THE ANATOMY OF Humane Bodies EPITOMIZED.

WHEREIN

All the *PARTS* of Man's Body, with their *ACTIONS* and *USES*, are succinctly described, according to the newest Doctrine of the most Accurate and Learned Modern Anatomists.

The SEVENTH EDITION, *Corrected and Improved, both in the Discourse and Figures.*

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LONDON:
Printed for W. TAYLOR, at the *Ship* and *Black Swan* in *Pater-noster-Row*; and W. MEARS, at the *Lamb* without *Temple-Bar*, 1721.

Librum hunc cui Titulus,

THE

ANATOMY of Humane Bodies,

Dignum censemus qui Imprimatur.

Tho. Millington, Præses.

Gault. Charleton,
Rob. Pitt,
Sam. Garth,
Humphred. Brooke,
} Censores.

Jan. 6. 170$\frac{2}{3}$.

TO THE

READER.

INstead of *beſpeaking* the Reader's Favour (as is common with Authors) I have the pleaſanter Task of *boaſting* of *it*: For to *that* chiefly is it owing, that this Book, which deſerved not a *Second Impreſſion*, has now paſt a *Seventh*. And I hope thoſe who have been ſo *kind* as to buy off the *former*, will not reckon it for a Fault, that *This* pretends to be more correct and compleat than they; for to have continued the known Errors and Imperfections thereof, would have been an Injury both to the Reader, and to my ſelf: *To the Reader*, in obtruding acknowledg'd Errors, and concealing new Diſcoveries; And *To my ſelf*, in

giving Occasion to be thought negligent in what I have taken so great pains in, and ignorant of what I know.

But my publishing this Book now a *Seventh* time in *English*, needs a better Apology than I can give: Only this I can say, That though it speak *English*, yet none shall well understand it, that is a Stranger to the more learned Languages: And therefore it disdains the Conversation of *Quacks* and *Old Women*, leaving them to meditate on the traditional Virtues of their Receipts, without offering to instruct them in *the Knowledge of themselves*, of which their Ignorance and Impudence render them incapable in any Sense.

Its Ornaments indeed are in a great measure borrow'd, but it fears not the Fate of the *Daw* in the Fable, to be unplum'd and laugh'd at; because they are not *furtivi colores*, seeing it struts not in them as its own, but has every where the Ingenuity to confess the true Owners, whom if the Reader desire to know, it here presents him with a List of the Principal.

Adrian. Spigelius *de Humani Corporis fabrica.*
Isbrandi de Diemerbroeck *Anatome Corporis humani.*
Thomæ Bartholini *Anatome.*
D. Willisius *de Cerebro.*
——*Exercitationes Medico physicæ duæ,* 1. *De Sanguinis Accensione.* 2. *De motu Musculari.*

——*De primis viis, & de respirationis organis,* in his first and second Part of his *Pharmaceutice Rationalis.*

Dr. Highmore's *Corp. hum. Disq. Anatomica.*

M. Malpighii *Epistolæ Anatomicæ de Cerebro, Linguâ, Tactûs organo.*

——*De viscerum structura,* viz. *Hepatis, Cerebri, Corticis & Lienis.*

——*Exercit. de Omento, Ping. & Adip. duct.*

Nicolai Stenonis *Dissertatio de Cerebri Anat.*

——*De Musculis & Glandulis Observationum specimen.*

——*De Glandulis Oris, & novis earundem vasis Observationes Anatomicæ.*

Caroli Fracassati *Dissertatio Epistolica de Cerebro.*

Dr. Lower's *Tractatus de Corde.*

Dr. Glisson's *Tractatus de Ventriculo & Intestinis.*

—— *Anatomia Hepatis.*

Dr. Charlton's *Enquiries into Humane Nature, in* IV *Anatomick Prelections in the New Theatre of the Royal College of Physicians in* London.

Dr. Wharton's *Adenographia, sive Glandularum totius Corporis Descriptio.*

Lamb. Velthusii *Tractatus duo Medico-physici, unus de Liene, alter de Generatione.*

Dr. Harvey's *Exercitationes Anatomicæ de Cordis motu, & circulatione Sanguinis.*

——*Exercitationes de generatione Animalium.*

Casp. Bartholin. (*Thom. F.*) *Diaphragmatis structura nova.*

Francisci Stockhamer, *Doctoris Medici & Anatomici Microcosmographia.*

Laurentii Bellini *Exercitatio Anatomica de structura & usu Renum.*

Dr. Grew's *Comparative Anatomy of Stomachs and Guts,* subjoined to his *Musæum Regalis Societatis.*

Ant. Nuck *de ductu salivali novo, saliva, ductibus Oculorum aquosis, & humore aqueo.*

Gualt. Needham *Disquisitio Anatomica de formato fœtu.*

Joh. Conr. Peyeri *Parerga Anatomica & Medica*, viz. *de Glandulis, Intestinalibus*, &c.

Joh. Conrad. Bruneri *Experimenta Nova circa Pancreas.*

Dr. Mayow's *Tractatus quinque Medico-physici*, &c.

Regneri de Graef *Opera omnia.*

Johannis Swammerdami *Miraculum Naturæ, sive uteri Muliebris fabrica.*

Joh. Alph. Borelli *Opus posthumum de motu Animalium.*

Frederici Ruyschii *responsiones ad D. Joh. Gaubium, & Joh. Jac. Campdomercum.*

Dr. H. Ridley's *Anatomy of the Brain.*

Dr. Brigge's *Ophthalmographia, sive Oculi ejusq; partium Descriptio Anatomica.*

Dr. Cole's *Cogitata de Secretione Animali.*

Dr. Croone *de ratione motûs Musculorum.*

Mons. du Verney of the *Ears.*

Tauvry's *Anatomy.*

Dr. Henshaw's *Aero-Chalinos.*

Mons. Perrault *Essais de Physique*, &c.

Steph. Blancardi *Anat. Reformata.*

Philippi Verheyen *Corporis humani Anatomia.*

Dr. Haver's *Osteologia nova.*

Mr. Cowper's *Appendix to his* Myotomia reformata.

Not to mention divers others.

These,

Theſe, I ſay, are the Authors which have chiefly adorn'd this *Book*, ſome whereof were not ſought to in the former Editions; and thoſe that were, have now (ſome of them) been more liberal in contributing their Symbols to make it more complete.

As it is, if it may *aſſiſt the Memory* of ſuch as are *well-skill'd* in Anatomy, or *inſtruct* and *direct* the young *Beginner*, I have not miſs'd of my Deſign.

Farewell.

THE

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THE

THE

Introduction.

ANATOMY *is the artificial Separation of the Parts of the Body by Section, instituted for the attaining to the Knowledge of its Frame, and the Use of each Part.*

Anatomy what.

All animal Bodies of convenient Bulk, are the *Subject* of Anatomy: But an human Body is the Primary, both because its Frame is more perfect and exquisite than that of another; and because the Anatomist dissects others, to the end only that by comparing those with this, he may obtain a more accurate Knowledge of it, the Preservation and Cure whereof is the principal and ultimate *End* of Anatomy.

Its Subject, and End.

This Art being so noble for its *Subject*, and so beneficial for its *End*; as many as have taken pains in cultivating of it, have deserved very well of Mankind: for Skill therein, as it is very pleasant and satisfactory unto all, so is it absolutely

neceſſary for ſuch as take upon them to adminiſter Medicin, or practiſe Chirurgery. But the *Minima* or ſmalleſt Particles, whereof the Parts of our Bodies conſiſt, being ſo very fine, that many of them cannot be diſcovered by the naked Eye, and ſome deny to ſhew themſelves to the beſt Glaſſes that have yet been invented; 'tis no wonder that there have been and ſtill continue various Opinions concerning the nature of ſeveral Parts, and conſequently of their Actions and Uſes, and the manner and reaſon of them. But the unwearied Diligence of ſome later Anatomiſts hath brought many things to light, wherein all Antiquity was miſtaken; whoſe Diſcoveries, collected with the greateſt Care, I ſhall inſert (with due commemoration of the Authors) in their proper Places in this Treatiſe. Before our Entrance whereupon, I think it neceſſary, by way of *Introduction*, firſt to explain to the young Student in Anatomy, what thoſe *ſimilar* Parts are that the Bulk of the Body conſiſts of; that when *diſſimilar* Parts which conſiſts of them, are deſcribed, he may the better underſtand what is ſaid.

The Fabrick of the Body conſiſts of parts ſimilar and diſſimilar.

And firſt we muſt explain what is meant by *ſimilar* and *diſſimilar* Parts. *A ſimilar* (otherwiſe called a *ſimple*) Part, is that which though it be cut or divided into ſeveral Pieces, yet they will be all of the ſame Nature, ſubſtance and denomination one with another, and with the whole; as every portion or particle of a *Bone* (v. g) is *Bone*. A *diſſimilar* (otherwiſe called a *compound*, and an *organical*) Part, is that whoſe portions are neither of the ſame ſubſtance, nor denomination: as (*v. g.*) a *Finger*, which conſiſts of the Skin, Fleſh, Bone, *&c.*

Similar parts what.

Diſſimilar what.

OF

Of this later kind of Parts, this is no proper place to treat: And as concerning the former, the Reader muſt underſtand, that though they be called ſimple or ſimilar, 'tis not meant that they are *truly* ſo: (for there are none amongſt thoſe we term ſo, whoſe leaſt Particles are not of different natures and kinds;) but that they appear ſo to the more ſuperficial and ſlight View of the Anatomiſt; and to diſtinguiſh them from the compound or diſſimilar Parts, whoſe diverſity of ſubſtance the Eye at the firſt Glance diſcovers.

Similar Parts are Eleven.

Theſe ſimilar Parts are commonly reckon'd to be Eleven, *viz.* the *Skin*, a *Membrane*, *Fleſh*, a *Fibre*, a *Vein*, an *Artery*, a *Lympheduct*, a *Nerve*, a *Ligament*, a *Cartilage*, a *Bone*. Theſe are common to the whole Body, there being no diſſimilar or organical Part which does not conſiſt of ſeveral of them. There are beſides theſe, other Parts which may alſo be called ſimilar as to their ſubſtance; but becauſe they are proper only to ſome particular Part, 'twill be more convenient to treat of them when we come to ſuch Part: and therefore we ſhall omit to ſpeak of them here, and confine our ſelves to the Parts mention'd.

I. *The Skin.*

The Word *Skin*, though in a large and vulgar acceptation it be applied to the Membranes of the Muſcles, *&c.* (as we commonly ſay ſuch a piece of Fleſh is *skinny*) yet Anatomiſts underſtand it only of the outward integument or cover of the Body, which the *Latins* term *cutis*.

II. *A Membrane.*

The word *Membrane* is a common appellation to all the coverings that inveſt the ſolid parts of the Body, or contain the fluid humours. Thus the Bones, Muſcles, Brain, *&c.* are cloathed

with Membranes; and the Gall, Humours of the Eye, *&c.* contained in them.

III. *Fleſh, four ſorts of it.*

Fleſh is an uncertain Term, unleſs ſome reſtrictive Explication be added to it, to limit its being meant of this or that particular ſort of Fleſh; there being four ſorts of it, *viz.*

1. *Muſcular.*

1. That of the *Muſcles*, which moſt properly bears the Name; and comprehends all the red, ſolid (yet ſoft) ſubſtance, that the bulk of the Body chiefly conſiſts of; which ſhall be farther deſcribed in the *fifth Book.*

2. *Viſcerous.*

2. That of the *Viſcera* or *Bowels*, *viz.* of the Liver, Spleen, and Kidneys, of which in the *firſt Book.*

3. *Membranous.*

3. *Membranous* fleſh, that namely which is partly membranous, and partly fleſhy, as the ſubſtance of the Gullet, Stomach, Inteſtins, Womb, Bladder, and the *Membrana carnoſa* (ſo called) it ſelf; of all which more afterwards in their proper places.

4. *Glandulous.*

4. That of the *Glands* (or Kernels.)

Glands of two kinds.

The *Glands* in reſpect of their *conformation*, are uſually divided into *conglobate*, and *conglomerate*; and theſe have a different *Uſe* the one from the other.

1. *Conglobate.*

1. The *conglobate* are ſmooth in their ſurface, and are made up of one continued ſubſtance as it were: the *Uſe* whereof is to ſeparate the *lympha* from the arterial blood, and to remand it by the Lympheducts, either into the chyliferous, or ſanguiferous veſſels (only thoſe in the Meſentery, as likewiſe thoſe in the Breaſts of Nurſes are thought to miniſter to the chyle, as well as to the *lympha.*)

2. *Conglomerate.*

2. The *conglomerate* are ſomewhat uneven in their ſurface, and conſiſt each as it were of many leſſer glands: and their *Uſe* is, to ſeparate from the Blood, and alſo to elaborate and alter ſeveral ſorts of juices, and

then

then by one or more proper ducts to convey the same into peculiar cavities. As the *Parotides* and maxillar glands convey the *saliva* into the Mouth by their salival ducts, *&c.*

A *Fibre* is defined by Dr. *Glisson* (in *cap.* 4. *de Ventric.*) to be a *body in figure like a thread, slender, tenacious, tensile, and irritable, made of spermatical matter, for the sake of some motion and strength.* They are of two sorts, *fleshy*, and *nervous*: The first constitute a great part of the Muscles, and are tubular, filled with a fluid (of which see more *Book* V. *Cap.* I.) and are the main Instruments of Motion: The latter (being also tubular, as some think) run through, and are interwoven in the nervous Parts, and are the principal Organs of sense: being otherwise called *membranous* Fibres, when they are interwoven in Membranes. IV. *A Fibre.*

A *Vein* is a sanguiferous Vessel, whose larger branches in the habit of the body, especially in the limbs, run next under the Skin, and both there and also in the Venters (*viz.* belly, breast and head) serve to convey back again towards the heart, that blood which was sent from thence by the Arteries into the respective parts. They are of a thinner substance and looser texture than the Arteries: and of a like nature with them (only finer) are the *milky* veins that convey the chyle, and also the peculiar ducts that discharge the particular humours from the conglomerate glands; and somewhat finer yet are the Lympheducts that return the *Lympha* separated from the arterial blood by the conglobate Glands, of which by and by. V. *A Vein.*

An *Artery* is also a sanguiferous Vessel, and generally holds the same course with a Vein, but lies deeper. It can no where be seen in the VI. *An Artery.*

ſurface of the body, but may be felt to beat in ſeveral parts at the ſame time with the heart, and its pulſe is chiefly indicative of the temper of the blood, but partly alſo of the vigour or defect of ſpirits. Its coat is ſtronger and more fibrous and denſe than that of a Vein. Its uſe is, to convey blood and vital ſpirit from the heart into all the parts, for their nouriſhment, and the conſervation of their innate heat.

VII. *A Lympheduct.* *Lympheducts* are ſmall pipes, conſiſting of an exceeding thin and pellucid coat, conveying a moſt limpid humour, called *Lympha*, into the maſs of blood. They are to be found almoſt in all the parts of the body, out of which they ſpring by many ſlender Roots, and by and by joining together make more large and diſcernible Trunks. When I ſay, they convey the Humour contained in them into the maſs of blood; I mean, generally, but not always: for thoſe which ariſe out of the belly, diſcharge themſelves into the *Receptaculum chyli*; and thoſe in the Cheſt, into the *ductus thoracicus*. But then at length the *Lympha* is carried along with the chyle into the ſubclavian Vein: And ſo it comes much to one, as if it were more immediately emptied thereinto. The way to gain a ſight of them is, in a Creature diſſected alive to tye ſome large Vein, which a Lymphatick Veſſel accompanies: for the Lympheduct being tyed at the ſame time, and thereby the current of the *Lympha* ſtopt, the duct will ſtrangely ſwell, and ſeveral Valves in the Veſſel will ſhew themſelves, as ſo many knots in a Reed. The Veins that are tyed with this effect, are the *vena potæ* near its egreſs out of the Liver, the *vena Splenica* near the Spleen, *&c.*

VIII. *A Nerve.* The *Nerves* are whitiſh round veſſels taking their origin from the medullar ſubſtance of the

brain

brain (taken largely) and the ſpinal marrow, conveying thence animal ſpirits into all the parts, for their ſenſe and motion reſpectively. They are without any ſuch ſenſible cavity or humour flowing therein, as the Veins and Arteries have; and conſiſt of a double coat derived from the two membranes that cloath the brain, and a medullar ſubſtance contained therein. Their diviſions and diſtributions do not correſpond with thoſe of the Veins and Arteries, nor have they one common trunk from whence all the reſt are propagated, as thoſe have, but ſpring each from its particular root; unleſs one will call the *medulla oblongata* continued into the *ſpinalis*, a Nerve, and ſo make it the common trunk.

IX. *A Ligament.*

A *Ligament* is a Part of a middle Subſtance betwixt a Cartilage and a Membrane, appointed for the tying of ſundry Parts together. Thoſe which tye the Bones to one another are void of ſenſe, but thoſe that knit other Parts together, are (dully) ſenſible.

X. *A Cartilage.*

A *Cartilage* (or Griſtle) is of a middle Subſtance betwixt a Ligament and a Bone. It is flexible, but inſenſible: and by the drying up of its moiſt glutinous Particles, in Age it often degenerates into Bone; whence, in a great meaſure, is the Stiffneſs in the Joints of old Men, moſt of the Ends of the Bones in their Articulations with one another being tipped with Cartilages, which in Age alſo grow bony.

XI. *A Bone.*

A *Bone* is a very dry, cold and hard Part, inflexible, void of ſenſe, affording ſtabiliment and form to the whole Body. Some Bones are more ſpongy and porous, and others more ſolid. Others again have large Cavities, filled with

Marrow; others none. But of theſe, and all the other ſimilar Parts, more in their proper Places.

Thus much I thought good to premiſe by way of *Introduction*, to make the Reader more capable of receiving both Delight and Benefit in peruſing this Anatomical Treatiſe, to which I now proceed.

The First BOOK.

OF THE LOWEST CAVITY, CALLED ABDOMEN.

CHAP. I.

Of the Division of the whole Body, and of its Parts.

AN *human Body* may be considered either *generally*, with respect to the *whole*; or *particularly*, with respect to each *part* of which it consists. *The Body considered in two respects.*

In its *general* consideration there are to be taken notice of, its external form or shape, its bulk, and its colour. But these Accidents being obvious to the eye of every Man, as well as to the Anatomist's, are no proper subjects for our Discourse. 1. *Generally.*

The *particular* consideration of it observes and describes the figure, connexion and composition or structure of each several *part*, and the great diversity of their Actions and Uses. 2. *Particularly.* The

The division of the whole Body. The *whole* Body is divided into the *Trunk*, (containing three *Venters*) and the *Limbs*. The three *Venters* are the Cavities of the *Abdomen* or Belly, the Cheſt, and Head. The *Limbs* are the Arms, Thighs and Legs.

A part defined. A *Part* may be thus defined, *viz. It is a bodily or ſolid Subſtance, cohering with, making up, and partaking of the life of the Whole, and ſerving for ſome function, or uſe.*

In this definition are implied theſe five things.

1. A part muſt be *ſolid*, whereby the ſpirits and humours are excluded.

2. It muſt *cohere* with the whole, that is, be not only contiguous, but continuous to it: and from hence alſo the ſpirits and humours are excepted, as only touching the ſides of the veſſels as they paſs along, being contained in them, but not united to them.

3. It (with others) muſt ſerve to *compleat* or *make up* the whole. Whence the Child in the Womb is not to be reckon'd a part of a pregnant Woman, though it be knit to her Womb by the Navel-ſtring (the *placenta* intervening) becauſe after delivery ſhe remains a perfect Woman, as ſhe was alſo before Conception.

4. It muſt partake of the *life* of the whole: whereby the nails and hairs are exempted, which have only a vegetative, but no animal life.

And 5. It muſt have ſome *function*, or *uſe*: ſo that preternatural excreſcencies, as Warts, *&c.* are not to be reputed parts, (being alſo excluded by the third head, as contributing nothing to the perfection of the whole.)

Having mentioned the *function* and *uſe* of a part, it will be convenient to explain what is meant by them, and to diſtinguiſh them.

The

The *function* (or *action*) of an (organical) part, *is a certain effective or operating motion produced by it, from its own proper aptitude.* And is either *private*, or *publick.* By the *private* Action the parts only provide for themselves; but by the *publick* for the whole Animal. As for instance: The stomach by a *private* action converts the blood that is brought to it by the Arteries, into its own nourishment: But by its *publick* action, which is Concoction, or turning the food into chyle, it provides for the whole Body.

The function of a part what. It is two-fold, private and publick.

The *use* of a part is that assistance which the less principal parts afford to the principal one in performing its Action. And it differs from the *action* of a part in *two* respects. *First*, In that those parts only are said to have an *action*, which operate; whereas many have an *use*, which act nothing at all themselves, but only accommodate and assist those that do act. Thus the Fat has no *action* of its own, but it is *useful* to cherish and moisten the muscles, *&c.* that their motion or action may be performed moreglibbly and easily. *Secondly*, An *action* belongs to or proceedeth from the *whole* organ that operates; but every *particular* part that makes up the organ, hath an *use.* Thus the *whole* Muscle exerts its *action*, which is contraction: But the several *parts* of which a Muscle consists, have *each* of them their *use* to assist this action; as, the Membrane that invests it, is of use to inclose and contain its fibres, and to distinguish and keep it apart from other Muscles; the use of the Nerve is to bring it animal spirits; of the Artery, to supply it with blood, *&c.* But because the *action* of a less principal part, may be of *use* to further that of one more principal; as also because the *action* of *several* organs may conspire to *one use* (as the Muscles of the

The use of a part what, and wherein it differs from the action.

the *Abdomen*, to the excluſion of the excrements) therefore *action* and *uſe* are often confounded, and uſed the one for the other by Anatomiſts; nor ſhall we every where in the following Tract diſtinguiſh them ſo nicely.

The diviſion of the parts. The *parts* of the *body* have a *twofold* difference or diſtinction; the one from their *matter*, and the other from their *function*, or *end*.

1. *From their* matter. In reſpect to the *matter* of which they conſiſt, they are divided into *ſimilar* and *diſſimilar*, of which we have treated fully enough before in the *Introduction*.

2. *From their* function, *or end, viz. into* organical, In reſpect of their *function*, or *end*, they are divided into *organical*, and *non-organical*.

