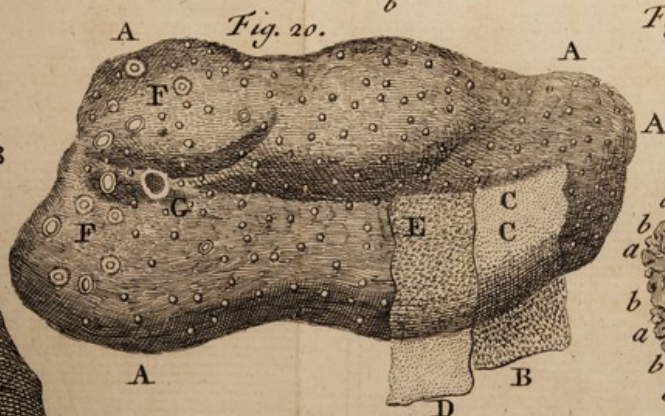
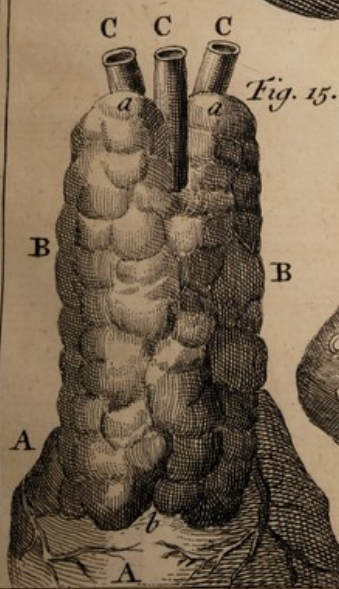
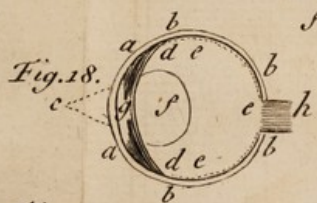
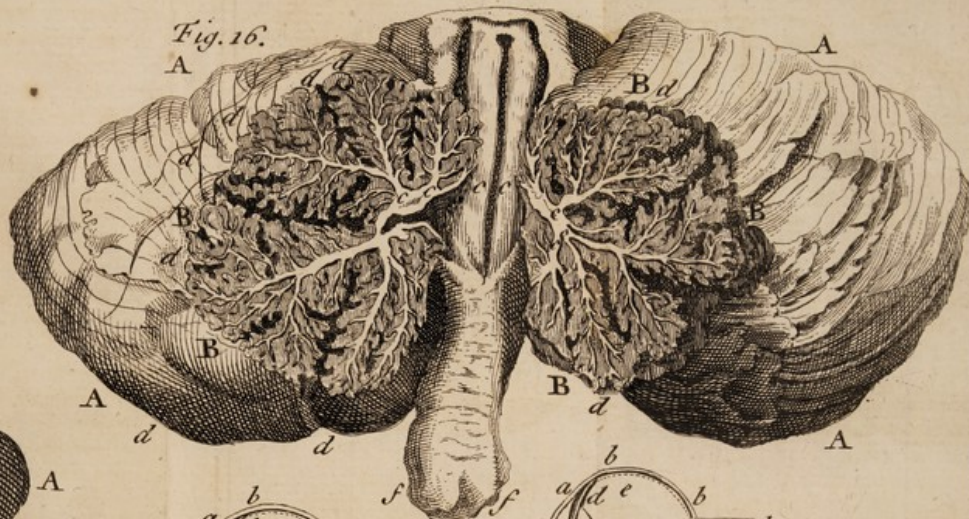
*A*, The trunk of the vena penis; into which, after piercing its valve, the mercury is easily thrown, in sufficient quantity.

*BB*, The division of this vein, about the middle of the penis, into two considerable branches.

*CC*, The sub-divisions and distributions of the smaller ramifications from these, over the corona, and adjacent parts of the penis.

*DD*, The surprising and inextricable course of a multitude of extremely minute ramifications from the former vessels, thro' the whole surface of the glans: they









B

B

Fig. 1



they run here in tortuous and flexuous meanders, in the manner of the intestines, or of feminal vessels in the testicles; and are so extremely numerous, that the whole superficies of the glans seems intirely composed of them.

*eee*, Vessels of various sizes; some very minute, others larger, some very large, which creep along different parts of the penis, surrounding and running over and under one another.

*F*, The termination or extremity of the urethra, where the urine is voided.

*G*, A cord, with which, after the injection, the hinder part of the penis is tied, that the mercury may not run out again, as it otherwise would easily do.

*H*, The hinder part of the penis cut off.

Fig. 23. Represents the lower surface of the same penis, in which the veins, thus filled with mercury, are seen running in a strangely irregular and devaricated manner, and making frequent anastomoses one with another over this whole surface, and particularly over the urethra. They are extremely numerous in every part of this surface of the penis, but particularly about the frænum; where they are, indeed, too elegantly ramified to leave it in the power of an engraver to do them justice; but are beautifully seen in the preserved preparations of the part.

*A*, The frænulum of the penis, furnished with a multitude of vessels finer than hairs.

*B B*, The corona and neck of the penis, furnished with a yet greater number of vessels of the same extreme minuteness.