An *organical* part is that which is deſigned for performing ſome action. Such as are chiefly the *diſſimilar* parts; but yet ſome of the *ſimilar* may be alſo termed *organical:* As for inſtance, a Nerve, which conveys and diſtributes the animal ſpirits; and likewiſe the Arteries and Veins, which do the ſame to the blood.

and non-organical: *as alſo into* principal, A *non-organical* part is that which has only an uſe, and no action; as a Griſtle, Fat, *&c.*

Again in reſpect of their *function*, or *end*, the parts are divided into *principal*, and *miniſtring*.

A *principal* part is that which performs the moſt noble and principal action, and from which the actions of many other parts proceed, or are aſſiſted. Of which ſort are, 1. The *Heart*, which is the (diſtributing) fountain of vital heat, and nutritive blood, communicating both to all the other parts, by its continual pulſation. 2. The *Brain*, which is the fountain of the animal ſpirits, and ſo the Author of all ſenſe and motion. To theſe ſome add, 3. The *Genitals*, on which the preſervation of the *Species* depends: as on the other, that of the *Individual*.

A *miniſtring* part is that which miniſters to or aſſiſts the principal: ſuch as the Stomach, Liver, Reins, the Hand, *&c.* And of theſe ſome are *neceſſary*, others *not*. *and* miniſtring.

The *neceſſary* are thoſe without which a Man cannot live. Such as are the Stomach, Liver, Lungs, *&c.* *The* miniſtring *are either* neceſſary, *or* not neceſſary.

The *not neceſſary* are ſuch as contribute to the well-being, but are not abſolutely neceſſary to the life of a Man: as an Hand, a Leg, ſimple muſcular Fleſh, which in conſumptive Perſons is almoſt wholly ſpent.

There are alſo other diviſions of the parts of the Body, as into parts *containing*, parts *contained*, and the *ſpirits*, expreſs'd by ὁρμῶντες, or *impetum facientes*, by *Hippocrates*.

Fernelius divides the Body alſo into *publick*, and *private Regions*. The *private* are ſuch as the Brain, Reins, Womb, *&c.* The *publick* are Three. The firſt includes the *Vena portæ*, and all the Parts whither its Branches reach. The ſecond begins at the roots of the *Cava*, and ends in the ſmall veins before they become capillary. The third contains the Muſcles, Bones, and the bulk of the Body, and is terminated by the Skin. But this Diviſion is only of uſe in Medicin.

CHAP. II.

Of the Circumſcription, Regions, and Parts of the Abdomen.

IN the former Chapter we divided the *Whole* Body into the *Venters*, and *Limbs*. Of which, becauſe the Venters are more ſubject to Putrefaction,

faction, as containing parts that are very moiſt and flabby; whereas the Limbs conſiſt of parts that are more dry and firm, ſuch as the Bones, Muſcles and Tendons: I ſay, on this account, the Venters are uſually firſt diſſected, and of them firſt of all the *Abdomen* or lower Belly that contains the Guts, which, of all other parts, are apteſt in a ſhort time to ſend forth noiſome ſmells, and be offenſive to the Anatomiſt. We ſhall begin with *it* therefore, and in the ſecond place proceed to the middle Venter or *Cheſt*, and laſt of all to the *Head:* making each of theſe the Subject of a particular *Book*.

Before we begin to cut open the *Abdomen*, three things are to be conſider'd in relation to it. Firſt, Its *Circumſcription* or *Bounds*. Secondly, Its *Regions*. Thirdly, The ſpecial or conſtituent *Parts* of it.

The Circumſcription of the Abdomen

As concerning the *Circumſcription* of it, its *upper* part is ſevered (within) from the breaſt by the Midriff. In the *foreſide* it is bounded *above* by the *Cartilago enſiformis*, or the Heart-pit, and *beneath* by the Share-bones. On the *ſides*, by the ſhort Ribs, and *Oſſa Ilia*, or Hip-bones. *Behind*, by the *vertebræ* of the Loins, *Os Sacrum*, and the *Coccyx*.

Its Regions.

Its *Regions* are either *Anterior*, or *Poſterior*. The *Anterior* (which comprehends alſo the *Lateral*) is ſubdivided into three others, *viz.* the uppermoſt, middle, and loweſt.

1. *Anterior.*

The *uppermoſt*, which reaches from the *Cartilago enſiformis* to within three inches above the Navel, (parallel to the loweſt of the ſhort Ribs) hath three *parts*. Two *lateral*, which are called *hypochondria*, or *ſubcartilaginea*, becauſe they lie under the Cartilages of the ſhort Ribs. In the right *hypochondrium*

pochondrium lieth the greateſt part of the Liver, and part of the Stomach; and in the left, the Spleen, and a greater part of the Stomach. The third part is that which lieth *before*, between the two lateral Parts, and is properly called *Epigaſtrium*, becauſe the (middle of the) *Stomach* lieth *under it*. In this part remarkable is the Pit of the Breaſt, which formerly has been uſed to be called καρδία, but *ſcrobiculus cordis* by the modern Writers.

The *middle* Region extendeth it ſelf from three inches above the Navel, to three inches under it. The *forepart* is that where the Navel is, from whence it is called *Regio umbilicalis*. The two *lateral* parts are called in Engliſh the *Flanks*; in Latin *Ilia*; by *Ariſtotle* λαγόνες, either from their *laxity* or ſoftneſs, or from λαγνεία, *ſalacitas*, as if they were the ſeat of *Luſt*; by *Galen* κενεῶνες, becauſe being placed between the *Oſſa Ilia*, and Ribs, they are lank, and ſeem *empty*. They are called by Dr. *Gliſſon*, *Epicolicæ*, becauſe on each ſide, this Region inveſteth the lateral parts of the Gut *Colon*.

The *loweſt* Region is called ὑπογάστριον, *hypogaſtrium*. This Region reaches from three inches below the Navel, to the *Os Pubis* and Groins, and hath three parts; two *lateral*, and one *anterior* or middle. The *lateral* are bounded by the *Oſſa Ilia*, ſo called, becauſe a great part of the *Ilium inteſtinum* lieth under them on each ſide. Beſides this, in the right lateral part are placed the beginning of the *Colon*, and all the *Cæcum inteſtinum*. In the left are contained the ending of the *Colon*, and beginning of the *inteſtinum Rectum*.

The *forepart* of the *Hypogaſtrium* by *Ariſtotle*, *lib.* 1. *Hiſt. animal.* 3. is called ἦτρον, by ſome (in ſpecial) *Abdomen*. At the lower part of it is ſeated

the

the *Pubes*, which in the adult or ripe of age is covered with hair; and on each side of this, the Groins, called βεβῶνες, or, *Inguina*. Within this forepart of the loweſt Region, are contained part of the Meſentery and ſmall Guts, the Bladder, and in Women the Womb.

2. *Poſterior.* The *poſterior* Region is divided into two parts, the upper and lower.

The *upper* is called the *Region of the Loins* reaching from the root of the Midriff to the top of *Os ſacrum*, and contains within it the Kidneys, the *Pancreas Aſellii*, the Centre of the Meſentery, the Receptacle of the Chyle, and the deſcending trunks of the *Cava* and *Aorta*.

The *lower* part of the hinder Region reaches from the top of *Os ſacrum*, to the lower end of the Rump bone or *Coccyx*. It is much broader above than below, and within it are included the ſtraight Gut, part of the Ureters, and in Women the Teſticles, or *Ovaria*, &c.

Its parts. The *parts* of the *Abdomen* are *containing* (or outer) and *contained* (or inner.)

Containing, The *containing* parts are ſuch as are either *common* to it with the reſt of the Body; or are *proper* to the *Abdomen* alone.

and contained. The parts *contained* ſerve either for *concoction*, for *ſeparation of excrements*, or for *generation*. Of all which in order, and firſt of the *common containing* parts,

CHAP. III.

Of the common containing Parts of the Belly.

The common containing Parts of the Belly. THE *common containing* Parts of the Belly are five, the *Cuticle* or *Scarf-skin*, the *Skin*, the *Fat*, the *Membra Carnoſa*, and the *common Membrane* of the Muſcles. The

The *Scraf-skin*, in Greek is named ἐπιδερμὶς, ὅτι ἐπὶ τὸ δέρμα τίθεται, *becauſe it is placed upon the true Skin* as a Covering. It is as large as the true Skin, and more compact; for the ſerous Humour that in *Puſtules* and Bliſters ouzes through that, is ſtopt by the Denſity of this. Yet it is full of Pores, for the Evacuation of Sweat, and Exhalation of Vapours. It has neither Blood-Veſſels nor Nerves diſperſed through it, and therefore is void of Senſe. 1. Cuticula, *or Scarf-skin.*

It is bred of a viſcous and oleous Vapour of the Blood, raiſed and exhaled by the natural Heat of the ſubjacent Parts, and dried and condenſed by the external Cold, as moſt Anatomiſts have taught; but Dr. *Gliſſon* thinks it to be a ſoft, ſlippery, viſcid and tranſparent Juice (like the White of an Egg) iſſuing out of the capillary Extremities of the Nerves, which end in the outward Superficies of the true Skin, where it is coagulated, and by its Viſcoſity ſticketh upon it like Glue; ſo that it can hardly be ſeparated therefrom by a Knife, but may eaſily by a Veſicatory. It ſometimes alſo almoſt wholly peels off in ſcarlet or burning Fevers, and the Small-pox; but a new one preſently ſucceeds it. *Diemerbroeck* thinks, it is bred neither of theſe ways, but has a ſeminal Principle as well as the Skin itſelf, or any other ſolid part: But not ſo probably, ſeeing it has no Senſe, and may be *often* quite loſt, and yet preſently regenerated: *All* which Circumſtances agree to no part that has a ſeminal Principle. And whereas he objects, that becauſe Infants when they are born have a Scarf-skin, therefore it cannot be bred by Condenſation, ſeeing there is neither Cold nor Drineſs in the Womb; but on the contrary, Warmneſs and Moiſture, which will hinder all Condenſation: Dr. *Gliſſon* *Its Matter.*

ſolves this Objection, by ſhewing how a Liquor may be condenſed or indurated two ways: The *one*, by ſeparation of the thinner Parts by way of Exhalation, which is properly called *Deſiccation*, and this he confeſſes cannot happen in the Womb: The *other* by *Coagulation*, that is, ſeparating the more ſerous Part of the Matter from the thicker Particles; which ſort of Condenſation may take Place well enough in the Womb. See his *Tract. de ventric.* &c. p. 11, 12. where he very clearly makes this out.

Some, from their Obſervations by their Microſcopes, affirm the Cuticle to be ſcaly, like that of Fiſhes: But ſeeing it is ſo denſe as to contain the *Serum* in raiſing of Bliſters, (as well as for other Reaſons) 'tis very improbable that 'tis of that Texture, though perhaps its outer Surface may appear ſo.

Uſes. The *Uſe* of it is, Firſt, To defend the Skin (which is of an exquiſite Senſe) from external immoderate either Heat or Cold. In cold Weather its Pores are ſo ſtraitned, that the more tender Parts lying under it are not too much affected with the Cold: In hot Weather, by its Compactneſs, it hindreth too great Perſpiration.

Secondly, To be a *Medium* between the Skin and the Object to be felt; for when it is rubb'd off, the true Skin cannot endure the touch of other Bodies without Pain.

Thirdly, to hinder the ſerous Humour from iſſuing from the capillary Arteries; for this we ſee to happen, when the *Cuticula* is rubbed off by any means.

Fourthly, To make the Body more beautiful; which it does by ſmoothing the Aſperities of the true Skin, and inducing a comely Colour of white and red. Whiteneſs is natural to this part, and

and the Redneſs is owing to the Blood that is affus'd to the outward ſuperficies of the true Skin: which being ſeen through the Cuticle, makes that florid Colour.

Next under the Cuticle lieth the *true Skin*, which is five or ſix times thicker than it. In Greek 'tis called δέρμα or δέρις, either from δέρω to *fley*, or *q.* τέρμα, becauſe it is the *End*, or ſuperficial *Boundary* of the Body. 2. Cutis, *or the true Skin.*

It is is naturally *white*, as other *Membranes*: But in living and healthful Perſons, and ſuch as live in a temperate or ſomewhat cold Climate, from the afflux of the Blood toward it, and the Colour of the ſubjacent Parts, it is of a reddiſh roſie Colour. But in thoſe that live under the Æquinoctial Line, and in exceſſively hot Climates, it appears black: Not but that both itſelf, and alſo the Cuticle are truly white in them, as they are in the Europeans: But as *Malpighius* probably conjectures, it appears of that hue, from the Blackneſs of that Mucous and reticular Body which lies betwixt it and the Cuticle, of which more by and by. *Its Colour.*

It is made up of *nervous Fibres*, very cloſely interwoven one with another, and of a *Parenchyma* that fills up the Inteſtices and Inequalities thereof. That it has ſuch a *Parenchyma*, may appear by this, that when a Sheep-skin (for inſtance) has been ſome while ſteept in Water, one may with an Ivory Knife, or the like, ſcrape a great deal of mucous ſlimy Matter off it, whereby it becomes much lighter, thinner, and in ſome meaſure tranſparent, as we ſee in Parchment. Moreover, according to *Malpighius*, it is beſet with innumerable pyramidal *papillæ*, whoſe Heads jet out of its Surface, but are covered by the Cuticle: Which *papillæ* he is inclined to believe to *Matter.*

be the Ends of the Nerves perforating the Skin, and not raiſed from the Skin's proper Subſtance. And amongſt them, he ſays, there is ſpread over the Surface of the Skin, a certain mucous and *reticular* Body with Holes in it, for the Emerſion of their Heads, and alſo for the Paſſage of the Sweat-Veſſels. Theſe Sweat-Veſſels ariſe from the Glands that the Skin is every where beſet with, and convey out that Sweat that is ſeparated from the Arteries in the Glands.

This *reticular Body* of *Malpighius*, *Frederick Ruyſch* (in Anſwer to *Gaubius*'s firſt Letter, *p.* 10.) ſays, "Cannot be ſeen without Optick Inſtruments, "and can hardly be ſhew'd by the vulgar and "common way of Diſſection, much leſs can the "*pyramidal papillæ*; Particles which the Profeſ- "ſors of Anatomy in their Diſſections are wont "to take no Notice of, although they are to be "reckon'd ſo neceſſary to be known and ſeen "of the Students of Phyſick, that they are by no "means to be neglected in anatomical Admini- "ſtrations, eſpecially private ones." Of the *reticular Body*, and of the *pyramidal papillæ*, you have his Figures in the firſt *Table* of this Book.

Difference of Thickneſs.

The Skin in the Forehead and Sides is thin, thinner yet in the Palm of the Hand, but thinneſt of all in the Lips: In the Head, Back, and under the Heel it is thickeſt. It is thinner in Children and Women, than in Men; and in thoſe that live in hot Countries, than thoſe that live in cold. And this (as *Spigelius* obſerves) is the Reaſon why thoſe that are born in cold Countries, when they come under the Equinoctial Line, are often taken with Fevers, becauſe that great Heat that is there excited in the Body by the outward Air, cannot exhale through the too thick Skin; but being retained, induces a preternatural Heat, and ſo a Fever.

It

It is full of *Pores* as well as the *Cuticula*. For thoſe who deny them, oppoſe not only Reaſon, but ocular Demonſtration. The paſſing of Quick-ſilver through a Sheep-skin, evidences this; and Mr. *Boyle* has try'd the ſame in a piece of the Skin of a Man's Arm. And any one may ſatisfy himſelf by an ordinary Perſpective, or but a good Pair of Spectacles, of the ſame. For if when he is ſweaty, he wipe off the Sweat from the Tips of his Fingers, he may plainly ſee freſh Sweat iſſue out by the Pores, and ſtand in little Drops. *Pores.*

It is of a moſt exact *Temperature*, neither too cold nor too hot, that it might the more accurately judge of the Temperature of tangible things. Its *nervous* part, which is naturally cold, is attemper'd by the heat of the arterial Blood, that flows continually for the ſupply of its parenchymatous Part: And its *Parenchyma* is not heated too much by the afflux of the Blood, becauſe it is lodged among ſo numerous cold nervous Fibres. It has very many both capillary *Arteries* and *Veins* diſtributed through it; as alſo abundance of *nervous* Twigs, which endue it with a moſt exquiſite Senſe. *Temperature and Veſſels.*

As for the *Hair* that in many Places grows out of the Skin, we ſhall defer our Diſcourſe of it, till we come to treat of the Hair of the Head, in *Book* III. *Chap.* 2. *Hair.*

Its *Action* is Senſation or Feeling. Which Action is chiefly performed by thoſe fore-mentioned *pyramidal Papillæ*, which *Malpighius* by the Microſcope hath obſerved to ariſe out of it, in greater plenty in ſuch Parts as are of more exquiſite Senſe, as the Palm of the Hand, Soal of the Foot, *&c.* but in leſs in ſuch as are of a more dull. *Action.*

Its *Uſe* is, Firſt, To cloath the whole Body, and defend it from the Injuries of the Weather, *Uſes.*

&c. Secondly, To be a general Emunctory to the Body, by which all its Exhalations may fitly tranſpire. Which whether it be done only thro' its Pores, as moſt Anatomiſts have affirmed; or alſo through its very Subſtance, as Dr. *Gliſſon* has of late aſſerted, is a Controverſy hardly worth the inſiſting on.

Laſtly, In ſeveral Places of the Body, to put forth and nouriſh the Hair, for the Fence and Ornament of the reſpective Parts.

3. *Fat.* Next under the Skin lies the *Fat*, which is commonly taken to be a Covering diſtinct from the *Membrana Carnoſa* that lies under it, having the Name of *Membrana Adipoſa* given it; but Dr. *Gliſſon* reputes it only a Part of the *Carnoſa*: For he ſays, that Membrane in its outer Part is full of membranous Cells, which are fill'd with a yellowiſh Fat, ſomewhat like as the Cells in the Pulp of an Orange are fill'd with its Juice. *Malpighius* ſays, ["The Blood-Veſſels are expanded like the Boughs of Trees, every where thro' the Membrane that lies under the Fat, and the membranous Cells full of fatty Globules hang upon their Ends, like Leaves upon the Boughs of Trees. The Cells are of almoſt an oval Figure, and are like the Lobules of which the Lungs are compoſed, or rather like a conglomerate Gland. They are knit to one another by the Membrane out of which they are formed. And thro' the ſame Membrane and Cells, he ſays, do not only capillary Veins and Arteries, but *Ductus adipoſi* alſo run, which ſwell with Fat, eſpecially if they be beheld in an Animal newly kill'd. Whether theſe Veſſels, *adds he*, propagated through all the Fat that is placed in the Circumference (or *ambitus*) of the Body, flow from the Caul, as from their Root,

" Senſe

" Senſe has not as yet diſcover'd: But ſeeing the " Caul is knit to the Back, as to the Centre of " the whole Body, it does not ſeem unlikely but " that they may be propagated in every Regi- " on of the Body, by means of the *Membrana adi-* " *poſa* that is extended over all; as we obſerve of " the Lympheducts, tho' they want any notable " and common Trunk. Thus far he.] Whether we ſhould call it *Fat*, or the *fatty Membrane*, is not worth the while to diſpute; nor much matters it, whether we repute the Fat, and ſubjacent Membrane, for one or two Integuments. Let every one enjoy his Opinion. For my ſelf, I chuſe rather to diſtinguiſh them, and conſider them apart.

Its Definition.

Fat is defined to be an unctuous white Matter, collected in very thin Membranes, deſigned for cheriſhing and lubricating the Parts.

Situation.

In Men it is *placed* next under the Skin, and that all the Body over, except in the Lips, the upper part of the Ear, Eye-lids, Cod and Yard, which have no Fat at all; and in the Forehead, where the Skin cleaveth cloſe to the carnous Membrane; as alſo, according to ſome, in the Temples. It is collected in the Cells beforementioned, and according to the common Opinion, is bred of an oily Portion of the Blood, ſweating like a Dew out of the Veins, and afterwards concreting: But according to *Malpighius*, the *Vaſa adipoſa* are the Conduits of its Matter, as ſhall be farther ſhewn in *Chap.* 5. of the *Omentum*, or Caul.

This Fat is properly call'd *Pinguedo*, whereas that of the Caul, *&c.* is called *Sevum*, Suet, or Tallow. And they differ in this, that *Pinguedo* is eaſily melted, but not ſo eaſily congealed; whereas *Sevum* is not eaſily melted, but is eaſily

congealed. Beſides, *Pinguedo* is not brittle, but *Sevum* is.

The *Uſes* of it are theſe; Firſt, It defendeth the Body from the external Air.

Secondly, It preſerveth the natural Heat.

Thirdly, It farthereth Beauty, by filling up the Interſtices of the Muſcles, and Wrinkles of the Skin; whence very lean People, for want of it, look ſhrivell'd and deform'd.

Fourthly, by filling up the empty Spaces between the Muſcles, it rendreth the Motion thereof more glib and eaſy, (ſo it do not abound too much) and keepeth all the Parts from Drineſs or Breaking. Hence it beſmears the Extremities of the Cartilages, the Jointings of the greater Bones, and the Veſſels that they may paſs ſafely.

Laſtly, *Malpighius*, rejecting all theſe Uſes as primarily intended, thinks the principal Uſe of it, whilſt it is mix'd with the Blood, is to be a continual *Pabulum* (or Food) of the natural Heat, whereby the vital Flame (and conſequently Heat) is perpetuated. Alſo to mitigate the Acrimony of the Blood, and join and unite the ſaline Particles thereof, ſo as that they become aſſimilable to the ſolid Parts for their Nutriment, ſerving to thoſe Particles as Oil to Colours in Painting, or Lime to Stones in Building. When it is ſeparated from the Blood, and collected here or other where, he is inclin'd to the common Opinion, that in caſe of Famine, it paſſes into the Nouriſhment of the Body. But as to its more ordinary uſe, when collected in particular Parts, the Reader may find it where thoſe Parts are treated of.