*C C*, The whole inferior superficies of the glans, full of extremely minute vessels, like the other surface, and these spreading and devaricating in the same wonderful manner.

*D D*, The urethra, protuberating. The corpus cavernosum of this part, being filled with the quicksilver, extends it in this manner, and occasions a beautiful view of the minute and innumerable vessels which run over it.



*E E*, The two corpora cavernosa of the penis, containing the urethra between them, filled also with the quicksilver. These, as well as the urethra, are covered with a multitude of vessels, some of them considerably large, which run with a number of flexuosities and anastomoses all over them, and are filled, as the rest, with quicksilver.

*F*, The end of the urethra.

*G*, The cord with which the penis is tied.

*H*, The hinder part of the penis cut off.

It is not always that a penis can be thus completely and beautifully injected, tho' the same caution be used in the operation. It frequently happens, that the matter of the injection, thrown in at the vein of the back of the penis, makes its way out by the urinary passage: but even miscarriages of this kind are not without their use: we discover by this the communication that there is between the urinary passage and the veins of the penis, and may make a more natural guess at the progress of the venereal taint from it than any way else.

*Explanation of the Sixth Plate.*

Fig. 24. Exhibits a drawing of a human testicle, the seminal vessels of which have been unfolded in the manner first taught by Ruysch.

*A*, The tunica albuginea of the testicle, separated from the seminal vessels, and turned back.

*B B*, The seminal vessels of the testicle unfolded: in these the matter of the semen is elaborated: they hang in the manner of hairs; and the whole interior substance of the testicle may be seen to be composed of them.

Fig. 25. Represents a human testicle of a very peculiar structure, demonstrated in the publick schools at Helmstadt.

*A*, The descendent aorta.

*B*, The vena cava inferior.

*C C*, The emulgents.

*D*, The origin of the spermatick arteries from the trunk of the aorta.



Fig. 22.

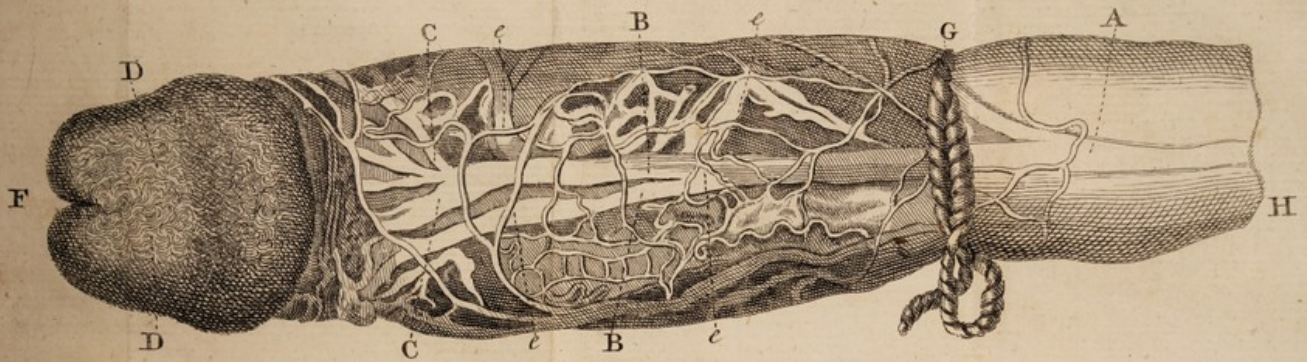
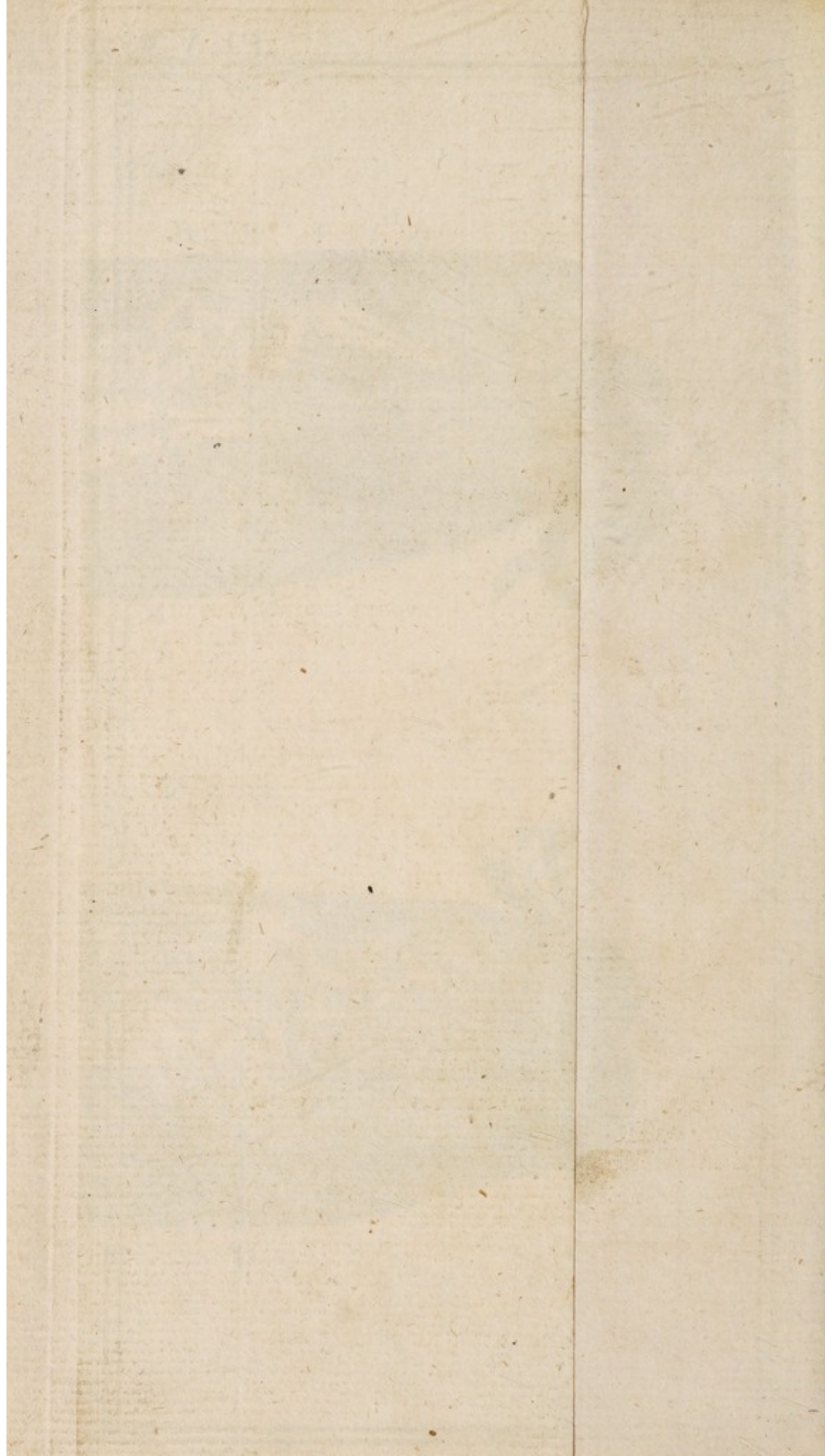


Fig. 23.









*e*, The right spermatick vein, from the trunk of the vena cava.

*f*, The left spermatick vein, arising from the left emulgent.

*g*, The right spermatick vein and artery, folded together in the usual way, and running to the testicle.

*h*, The right testicle.

*ii*, The epididymis, taken out of the scrotum.

*k l*, The vas deferens, or ejaculatory vessel. All these three were in their natural condition and situation on this side.

*m*, The left testicle, which had never descended into the scrotum; but remained in the abdomen, in that part where the spermatick vessels usually make their way out of the abdomen. This was much smaller than the other, and had no epididymis.

*n o*, Represents the epididymis, which, in this subject, was almost intirely separate from the testicle: it only adhered to it at *n*. The rest of it, after passing thro' the place usually destined for the road of the spermatick vessels among the muscles of the abdomen, went out of the abdomen, and extended itself quite down to the scrotum; so that the part marked *o*, which is its lower extremity, was situate in the upper part of the scrotum.

*p*, The duct, or vas deferens, as if it had come from the testicle in the scrotum, ascending again into the abdomen, under the testicle *m*; whence going on to

*q*, It emerged again; and, in the usual way, from the letter

*r*, Passed to the vesicula seminalis of its own side.

*R*, The place where the spermatick vessels divided; and part

*s*, Went to the testicle; but part

*t*, Also went to the epididymis.

We have opportunity of observing, in this *lusus naturæ*, in what an exact and regular manner a part, a little different from the ordinary state, may be formed. In this nothing was wanting; but the parts which are usually joined, namely, the testicle and the epididymis, were separated from one another; yet all was provided for.

As



As the testicle, in the usual course of nature, should have been in the scrotum, but was accidentally lodged, in this case, in the abdomen; nature yet took care, that a part of the apparatus of it, namely, the epididymis, with part of the ejaculatory vessel, should pass out of the abdomen toward its usual place: and thus, tho' the fabrick of this testicle was not of the usual kind, yet, by this contrivance, it was rendered capable of performing all the necessary offices of a testicle, as much as if it had been constructed exactly in the usual manner. There is no question but that, according to this fabrick, the semen might pass from the testicle thro' the epididymis to the vasa deferentia.

Fig. 26. *aaa*, Exhibits the right vesicula seminalis opened, recent, but washed; so that not only its various cellules, but its internal reticulated surface, described by Santorini, come in view.

*bbb*, The internal reticulated surface, appearing like a corpus reticulare; and much resembling the interior surface of the gall-bladder, as Ruysch has drawn it. In the cells of this reticulation, probably, the semen receives a yet farther elaboration than it had had before. The object itself, properly cleansed, exhibits a view of this structure, however, much better than a figure can represent it.

Fig. 27. Represents a human foetus of three months: an abortion included, in a beautiful manner, in its membranes, as it were, in an egg, and swimming in its own liquor. Every thing is represented, in this figure, of the natural size.

*A*, The foetus, with its large head; the eyes large, protuberant and black, as they usually are in this state, appearing thro' the liquor and membranes.