4. *Membrana carnoſa.* The *carnous Membrane* is only *properly* ſo called in Brutes, in whom it is truly *fleſhy* and muſcular;

lar; so that by means hereof they can at pleasure move and shake their Skin, which is contiguous to it, no Fat intervening between them: But in Man, seeing it has no carnous Fibres, or *Parenchyma*, it is very improperly termed *carnous*. We shew'd just now, Dr. *Glisson*'s Opinion to be, that it is not truly distinct from the *Fat*, but the Fat is a Part of *it*: And upon account of the Fat that adheres to it, he thinks it deserves the Name of *adiposa*, rather that *carnosa*. Only in the Forehead and Neck it looks somewhat fleshy, and therefore may in those Places, with better Reason be called so.

The *Uses* that we ascribed to the *Fat*, agree also to this Membrane, *viz.* To defend the Body from external Cold, and to preserve the natural Heat, *&c.* Yea, it serves also to sustain and strengthen the Vessels that pass betwixt the Skin and Muscles, between which it is placed. Some make this Membrane the Seat of that *Horrour* or Shivering that happens in the beginning of Ague-fits, supposing it to be of exquisite Sense, and that it is then twitched by sharp Humours. But I think that Symptom rather proceeds from the like Affection of the Membrane next under it, which is, *Its Use.*

The *common Membrane of the Muscles.* This is spread over all the Body (except the Skull, according to some) and is knit by Fibres somewhat loosely, both to the foregoing that lies above it, and to the proper Membrane of each Muscle that lies under it. It is very thin, but strong; it is not yellow, like the former, but whiter, and more transparent. 5. *The common Membrane of the Muscles.*

Dr. *Havers* in his *Osteologia nova*, p. 199. says, "He has observ'd the same sort of Glandules "in this Membrane, as those which occupy the Mem- *Its Glands.*

" Membrane that lies over the Joints in all that
" Part which has none of the large Glands:
" And amongſt many of the Tendons, there are
" ſeveral of the larger Glands, or the leſſer Glan-
" dules conglomerated into the Form of Glands.
" So that he dare be poſitive in this Aſſertion,
" that the common Membrane of the Muſcles
" is every where glandulous.

Uſe. Upon this Suppoſition, the Uſe of this Membrane muſt be *not only* (as has hitherto been taught) to ſerve as a common Bag to contain the Muſcles in, and to help to keep them in their proper Places; *but alſo* to moiſten and beſmear the ſubjacent Muſcles and their Tendons, with a mucilaginous Liquor, which lubricates them, and ſo makes them more glib and pliable in their Motion.

CHAP. IV.

Of the proper containing Parts.

The proper containing Parts of the Belly. THE *proper containing* Parts are the *Muſcles* of the Belly, and the *Peritonæum*.

1. The Muſcles. As to the *Muſcles*, ſeeing we have aſſign'd a particular Book (*viz.* the Vth) for the Deſcription of all the Muſcles of the Body, we ſhall refer the Reader thither for theſe of the *Abdomen*, (where he may find them fully deſcrib'd, *Chap.* 17.) and at preſent content our ſelves with only naming of them. There are five Pair of them: The outermoſt are the *Obliquely deſcending*; the next, the *Obliquely aſcending*; the third, the *Recti*; the fourth, the *Pyramidal*; and the inmoſt, the *Tranſverſe*. All which being removed, the *Peritonæum* appears next.

2. *The* Peritonæum The *Peritonæum*, or inmoſt inveſting Coat of the

the Belly, commonly call'd its *Rim* (derived from περιελίνω, from its Office of *encompaſſing*) adheres *above* to the Midriff, *below* to the Share, and Flank or Hip-bones; in the *fore-part*, firmly to the tranſverſe Muſcles, but chiefly to their Tendons about the *Linea alba*; *behind*, to the fleſhy Heads of theſe Muſcles looſely. The end of this Connexion, is both for its own Strength, and that it may the better comply with and ſerve the Muſcles in their Compreſſion of the Belly.

Its Figure and Subſtance.

Its *Figure* is oval, and its *Subſtance* membranous. The inner Superficies of it, which reſpects the Guts, is ſmooth, equal, and ſlippery, bedew'd with a kind of watery Humour, ſteaming or exhaling from the Parts contained in the *Abdomen*; but the outer Superficies, whereby it cleaves to the aforeſaid Bones and Muſcles, is rough and unequal.

Origin.

As for the Origin of it, *Fallopius* will have it to proceed from the ſuperior and inferior *Plexus* of the Nerves of the *Abdomen*; for from them it cannot be ſeparated without tearing. To him Dr. *Gliſſon* aſſents. Some derive it from the Ligaments, by which the *Vertebræ* of the Loins, and of *Oſ ſacrum* are knit one to another; eſpecially from thoſe of the firſt and third of the Loins, becauſe it is there thickeſt. *Diemerbroeck* denies it to have any Origin at all, other than the firſt ſeminal Matter out of which it was formed in the Womb. But that is only its *material* Principle, and hinders not but that it may have (according to Dr. *Gliſſon*'s Diſtinction) a Principle or Origin of Continuation.

Duplicity.

It is *double* every where, but appears ſo to be, chiefly about the *Vertebræ* of the Loins, and in the *Hypogaſtrium*. For in the former Place, between its Membranes, lies the *Vena cava*, the *Aorta*,

Aorta, the Receptacle of the Chyle, and the Kidneys; and in the latter, the Bladder, and in Women the Womb.

Perforations. *Above*, where it adheres to the Midriff, it has three *Foramina*, or Holes; the first on the right Side, whereby the ascending Trunk of the *Vena cava* passes; the second towards the left side, for the Gullet (with the Nerves of the eighth Pair inserted into the upper Orifice of the Stomach) to descend by; the third behind, by which the great Artery or *Aorta*, and the intercostal Nerve descend, and the *Ductus Chyliferus* ascends. *Below*, it has Passages for the streight Gut, for the Neck of the Bladder, and in Women, for the *Vagina* of the Womb; also for the Veins, Arteries and Nerves that pass down to the Thighs. *Before*, in a *Fœtus*, at the Navel, for the umbilical Vessels to pass in and out by.

Processes. It has two remarkable *Processes* in Men, placed before, by the *Os pubis*, on each side one. They are certain oblong Productions of its outer Membrane passing through the Holes of the Tendons of the oblique and transverse Muscles, and descending into the Cod, there bestowing one Tunicle on the Stones, and containing them like a Bag. There are also two Processes in Women, but they reach only to the *Inguina* or Groins, and terminate in the upper part of the Privity, or the Fat of *Mons Veneris*. The inner Membrane of the *Peritonæum* (in Men) reaches but to the very Holes through which the Processes descend, which it makes very strait; but being either relaxed or broken, the outer gives way, and so there follows a Rupture, either the Caul or the Guts, or both, falling down thereby into the Cod. By the Holes of the Processes there descend, in Men, the Vessels preparing the Seed, and the

Muscles

Fig. I.

Fig. 2.

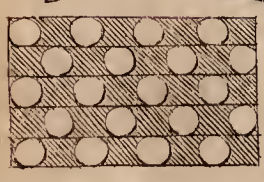


Fig. 5.

Fig. 4.

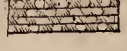
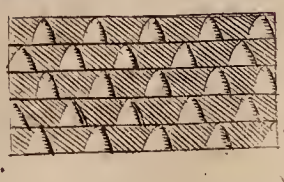


Fig. 3.



Muſcles called *Cremaſteres*; and by them aſcend the Veſſels bringing back the Seed. In Women there paſs by them the round Ligaments of the Womb, which after ſpreading themſelves, and growing jagged, are either joined to the *Clitoris*, or elſe terminate before they come at it, in the Fat of *Mons Veneris*.

Veſſels. It has *Arteries* and *Veins* from the Mammary and Epigaſtrick, and from thoſe of the Midriff or the Phrenick. It has ſlender Threads of Nerves from the Pairs of the *Vertebræ* of the Loins chiefly.

Uſe. Its *Uſe* is to aſſiſt the equal and orderly Contraction of the Belly, for the expulſion of the Excrements, and by its ſmoothneſs to prevent the Guts being hurt by the circumjacent Parts. Its ſeveral other more private Uſes may be obſerved in the foregoing Deſcription of it.

And thus far of the Parts *Containing*.

TAB. I.

Fig. 1. Shews the Parts contained in the *Abdomen*, which appear to the firſt View after all the containing Parts are removed.

aaaa *The Skin of the* Abdomen *turned back, whoſe inſide is fatty.*

bbbb *The* Omentum *or Caul.*

cccc *The Gaſtro-epiploick Veſſels.*

dd *The Stomach.*

ee *The Liver turned ſomewhat up, that the Stomach may be the better ſeen.*

f. *The broad ſuſpenſory Ligament, whereby the Liver is faſtened above to the Midriff.*

g *The Gall bladder, which is ſeated in the under or hollow ſide of the Liver, but here appears through the Liver's being lifted up.*

Fig. 2.

Fig. 2. *Shews (from* Ruyſch) *the true Delineation of* Malpighius's reticular *and* ſubcuticular *Body, as it appears by a Microſcope.*

Fig. 3. *Shews the pyramidal* Papillæ *in like manner.*

Fig. 4. *Shews the reticular Body about as large again as its natural Bigneſs.*

Fig. 5. *Shews the pyramidal* Papillæ *likewiſe twice as big.*

CHAP. V.

Of the Omentum.

Of the Parts contained in the lower Belly.

THE Parts *Contained* miniſter either to *Nutrition*, for the Conſervation of the Individual, or to *Procreation*, for the Conſervation of the *Species*.

Nutrition being an aſſimilating the Food taken, into the Subſtance of the Parts; before this is done, it undergoes two Changes, firſt into *Chyle*, and then into *Blood*.

All the Organs of *Chylification* are included within the *Abdomen*, but of *Sanguification* not ſo.

The principal Inſtrument of *Chylification*, is the *Stomach*; but the *Caul*, *Guts*, (eſpecially the *Small*) *Pancreas*, &c. are aſſiſting to the Action.

The principal Inſtruments of *Sanguification*, were heretofore ſuppoſed to be the *Liver* and *Spleen*, upon a Preſumption that all the Chyle went to the one or other directly from the Guts: But ſince it has been diſcover'd, that none of the *Venæ lacteæ* paſs to them, but that the whole Chyle is convey'd into the common Receptacle, and from thence, directly by the *Ductus thoracicus* to the Heart, they are diſcharg'd from the Task of Sanguification; tho' it cannot be deny'd, but they contribute to the refining and perfecting of the Blood already made.

Both

Both the Chyle and Blood have their *Excrements*, the chief whereof are both ſeparated from them, and conducted out of the Body by Parts contained in the *Abdomen*. Thoſe of the Chyle are the *Fæces*, collected in the thicker Guts, and evacuated by Stool. Thoſe of the Blood have been taught to be two, *viz.* Choler, and the ſerous Humour. Choler is ſeparated by the Liver, and is received by the thinner part of it, by the *Veſica fellea*; but the thicker by the *Porus bilarius*. But it is not purely an Excrement, ſeeing it has a conſiderable Uſe within the Body, as will appear in *Chap.* 11. *Of the Liver*, and deſerves not that Name, any more than the Juice ſeparated by the *Pancreas*. The ſerous Humour is ſeparated by the Kidneys, and from thence convey'd to the Bladder by the Ureters, to be piſt out.

The Parts miniſtring to *Procreation*, are the *Genitals* both in Men and Women.

The Caul. After the *Peritonæum* is ript open, the Part which lies uppermoſt is the *Caul*. *Its Names.* In Greek it is called ἐπίπλοον, from ἐπιπλέω *innato*, becauſe it ſeemeth to ſwim upon the Guts. In Latin, *Omentum*, from *Omen*, becauſe the Soothſayers uſed to divine by it; or *q. Operimentum*, becauſe it covers the Guts: and otherwiſe *Rete*, or *Reticulum*, from its Contexture, which is *Net-like*; whence alſo in Engliſh it is commonly called the *Net*.

Subſtance. It is compoſed of two *Membranes*, betwixt which the Veſſels run, and the Fat and Glands are placed. They are very thin, and, where the Fat hinders not, tranſparent.

Figure. For *Shape*, it is compared by Dr. *Gliſſon*, to a Woman's Apron, when the lower part of it is turn'd up, and tuck'd under the Girdle. For it conſiſts of two Leaves, whoſe upper Edges are knit to different Parts; but its bottom is continued,

much, and is like the bottom of a Satchel, to which it is also compared by some.

Connexion. I say, its two upper Edges are knit to different Parts; for that of the *fore*-Leaf, beginning at the little Lobe of the Liver, (which it involves) adheres to the under or hollow side of the Liver, to the *Duodenum* and *Pylorus* (somewhat towards their fore-side) to the bottom of the Stomach, and to the Suture of the Spleen. That of the *hinder* or *inner* Leaf is continued from the former, and passing from the Spleen backwards, returns towards the right side again, by the way adhering to the *Pancreas*, to that part of the *Colon* that runs under the Stomach, to the Back, to the *Duodenum* (somewhat towards its Back-side) and at last is joined or continued to the Fore-leaf, at the aforesaid little Lobe of the Liver. As for its bottom, it is knit to no Part, but hangs loose upon the Guts, reaching commonly a little below the Navel, but sometimes to the very bottom of the Belly. Sometimes it falls down out of its Place, and descends into the Cod; which kind of Rupture is called *Epiploocele*; and other times, when the Navel has been burst, it has jetted out and filled the same, as in the *Omphalocele*.

Rise. It is commonly said to have a double *Origin*, namely, its Fore-leaf to spring from the Stomach, and its Hinder from the *Colon*. But seeing both these have their outer Coats from the *Peritonæum*, and that the Caul itself cleaves also to it at the Back, it is most reasonable to draw its Rise from thence. Whence descending below the Navel, it turns up again, and ascending to the Stomach, cleaves to it; and so may more properly be said to end, than to begin there.

Cavity. Betwixt its Leaves or Walls there is formed a notable *Cavity*, which some very weakly have

destin'd

deſtin'd to divers Uſes, whereas it reſults only accidentally, and was not framed by Nature for its own ſake. ["For (as Dr. *Gliſſon* reaſoneth) "whilſt Nature is ſollicitous about providing a "fit Deputy (and that membranous) for the Me-"ſentery, and ſtuffing it with Fat, through which "Veſſels may be carried to the Stomach, Liver, "Spleen, *Pancreas* and *Colon*, and whereby ſhe "may join all thoſe Parts after a due manner; "and moreover whilſt ſhe takes care that it hang "down looſely, and beſmear both the Stomach "and Inteſtines with its Unctuouſneſs; and in "the mean while be every where continuous to "it ſelf: I ſay, whilſt ſhe diligently propoſes all "theſe Ends, if ſhe will obtain them, ſhe muſt "needs make the Caul hollow, as it is above de-"ſcribed, and its propending part muſt needs "imitate the bottom of a Pouch.]

Veſſels. The *Omentum* aboundeth with *Veſſels* of ſeveral ſorts, but ſuch as do not properly belong to it, or terminate in it, but are carried through it to other Parts, from which they are moſt of them denominated. We ſhall begin with the *Arteries*, and tranſlate hither the Account that the above-named Doctor gives of them, and alſo of the Veins, which is very exact. "Its *Arteries* are "propagated from the *Cæliaca*; or rather, its "inner Leaf, near its Origin, receives and up-"holds this Artery (as ſoon as it ſprings out of "the *Aorta*) betwixt its Membranes. It is divi-"ded into two branches, the *right* and *left*. The "*right* being joined to the *vena Portæ* in the *Pan-"creas*, and fenced with the Membranes of the "*Omentum*, is carried into the hollow ſide of the "Liver; but it firſt ſends forth theſe branches, "the *Pyloricus*, to the hinder ſide of the right Ori-"fice of the Stomach; the *Arteriæ cyſticæ gemellæ*,

" the *Epiplois dextra*, a Portion whereof is diſpen-
" ſed to the Gut *Colon*; the *Inteſtinalis*, carried to
" the *Duodenum*, and beginning of the *Jejunum*;
" the *gaſtro-epiplois dextra*, which is diſtributed
" into the bottom of the right ſide of the Sto-
" mach.— The *left branch* of the *Cæliaca*, called
" *ſplenicus*, is greater than the *right*, and being
" included within the Membranes of the hinder
" Leaf of the *Omentum*, is carried directly left-
" ways under the bottom of the Stomach to the
" Suture of the Spleen. In its paſſage it ſends forth
" many branches: *Upwards, one* notable one cal-
" led *Arteria gaſtrica*, which ſpreads it ſelf thro'
" the bottom and ſides of the Stomach, and its
" upper Orifice, where it gets the Name of
" *Coronaria*; alſo a *ſecond*, called *gaſtro epiplois ſini-
" ſtra*, whereof one Portion is diſperſed into the
" bottom of the left part of the Stomach, and
" both its fore and hinder Parts, and the remain-
" der is ſpent on the fore-Leaf of the *Omentum*;
" it ſends forth a *third* alſo, that famous branch
" called *vas breve arterioſum*, which is inſerted
" into the left ſide of the left or upper Orifice of
" the Stomach. *Downwards* alſo it ſhoots forth
" ſome branches, as the *Epiplois ſiniſtra*, which
" being divided into two Rivulets, waters partly
" the hinder Leaf of the *Omentum*, and partly
" the *Colon* itſelf; alſo another little branch
" which is wholly ſpent on the left part of the
" hinder Leaf of the Caul.

2. *Veins.* " The *Veins* that anſwer to the ſaid Arteries
" riſe almoſt all from the *ſplenick* branch; the
" Trunk of which Veins, after it is joined with
" the Stem of the ſplenick Artery, puts forth
" branches exactly anſwering and proportioned
" to thoſe of the ſaid Artery; and all the bran-
" ches of both Veſſels are diſpenſed to the ſame

reſpe-

" reſpective Parts, and are denominated from " them, ſo that 'twould be needleſs to ſtay lon- " ger on their diſtribution; only the branch that " goes to the right or lower Orifice of the Ven- " tricle, called of ſome *Pyloricus*, takes its Riſe " from the Trunk of the *Porta* before 'tis divi- " ded.

It has but very ſmall *Nerves* proceeding from the Intercoſtal or ninth Pair: which, as the Veins accompanying the Arteries, and having the ſame Names, we ſhall not take the pains to trace. 3. *Nerves.*

But beſides theſe Veſſels formerly known, *Malpighius* thinks that he has diſcover'd a new ſort, which he calls *Ductus Adipoſi*, and will have to nouriſh and encreaſe the Fat, diſcharging the Arteries and Veins from that Office. He ſays, 4. *Vaſa Adipoſa.*

' They are ſo very ſmall, that they admit not a ' Ligature, from whence one might diſcover their ' Nature, *viz.* Whether they be hollow, ſo as ' that the Fat might be conveyed by them as by ' Pipes; or whether they be only like Filaments ' or ſmall Threads, along which the fatty Parti- ' cles drill. But he inclines to think they are ' hollow like Veins. He confeſſes, that he could ' not yet diſcover by the Eye, from whence they ' take their Riſe, though he has endeavoured to ' find it out in many, and thoſe divers ſorts of ' Animals; but thinks it probable, that they ei- ' ther ſpring from the Spleen, or from the Sto- ' mach, or from the Glands. The Reaſons why ' he ſuſpects they may ſpring from the *Spleen* are, ' That there is a notable Vein ariſing from the ' Spleen, that ſends abundance of Slips all thro' ' the Caul; and the Spleen in all Creatures is ' placed in the Center of the Caul: And that ' there are abundance of fibrous Bodies diſcern- ' ible in the Spleen, that run through its Paren-

'chyma from one Membrane to another, and 'have no communication with the Blood-Ves-'ſels. Theſe he ſays, ſo far as he could perceive, 'are cloſely knit to the Membrane of the Caul 'that enters the Line or Suture of the Spleen 'with the Splenick Veſſel; and ſeeing it appears 'not as yet, whether they be hollow, or of what 'Origin they are, or what Uſe they ſerve for, 'one may reaſonably doubt whether they be not 'the firſt Root of theſe *Ductus Adipoſi*, or at leaſt 'have Communication with them. As for their 'Riſe from the *Stomach*, this may be ſaid, That 'the Caul has a notable connexion with it, 'being knit ſtrongly to it through its whole 'Length, and receiving Blood-Veſſels from it. 'That in ſome Fiſh there grows a notable Mem-'brane from the bottom of the Stomach, that 'has Veſſels differing from the ſanguineous. 'And he thinks it not unreaſonable to ſuppoſe, 'ſeeing in the Stomach, and in the Inteſtines 'that are continued to it, by means of the At-'trition and exquiſite Solution of the Food, the 'Particles of it acquire ſuch a Liberty, that thoſe 'that were originally in it being let looſe, or 'by a new Mixture and mutual Adaptation be-'ing ſhaped and conglobated into a new Nature, 'have new Motions and Actions; I ſay, ſeeing 'by theſe means there may not want Matter 'for propagating of Fat, it will not be improba-'ble that there are proper Veſſels alſo for the 'propagating of it, and conveying it to the 'Parts. The third Part whence theſe Ducts may 'ariſe, are the *Glands*, into which, later Anato-'miſts have obſerved lacteal Veſſels to be carri-'ed. The Glands themſelves (he ſays) contain 'much Fat, from whence it is that they are ſo 'luſcious to the Taſte; and he thinks it proba-

'ble

'ble that the Glands are either the Fountains 'of Fat, or at leaſt are a *medium* of its Propaga- 'tion.] Thus that curious Perſon. But whether there be indeed ſuch peculiar Veſſels I cannot affirm, having never been able to diſcover them by the naked Eye, or by ſuch Glaſſes as I have made uſe of.

5. Venæ Lacteæ.

Dr. *Wharton* in his *Adenographia, cap.* 12. declares, That he has obſerved ſome *Venæ Lacteæ* ariſing out of the bottom of the Stomach, (*Diemerbroeck* ſays, from the beginning of the *Jejunum*) which are received into the *Omentum*, and being inſerted into a pretty large Gland, do from thence ſpring again, and are carried obliquely downwards, croſſing the right End of the *Pancreas*: One would think, ſaith he, at the firſt Sight, that they enter'd into the *Pancreas*, but they do in truth paſs it, and make towards the common Receptacle of the Chyle, into which they empty themſelves.

Its Glands.

The ſame learned Phyſician, does in the ſame Place give an account of two *Glands* that are naturally found in it. One *greater* near its being joined unto the *Pylorus*, and into this it is that the *Lacteæ* are inſerted; another ſomewhat *leſs* placed towards the Spleen; and this he has obſerved ſometimes double, triple, yea, manifold. Preternaturally it has ſometimes many more.

Fat.

The laſt part of which the Caul conſiſts, is its *Fat*, which is not ſpread equally all over it, but is gathered there chiefly where the Veſſels run; the Spaces betwixt being only membranous. It is collected in little membranous Cells, included betwixt the two inveſting Membranes, and its Matter is derived from the Blood-Veſſels, according to the common Opinion; but according to *Malpighius*, it is communicated by the *ductus adi-*

posi before-described. The fore Leaf has more Fat than the hinder; and the upper part of the fore Leaf that is knit to the Stomach, is the fatteſt of it. In very fat Perſons this part grows to a great bulk, but in conſumptive People there is little left beſides the Membranes and Veſſels; and **Peyerus* writes, that in all hydropick Perſons that he ever diſſected (and he has diſſected very many) the Caul was always extenuated and putrid.

**Meth. Hiſt. Anat. Med. p.* 97.

Its Uſes. The *Uſes* of it are theſe: *Firſt*, It cheriſheth the internal Heat of the lower part of the Stomach, and of the Inteſtines. Which appears by the Story that *Galen* tells of a Fencer, who being wounded in the Belly, and the Caul being taken out, afterwards when the Wound was healed up, felt great Coldneſs upon his Belly, ſo that he was forced to wear Woollen upon it. Yet *Riolanus* affirms from his own Obſervation, that ſuch as have had the Caul cut out, have found no prejudice by it to their Concoction.

Secondly, It miniſtreth Nouriſhment to the Parts in a long want of Food, its Fat being receiv'd into the Veins, and mix'd with the Maſs of Blood.

Thirdly, Like the Meſentery, it ſerves to convey ſafely the Veſſels to other Parts, as to the Stomach, *Colon*, *Duodenum*, Spleen, *&c.*

Fourthly, It keeps the outer Superficies of the Guts moiſt and glib, that they may the better perform their periſtaltick Motion.

Fifthly, it ſerves alſo to knit looſely together the Stomach, Liver, Spleen, *Pancreas*, *Colon* and *Duodenum*. This Connexion was to be looſe, becauſe the Stomach and Guts are ſometimes diſtended, and ſometimes empty, and accordingly take up more or leſs room; but yet it is not ſo looſe, but that it is ſome ſtay to them, and partly hinders them from departing out of their Places.

CHAP.

CHAP. VI.

Of the Gullet.

THE Caul being removed, the *Stomach* offers itself next to Examination; but seeing the *Gullet* is as it were the Pipe or Funnel to it, tho' that be seated in the *Thorax*, and so should be considered in the next Book; yet because of its Relation to the Stomach, being but an Appendage of it, we shall treat of it here before we proceed to that. *The Gullet.*

It is called in Greek οισόφαγος, ὅτι οἴει τὸ φάγημα, because it conveys the Meat to the Stomach. *Its Name.*

It is an organical Part, round and hollow, beginning at the Root of the Tongue, behind the *Larynx*, (which part of it is called *Pharynx*,) and descendeth from thence directly between the Windpipe and the *Vertebræ* of the Neck, and the four first *Vertebræ* of the *Thorax*, upon which it resteth; but when it is come to the fifth *Vertebra*, it giveth way to the descending Trunk of the great Artery, by bending a little to the right Side; afterward, accompanying the Artery down to the ninth *Vertebra*, there it turns a little to the left again, and climbs upon the Artery; and by and by about the eleventh *Vertebra* it passeth through the Midriff, a little on the left Side of its nervous Center, at a Hole distinct from that of the great Artery, and is inserted or continued into the left Orifice of the *Ventricle*. *Origin and Descent.*

It is composed of three *Membranes*: The *utmost* is common to it and the Stomach, and is very thin, being endowed only with membranous Fibres, and those very slender. Some derive its Origin from the Midriff, others from the *Pleura*, *Substance.*

others from the *Peritonæum*; and others laſtly, from the Ligaments of the *Vertebræ* of the Neck and Breaſt, upon which it reſteth. 'All which 'Opinions (according to Dr. *Gliſſon*) may be 'true, if they be intended only of an Origin of 'Continuation, or Connexion, ſeeing it is con-'tinued plainly to the three firſt, and knit to the 'laſt; but none of them is true, if they be in-'tended of a ſuſtaining or maintaining Origin, 'or of a Principle of Influence. The ſecond or *middle*, is fleſhy and thick, and conſiſts of two ranks of fleſhy Fibres, which aſcend and deſcend obliquely (ſpiral-wiſe) and do mutually intercuſſate or croſs one another, ſo as that the Fibre, which, before it meet with another to interſect, did lie underneath another, rides upon that which it interſects, and ſo continues uppermoſt till it come to a ſecond, under which it paſſes again, and ſo on by turns. The third or *innermoſt*, is indued with ſlender ſtreight Fibres, and thoſe only, as ancient anatomiſts have taught; but Dr. *Willis* affirms it to have Fibres of divers Kinds, and thoſe diverſly woven one with another. It is wholly nervous, ſaving a certain woolly or downy Subſtance that cloaths its inſide. It is continued to that Membrane that covereth the Mouth, Jaws and Lips; and (according to Dr. *Willis*) it deſcends three Fingers breadth below the Mouth of the Stomach. From its being thus common to the Mouth, Gullet, and upper Oriſice of the Stomach, proceeds that great conſent among theſe Parts in Vomiting, *&c.*

Veſſels. It hath Veins in the Neck from the Jugulars, in the *Thorax* from the *vena ſine pari*; but where it is join'd to the Stomach, it has ſome Twigs from the *Ramus coronarius*, which is a branch of the *vena portæ*.

It

Its *Arteries* in the Neck from the *Carotides*; in the *Thorax* from the Intercoſtals, and in the *Abdomen* from the *ramus cœliacus coronarius.*

Nerves it hath from the *par vagum*, or eighth Pair.

It hath four *Glandules*; two in the Throat, which are called *Tonſillæ*, or Almonds, common to it and the *Larynx*, which ſeparate a mucous, or pituitous Humour to moiſten them. (Their Deſcription ſee in *Book* II. *Chap.* 14.) Other two it hath near its Middle, on its out and back-ſide, about the fifth *Vertebra* of the *Thorax*; namely, where it gives way to the Trunk of the *Aorta*, and turns ſomewhat to the right-ſide, or at that place where the *Aſpera Arteria* is divided into two Branches. Theſe are as big, each of them, as a Kidney-bean, and of the ſame ſhape: but ſometimes there are more than two, and then they are leſs. They are ſoft and fungous; and their Uſe has been reckoned to be for the ſeparation of a Juice to moiſten the Gullet. But Dr. *Wharton* rejects this Opinion, becauſe there appears no excretory Veſſel that might convey the Liquor that is ſeparated in them to within the Gullet. However, tho' ſuch Veſſel do not appear, yet it is more probable that they ſerve for that Uſe, than for that which he aſſigns to them, *viz.* To draw out from the *Lympha* that runs through them, that Juice which is more mild and fit for Nouriſhment, for the uſe of the Nerves that are faſtened to them; or to depoſit the remainder into the common chyliferous Duct, by a Pipe, which he ſuppoſeth there muſt be, but does not deſcribe. *Glandules.*

The Gullet ſerveth as a Conduit to convey Meat and Drink by from the Mouth to the Stomach: For theſe being turned down into the Throat, *Uſe.*

Throat by the Tongue, all the Membranes of the *Pharynx* are relaxed for the reception thereof, and presently the same are squeezed down the Gullet, by the constriction of its middle Coat, and the Muscles of the *Pharynx*. But concerning its Action, and in what Manner, and by what Help swallowing is performed, see more fully and particularly in the Fifth Book, *Of the Muscles*, Chap. 12.

CHAP. VII.

Of the Ventriculus *or Stomach.*

The Stomach. Its Names.

THat part which we term *the Stomach* in English, in Latin is called *Ventriculus*, without any Addition, to distinguish it from the other Ventricles, which have always some other Word added to determine the Signification, as *Ventriculus Cordis*, *Ventriculus Cerebri*. In Greek it is called γαστὴρ and κοιλία, (from its *Cavity*) as also καρδία, which last Name is given chiefly to its upper Orifice, which has a notable Consent with the Heart, from their community of Nerves, (both being supplied by the *par vagum*:) and hence a Pain here is called *Cardiaca Passio*.

Number.

In Man it is but *one*; but such Quadrupeds as chew the Cud, especially all that are horned, have four Stomachs; the first whereof is called μεγάλη κοιλία, in English the *Paunch*; the second, κεκρύφαλος, in Latin *Reticulus*; the third ἶχλυος, *Omasus*, in English the *Feck*; the fourth ἄνυσρον, *Abomasus*, in English the *Read*. Such Fowl also as live upon Corn, have two Stomachs; the first membranous, called *Ingluvies*, the *Crop*; the second carnous, called *ventriculus carnosus*; in English, the *Gizard*.

Gizard. Betwixt theſe two ſome name a third, called *Echinus*; but it ſeems rather a Paſſage only betwixt theſe two, than itſelf a diſtinct one. But this is not a Place to be particular as to the Differences of Number or Shape, *&c.* of the Stomachs of ſeveral Animals, having deſigned only a ſuccinct Anatomy of Man. But the Inquiſitive may ſatisfy themſelves in the learned Dr. *Charleton*'s ſecond Prelection before the College of Phyſicians, Entituled *Hiſtoria Ventriculi*; or more fully in the ingenious Dr. *Grew*'s *Comparative Anatomy of Stomachs and Guts*, publiſhed with his *Muſæum Regalis Societatis*.

It is ſeated immediately under the Midriff, which, when it is too full, it bears againſt, and ſo cauſeth difficulty of breathing, by hindring the Motion of it. In the fore-part, on the right Side, it is covered with the hollow ſide of the Liver; on the left ſide it is touched by the Spleen; its back-ſide upon full feeding, bears againſt the *Vena cava* and Spine; to its Bottom length-ways is the Caul knit; the backſide of its bottom reſteth on the *Pancreas*, and the foreſide on the *Colon*; all which further its Heat. *Situation.*

The *Bigneſs* of it is commonly ſuch, as is capable to receive ſo much Food at one time, as is ſufficient for Nutrition. When it is emptied, Dr. *Gliſſon* ſays, that it hardly weighs an hundredth part of the whole Body; ſo that 'tis a wonder ſo ſmall a part ſhould cook for the whole. It is leſs in humane Bodies than in Brutes, conſidering the proportion of their Bodies. It is commonly leſs in Women than in Men. They who have wide Mouths have large Stomachs. *Bigneſs.*

It is longiſh and pretty round, very much reſembling a Bagpipe in ſhape. It hangs croſs the Body; and its two Orifices (by which the Meat *Figure.*

is

is received in from the Gullet, and the Chyle let out into the Guts) ſtand higher up than its Middle, ſo that its upper part makes, as it were, the Concave of an Half-moon. It is more capacious on the left-ſide than on the right.

Connexion Its left or upper Orifice is continued from the Gullet, by the means whereof it is *knit* to the Midriff; and its right or lower Orifice is continued to the Gut *Duodenum*. Its Bottom in the whole length of it has the upper Edge of the Fore-leaf of the Caul adhering to it, by whoſe Mediation it is joined to the Liver, Back, Spleen, *Colon* and *Pancreas*.

Subſtance. The *Subſtance* of it is membranous, that it might admit of Diſtention and Contraction. It conſiſts

Membranes. of three *Membranes*. The *firſt* or *outmoſt* is common to it and the Gullet, and is derived from the *Peritonæum*. But yet it is not wholly derived from thence: For as Dr. *Gliſſon* argues, Seeing this Coat is fibrous, and the *Peritonæum* is not; its Fibres cannot be owing to that, ſeeing *Nihil dat quod non habet*. Theſe Fibres (being nervous) are ſtreight, running from one Orifice to the other, and encompaſſing both its bottom and ſides in their whole Longitude. Near the Orifices, and towards the bottom of the Stomach, they are far thicker than in the ſides, inſomuch as there they ſeem, in a manner, carnous and motory. They croſs at right Angles, the carnous ones lying next under them, as ſerving not only to cover them, but to bind them faſt, and to hinder them from ſtarting out of their Ranks.

The *ſecond* or middle Coat is *proper* and fleſhy, and conſiſts of two ranks of fleſhy Fibres, (with a *Parenchyma.*) the outer Rank are the more numerous, and are *tranſverſe*, running croſs or round the Stomach; and under theſe lie another rank, which

which (as Dr. *Willis* affirms) upon the top of the Stomach, run ſtreight from the left Orifice to the right; but the remainder of them tend along each ſide of the Stomach obliquely forwards toward the Bottom, and meet one another there.

The *third*, or inmoſt is likewiſe *proper*, but is nervous. On its inner ſuperficies it is lined with a downy Subſtance (as the inmoſt of the Gullet alſo is) ſomething like Velvet, which appears very plain after a light boiling of the Stomach. Dr. *Willis* thinks this downy Cruſt to be a diſtinct Coat from the Nervous, becauſe after dipping the Stomach in hot Water, it may be eaſily ſeparated from it: And when it is ſo ſeparated, becauſe on its outer Superficies, which adheres to the nervous Coat, it is beſet with abundance of Ring-like Glands, he calls it the *glandulous* Coat. When this is removed, the truly nervous Coat appears, which is endued with all ſorts of Fibres; but the ſtreight are moſt numerous, there run abundance of Blood-Veſſels along it, which terminate in its inner Superficies, that adheres to the glandulous Coat. So that 'tis probable the Mouths of the Arteries may diſgorge ſomewhat into the Stomach through the Glands in which they terminate.

This inmoſt Coat hath abundance of Wrinkles or Folds, which reſult from its being much larger than the two other. And the Uſe of them ſeems to be to hinder the too quick Paſſage of Things through the Stomach, and to retain ſome remainders of the Chyle, which may be of Uſe for the Chylification of the next Meal.

Beſides theſe Membranes with their Fibres, the Stomach hath alſo a *Parenchyma*, eſpecially its middle Coat: but it is not ſanguineous, but of a peculiar ſort. That it has a *Parenchyma* is plain; for

for without one, how ſhould the Inequalities that ſpring from the Texture of the Fibres, be filled up? Or whence ſhould all that ſlimy ſtuff come, that thoſe who make Strings for Muſical Inſtruments, ſcrape off from the ſmall Guts? Doubtleſs that can be nothing but this *Parenchyma* we ſpeak of, ſeeing after ſuch ſcraping they have loſt nothing of their ſtrength, which they owe to the Fibres and Membranes. And 'tis apparent, that the Subſtance of the Guts and Stomach is the ſame. Some think this *Parenchyma* to be almoſt wholly glandulous.

Orifices. It hath two *Orifices*: Of which the *firſt* is on the left ſide, and is called the *upper*; not becauſe it is ſituated higher than the other; but becauſe the Meat enters into the Stomach by it, as it goes out by the other, which is therefore called the *lower*. This is wider than the other, becauſe the Meat is only groſly broken by chewing, when it paſſeth through it; whereas it is diſſolved into a Liquor (called Chyle when it paſſes out by the other. It is called in Greek καρδία, *Cor*, from whence the Region of the Stomach under the *Cartilago enſiformis*, is called *Scrobiculus Cordis*, or Heart-pit; and hence alſo the Pains which happen in it, are called καρδιαλγίαι, and καρδιωγμοὶ, becauſe there is a great conſent between it and the Heart, by reaſon that they both of them derive their Nerves from the eighth Pair; ſo that one being affected primarily, the other muſt ſuffer by conſent. It hath orbicular Fibres, that the Meat and Drink being once receiv'd within the Capacity of the Stomach, it might be exactly ſhut, leſt Fumes and the Heat ſhould break out to the hindrance of Concoction, and annoyance of the Head.

The *other* is ſeated on the right ſide, and by the Greeks

Greeks is called πύλωρος, *Janitor*, or Door-keeper, becauſe as a *Porter*, it makes way for the *Chyle* to deſcend to the *Duodenum*. Here the inmoſt nervous Coat is very full of Wrinkles; and the middle, which is carnous, as every where elſe, ſo here alſo hath two Ranks of Fibres; firſt tranſverſe or annular, to ſtraiten this Paſſage, or ſhut it upon occaſion; and ſecondly ſtreight, *viz.* ſuch as running length-ways do gather up and draw the reſt of the Stomach towards this Door, for the diſtribution of the Chyle, after it has been ſufficiently concocted in the Stomach. And on the contrary, when theſe Fibres begin to be contracted at the other end, they often draw the *Pylorus* towards the left Orifice, as in Vomiting: And when the Convulſion is continued further, the *Duodenum* is drawn upwards, and thence the Choler and Pancreatick Juice are pump'd up, as it were into the Stomach. The beginning of the *Pylorus*, where its Coats are thickeſt, Dr. *Willis* calls its *Antrum*.

It hath *Veins*, firſt immediately from the *Trunk* itſelf of *Vena portæ*, and this is *Pyloricus Ramus*. Secondly, from the Branches of the ſame, and ſo from the *Ramus ſplenicus* thereof, it hath *Gaſtrica minor*, and *Gaſtrica major* (the largeſt Vein of the Stomach) from whence *Coronaria* ſpringeth; *Gaſtro-epiplois ſiniſtra*, and *Vas breve*: and from the *Ramus meſentericus*, before it is divided, it hath *Gaſtro-epiplois dextra*. All theſe Veins (as the reſt of the whole Body) ſerve only to convey back again (towards the Heart) the remains of the Arterial Blood, which in the Circulation is not ſpent on the Refection and Nouriſhment of the Part; tho' ſome learned Modern Anatomiſts think, that beſides the Arterial Blood, they receive ſome of the more ſubtile part of the Chyle, *Veins.*

for

for its readier Conveyance into the Mass of Blood, and thence draw a Reason of the very quick Refreshment that hungry and faint Persons receive by eating or drinking.

Arteries. It hath its Arteries from *Ramus cœliacus*, which do accompany every Vein, and have the same Denomination with them. Most Anatomists are now of Opinion, that these Arteries do not only convey Blood to the Stomach for its Nourishment, and for its Warmth to help its Concoction; but that they empty out of themselves, through the Glands of the Stomach, a certain spirituous Liquor into its Cavity, which being joined with the Reliques of the Chyle that stick in its downy Coat, and the *Saliva* which mixes itself with what we eat, or is swallowed at other times, make that Juice which is called the *Ferment* of the Stomach, which contributes more to the dissolving the Aliments than the *Heat* of it, which the Ancients made the main Instrument of its Action.

Nerves. It hath *Nerves* from the *par vagum*, (Dr. *Willis*'s eighth Pair) whose Trunks passing down (below the Pneumonick Branches) by the sides of the Gullet, are each divided into *two Branches*, the *outer* and *inner*. Both the *inner Branches* by and by bending to one another grow into one, which passing with the Gullet through the Midriff, goes on the *outside* of the Orifice of the Stomach, and spreads itself in its *Bottom*. *The two outer Branches* in like manner inclining to each other, unite into one, which descending to the Stomach by the *OEsophagus*, and arriving at the *inner Side* of its Orifice, there turns back, and creeps through its *upper part*. The *inner* and *outer Branches*, as they come one on one side, and another on the other side of the upper Orifice of the Stomach, send forth many small Twigs, which mutually inosculating,

culating, make there a net-like *Plexus*. From this *Multitude* of Nerves, interwoven in the Mouth of the Stomach, proceeds that great Conſent betwixt it and the Head. (So that in any great Concuſſion of the Head, there follows a Vomiting; and from the foulneſs of the Stomach, the Head-ach, *&c.*) Here at this upper Orifice, for the ſame Reaſon is the ſenſe of Hunger moſt urgent. Into the bottom of the Stomach are ſome Twigs inſerted, that ſpring from the left *Meſenterical Branch* of the Intercoſtal Pair.

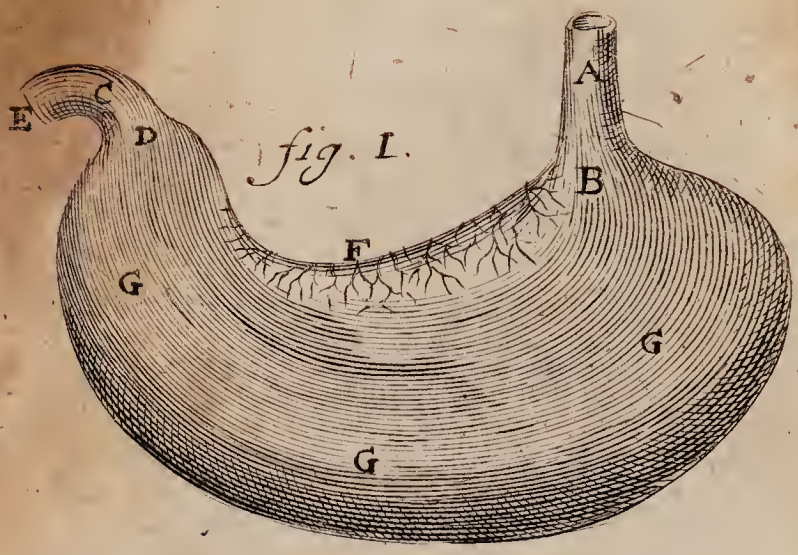
There are alſo ſome *Venæ Lacteæ*, which ſpring out of the bottom of the Stomach, whoſe Paſſage from thence to the common Receptacle, we deſcribed before in *Chap.* 5. from Doctor *Wharton*. Venæ Lacteæ.

And ſome affirm, there are *Lympheducts* which run along the Stomach, and empty themſelves into the common Receptacle.

Now as to the Cauſe of *Hunger*, omitting ſundry Opinions about it, I ſhall give but that one Reaſon of it, which *Diemerbroeck* thinks the moſt probable, and thus expreſſes: ['It is cauſed from 'fermentaceous (or diſſolving) Particles partaking of Acrimony, bred of Spittle ſwallow'd, and 'other ſaltiſh or acid things eat or drunk, which 'ſticking to the Coats of the Stomach, and 'brought to ſome acidity by it, or remaining 'in it after the Chyle is ſent off, affix'd to its 'inmoſt wrinkled Membrane (eſpecially about 'its upper Orifice) moleſt it by their twitching, 'which twitching being communicated to the 'Brain by the nerves of the eighth Pair, an Imagination of taking Meat is excited to aſſwage 'that troubleſome Corroſion.] He that doubts of the Truth of this Opinion, may find it evinc'd at large in his *Anatome Corporis Humani*, cap. 6. p. 39, *&c.* *The Cauſe of Hunger*

The Action of the Stomach. Chyle.