*BBB*, The exterior tunic of the chorion, which is very full of vessels, which hang every where in great numbers, in the manner of fibrous roots. This is a circumstance most of the anatomical writers had not hit upon, 'till this subject occurred.

*CCC*, Part of the pellucid tunics of the foetus, from the others of which this vascular part is separated,  
and



Fig. 24.



Fig. 25.

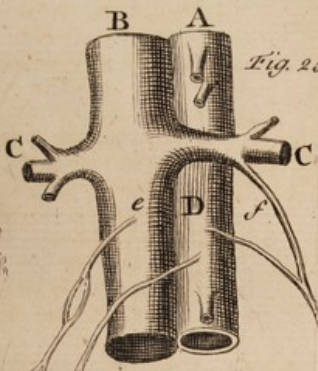


Fig. 28.

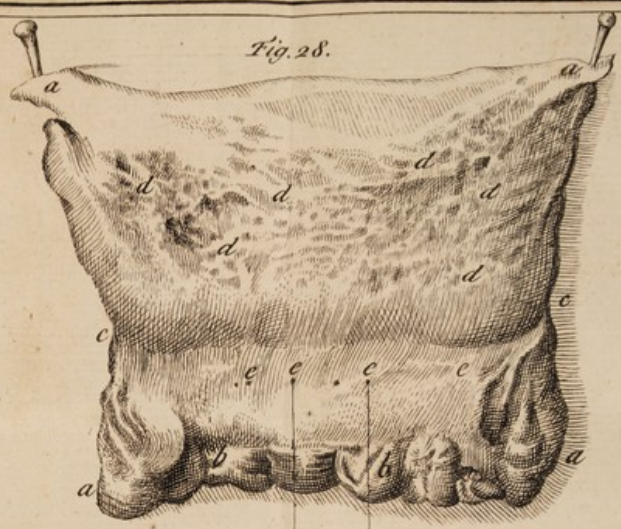


Fig. 27.

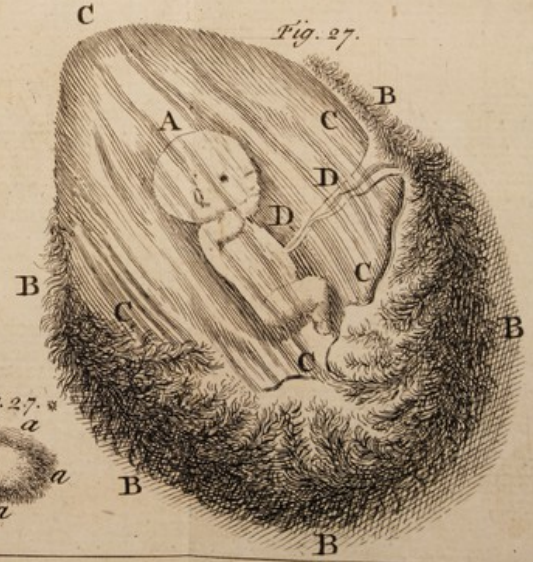


Fig. 26.



Fig. 27.









and drawn back, that it might be in view, together with the foetus in its liquor. The greater part of this ovum humanum, if we may be allowed the expression, is furnished with the same kind of fine slender fluctuating vessels.

*DD*, The funiculus umbilicalis, appearing but in an imperfect manner at this period.

Fig. 27. *aaa*, Exhibits an ovulum from a woman, who was, as herself imagined, about a month gone with child: it was evacuated with great pain, and a large hæmorrhage, from the uterus. It is almost pellucid, and exhibits in its circumference a great number of vessels, or radiculæ of the chorion, like hairs.

*b*, A little corpuscle visible in it, and seeming the imperfect sketch of the embryo.

Fig. 28. *aaaa*, Exhibits part of the anus and intestinum rectum opened.

*bb*, Certain unequal and irregular eminences and rugæ in the outer circumference of the anus; where also there appeared, in this subject, a number of tumid livid veins.

*ccc*, The margin or verge of the anus, where, from the letters *cc* to *aa* on the under part, there appear a kind of fimbriæ; when the sphincter and the rectum usually differ in colour.

*dddd*, Expresses a multitude of very minute apertures or oscula, about the extremity of the intestinum rectum, together with a number of roundish glands.

*eee*, Certain larger oscula, or apertures, large enough indeed to admit a hair: these are situate below the fimbriæ of the rectum, where the sphincter is placed.

*Explanation of the Seventh Plate.*

Fig. 29. Exhibits the ileum, colon, cæcum, and its vermiform appendage, as they were found in a new-born infant; distended by inflation, and dried.

*AA*, Part of the ileum, in which is shewn its ingress into the left side of the colon.

*BB*,



*BB*, Part of the colon.

*C*, The cœcum; with its change into the processus vermiformis, which is peculiar and different in this state from what it is in adults. In infants of this period the cœcum becomes gradually smaller and smaller, 'till it forms this process, so as in the whole to be of a sort of conic figure; whereas, in adults, it is much otherwise.

*DE*, The vermiform process of the cœcum, which, in this subject, was inflected in a very singular and extraordinary manner. It first passed under the ileum from *C*, and ascended to *D*: after this it was again reflected above the ileum, and descended to *E*.