The *Action* of the Stomach is *Chylification*. Now *Chyle* is a pretty thick white Juice like Barley-Cream, made out of the Aliments taken; the manner whereof is well expreſt by the ſame Author. [‘ While the Meat is chewing in the Mouth, it ‘ is mix'd with the *Saliva*, which not only ſoftens ‘ it, but endows it with a certain fermentative ‘ Quality, unto which contributes alſo the ‘ Drink (whether Beer, or Wine, or ſome other) ‘ which often contains in it acrimonious Parti-‘ cles and fermentaceous Spirits. The Stomach ‘ by the help of it's Fibres, embraceth cloſely the ‘ Meat thus chew'd and ſwallow'd, and mixeth ‘ therewith ſpecifick fermentaceous Juices, bred ‘ in its inner Coat, and impregnated with the ‘ *Saliva*. Then by a convenient Heat there is ‘ made a Mixture and Eliquation of all; inaſ-‘ much as the fermentaceous Particles entring ‘ into the Pores of the Meat, do paſs through, ‘ agitate and eliquate its Particles, diſſolving the ‘ purer from the craſs, and making them more ‘ fluid, ſo that they make another form of Mix-‘ ture, and unite among themſelves into the re-‘ ſemblance of a milky Cream; after which, to-‘ gether with the thicker Maſs, with which they ‘ are as yet involv'd, by the Conſtriction of the ‘ Stomach, they paſs down to the Guts, where ‘ by the mixture of the Bile and the pancreatick ‘ Juice, they are by another manner of Fermen-‘ tation quite ſeparated from the thicker Maſs, ‘ and ſo are received by the lacteal Veſſels,] as the thicker is ejected by Stool. This ſeems to me a very rational Account of Chylification, and of the *Ferment*, by which it is chiefly performed; unleſs there ought to be added another Ingredient to compoſe the Ferment, *viz.* The Air, whoſe Particles are plentifully and intimately mixed with



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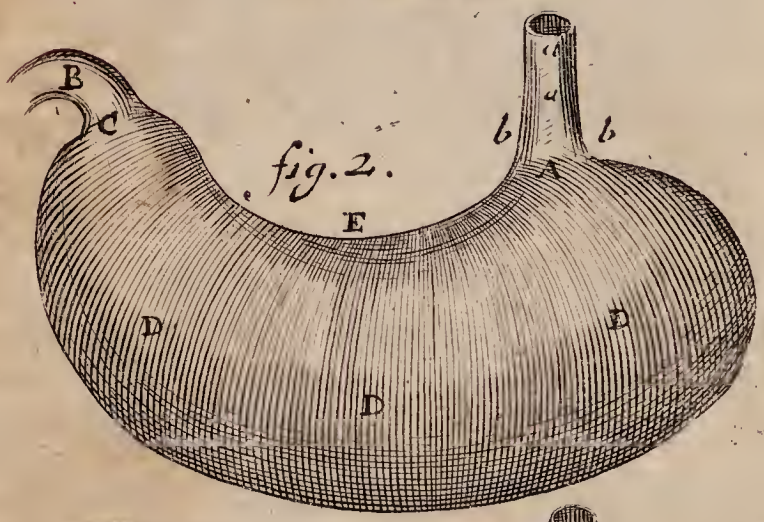

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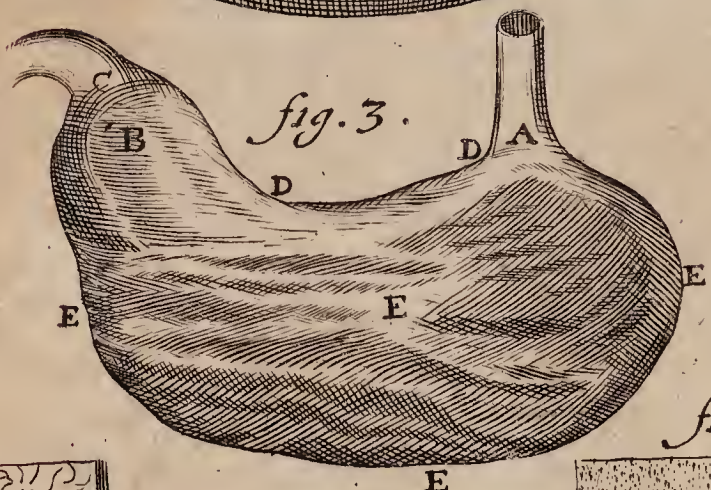
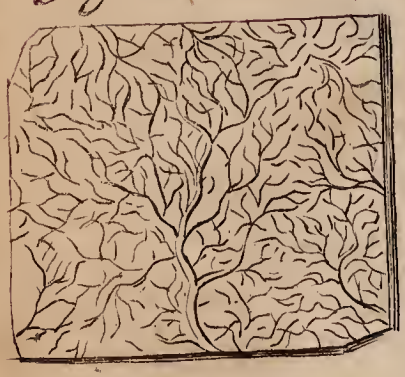


fig. 3.

fig. 4.



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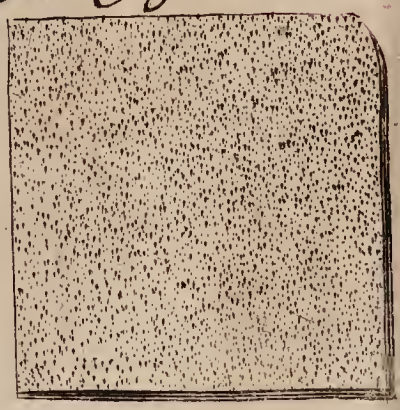

with the Meat in chewing, and swallowed with it. See farther of the Action of the Stomach in Dr. *Charleton*'s third Prelection before the College of Physicians, *Sect.* 6. *p.* 112.

Tab. II. *Representeth the several Coats of the Stomach with their Fibres, from* Dr. Willis.

Fig. 1. Expresses the outmost nervous Coat of the Stomach, whose nervous Fibres running lengthways of it, cut the outer carnous ones that lie under them, at almost right Angles.

A *The Gullet, in whose outer Coat all the nervous Fibres descend streight, crossing obliquely the carnous ones that lie under them.*

B *The Mouth of the Stomach.*

C *The* Pylorus *with its* Antrum D, *and a Portion of the* Duodenum *continued from it,* E.

F *The upper part of the Stomach, where the Blood-Vessels appear very numerous.*

GGG *The nervous and slender Fibres running lengthways of the Stomach from one Orifice to another, and further each way.*

Fig. 2. Shews the Stomach divested of its outmost nervous Coat, that the outer or convex Superficies of the middle Coat, with its carnous Fibres, may appear.

A *The Mouth of the Stomach into which the Gullet* aaa *is inserted, and which the circular carnous Fibres* bbb *encompass, shutting it upon occasion, by contracting themselves.*

B *The* Pylorus *with the* Duodenum *continued to it.*

C *The Orifice and* Antrum *of the* Pylorus, *both which the circular Fibres, when they are contracted, straiten, and seem to shut.*

DDD *The circular Fibres encompassing the Stomach depth-ways.*

E *The Top of the Stomach, Where these Fibres springing, whilst they are contracted, draw towards it the whole Bulk of the Stomach very much straitned.*

Fig. 3. shews the Stomach turn'd inside outward, that the downy Crust with the Wrinkles and Folds may be seen.

A *The left or upper Orifice of the Stomach.*
B *The* Antrum *of the* Pylorus, *in which the Coats are thicker.*
C *The right Orifice to which the* Duodenum *is continued.*
DD *The Top of the Stomach between the two Orifices.*
EEEE *Its Sides, End and Bottom, in which the downy Crust of the inmost Coat, with the Wrinkles and Furrows therein, are expresst to the Life.*

Fig. 4. Represents a piece of the nervous Coat, in which, the downy Crust being removed, its inner or concave Superficies appears, with a very thick branching of Vessels.

Fig. 5. Shews a piece of the downy or glandulous Coat, in which its outer Superficies, that cleaves to the nervous Coat, appears very full of Glandules, and the Mouths of Vessels.

CHAP. VIII.

Of the Intestines or Guts.

The Guts. Their Name. THE Guts are called in Latin *Intestina*, and in Greek ἔντερα, ἀπὸ τῦ ἐντὸς εἶναι, from their being placed within the Body.

Figure. They are oblong, membranous, hollow, round, diversly winding, continued from the *Pylorus* to the *Podex*, for conveying the Chyle, and the Excrements of the first Concoction.

They

They are *knit together* by the Meſentery, by which, and by the intervention of the Gaul (part of which adhereth to the Beginning of the *Duodenum*, and the middle part of the *Colon*) they are tied to the Back, and fill the greater part of the Cavity of the *Abdomen*. *Connexion*

They are of a membranous *Subſtance* like the Stomach, thinner in the ſmall Guts, and thicker in the great; and the nearer they come to an End, the thicker they are, as the lower End of the *Colon*, and the *Rectum*. *Subſtance.*

On the outſide they are covered with a pretty deal of Fat, to make them more ſlippery, and more fit for their Motion. *Fat.*

The *Length* of the Guts is about ſix times the Party's Length whoſe they are. They are thus long (and winding) that the concocted Aliments paſſing out of the Stomach, by their long ſtay in the Guts, might the more commodiouſly be fermented by the Admixture of the Bile and pancreatick Juice, and ſo the more ſubtil chylous Parts being ſeparated from the thicker Maſs, might be the better and more leiſurely driven into the narrow Orifices of the lacteal Veſſels, partly by the proper periſtaltick Motion of the Guts, and alſo by the impulſion of the Muſcles of the *Abdomen* moved in Reſpiration. And hereby two great Inconveniencies are avoided; the one of eating almoſt continually, which would have follow'd from the Chyle's not having time enough to have its Particles ſeparated and diſtributed, before it would have arriv'd at the *Anus*, whereby the Body muſt needs receive but ſmall Suſtenance from any thing eat or drunk; the other (for the ſame Reaſon alſo) of having almoſt a continual need of going to Stool; as happens to ſuch voracious Animals as have a ſtreighter Paſſage from the Stomach to the *Anus*. *Length.*

Coats. They have three *Coats*, like the Stomach. The *outmoſt* is *common*, and is derived from the *Peritonæum*, but mediately; for in the *Duodenum*, and that part of the *Colon*, which runneth under the Stomach, it proceedeth immediately from the Membranes of the Caul, which is knit to thoſe Guts; and in the *Jejunum Ileum*, the reſt of the *Colon*, the *Cæcum* and *Rectum*, it proceedeth from the Membranes of the Meſentery. It is all over beſmear'd with Fat, and is truly nervous.

The other two Coats are *proper*. The outer of them, being the middle of the three, is carnous. It has two Ranks of moving Fibres, one lying under the other. The firſt and inner Rank is annular, or tranſverſe, which encompaſſing the whole cavity of all the Inteſtines in very cloſe Order, is inſerted into the Hem or Selvedge of the Meſentery as into its Tendon. The other Rank is of ſtreight Fibres, which being ſpread above the former, and cutting them at right Angles, reach along the whole length of the Inteſtines, and their Tendon ſeems to be the outmoſt Coat, which being wholly nervous, or as it were tendinous, is wrapt about the whole Rank of theſe Fibres. This Coat is the chief Agent in the periſtaltick Motion of the Guts.

The *innermoſt* is nervous, altho' it ſeem to be fleſhy, by reaſon of the cruſty Subſtance with which it is lined. This Lining is called by *Pecquet*, a ſpongy *Periſtoma*; by *Bilſius* a woolly *Moſs*. It ſerves as a Filtre for the Chyle to tranſcolate through, in order to its entrance into the *Venæ lacteæ*; and beſides, it hindreth Excoriation, which might be cauſed when ſharp Humours paſs through the Guts. Some (as particularly Dr. *Willis*) take it for a diſtinct Coat, and call it *glanduloſa Tunica*, or *Villoſa*; being altogether like

that

that of the Stomach, which is deſcribed in the foregoing Chapter, and having the ſame Uſe with it.

This Membrane in the ſmall Guts, eſpecially the *Ileum*, is full of Wrinkles to ſtay the *Chyle* from paſſing too ſoon; which Wrinkles are cauſed, for that this inmoſt Coat, if it be ſever'd from the former, and the Wrinkles ſtretch'd open, will be (according to *Fallopius*'s Obſervation) thrice as long as it. And the ſame Membrane is expanded in the *Colon* into little Cells, for the ſlower paſſing of the *Fæces*. Theſe Wrinkles in both are called by * *Kerkringius*, *Valvulæ conniventes*. It has all ſorts of Fibres, and contains the Mouths of all the Veſſels both ſanguineous and lacteal, which are cover'd with that ſpongy Cruſt before-mentioned.

* Kerk. *obſ. Anat.* xxxix. p. 85.

What was ſaid of the *Parenchyma* of the Stomach in the foregoing Chapter, may, without repeating it here be applied to the Guts likewiſe.

Many late Anatomiſts have obſerved abundance of *Glands* to ſtick in this inmoſt Coat, (beſides thoſe which make Dr. *Willis*'s glandulous Coat) but they have been treated of by none, I think, ſo exactly as by *Peyerus*, who has writ a ſmall Tract of them, and deſcribes them thus; [‘They are very ſoft and delicate as to their ‘Subſtance, *he ſays*, ſo that if one handle 'em ‘ruggedly, they are eaſily ſqueez'd and defac'd. ‘They cannot be ſeen on the outſide; but if one ‘ſlit open the Gut lengthways, and thruſting ‘his Finger againſt the outſide, preſs the in‘ſide out by the Slit, and hold it to the Light, ‘they plainly appear like little Teats, with each ‘one a ſmall Pore in its Top, toward the Cavity ‘oft he Gut, as their Baſes or Back-ſides have

Glands.

'Blood-veſſels (and, as he ſays, Nerves too) in-'ſerted into them. If one preſs with his Finger 'on their Backſide, there will iſſue out of their 'Pore a clammiſh Humour. There are but very 'few (ſometimes none) of them in the *Duodenum* 'or *Jejunum*, but they are moſt numerous in the '*Ileum*, eſpecially towards its lower End, and 'they are chiefly on that ſide of the Gut that is 'oppoſite to the adheſion of the Meſentery. 'Where they are; they are not ſingle, but a Knot 'or Cluſter of them together, whence, (as alſo 'from their Uſe) he reckons them in the number 'of *conglomerate* Glands. They are thus in knots 'in the ſmall Guts; but in the *Cæcum*, *Colon* and '*Rectum* they ſtand ſingle, but are larger than the 'other, with every one a Pore in it likewiſe. 'Theſe are almoſt as big as a Vetch (and of the ſame ſhape) but thoſe in the ſmall Guts are but 'about the bigneſs of a Millet. He thinks the 'office of thoſe in the *ſmall* Guts is to ſeparate a 'double ſort of liquor, *viz.* a ſubviſcid and glu-'tinous *Serum* from the Arteries, and a nitro-ae-'reous Spirit from the Nerves, (according to Dr. *Mayo*'s opinion) 'which two being mixt to-'gether, make a fermentative Liquor for the 'perfecting of Chylification in the Inteſtines. 'But thoſe in the *thick* Guts, *he ſays*, ſerve for 'little elſe but to ſpue out a clammiſh Humour, 'by means whereof the Guts are fenced againſt 'the hardneſs of the Excrements, *&c.* and alſo 'the Particles of the Excrements themſelves, 'are thereby glued together, as it were, into a 'due Conſiſtence. Yet he ſuſpects there is ſome-'thing of a nitro-aereous Spirit alſo mixt with 'this Humour, and thinks it moſt probable that 'the *flatus* in the *Colon* owe their origin thereto.] Thus he.

As

As to their *Veſſels*, the *Veins* ſpring from the *Porta*, but not all of them from the ſame branch: For the *Duodenalis Surculus* is ſent into the *Duodenum*, and the *Hæmorrhoidalis interna* to the left part of the *Colon* near its ending, which running downwards from thence under the *Rectum* is inſerted into its End or *Anus*; as the *dexter meſentericus* is ſent to the *Jejunum*, *Ileum*, *Cæcum*, and the right part of the *Colon*. *Epiploïs poſtica* is inſerted into the middle part of the *Colon*, which marcheth acroſs under the Stomach. Beſides theſe, a ſprig from the *Ramus Hypogaſtricus* of the *Vena cava* is ſent to the Muſcles of the *inteſtinum Rectum*, which maketh the *external hæmorrhoidal*. *Veins.*

The *Uſe* of theſe Veins inſerted into the Inteſtines the Ancients thought to be, both to carry venal Blood to them for their Nouriſhment, and alſo to receive the Chyle out of them and carry it to the Liver, there to be turn'd into Blood. As to the firſt Uſe, 'tis certain (by the Circulation of the Blood) that theſe Veins carry nothing to the Guts; but the Blood that is in them, is all received from the Arteries there, to be carried back towards the Liver, and ſo to the Heart: but as to the latter there are ſome learned Anatomiſts that ſtill think, though the greateſt part of the Chyle is received by the *Venæ lacteæ*, yet that ſome part is ſuck'd in by theſe Veins, that it may be more readily convey'd into the maſs of Blood. But this opinion is exploded by others as learned and more numerous, who deny any ſuch Office to them, to whom I ſubſcribe. *Their Uſe.*

Beſides the ſanguineous Veins, there are another ſort of Veins inſerted (more or fewer) into all the Guts, called *Lacteal*, but of them we will treat in a diſtinct Chapter.

The *Arteries* ſpring partly from *Ramus cæliacus* *Arteries.*

in-

inteſtinalis, partly from both the *Meſentericæ*. To the *Duodenum* and the beginning of *Jejunum*, a ſprig is ſent from the right *Ramus cœliacus*: but to the reſt of the *Jejunum*, to *Ileum*, *Cœcum* and the right part of *Colon*, *Meſentericus ſuperior*; to the left part of *Colon*, and to the *inteſtinum Rectum*, *Meſentericus inferior*. This laſt paſſing along the *Rectum* to the *Podex*, makes the *internal hæmorrhoidal* Artery, as ſome branches from the *arteria hypogaſtrica* make the *external*. Laſtly, *Epiploïs poſtica*, which riſeth from the lower part of *Arteria ſplenica*, (which is the left branch of *Arteria cœliaca*) is ſent to the middle part of the *Colon*, which lieth under the Stomach.

Their Uſe. Their *Uſe* is to convey Nouriſhment and Warmth to the Guts; and when the Body is morboſe, to carry thither the Impurities of the Blood, upon a Purge taken, or critically ſo to paſs out by Stool. Yea, 'tis very probable, according to *Peyerus* his Opinion before-cited, that ſuch Arteries as terminate in the Glands above-deſcried, do ſpue out through them into the Guts, even in a healthful State, that ſlimy Humour that bedaubs the inſide of them.

Nerves. *Nerves* they have from the inferiour Ramifications of the *Intercoſtal* or ninth pair. The *Duodenum* hath ſome twigs from the upper branch of the *Ramus Meſentericus*, called *Stomachicus*, which go alſo to the *Pylorus*. All except the *Rectum* have many twigs chiefly from the *Plexus meſentericus maximus*, and ſome alſo from other Meſenterical *Plexus* of the intercoſtal Pair; but the *Rectum*, with the lower end of the *Colon*, receives ſlips from the *plexus Abdominis infimus* or *minimus*; and the utmoſt extremity of the Intercoſtal is inſerted into the *Sphincter ani*, whither alſo paſs three or four that ſpring from the bottom of *Os ſacrum*.

Theſe

These Nerves serve for the feeling, and for the peristaltick or worm-like Motion of the Guts; which though it be obscure and slow, yet because it is continual, it had need of so great a number of Nerves or nervous Fibres as are bestowed on the Intestines. Now this Motion is in some measure performed by the streight and oblique Fibres, but especially by the transverse or annular (of the middle Coat,) whereby what is contained in them is driven from above downwards: unless it happen that the motion be inverted, as in the Iliack Passion, in which they drive their Contents from below upwards. *Peyerus* thinks that even in a natural state (at least in the small Guts) this Motion is reciprocal, the contractions of the Fibres being carried sometimes upwards, and sometimes downwards; to the end that both the fermentative Liquors may by this Agitation be the more intimately mixed with the chylous Mass, and also the Chyle the better distributed into the Lacteal Vessels. If it were otherwise, the descent of the Chyle, he thinks, would be so hasty, that every one would labour under the *Cæliaca affectio*. And he quotes from *Wepfer* an Instance in an humane Body, and alledges his own Observation in all his Dissections of Creatures alive, for the Confirmation of the Truth hereof. But the Learned and Curious that would be further informed about the peristaltick Motion, may consult Dr. *Glisson*, in *cap.* 15. of his Book *de Ventriculo & Intestinis*, or Dr. *Charleton*, in Sect. 3. of his third Prelection before the College of Physicians. As for that other *Use*, which *Peyerus* ascribes to the Nerves, of transmitting a nitro-aereous Spirit through the Glands into the Guts, which mixing with that Humour that is separated from the Arteries, makes a Ferment for the perfecting

The Peristaltick Motion.

perfecting of Chylification in the Inteſtines, the Reader is at his diſcretion what Opinion he will entertain of it.

The Diviſion of the Guts. Tho' the Guts be one continued Body from the *Pylorus* to the *Anus*, yet from the thickneſs of their Subſtance, as alſo from their Magnitude, Figure, and Variety of Office, they are diſtinguiſh'd into ſeveral by Anatomiſts, and firſt into *thin* and *thick*.

The Differences between the *thin* and *thick* Guts are thus ſumm'd up by *Aquapendent*: 'The 'thin or *ſmall* are placed above, are long, equal, 'round, rolled about in Wreaths, full of Wrin-'kles, interwoven with innumerable Veins, and 'Chyle is found in them: On the contrary, the 'thick are placed below, are ſhort, anfractuous, 'without twiſting Wreaths, and endued with 'fewer Veins; and the Wrinkles or Folds in the 'Guts are expanded, and there reſult from them 'certain Receſſes or Cells, and the *Fæces* are 'found in them.

The Thin. The *thin* poſſeſs the umbilical Region, and *Hypogaſtrium*: and in reſpect of their Figure, Situation, Longitude, and plenty of lacteal Veſſels, they are divided into three, *viz.* The *Duodenum*, *Jejunum*, and *Ileon*.

1 Duodenum. The firſt is called *Duodenum*, becauſe the Ancients thought it to be *twelve* Inches long. But being chiefly vers'd in the Diſſection of Brutes, they were thereby deceived; for tho' in Sheep, for Inſtance, it be of that length, yet in Man it is but about four Fingers. It is continued from the *Pylorus*, from whence turning backwards and downwards, it reaches to the middle of the greater and right end of the *Pancreas*, and is none of it knit to the Meſentery, but to the Fore-leaf of the Caul. It is thicker in its Membranes than the

two following ſmall Guts, but its Paſſage (becauſe ſtrait) is ſtraiter than theirs. Towards its lower End (ſometimes higher, ſometimes lower) it has moſt commonly two Ducts leading obliquely into it; firſt, the *Ductus choledochus communis*, by which the Bile from the Liver enters this Gut; and ſecondly, a little below this, *Ductus pancreaticus*, (otherwiſe *Wirtſungianus*) by which the pancreatick Juice paſſes hither from the *Pancreas*, or Sweet-bread; though theſe two Ducts are ſometimes joined into one, and both open by one Mouth into this Inteſtine.

The ſecond is called *Jejunum*, or the hungry Gut, becauſe it is for the moſt part found empty; partly by reaſon of the multitude of milky Veins that enter it, partly by reaſon of the Fermentation of the acrimonious Choler with the pancreatick Juice, which are both poured in juſt before its Beginning. In Length it is about eight Feet. It beginneth on the right Side, under the *Colon*, where the *Duodenum* endeth, and the Guts begin to be wreathed; and filling a good part of the umbilical Region, eſpecially on the left Side, it is continued unto the *Ileum*, from which it may be diſtinguiſh'd firſt by its Emptineſs, ſecondly, by its greater number of Veins and Arteries, from which it looks reddiſh; thirdly, from the nearneſs of the Folds or Wrinkles of its inmoſt Coat one to another, which are but about half an Inch diſtant, whereas in the *Ileum* they are a whole Inch or more; and laſtly, from the Thickneſs of its Coats, as being thicker than thoſe of the *Ileum*. 2. Jejunum.

The third is called *Ileum*, ἀπὸ τῆς εἱλέσεως, *à circumvolvendo, from* its many Turnings and Windings. It hath thinner Membranes than the two foregoing. It is ſeated under the Navel, and filleth both 3. Ileum.

both the *Ilia*. It is the longeſt of all the Guts, for in Length it containeth above twenty Feet; but it is the narroweſt of all, for it is but about a Finger's breadth in Diameter. It hath fewer Wrinkles than the *Jejunum*, and leſſer; about the lower End of it they ſcarcely appear.

At its Beginning it is diſtinguiſhed from the *Jejunum*, by all the four Particulars above-mentioned; and it is eaſily diſtinguiſhable from the *Cæcum* or *Colon*, being not join'd to theſe by a ſtreight Duct, but tranſverſe. For the *Cæcum* and *Colon* are ſo united, as to make one continued ſtreight Canal, whoſe lower ſide the *Ileon* aſcending pierceth, and into the latter whereof its inner Coat hangs looſely the length of half an Inch at leaſt, making the Valve itſelf of the *Colon*, and is the Limit that divides the *Cæcum* from it.

This *Ileum* often falls down into the Cod, whence ſuch a Rupture is called Inteſtinal. And in this Gut happens the Diſtemper called *Volvulus*, or *Iliaca Paſſio*, wherein there is often vomiting of the dungy Excrement. This Diſtemper is cauſed herein, either when one part intrudes into another, or when the Gut is twiſted and twined like a Rope, or when it is ſtuff'd with ſome Matter that obſtructs it; or laſtly, when it falls out of its Place into the *Scrotum*, as was noted before. And thus much of the firſt ſort of Inteſtines, *viz.* the *ſmall* or *thin*.

Their Valves.

I have once and again made mention of the Wrinkles in the inſide of the *Jejunum* and *Ileum*, which by modern Anatomiſts are called *Valvulæ conniventes*. Theſe happen from theſe Guts inmoſt Coats being much longer than the two other; from hence it muſt needs ever and anon wrinkle or bag out, and where it does ſo ſtraiten the Paſſage; by which means the Chyle deſcends more

more ſlowly, and thereby the Lacteal Veſſels have the more time to imbibe it.

Now follow the *Inteſtina craſſa*, the *thick* or great Guts; they are three in number alſo. *The thick Guts.*

The firſt is called *Cœcum*, τυφλὸν, the *blind* Gut, becauſe one end of it is ſhut, ſo that the *Chyle* (or *Fæces* rather) both goes in and comes out at the ſame Orifice. In Man it is about as thick, and but half as long as your Earth-worms ſtretched out at length; only its Mouth that opens towards the *Colon*, is pretty large. It owes its Origin rather to the *Colon*, than the *Ileum*, and ſeems to be as it were an Appendage to it. It is bigger in an Infant than in a Man. It is not tied to the Meſentery, but being placed in the Cavity of the right *Os Ileum*, by its End it is joined to the right Kidney, the *Peritonæum* coming between. In ſound Perſons it is generally empty. In four-footed Beaſts it is always full of Excrements. Apes have it larger than a Man, Dogs larger than Apes; but Conies, Squirrils and Rats, largeſt of all, if you conſider the Proportion of their Bodies. Its Uſe is very obſcure in Men, being ſo very ſmall, and commonly empty. But in grown *Fœtus's*, or Infants new-born, it is full of Excrement, for which it ſerves as a Store-houſe, till after the Birth that they go to Stool. And in ſuch Animals as have it large (according to Dr. *Gliſſon*) it ſerves for a Bag, or ſecond Ventricle, wherein the prepared Aliments may be ſtored up, and ſo long retained till a richer, thicker, and more nutritive Juice may be drawn from them. 1. Cœcum.

The ſecond is *Colon*, κῶλον, either *quaſi* κοῖλον, *cavum*, becauſe it is the *holloweſt* or wideſt of the Guts; or elſe ἀπὸ τῦ κωλύειν, *ab impediendo*, becauſe it *detaineth* the Excrements. It hath its Begin- 2. Colon.

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ning at the *Os Ilium* on the right Side, and ascending by its Spine, it arrives at the right Kidney; to which Parts it is annexed by a membranous Connexion. From thence bending left-ways it creeps under the Liver by the Gall-bladder (which tinges it there a little yellowish) to the bottom of the Stomach, to the whole Length whereof it is tied by the Mediation of the Fore-leaf of the Caul, as it is knit also to the *Pancreas* and Loins by the Mediation of the hinder Leaf. Then it comes to the lower part of the Spleen, and is knit to it. Then touching the left Kidney, and adhering firmly to it by Fibres, it comes to the left *Os Ilium*; from which descending by the left Groin to the *Pelvis*, it embraceth the bottom of the Bladder behind on each side. Afterwards it ascends upwards by the right Groin, near the Place from whence it first took its Rise; and thence marching back again towards the left Side, and running itself in betwixt the *Ileum* and Back-bone, it reaches to the Top of *Os sacrum*, and there unloads itself into the *Rectum*. Its Length, according to Dr. *Glisson*, is about seven Feet; others reckon it shorter. It goeth almost quite about the *Abdomen*, next to the Muscles, that it may be the better compressed by them, for Avoidance of the Excrements. *Diemerbroeck* has an ingenious Reason why it should pass under the Stomach, *viz.* That as Chymists judge no Digestion more natural, than that which is performed by the Heat of Dung; so the Heat of the Excrements in the *Colon* does help the Coction of the Stomach.

Its Cells and Ligament.

It is not of one continued equal Width, but at about every two or three Inches distance it is more contracted, being somewhat furrow'd on the Out-side, and rigid on the inner, whereby the Gut is divided into several Cells. This comes

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to pass partly indeed from the inmost Coat's exceeding the middle and outmost somewhat in Length, but chiefly from the *Ligament* (which is half an Inch broad) that runneth on the upper and middle part of this Gut all along, and is much shorter than the Membranes of the Gut, as appeareth when it is cut through here and there, for then the Gut may be stretched out to near half as long again. The *Use* of these *Cells* is to hinder the flowing of the Excrements into one Place, which would compress the Parts adjacent; as also for the slower Passage of the *Fæces*, that we may not have a continual and hasty need of going to Stool. On its Out-side, especially from its passing by the Spleen, to its joyning to the *Rectum*, it has a great many fatty Knots, which serve to moisten and lubricate it, that the *Fæces* may pass the more glibbly. The *Rectum* also has such-like, for the same Reason.

It hath a *Valve* where it is joined with the *Ileum*, which Valve is nothing else but the inmost Coat of the *Ileum*, propending or hanging out flaggy into the *Colon*, (as was noted before:) For its Shape, *Spigelius* compares it to the *Sigmoides* in the right *Sinus* of the Heart. This Valve so stoppeth the Hole which is common to the *Ileon* and *Colon*, that Flatuosities cannot ascend from this latter into the former, much less Excrements regurgitate. But if the Peristaltick Motion of the Guts be inverted (as in the Iliack Passion) so that the inmost Coat of the *Ileum* be drawn back from its depending into the *Colon*, the Excrements of the *Colon*, yea, Clysters themselves may ascend up thro' the small Guts into the Stomach, and be thrown up by Vomit. *Its Valve.*

The third is *Intestinum Rectum*, the *streight* Gut. This hath its beginning at the first *Vertebra* of 3. Rectum

the *Os ſacrum*, where the *Colon* endeth; and paſſeth ſtreight downwards to the Extremity of the *Coccyx*. It is firſt ty'd on its *Back ſide* to both theſe Bones, by Mediation of the *Peritonæum*, to keep it from falling out; and on its *Fore-ſide* it grows in *Men* to the Neck of the Bladder, (whence in the pain of the Stone there, there generally happens a *Teneſmus*, or continual inclination to go to Stool) and in *Women* to the Neck of the Womb; but in both there is a muſculous Subſtance that comes between. It is a Foot in Length, not ſo wide as the *Colon*, but its Membranes are thicker.

Its Sphincter Muſcle. At its lower End (called the Fundament) it has a Sphincter Muſcle, by the help whereof it is cloſe purſed up, to hinder the continual Exit of the *Fæces*. But in going to Stool the ſame is partly voluntarily relaxed, and partly forced open by the Excrements themſelves, whilſt they are ſqueezed or forced down through the Compreſſion of the Guts, by the Contraction of the Abdominal Muſcles.

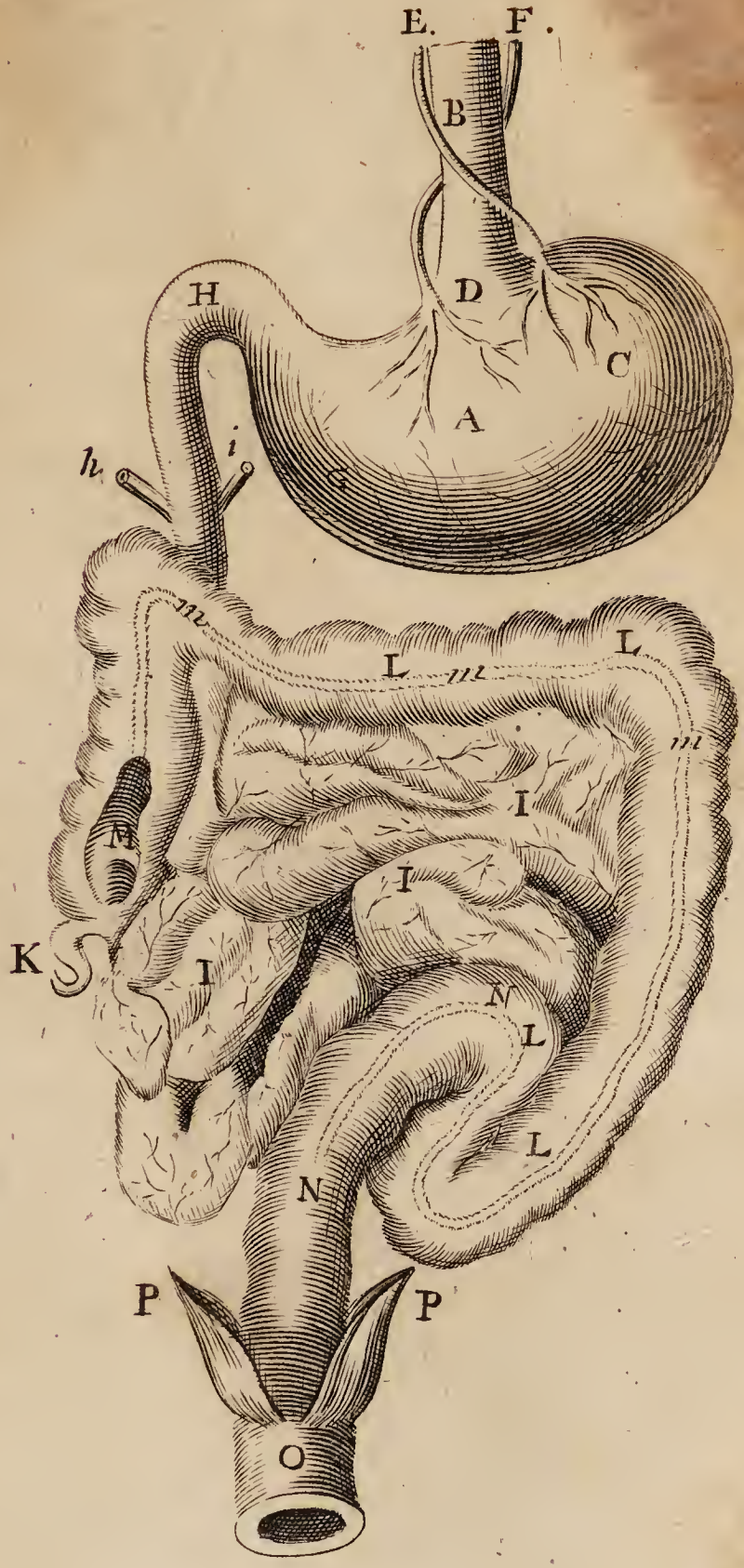
This Gut (eſpecially its inner Membrane) uſually bags a little out in ſtaining at Stool, or upon taking Aloetick Purgers, yea ſometimes ſo much, that it requires an artificial putting up again.

As for the *hæmorrhoidal* Veins and Arteries, that are inſerted into the *Anus*, we have given an Account of them before in this Chapter, as we ſhall do of the *Muſcles* belonging to it, in Book V. *Of the Muſcles*, Chap. 19.

The Explication of the Figure.

A *The Stomach.*
B *The Gullet*, or Oeſophagus.
C *The left and larger part of the Stomach.*
D *The upper Orifice of the Stomach.*

E *The*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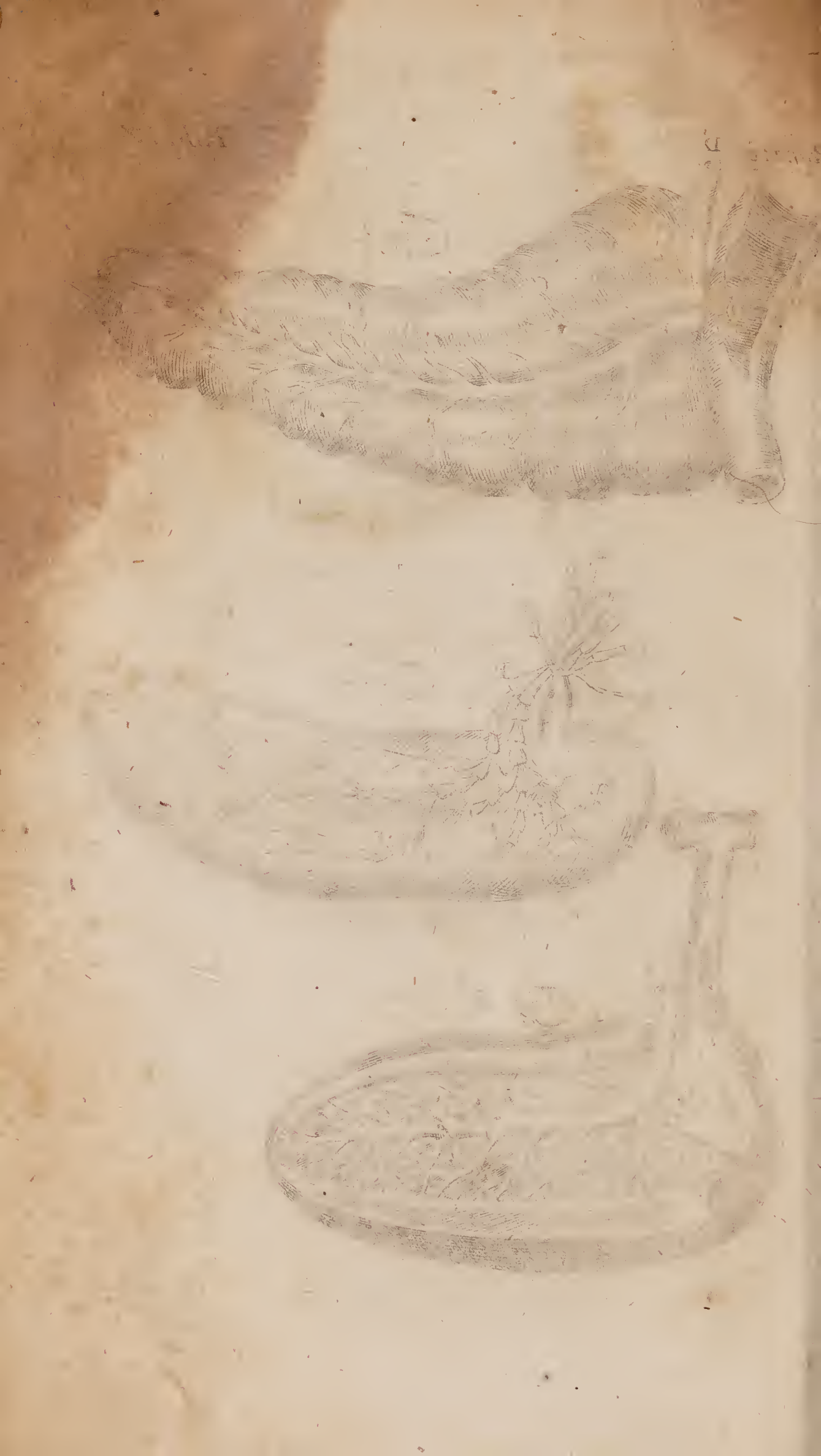


E *The right external Nerve of the ſixth Pair (Dr. Willis's eighth) encompaſſing the Orifice.*
F *The left external Nerve of the ſame Pair.*
GG *The gaſtrick Veſſels creeping along the Bottom of the Stomach.*
H *The lower Orifice of the Stomach, called* Pylorus.
h *The Inſertion of the Gall-Paſſage into the* Duodenum.
i *The Inſertion of the* Pancreatick Duct *into the ſame.*
III *The* Jejunum *and* Ileum, *with the Veſſels creeping along them.*
K *The* Cæcum.
LLLL *The* Colon.
M *The Valve in the beginning of the* Colon *opened.*
mmm *The Ligament holding together the Cells of the* Colon.
NN *The* Rectum.
O *The Sphincter of the* Anus.
pp *The Muſcles called* Levatores Ani.

CHAP. IX.

Of the Meſentery.

The Meſentery. Its Name and Deſcription.

THE *Meſentery* is ſo called from its Situation: For it has its Greek Name μεσέντερον (from whence the Engliſh is derived) from its being placed in ἐν μέσῳ τῶν ἐντέρων, *in the midſt of the Inteſtines.* And it is a membranous Part, ſituated in the middle of the lower Belly, ſerving not only for conveying ſome Veſſels *to* the Inteſtines, and others *from* them, but alſo ties moſt of the Guts together ſo artificially, that for all their manifold Windings, they are not entangled and confounded. Which may be much wondred at, how

the Guts, being about nine or ten Yards long, ſhould, all but the *Duodenum* and part of the *Rectum*, be comprehended by that Circumference that is but a Span diſtant from the Centre; for no longer is the *Meſentery* betwixt thoſe Bounds. But it is almoſt of a circular Figure, which is moſt capacious; and tho' it be narrow and plain at its Riſe, yet its Circumference is wrinkled and enlarged into ſo many Folds, as to be three Ells in Length, whereby it comes the nearer to anſwer the Length of the Guts.

Riſe. It has a double Origin, an higher and a lower. The higher is at the firſt, and the lower at the third *Vertebra* of the Loins.

Subſtance. It is compoſed of two *common Membranes*, which are propagated or continued, from a Duplicature of the *Peritonæum*; and betwixt theſe two, it has a third Membrane that is *proper*, (which was firſt diſcover'd by Dr. *Wharton*, in a young Maid) and is thicker than either of the other two, wherein the Glands are ſeated, and by which the Veſſels are conducted.

As for the *Fat* with which it is ſtuff'd betwixt its Membranes, tho' the ſame happen naturally to it, yet ought it not to be reputed a proper part of it. For not to mention that in Dogs, Cats, and ſuch-like Animals, this part is very thin and tranſparent, even in humane *Embryo*'s it is without Fat; and in very lean Men there is but little; tho' in fat Men it be heaped up to ſo great a Thickneſs.

Parts. The Parts contained in the Meſentery, are either common or proper. The *common* are Veins, Arteries, Nerves, and Lympheducts. The *proper* are Glands, and the *Venæ lacteæ*. Of theſe laſt we ſhall ſpeak in the next Chapter, of the reſt here. Beſides this diviſion of its Parts, it admits of another,

ther, with reſpect to the Guts that are connected by it; that part of it which connects the ſmall Guts, being diſtinguiſh'd by the Name *Meſaræum*; and that which connects the great, by the Name *Meſocolon*, of Which more by and by.