Fig. 30. The same intestines presented in a back view, in order to the shewing more distinctly in what manner it is that the cœcum is transformed into the processus vermiformis, usually in infants.

*AA*, The ileum, with its ingress into the colon.

*BB*, The colon.

*C*, The cœcum.

*D*, The beginning of the vermiform process.

*EE*, The singular inflexion of it, in this subject, about the ileum.

Fig. 31. Exhibits a processus vermiformis of the cœcum of an adult separated, with its peculiar flexions and gyrations. This is longer than the process usually is.

*A*, Its beginning, cut off from the cœcum.

*B*, Its extremity, turning upwards.

*C*, Its singular flexions.

Fig. 32. Represents the longitudinal sinus of the dura mater; into the sides of which, in this subject, a peculiar transverse sinus was inserted.

*AA*, The open part of the longitudinal sinus.

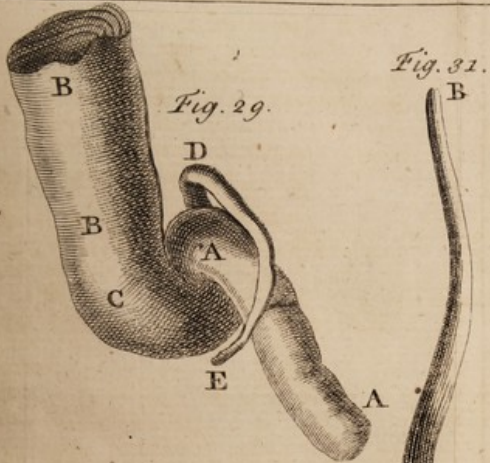
*B*, The place where in this subject it divided, accurately and exactly, into two equal lateral ones; which is not the case indiscriminately in all subjects.

*CC*, The beginnings of the two lateral sinus's.

*DD*, The lateral sinus's, cut off in their progress.

*E*,

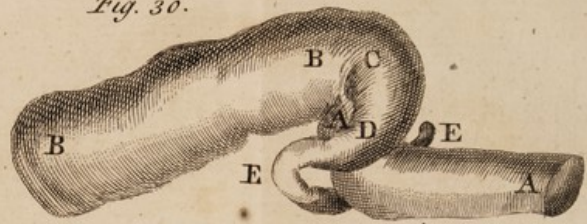




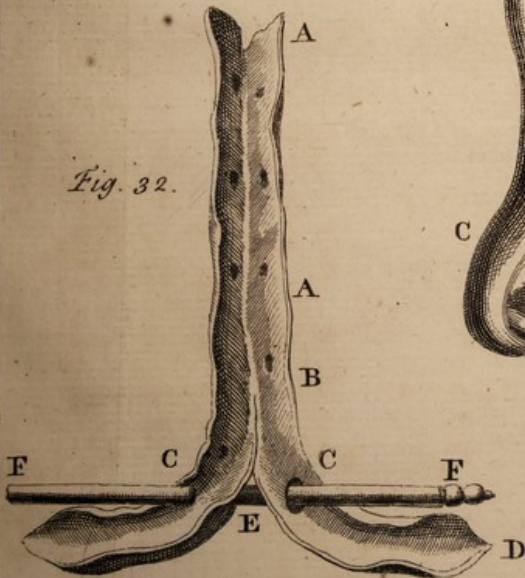
*Fig. 31.*



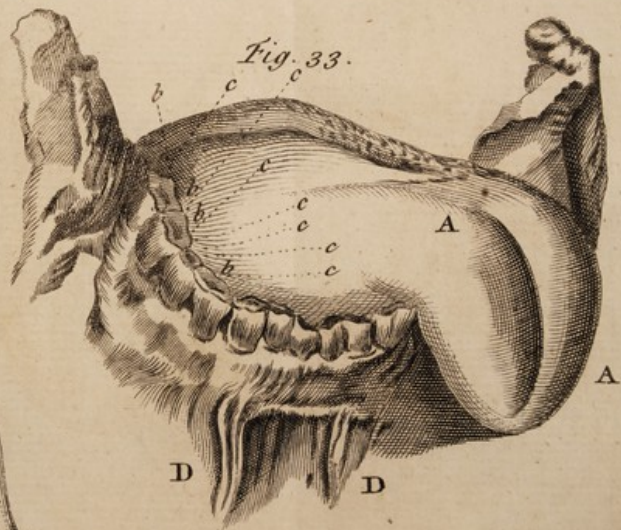
*Fig. 30.*



*Fig. 32.*



*Fig. 33.*









*E*, The transverse sinus, which made a communication between the two lateral ones.

*FF*, A thick style, which passed easily thro' this transverse sinus.

The opening of this transverse sinus was smaller on the left side than on the right.

Fig. 33. Exhibits a view of the tongue, with the lower jaw, to which it adheres. We see in this the oscula of the salival ducts of the sublingual gland, as they appeared in the subject, mentioned S. 278, of this Compendium.

*AA*, The tongue, turned to the left side.

*bbb*, The oscula of the ducts of the sublingual gland, seven of which appeared on this side.

*ccc*, Bristles introduced into the oscula of these parts.

*DD*, The two elevator muscles of the lower lip.