The *Veins* are called *Meſaraicæ*; theſe ſpring from *Ramus meſentericus dexter & ſiniſter*, branches of the *Vena portæ*. (Their Uſe, as alſo that of the Arteries, was ſhewn in the Chapter before, ſpeaking of the Veſſels belonging to the Guts.) *Veins.*

It hath alſo two *Arteries*, the one ſuperior, the other inferior, Branches of the *Arteria meſenterica*, which paſs as the Veins do. *Arteries.*

As for the *Nerves*, *Dr. Willis* deſcribeth them very accurately, in his Book *de Cerebro*, cap. 25. which take thus in ſhort. ['As ſoon as the *intercoſtal Pair* is deſcended as low as over againſt the 'bottom of the Stomach, it ſends forth on each 'Side a large meſenterick Branch, each of which 'is again divided, and makes two *Plexus* in each 'ſide. In the middle of theſe is the greateſt '*Plexus* of all, which (as he ſpeaks) is like the 'Sun amongſt the Planets; from which, Twigs 'and numerous Fibres are diſperſed into all the 'Parts of the Meſentery, which accompanying 'the ſanguiferous Veſſels in their whole Proceſs, 'do climb upon and twiſt about them.] Others it hath from thoſe which ſpring from the *Spinalis Medulla*, between the firſt, ſecond, third, and fourth *Vertebræ* of the Loins, as *Spigelius* affirmeth. *Nerves.*

Beſides theſe Veſſels known to the Ancients, betwixt 40 and 50 Years ago there were found out another ſort by *Tho. Bartholin* (a learned *Dane*) and called by him *Vaſa lymphatica*, which he gives a large Account of in *Append.* 3. to the *Libel.* 1. *de Venis*, of which (beſides what was *Lymphe-ducts.*

ſaid of them in the Introduction) I ſhall give a *Compendium here*, becauſe the Meſentery abounds with them.

Their Figure. They are of *Figure* long and hollow like a Vein, but very ſmall and knotty, having very many Valves which permit the *Lympha* or Water contained in them, to paſs to the chyliferous Veſſels (and many Veins) but hinder its return.

Colour and Subſtance. They are of a pellucid and chryſtalline *Colour*, like *hydatides, conſiſting of* a tranſparent and moſt thin Skin, which being broken, and the *Lympha* flowing out, they utterly diſappear.

Number. Their *Number* cannot be defin'd, for they are almoſt innumerable.

Riſe. As to their *Riſe*, *Bartholin* ſpeaks uncertainly; but *Malpighius* affirms, that they always proceed from *Glands*, and *Steno*, that they always either ariſe from or are inſerted into Glands.

Inſertion. As to their *Inſertion* or ending, thoſe under the Midriff do diſcharge their Liquor into the *Receptaculum Chyli*, (to be ſpoken of in the next Chapter.) Thoſe in the *Thorax*, immediately into the *thoracick Duct*. And thoſe of the Neck, Arms, *&c.* into the *jugular* Vein. *Bartholin* thought they all diſcharg'd themſelves into theſe three Channels; but *Diemerbroeck* affirms, they open alſo into many other Veins; and quotes *Steno*, noting that they empty themſelves into the jugular and other Veins; and alſo his Countryman *Frederick Ruyſch*, writing, that by the Ligature and Structure of Valves, he has plainly ſeen, that all the Lympheducts in the Lungs do diſcharge their *Lympha* into the ſubclavian, axillar, and jugular Veins.

Difference De Muſc. & Gland. p. 41. *Steno* diſtinguiſhes them into three ſorts; for ſome from their firſt Origins (but what thoſe are, he cannot ſay) are diſperſed over the Surface

of

of the firſt Glands they approach unto; others run from the hollow ſide of one Gland to the gibbous of another; and a third ſort run from the hollow ſide of theſe latter, to the Veins into which they diſcharge their *Lympha*. Whence (ſuppoſing this Difference) any Inquiry may ariſe, Whether the Lympheduct that paſſes out of the hollow ſide of the Gland, carry a more elaborated *Lympha* than that which entered into its gibbous Side? Or whether only the Quantity be encreaſed? I believe, that into every Gland there enter an Artery, Vein and Nerve, and therefore that ſome new *Lympha* is added to that which was brought in from the Lympheduct inſerted into it, which together therewith enters into the Lympheduct ariſing out of it; but that there is no further Elaboration of the former *Lympha*, which I think perfect at its entrance into the firſt Lympheduct.

What the Lympha *is.*

There has been much Diſpute what this *Lympha* which they carry, is. It ſeems to *Bartholin* to be meer limpid Water; but to ſimple Water there is added an alimentary Liquor, or a thinner part of the Chyle, fit for Nutrition, throughly mixed with it. The former, he ſays, is caſt off either by Sweat, or other ways, whereby Water paſſes away; the latter is circulated on. *Gliſſon*, that it is a Liquor condens'd from the *Halitus* of the Blood (like Dew) driven into theſe Veſſels, and flowing back with the Vehicle of the Aliment brought by the Nerves. *Segerus* (and *Sylvius*) that it is the Animal Spirits, or is made of them, which, after they are diſtributed into all Parts by the Nerves, are there partly conſumed and diſſipated, and are partly condens'd into this Water. *Diemerbroeck* quotes more Opinions beſides theſe, but rejects them all, and eſtabliſheth

This of his own, *viz.* [‘That it is a fermentaceous Liquor ſeparated from the ſerous Part of the Blood in the conglobate Glands, yet not ſimple, but impregnated with much fus'd and and volatile Salt, and alſo with ſome ſulphureous Particles; which, when it is conveyed to the *Vaſa chylifera*, makes the Chyle thinner, and apt to dilate eaſily in the Heart; and when to the *Veins*, prepares the venous Blood (now too thick) for a quick Dilatation in the Heart.] This *Lympha*, whatever it be (or be for) differs from the *Serum*; for if one gather a little of it in a Spoon, and let it ſtand, without ſetting it on the Fire, it will turn into a Gelly, which the *Serum* will not do.

And thus much of the *Lympheducts* (with their *Lympha*) in general: As to thoſe particularly of the Meſentery, ſome only paſs through it from other Parts, as from the Liver, *&c.* but many have their Riſe in it, and both the one and the other are emptied into the *Receptaculum Chyli*.

The Glandules of the Meſentery

It hath many little ſoftiſh *Glands* fix'd in its proper Membrane, cover'd on each ſide by the two common ones, and beſet with Fat. If you cut them in two, and preſs them with your Fingers, you may ſqueeze a whitiſh Liquor out of them. They are whiter in young People than in old. In Number they are very uncertain; in Man fewer, and ſmaller alſo than in other Creatures. The biggeſt by much is at the Riſe or Centre of the Meſentery, (called by *Aſellius*, *Pancreas*) into which (in a manner) all the *Venæ lacteæ* are inſerted. Of its Uſe, as alſo of the leſſer, we ſhall ſpeak in the next Chapter, when we come to treat of the Paſſage of the Lacteals. We will only note here, that when theſe Glands grow

ſcirrhous,

ſcirrhous, or are any ways obſtructed, ſo that the Chyle cannot tranſcolate through them, there follows a *Fluxus cœliacus*, or *chyloſus*, which continuing, there enſues an Atrophy, and the Party dies tabid. And perhaps from the ſame Obſtruction in the Glands, the Courſe of the Lympha being ſtopped, and by that means the Lympheducts that paſs from one Gland to another, being over-extended and burſting, an *Aſcites* is partly cauſed.

The Diviſion of the Meſentery

It is but one, yet becauſe of its different Thickneſs, it is divided by ſome into two Parts, (as was noted above.)

The one they call *Meſaræum*, μεσάραιον, becauſe it is placed ἐν μέσῳ τῶν ἀραιῶν (*ſubaudi* ἐντέρων) *in the midſt of the ſmall* Inteſtines, which it knits together; and this is the thicker Part of it. The other being the thinner, they call μεσόκωλον, being ſeated ἐν μέσῳ τῷ κώλῳ, *in the Midſt of the Colon*, to which it is joined in its whole Length, ſave only in the *Colon*'s Paſſage under the Stomach; and in its loweſt Border it adheres to a Part of the *Rectum*.

Diſeaſes.

Diſeaſes incident to this Part, are reckoned up by Dr. *Wharton* to be theſe; thoſe of *Intemperies*, Straitneſs or Obſtruction, Tumours of whatſoever Kind, (*Scirrhi*, *Scrophulæ*, *Strumæ*) Inflammations, Abſceſſes, Ulcers, and Tone vitiated. Of all which, the Reader that deſires fuller Information, may be ſatisfied by the ſaid learned Author, in his *Adenographia*, cap. 11.

CHAP.

CHAP. X.

Of the Venæ lacteæ, Glandulæ lumbares, Receptaculum commune, Ductus chyliferus Thoracicus, *and of the Motion of the Chyle.*

Venæ lacteæ Their Name.

VEnæ *lacteæ*, the *milky Veins* (so called from the *white* Colour of the Chyle which they carry) were not discover'd (as such) till the Year 1622. when *Gaspar Asellius* found them out in dissecting a live Dog well fed. But since him many others have made a more accurate Discovery of them than he.

Definition. They are slender pellucid Vessels, having but a single Coat, dispersed in great Numbers thro' the Mesentery, and appointed for the carrying of the Chyle.

Rise. Their *Rise* is from the inmost Membrane of the Intestines, where their Mouths are hid under a kind of a spungy Crust or *Mucus*, through which, by the Pression of the Guts, the Chyle is strained and received by the Mouths of these Vessels. From whence they proceed the readiest way to such Glandules of the Mesentery as are neerest to them: But in their Passage many small ones uniting to one another do commonly grow into one large Trunk; namely, a pretty way before they insinuate themselves into the Gland, to which we said they were going. But in their very Entrance into the Gland, or a little before, this Trunk separates again into new Branches, more and smaller than the other. And thus far they are called *Radicales*, or *primi Generis*, of the first Kind. Out of the Gland there spring again new capillary ones, which by and by meeting together, make one Trunk again as before, which keeping

keeping its Course towards the Centre of the Mesentery, enters as many Glands as lie in its way, being divided into new Branches just before its Entrance into each Gland, as before. But whilst all the Trunks bend one way, they also meeting with one another, do in process several of them grow into one. And at length all the Trunks arrive at the great or middle Gland of the Mesentery (called improperly *Pancreas*) which most of them enter into, but some of them pass over its Surface, and by and by they all empty themselves into the great or common Receptacle of the Chyle that lies behind the said Gland, those that were inserted into it, rising out of it in like manner as they did before out of the lesser Glands. As they run from one Gland to another, they are called *secundi Generis*, or of the second Kind: And from their having past all the Glands, to their opening into the common Receptacle, *&c.* they are called *tertii Generis*, or of the third Kind.

By the way, we cannot omit to take notice of those three Glands, which *Bartholin* calls *Lumbares*, from their being situated upon the *Loins*, and which he thus describes. * Two of them, which are larger, lie one upon the other, betwixt the descending *Cava* and *Aorta*, in that Angle which the Emulgents make with the *Cava*. The third being smaller, stands over these, under the Appendices of the Diaphragm. They have Communication, or are knit one to another by small lacteal Branches, especially the two larger.] He once thought them to supply the Place of the common Receptacle in Man; that not being so plain in him as in several Brutes. But since a Receptacle is acknowledged as well in Men as Brutes, Dr. *Wharton*'s Opinion concerning their Use, seems more probable, *viz.* That they supply the Place of

Glandulæ lumbares.

* *Anat.* p. 108. *Edit.* 74.

of thoſe larger Glands that are found in the Meſenteries of Brutes, but are not natural to Men; and for this Reaſon he preſumes, that all ſuch Animals as want thoſe greater Glands in the Meſentery, have theſe *Lumbares* as well as Men.

Receptaculum commune.

The *common Receptacle* is called *Receptaculum Chyli Pecquetianum*, from *Pecquet* who firſt found out both it and the *ductus Thoracicus* (whoſe beginning it is) in the year 1651. I mean he was the firſt that aſſigned the true Uſe unto them, but both were obſerved in Horſes by *Bartholomæus Euſtachius* above an hundred and thirty years ago, as appears in a Book he writ 1564. *pag.* 301. of the *Vena ſine pari*, wherein he has theſe Words, (as cited by Dr. *Wharton*) *From this notable left Trunk of the Throat*, (viz. *the* Subclavian Vein) *there ſprings a great Branch, which beſides that it has a ſemicircular Door*, (or Valve) *in its Origin, is moreover white, and full of a watry humour; and not far from its riſe, it is divided into two, that after a little ſpace unite again into one, which ſending forth no Branches, deſcends by the left ſide of the* Vertebræ, *and having paſt through the Midriff runs down to the middle of the Loins: where becoming larger, and folding about the great Artery, it has an obſcure ending, which I have not as yet well diſcover'd.*] Here we have a clear Deſcription of them, only that is the Beginning which he takes for the End; and contrarily. It is called the *common* Receptacle, becauſe it receives both the Chyle and Lympha promiſcuouſly; though ſome call it the Receptacle of *the Chyle* in particular, but without reaſon; for it might as well be called *Receptaculum Lymphæ*, as *Chyli*, for that the *Lympha* paſſes not only with the Chyle, but after this is all diſtributed, the *Lympha* ſtill continues to glide into it, and to aſcend by the

ductus

ductus chyliferous Thoracicus, which might as well be called *Lymphaticus* for the same reason.

It is *seated* under the Celiack Artery and Emulgent Veins, about the middle distance between the Kidneys and *capsulæ crabilariæ*, upon the *vertebræ* of the Loins, but for the most part rather toward the left side. *Pecquet* and *Casp. Bartholin* say, 'tis seated between the Tendons (or *Appendices*) of the Diaphragm; by the motion whereof it is pressed and milked, as it were, and its contents propelled. It is of a membranous but thicker *Substance* in Men than in Brutes, but not so capacious, seldom being so large as to admit ones Finger's End. Out of it there springs a Duct that presently ascends up into the *Thorax* (behind the descending Trunk of the *Arteria magna*) where it begins to be called *ductus Thoracicus*, but, according to *Sylvius*, it might more fitly be called *Spinalis*, seeing it runs along the Inside of the *Spina dorsi*. And now though it be past out of the *Abdomen* (of the Contents whereof we are here treating) yet we will trace it through the middle Ventricle to the Heart, whither it conveys its Liquor, for the same reason that being above to speak of the Stomach, we thought it best to describe the Gullet also, which is an Appendage to it, and by which the Meat descends into it.

Its Seat and Substance.

This *Duct* then having past the Midriff, marches farther upward under the great Artery, till about the fifth or sixth *vertebra* of the *Thorax*, where it turns a little aside from under it to the left hand; and so underneath the intercostal Arteries and Veins, and the Gland *Thymus*, it ascends to the left subclavian Vein, into whose lower side it opens, just there where the left jugular Vein enters into it on the upper side, so that

Ductus chyliferus thoracicus.

that their Mouths face one another. But it opens not into this Vein with any large Orifice, but by six or seven little ones, which are all cover'd in the Cavity of the *Subclavia* with one broad Valve, looking towards the *Cava* from the Shoulder, whereby there is granted to the Chyle and *Lympha* a free Passage out of the *Ductus Chyliferus* into the *Subclavia*, but their Return (or of Blood with them) out of the Vein into the Duct is prevented. This Duct ending thus in the Subclavian Vein, the Chyle that it conveys into it passes with the Blood (returning by the *Cava*) into the right Ventricle of the Heart, where we will leave it, and return to the *Venæ lacteæ* again; having only observed, that this Duct has many semilunar Valves that hinder the ascending Chyle and *Lympha* from gliding back again; which Valves are manifest by this, that the Chyle contained in the Duct may easily by the Finger be prest upwards, but by no means downwards; or if one make a hole in it, the Liquor tending from beneath upward will flow out at it; but that which is above it, is so stopt by the *Valves*, that it cannot be made to descend by it.

The difference between the Venæ lacteæ, *and the ordinary mesaraical Veins.*

The *Venæ lacteæ* differ from the ordinary Mesaraick Veins:

First, in *Bigness*; for the Mesaraicks are bigger, but the *Lacteæ* are far more in number. Which was necessary, in that more Chyle must pass by them the way that has been spoken, to make Blood of, for the nourishment of the whole Body, than there can be Blood remaining from the nourishment of the Intestines only, to return by the Mesaraicks to the Liver.

Secondly, they differ in *Colour*, by reason of the great difference in Colour of the Liquors they con-

contain. The Lacteals are white and limpid, by reason of the whiteness and clearness of the Chyle that is convey'd by them; but the Mesaraicks are of a dusky blackish Colour.

Thirdly, They differ in their *Insertion*; for the Lacteals, as has been said, (are the most of them) inserted into the great Gland of the Mesentery, from whence they run forward to the common Receptacle, but the Mesaraicks all terminate in the Liver.

Whether they differ from the ductus Lymphatici.

But though there be this plain difference betwixt these two, yet there is not the like betwixt the *Venæ lacteæ*, and the *Lympheducts*; for many good Anatomists do affirm, that before and after the distribution of the Chyle, not only the Receptacle and *Ductus thoracicus* contain *Lympha*, but that they have seen even the *Venæ lacteæ* themselves do so too, and question whether the same Vessels be not, in the Mesentery, common Conduits for both Liquors. I believe that the *Lacteæ radicales* (or *primi generis*) are truly distinct from the Lympheducts, but hesitate as to those *secundi, & tertii generis*.

Valves.

They have a pretty many *Valves*, but not so many as the *Ductus Thoracicus*. They may be discover'd the same way as we intimated those of the *Ductus* might, *viz.* That if they be pressed towards the great Gland, they are presently emptied; but if one press them from the Gland towards the Intestines, the Chyle will stop, and cannot be driven thither.

The reason of the Motion of the Chyle.

By what has been said, it sufficiently appears, what way the Chyle passes from the Guts to the Heart; but there is another thing to be enquired into, *viz.* What should be the Reason or Cause of this Motion. This we cannot impute to the *Attraction* of the *Lacteæ*, as if they suck'd up the

Chyle

Chyle out of the Guts, for ſuch elective Attraction has been along time exploded; but the true Reaſon is, the Preſſure of the Guts, whereby the Chyle is ſqueezed through their ſpungy inner Cruſt or Coat, into the Mouths of the *Lacteæ*. Which Preſſure proceeds partly from that undulating contraction of the Guts that is performed by their own Fibres, which one may plainly obſerve in Conies, *&c.* opened alive; and *partly* from their being heaved to and again by the Muſcles of the *Abdomen*, and the *Diaphragm* in Reſpiration. Now as ſoon as the Chyle is once got into the *Lacteæ*, we need not be ſollicitous for a Reaſon of its further Progreſs to the Receptacle, and up the Thoracick Duct; for what is once got in, cannot ſlide back again by reaſon of the Valves; and ſeeing ſo long as there is any Chyle in the Guts, there is no ceſſation of its being preſt into the *Lacteæ*, that which comes behind, muſt needs drive forwards that which went before, by which it is made to aſcend to the Heart. Which aſcent is alſo helped by the *Lympha* that mixes with it in the Receptacle and Duct, not only in that it is thereby diluted; but more eſpecially from that Motion which is impreſſed upon the *Lympha*, from the Pulſation of the Heart, whereby it is made to circulate by the Lympheducts, as well as the Blood by the Veins.

CHAP. XI.

Of the Liver.

The Liver. Its Situation.

THE *Liver* is ſeated in the upper part of the *Abdomen*, namely, about a Finger's breadth diſtance from under the Midriff, in the right Hypo-

Hypocondre (under the ſhort Ribs) which being of a great Bulk, it quite fills in a manner, and reaches from thence towards the left Side, a little beyond the *Cartilago Enſiformis*, or Pit of the Stomach. Its upper ſide is convex or round and ſmooth, the under is hollow, lying on the right ſide of the Stomach and *Pylorus*, &c. Its lower Edge reaches below the ſhort Ribs on the right Side, and very near as low as the Navel before.

Lobes. In Dogs and many other Brutes, it is plainly divided into divers *Lobes*; to which that Man's might ſeem to correſpond, many of the Ancients reckon'd it to have four Lobes, called *Porta*, *Menſa*, *Gladius* and *Unguis*; and *Galen* deſcribes five: But *Columbus* and *Gliſſon* do more truly affirm it to be undivided, or continuous: Only there is a little Protuberance in its hollow Side, to which the Caul is knit, which *Spigelius* called a Lobe, and from him others; but it is improperly called ſo, and is not at all like the Lobes in the Livers of Brutes.

Ligaments. It has three *Ligaments* (properly ſo called) which according to Dr. *Gliſſon* (*de Hepate*) are theſe. The firſt is called *Suſpenſorium*, becauſe it *ſuſpends* the Liver, or ties it up to the Diaphragm; it is broad, membranous and ſtrong, ariſing from the *Peritonæum*, and is not only fixed to the outer Membrane of the Liver, but does indeed make it, and deſcends even into the Liver, and is ſtrongly faſtened to the common Sheath or *Involucrum* of the *Vena cava*, (there where the umbilical Vein is continuous to it.) By this ſtrong Inſertion it is the more able to bear up the great Weight of the Liver.

The ſecond is the *Vena umbilicalis*, which after the Birth, cloſes up and hardens into a Ligament. It is directly oppoſite to the former. It paſſes

out of the hollow side of the Liver by the *Porta*, and terminates in the Navel. By this the Liver is kept from ascending upon the Motion of the Diaphragm upwards in Respiration.

The third is that whereby the Liver adheres to the *Cartilago Ensiformis*, this is thin and flaccid, but yet strong, broad, and doubled, arising from that Membrane wherewith the Liver is encompassed, (according to *Spigelius*) of which it is a Duplicature (according to Dr. *Glisson.*) This hinders it from fluctuating to one or t'other Side, or towards the Back.

Besides these three Ligaments, it has several other Connections to the neighbouring Parts, by the Vessels that come into it, or go out of it; but those would improperly be called Ligaments.

Membrane It is covered with a very thin *Membrane*, that springeth from the first Ligament (as was said before) which cleaveth firmly to the Substance of the Liver. It is sometime separated from it by a watrish Humour, issuing out of the capillary Veins, or Lymphaticks, whereby watrish Pustules, by the Grecians called ὑδατίδες, are engendred. If these break, the Water falleth into the Cavity of the Belly, and in part at least causeth that kind of Dropsy called *Ascites*.