The first or anterior of these oscula in the left side of the tongue in this subject was so large, that not only a bristle, but a small tube, was introduced into it, and an inflation might be made by it. The other oscula in general were smaller, especially two or three of them.

*Explanation of the Eighth Plate.*

Fig. 34. Exhibits a human tongue, in which two remarkable salival ducts were discovered in the foramen, commonly called cœcum, from its supposed closing at the end.

*A*, The foramen cœcum, which, in the subject examined on this occasion, was remarkably large, opened.

*b*, A salival duct, running towards the root of the tongue, filled with a red injection.

*cc*, A vesicle at the extremity of this duct, distended with saliva.

*d*, The beginning of another duct in the left side. This was not filled by the injection; but it was easily distinguished, as a duct, from the rest of the substance of the tongue by its whitish colour; and it was capable



of being distended by inflation, by means of a fine tube introduced into its orifice.

*e*, The place where this duct disappeared.

*ff*, The situation and course of these ducts: it is observable that they do not run along the surface of the tongue, but at the depth of a line under the involucra of it, which are removed in this figure.

The fabrick and structure of the oscula, expressed at *b* and *d*, was singular: they had the appearance of valves, or caruncles, which had collapsed; and did not appear as represented in the figure, unless forced open by inflation.

*gg*, Shew three other oscula, or foraminula, which were situated in the larger; one in the anterior part, and one on the right; the other on the left side. These admitted a bristle to a little depth, in an oblique direction; but it was impossible to find whether their cavity penetrated any farther. From this it appears, that this foramen, in subjects that have it, (for it is not universal) serves as a kind of common duct to various other smaller salival ducts of that part of the tongue: but, in all this, nature is by no means constant, but varies greatly.

*h*, The epiglottis.

*i*, Its anterior ligament.

*k*, Muscular fibres arising from the substance of the tongue, and inserted into this ligament, as if into a tendon. These, when they are found, (for all subjects have them not) serve for the raising the epiglottis, and may be understood to be properly a muscle of the epiglottis, and called glosso-epiglottideus.

*ll*, Two little ossicles of the os hyoides.

*mm*, The extremities of the horns of the os hyoides.

*nn*, Glands and papillæ of various shape, visible on the surface of the tongue about its middle.

*o*, The apex of the tongue, bent downwards.

Fig. 35. Exhibits the ducts beforementioned, as taken out of the tongue, with the foramen cœcum, which, in this figure, is not dissected, but appears as a common duct to several smaller ones.

*A*, The foramen cœcum, very large, as it appeared in this subject, with the canal formed by it, which was

near



near three lines long, and easily admitted a tolerably large tube.

*B B*, The two new salival ducts terminating in it, of the shape and size they appeared in this subject.

*C C*, The termination of these ducts, or, at least, the place beyond which they did not appear to run.

*D*, The place where the left duct became expanded into a pellucid vesicle, which was filled with a clear and colourless, but somewhat viscid fluid, having the appearance of saliva, and which seemed to have been forced thither by the throwing in the matter of the injection, which was of coloured wax.

Fig. 36. Exhibits several things that are observable in the palate, about the palate, and in the upper lip.

*a a*, The upper part of the palate, in which there appeared in this part no oscula or openings.

*b b*, The posterior part of the palate, very glandulous: in this part there appeared, in this subject, a great number of excretory oscula, or apertures, very manifest and obvious. Some of these readily admitted a fine style, many of them a bristle, to the depth of three or four lines; but this not in a strait direction, but somewhat obliquely toward the hinder part. These seldom appear so large as they did in the subject from which these drawings were made.

*c*, The place which corresponds to the canals, that Steno says are conspicuous in the osseous part, behind the dentes incisores, and run to the nose: but in this subject, tho' all the other parts in question were so remarkably large and fair, there was here no aperture, nor the vestige of any passage into the nostrils.

*D D D*, The upper lip bent back, that the interior parts may appear.

*d d d d*, Its lenticular or miliary glands, as they appeared in this subject, on removing the internal membrane of the mouth, extending themselves on each side as far as to the second of the dentes molares.

*e*, The ligament of the upper lip.

*f f*, Two conglomerate glands, observed in this subject, with certain excretory ducts, not described by any of the former anatomical writers.



*g g*, Bristles and styles let into these oscula, or apertures, to the depth of about two lines.

*i*, A part of this gland, where there appeared two large oscula, or apertures, which, on pressure, discharged some drops of saliva, in the manner of dew-drops.

Fig. 37. Exhibits the left of these two glands: its exterior surface is represented here, by which it is evidently seen to be of the conglomerate kind.

Fig. 38. Represents several things about the fauces and uvula, visible in the head and the upper jaw, viewed from below.

*a*, The duct in the fornix, or upper part of the fauces, situated under the anterior process of the os occipitis; and described in its place, in this work, as a mucous duct.

*b*, Its extent under the apophysis of the os occipitis, toward the great foramen, which is at least five lines in length.

*c*, The left Eustachian tube, with its oblique longitudinal aperture, and the cartilaginous limb surrounding it, as they appear, if viewed a little obliquely from the opposite side.

*d*, The right Eustachian tube, as it appears on the same view, in which we cannot look into its orifice, but can only see the posterior or exterior verge or limb.

*ee*, The oblique progress of both these tubes, as they run toward the ears.

*f*, A little hook, drawing off the muscle which lies upon the tube sideways; by which means the Eustachian tube of that side is brought much better into sight than it would be.

*g g*, The muscoli salpingo-staphylini, inserted into the hinder part of uvula, and serving to draw it back.

*h h*, The muscoli pterygo-staphylini, which are turned back over the corniculus, or styloide apophysis of the interior lamina of the pterygoide process, as if over a pulley, and inserted into the anterior part of the velum palatinum. Morgagni denies that these are properly



properly muscles of the uvula, because, he says, their tendons are affixed to the extreme verge of the bone of the palate: but a close inspection shews, that they are indeed partly affixed to this bone, but in part also to the velum of the palate.

*ii*, The fine and slender apophyses in the pterygodei, which Santorini has very properly distinguished by the name of cornicula, or little horns.

*k*, The uvula, bent back to the palate: in its middle, the glandulous membrane of the palate being separated, there appears the muscle called by Morgagni azygos uvulæ, as it appeared in this subject.

*ll*, The muscle of the uvula, called the ceratostaphylinus, lightly touched.

*mm*, The two posterior apertures of the nostrils, with the manner in which they open into the fauces.

*n*, The posterior part of the septum nasi, made by the vomer.

*oo*, The two heads of the occipital bone, which are articulated with the upper vertebra.

*p*, The foramen magnum, or great aperture of the occiput.

*qq*, The ears, appearing in some degree in this view.

The other parts, not immediately the subject of this disquisition, it is unnecessary to mark out.

Fig. 39. Exhibits the os vomeris, or vomer, which Santorini does not allow to be a distinct bone, but only a part of the os ethmoides: it is exhibited singly and distinct here, as it was taken from a subject of about thirteen years old. In this subject it was perfectly distinct and separate from the ethmoides; but it is to be observed, that in adults it concretes, and grows one bone with it.

*aa*, The vomer, consisting of two distinct lamellæ, or bony parietes.

*b*, The hollow, which receives the apophysis of the sphenoidal bone by gomphosis, with its edges reclined. This receives the apophysis just mentioned, as the alveoli of the jaws do the teeth; whence these two bones are very properly said to be joined by gomphosis.



*cc*, An interstice in its whole upper surface, between the two lamellæ; into which is inserted part of the septum nasi, which arises from the os ethmoides.

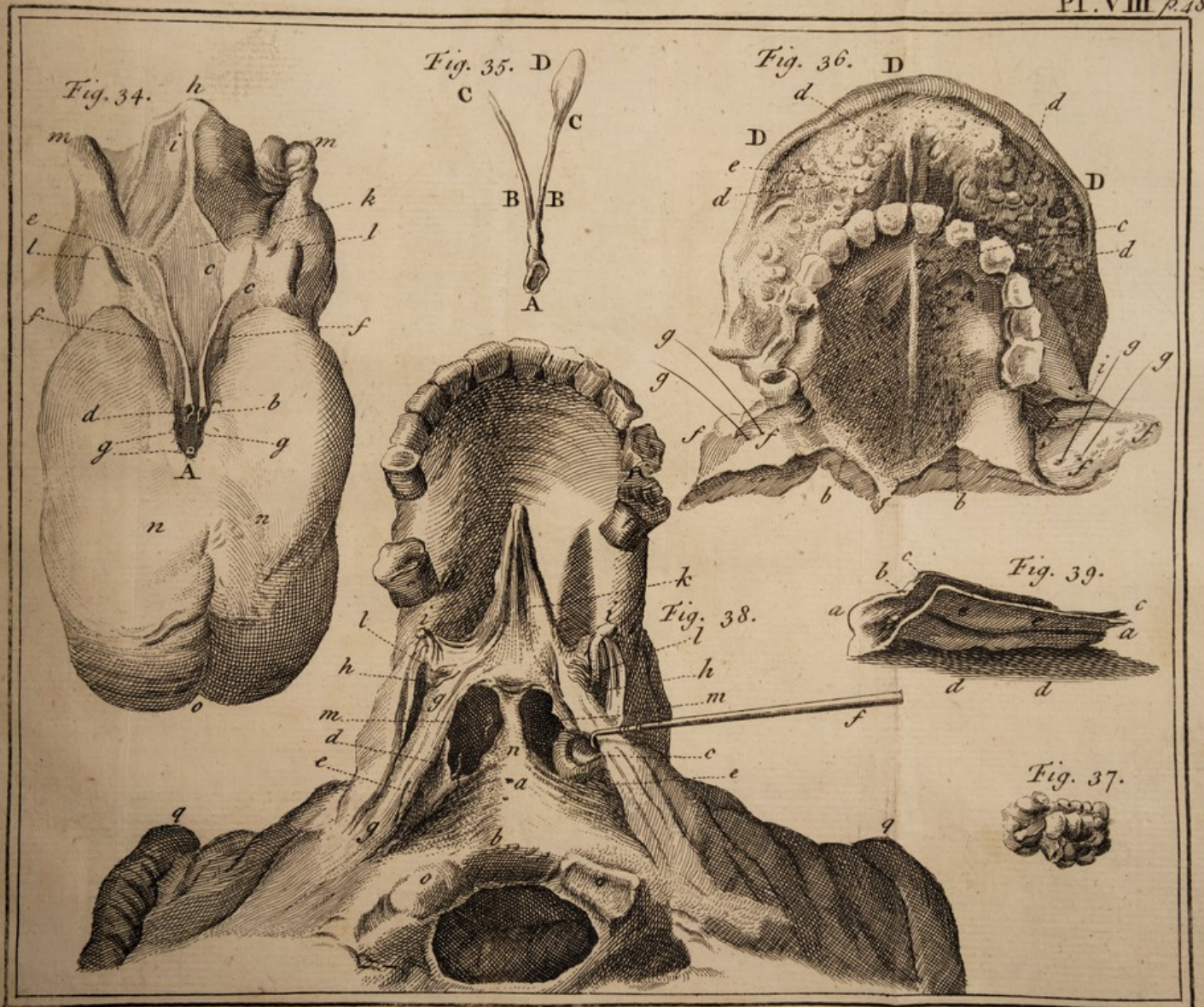
*dd*, The lower part, which is made with an edge, in the manner of a plough-share: this adheres to the bones of the palate, where they join one another.

*ee*, The right lamella, or paries of the vomer; to which the left lamella is placed opposite, in the other side.

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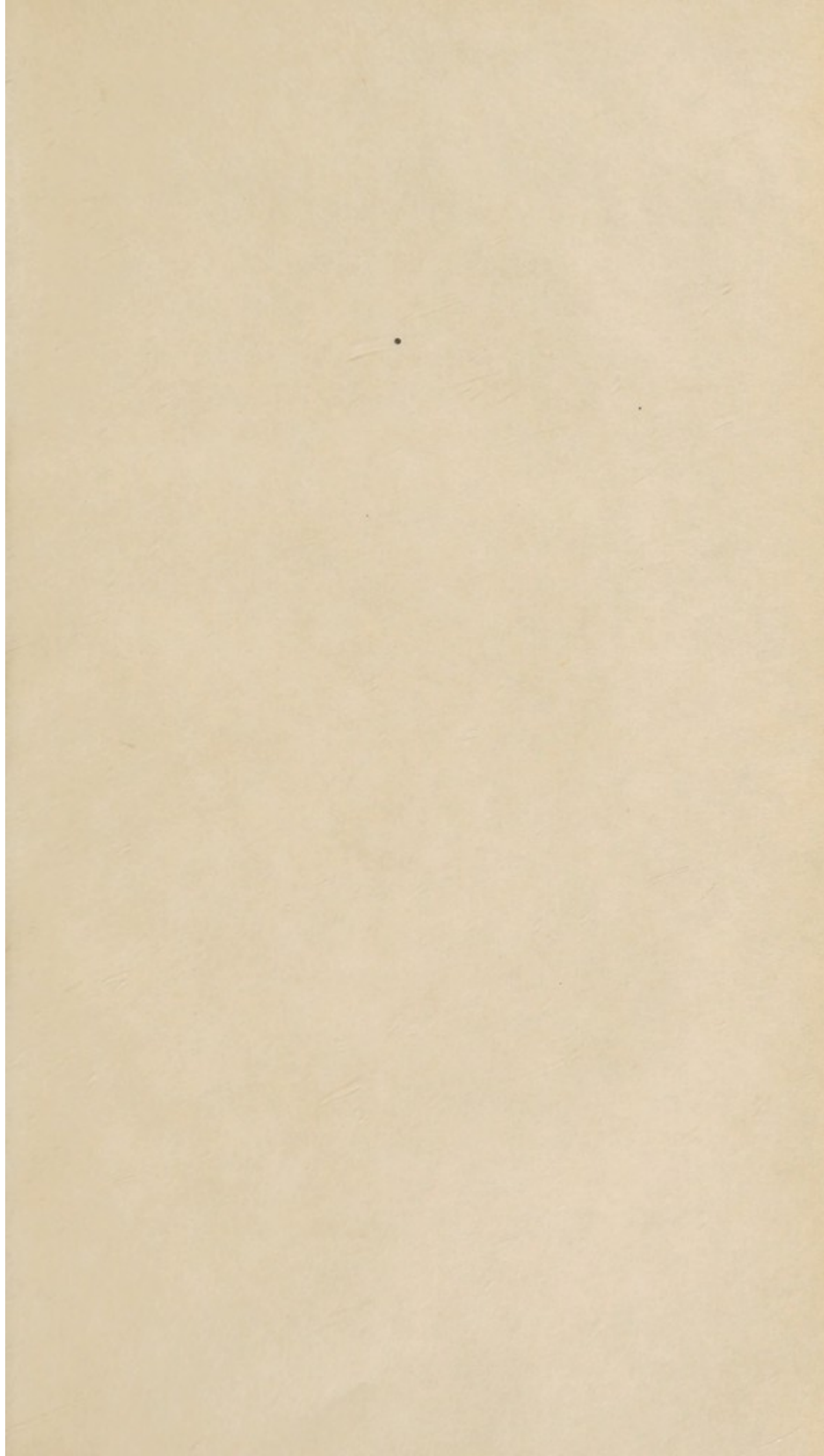
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