Substance. Its *Substance* (besides the Vessels) has used by most Anatomists to be called *Parenchyma*, as if it were nothing but an *Affusion* of some certain Humour about the Vessels, and there concreted. And because it looks red, they have esteemed it to be Blood. But red is not its proper Colour, as Dr. *Glisson* thinks; nor is it a parenchymatous, as *Malpighius* teaches. For the former says, That its Redness is only borrow'd from the great Quantity of Blood that is transcolated through it out of the *Porta* into the *Cava*, its proper Colour being pale,

pale, a little yellowiſh, ſuch as the Liver is of when 'tis boil'd; and yet that yellowiſhneſs ſeems to be cauſed by the Bile which is ſeparated in it: And the latter eſteems it to be glandulous, and naturally of a white Colour; whoſe Obſervations by the Microſcope, being curious, I ſhall expreſs in ſhort, as they are contained in his *Lib. de Hepat.* cap. 2, 3, 5. He ſays, [' That 1. the *Parenchyma* 'ſo called of the Liver in Man, is framed of in- 'numerable Lobules, which have commonly 'each of them ſix Sides like a Die, and conſiſt 'of ſeveral little ſix-corner'd Glands like the 'Stones of Grapes (ſo that the Lobules look 'like Bunches of Grapes) and are each cloathed 'with a proper circumambient Membrane, and 'are joined to one another by Membranes con- 'tinued from the circumambient, and running 'tranſverſly; yet ſo, as that certain *Rimulæ* or lit- 'tle Chinks reſult from the joining of the Sides 'of the Lobules together. 2. That the whole 'Bulk of the Liver conſiſts of theſe little Grape- 'ſtone-like Glands, and of divers ſorts of Veſſels; 'and hence that they may perform together a 'common Work, Reaſon concludes it neceſſary, 'that there be a Commerce betwixt theſe Glands 'and Veſſels, tho' Senſe cannot diſcern the ve- 'ry ſlender extreme Twigs of the Veſſels that 'are inſerted into the Glands. 3. That the little 'Branches of the *Porta*, *Cava*, and *Porus Bilarius*, 'do run through all, even the leaſt Lobules, in 'an equal Number: That the *Porta* does the 'Office of an Artery, and has ſo great Society 'with the *Porus Bilarius*, that both their Twigs 'are ſtraitly tied together in the ſame Cover. '4. That the Shoots of the ſaid Veſſels are not 'joined by Anaſtomoſes, but that the Grape- 'ſtone like Glandules, making the Chief Sub-

'ſtance of the Liver, are a *Medium* between the 'importing and exporting Veſſels, ſo that by 'the Interpoſition of theſe, the Importers trans-'fuſe their Liquor into the Exporters. From 'theſe Obſervations he concludes the Liver to 'be a *conglomerate Gland*, ſeparating the Bile.— 'And becauſe it is uſual for the conglomerate 'Glands, to have, beſides Arteries, Veins and 'Nerves a proper excretory Veſſel (as in the '*Pancreas*, *Parotides*, *&c.*) diſperſed through their 'Subſtance, receiving and carrying away the 'Humour ſeparated in them; this kind of Veſſel, 'in the Liver is the *Porus bilarius* with the Gall-'bladder.] Which Account of the *Parenchyma*, &c. of the Liver, tho' new, and far differing from any heretofore delivered by others, is now received generally among Anatomiſts. And whereas ſeveral Lymphatick Veſſels are ſaid to ariſe from the Liver, and therefore it may ſeem to have a double excretory Veſſel; he thinks, that, ſeeing in other Places the Lympheducts uſe to ariſe not from conglomerate, but conglobate Glands, therefore they do not truly ſpring from the Liver itſelf, but from thoſe conſpicuous conglobate Glands that are in the hollow of the Liver under the *Involucrum* or *Capſula*, where the Trunks of the *Porta* and *Porus bilarius* enter into it. Even, as *Steno* obſerves, that the Lympheducts which ſeem to ſpring from the *Parotides*, do not indeed ſpring from them, but from a conglobate Gland that is contiguous to them.

Veins. It hath two ſorts of *Veins*. In its upper Part the *Vena cava* entereth into it, and ſpreads itſelf all through it in the lower, as well as upper Part. Into the lower Side the *Vena portæ* is inſerted, whoſe Branches likewiſe run through its whole *Parenchyma*. Of both theſe Veins more fully in the two following Chapters. It

It has but very small and few *Arteries*; for the *Porta* serves it for an Artery, bringing Blood to it. Those which it has, do all arise from the right Branch of the *Arteria cœliaca* (called *Hepaticus*) which being sustained by the Coat of the Caul, ascends to the hollow of the Liver just by the *Vena portæ*, on whose Coat, with the bilary Vessels, and the Membrane of the Liver, it is wholly spent. For, as was said, the *Parenchyma* (so called) is nourished by the Blood brought by the *Porta*. *Arteries.*

It has Nerves from the Intercostal Pair, namely, one from the stomachical Branch thereof, another from the mesenterical (called *Hepaticus*.) But the Nerves are extended only to the Membrane and Vessels of the Liver (as the Arteries were) so that the *Parenchyma* has but a very dull Sense. *Nerves.*

Till the *Ductus Thoracicus Chyliferus* was found out, it was still believed that the *Venæ lacteæ* were inserted into the Liver, which was look'd upon as the great Organ of Sanguification: But now 'tis known for certain, that no *Lacteæ* at all go to the Liver, but that those Vessels which were taken for such, are *Lymphatick* Vessels, carrying from it a most limpid and pellucid Juice. That they are dispersed in the *Parenchyma* of the Liver, has not yet been observed; nay, as was noted before, *Malpighius* believes they are not derived from the Liver at all, but from those conglobate Glands that lie under the *Porta*, at its Ingress into the Liver, and sometimes adhere to it; from whence taking their course chiefly along the Mesentery, they open themselves into the *Receptaculum Chyli*. But supposing that they enter'd the Substance of the Liver, lest any one should suspect them to be Lacteals, for which *Lymphe-ducts.*

they were a good while taken, after the Lacteals of the Meſentery were found out, but the common Receptacle and Thoracick Duct were not as yet known: I ſay, leſt any ſhould ſuſpect them to be Lacteals, and ſo to import Chyle to the Liver, let him ſatisfy himſelf with this Experiment, *viz.* Let him in Viviſection make a Ligature about any one of them, or more, and he will ſee them preſently ſwell betwixt the Ligature and the Liver, but be empty on that Side towards the Receptacle. And the ſame will be more evident if he examine their *Valves* alſo, which open towards the ſaid Receptacle, but hinder any thing from coming back from thence to the Liver.

The Bilary Veſſels.

Concerning the *Bilary Veſſels* we ſhall forbear to ſpeak here, deſigning a particular Chapter for them, *viz.* Chap. 14.

The Liver does not ſanguify.

Hippocrates, in *lib.* 4. *de Morb.* ſays, *The Fountain of Blood is the Heart, the Place of Choler is in the Liver*; which comes very near the Truth, as ſhall appear hereafter. But after him both the *Greeks* and *Arabs*, generally held, that the Meſaraick Veins received the Chyle from the Guts, and brought it to the Liver, by which it was turned into Blood, which was carried from it into all the Parts of the Body by the Veins. Yea and even ſince the *Venæ lacteæ* were found out, Anatomiſts believed that they all terminated in it, becauſe they judged it the fitteſt Bowel for Sanguification, preſuming that that Task muſt be performed by ſome or other. But not to multiply Arguments for the Confutation of ſo generally rejected an Opinion, this one may be ſufficient to evince its Falſity, That none of the *Venæ lacteæ* are inſerted into the Liver, and conſequently no Chyle is imported into it, whereof

Blood

Blood ſhould be made. How and where Sanguification is performed, we ſhall ſhew when we come to the Heart.

Its true Action.

The Liver then being diſcharged from Sanguification, its true Action is to ſeparate the *Bile* from the Blood, which is brought plentifully to it by the *Vena portæ*. As to the manner of its Separation, ſome ſay it is meerly by Colature, others think a Fermentation alſo neceſſary. But this is too intricate a Controverſy to enter upon here, and therefore waving it, I ſhall paſs on to ſpeak of the Nature and Uſe of the *Bile*.

The Nature and Uſe of the Bile.

The Ancients (amongſt whom was *Ariſtotle*) thought it to be a meer Excrement, and to be of no other uſe, than by its Acrimony to promote the Excretion of the Guts. And this Opinion prevail'd ſo long, as it was believed that the Liver had a nobler Action than meerly to ſeparate the Choler. But now it being found out that it has no other Office, it ſeems unlikely that ſo bulky a Bowel was made only for the ſeparation of a *meer Excrement*, and therefore 'tis believed to be a *Ferment* for the Chyle and Blood. This new Doctrine I ſhall give entirely out of *Diemerbroeck*, *p.* 154. ['The Blood flowing into the 'Liver by the *Porta*, out of the Gaſtrick and Me'ſaraick Veins (and it may be a little by the 'Hepatick Artery) is mixed with an acrimoni'ous, ſaltiſh, and ſubacid Juice (made in the 'Spleen of the arterious Blood flowing thither 'by the Arteries, and of the animal Spirits by 'the Nerves) which is brought into the *Porta* 'by the *Ramus Splenicus*. Now both theſe being 'entred the Liver by the Branches of the *Porta*, 'by means of this ſaid acrimonious and acid 'Juice, and the ſpecifick Virtue or Coction of 'the Liver, the ſpirituous Particles, both ſul-

'phureous and ſalt, lying hid in the ſaid venous
'Blood, are diſſolved, attenuated, and become
'alſo a little acrimonious and fermenting; a
'certain thinneſt Part whereof, like moſt clear
'Water, being ſeparated from the other thicker
'Maſs of the Blood by means of the conglo-
'bated Glands, placed moſtly in the hollow
'ſide of the Liver, is carried from thence by
'many Lympheducts, as has been ſaid. But
'the fermentaceous Spirits of greater Acrimony,
'mixed with the thicker and more viſcid ſul-
'phureous Juices (for Sulphur is viſcid) and
'more ſtrongly boiling, whenas through the
'clammineſs of the Juices in which they inhere,
'they cannot enter the conglobated Glands,
'nor from them the Lympheducts, and yet
'through their fierce Ebullition are ſeparated
'from the Blood (as Yeſt from Beer) theſe fer-
'mentaceous Spirits, I ſay, being ſever'd with
'the Juice in which they inhere, become bitter,
'and are called *Bile*. Which *Bile* being tranſco-
'lated through the Grape-ſtone-like Glandules
'into the Roots of the *Porus Bilarius*, and of the
'Gall-Bladder, paſſes through them by the *Du-*
'*ctus communis* into the *Duodenum*, or *Jejunum*,
'where it is preſently mix'd with the Pancrea-
'tick Juice, and both of them with the alimen-
'tary Maſs, concocted in the Stomach, and now
'paſſing down this Way, which it cauſes to
'ferment. And becauſe at its firſt Entrance it
'is more acrimonious, and has its Virtue en-
'tire, and ſo cauſes the greateſt Ebullition with
'the Pancreatick Juice; hence the milky Juice
'contained in the Maſs concocted in the Sto-
'mach, is moſt readily, and in greateſt quantity
'ſeparated in the *Jejunum*, and by innumerable
'Lacteal Veſſels (which are more numerous in

this

'this than the other Guts) it is most quickly 'driven on towards the *Receptaculum Chyli*, and 'this is the Reason that this Gut is always so 'empty. But in the following, because the Fer-'mentaceous Spirits are a little pall'd, the Effer-'vescency becomes slower, and less efficacious, 'and the Chyle is more slowly separated from 'the thicker Mass, and therefore they have fewer '*Venæ lacteæ*. At length what remains of this 'fermenting Matter is mixed with the thick *Fæces* 'in the thick Guts, where by its Acrimony, it 'irritates them to Excretion.] Thus far that per-spicacious and judicious Anatomist. And indeed if the Liver have no other Office, but to separate the Choler, it is by no means to be reputed an Excrement: For though the Liver do not sanguifie, yet however it is to be esteemed as a very noble Part, seeing the Diseases thereof are generally so dangerous, and Wounds in it are so commonly mortal; and by consequence that Liquor which it separates must have some noble Use, and such as is very necessary unto Life.

CHAP. XII.

Of the Vena Portæ.

Vena Portæ.

THough it be the Method of Anatomists usually to deliver the Doctrine of all the Veins in a distinct Chapter or Book after the Description of the three Ventricles; yet seeing all the *Veins* seem (and by the *Galenists* have been affirmed) to have their Root in the Liver, of which therefore we cannot but take notice; on this account we will here describe their Branchings within the *Abdomen*, seeing they are Parts contained in it. Only, in Contradiction of *Galen's* Opinion, we desire it may be noted, that their Root

is

is more properly ſaid to be in thoſe Parts wherein they receive their Blood from the Arteries, than in the Liver (or in the Heart) whither they convey it. Now we ſhall in the firſt Place deſcribe the Branchings of the *Vena Portæ*.

Its name. It hath this Name from the two Eminences (called by *Hippocrates* πύλαι, *Portæ*, Gates) betwixt which it enters into the lower ſide of the Liver; and ſometimes, without the general Name of *Vena*, it is called only *Porta*.

Origin. Some think, that the *Vena umbilicalis* ought to be accounted its Root or Original, becauſe it is firſt formed in the *Fœtus*, and inſerted into the *Porta*. But this umbilical Vein, after the Birth, ceaſing from the Office of a Vein, and degenerating into a Ligament, though it might be accounted its Root then, it cannot properly now. Others think, that becauſe its Branches every where inſerted into the Inteſtines, Caul, Meſentery, *&c.* bring Blood from thence to the Liver (and not *vice verſa*) therefore thoſe ought rather to be accounted its Roots, and its Diviſions within the Liver, its Branches. And indeed ſtrictly and properly they ought to be accounted ſo; but however we ſhall not think it abſurd to ſpeak with the Ancients, who, becauſe they thought the *Porta* carried Blood from the Liver to the Guts, for their Nouriſhment, ſuppos'd it to ſpring out of the *Liver*.

As it enters into the Liver, it is inveſted with another Coat, which ſome call *Vagina portæ*, its Sheath; others *Capſula*, or *Involucrum*, its Caſe, or *Cover*, and *Capſula communis*, becauſe the *Porus biliarius* is involv'd in it as well as the *Porta*. This outer Coat it has immediately from the Membrane that cloaths the Liver, that is, it is continued from it, though it be of a clear other Subſtance, namely more denſe and carnous. It is inveſted with

with it in all its Ramifications, and ſo having a double Coat, is in that Reſpect an Artery, as alſo in that it brings Blood to the Liver, for its Nouriſhment, as well as for other Uſes; and laſtly, in that by means of the *Arteria hepatica*, inſerted into the *Capſula*, it has an obſcure Pulſation, (according to Dr. *Gliſſon*.)

Branchings in the Liver.

When it is enter'd about half an Inch into the Liver, it is carried partly to the right Hand, partly to the left, and ſo is ſhap'd into a *Sinus*, as it were, and thence is divided into five large Branches, four whereof are diffus'd all over the hollow Side of the Liver, but the fifth aſcends ſtreight to its upper Side, where it diſperſes it ſelf. The ſaid *Sinus* is more conſpicuous in an *Embryo*, becauſe the great Influx of nutritious Juice by the Umbilical Veins enlarges it much. Some make it a ſort of Heart, obſerving in it an obſcurer kind of *Syſtole* and *Diaſtole*, whereby the Motion of the Blood in the Branches of the *Porta*, within the Liver, is promoted in like manner as it is in the *Arteria pulmonaris* and *Aorta*, by the right and left Ventricles of the Heart. Without which Pulſation they think the Blood would hardly paſs out of the larger Branches of the *Porta* into the narrower, and ſo on into the Roots of the *Cava*. In an *Embryo*, very obſervable is the *Tubulus* or *Canalis venoſus*, which paſſes directly out of this *Sinus* into the *Cava* (almoſt oppoſite to the Mouth of the Umbilical Vein that opens into the *Sinus*.) This *Canalis*, or Pipe, is of the ſame Subſtance and Texture with a Vein, and enters into the *Cava* juſt as it penetrates the Diaphragm; and there alſo two other great Branches out of the Liver are inſerted into the *Cava*; and in the ſame Place this Pipe is alſo knit to the ſuſpenſory Ligament ſpoken of before, and after the Child is born

grows

grows it self into a Ligament, being in a manner oppoſite to the Umbilical Ligament. Its *Uſe* in the *Fœtus*, is for the freer and readier Motion of the Blood and Chyle out of the Umbilical Vein into the *Cava*, ſeeing the Current is hardly ſtrong enough to pervade the *Parenchyma* of the Liver; nor indeed is there any Reaſon why the ſaid Liquors ſhould paſs there-through, ſeeing there is either little or no Bile therein, or however they are not yet in a Condition to have the ſame ſeparated from them. But to return to the Diviſions of the *Porta*. The Ancients taught, that they were only ſpread in the ſinous or hollow part of the Liver, but Dr. *Gliſſon*, in his accurate Anatomy of it, affirms the *Porta* to be diſperſed very equally in all its Parts, upper as well as lower. And whereas it has been a conſtant Doctrine, that the Branches of the *Porta* open by *Anaſtomoſes* into thoſe of the *Cava*, the ſame learned Author, and many others ſince him, have obſerved, that there are no ſuch *Anaſtomoſes* at all, but that the Blood doth ouze through the glandulous *Parenchyma* of the Liver, out of the capillary Veins of the *Porta* into thoſe of the *Cava*. He that would be fullier inform'd hereof, may conſult his moſt accurate Book *de Hepate*. But we will now paſs to the Branches of the *Porta*, when it is gone out of the Liver.

Its Branches without the Liver. This Trunk having paſt a little from the Liver, before it be ſevered into Branches, puts forth two Twigs, out of its upper and fore-part, which are inſerted into the *Cyſtis fellea*, or Gaul-Bladder (and are from thence called *Cyſticæ gemellæ*) about the Neck of it, and ſpread by innumerable Twigs through its external Coat.

A third Twig alſo ariſes ſingle from it, which is larger than either of the former, and is inſerted into the Bottom of the right ſide of the Sto-

mach,

mach, from whence it ascends by its hinder side up to the *Pylorus*, which gives it the Name of *Pylorica*; it is otherwise called *Gastrica dextra*.

Having sent forth these three Twigs, the Trunk passeth down, and bending a little towards the left-side, it is parted into two remarkable Branches, whereof the upper is called *Sinister*, or the *Left*, and is the lesser: the lower, *Dexter*, or the *Right*, which is the larger. The *Left* is bestowed upon the Stomach, the *Omentum*, a part of *Colon*, and the Spleen; the *right* is spread through the Guts and Mesentery; the Left is called *Vena splenica*; but the Right *Vena mesenterica*.

The *Vena splenica* runs across the Body towards the left-side, being sustain'd by the hinder Leaf of the Caul, and hath two Branches issuing out of it before it come to the Spleen, *viz.* the *superior* and the *inferior*. Vena splenica.

The *superior* is called *Gastrica*, or *Ventricularis*, because it is bestowed upon the Stomach. It ascends obliquely towards the left part of the Stomach, into the back-side whereof it is inserted, and divides itself into three Sprigs, of which the two outmost are spent on the Body of the Stomach, but the middle ascends on its Back-side up to its upper or left Orifice, which it encompasses like a Garland, and is called *Coronaria*. From the *inferior* Branch two Twigs spring; the one is small, and sends Twigs to the right side of the inner Leaf of the *Omentum*, and to the *Colon* annexed to it. This is called *Epiplois*, or *Omentalis dextra*. The other is spent upon the same Leaf of the *Omentum*, with that part of the *Colon* which it ties to the Back, and is call'd *Epiplois*, or *Omentalis postica*.

When the *Ramus splenicus* hath just approached to the Spleen, it sends out two other Twigs, the upper

upper and lower. The *upper* is called *vas breve venoſum*, and is implanted into the left part of the bottom of the Stomach. It is ſometimes ſingle, in which Caſe it is properly called *Vas breve*, in the Singular Number; but more often there are two, three, or more of them, and then they ſhould be called *Vaſa brevia*. And note, that theſe Veſſels, be they one or more, do ſometimes ſpring from the *Ramus ſplenicus* after it has entered the Spleen.

This *Vas breve* was a Veſſel much renowned by the Ancients, who believed it carried an acid Juice from the Spleen to the Stomach, to ſtir up Appetite, and to help the Fermentation of the Meat in it; but it is certain, both by Ligature (whereby it filleth toward the Stomach, and emptieth toward the Spleen) and alſo by the general Nature of Veins, whoſe ſmaller Branches and Twigs ſtill receive the ſuperfluous arterial Blood from the Part where-into they are inſerted, and conduct it by the larger Channels towards the Heart; I ſay, it is certain from hence, that this ſame *Vas breve* carries nothing to the Stomach, but only brings from thence into the *Ramus ſplenicus* the Remains of the arterial Blood.

From the *lower*, two Twigs iſſue.

The firſt is called *Gaſtro-epiplois ſiniſtra*: This is beſtowed upon the left part of the bottom of the Stomach, and the fore-leaf of the *Omentum*, chiefly on its left part.

The ſecond ſpringeth moſt commonly indeed from the *Ramus ſplenicus*, but ſometimes from the left Meſenterick Vein; and running along the *Inteſtinum Rectum*, is inſerted into the *Anus* by many Twigs. This is called *Hæmorrhoidalis interna*, as that which ſpringeth from the *Vena cava* is called *Hæmorrhoidalis externa*.

Now

Now followeth *Vena meſenterica*, or the *right* branch of *Vena Portæ*. Before it be divided into branches, it ſendeth forth two twigs. Vena meſenterica.

The firſt is called *Gaſtro-epiplois dextra*; this is beſtowed upon the right part of the bottom of the Stomach, and the right ſide of the upper Leaf of the Caul.

The ſecond is called *Inteſtinalis*, or *Duodena*: It is inſerted into the middle of the *Duodenum*, and the beginning of the *Jejunum*, and runneth lengthways of them: whence ſome capillary Twigs go to the *Pancreas*, and the upper part of the *Omentum*.

After theſe Twigs are paſt from it, it enters by one Trunk into the Meſentery, where preſently it is divided into two Branches, to wit, *Meſenterica dextra, & ſiniſtra.*

Meſenterica dextra (placed on the right ſide) is double, and ſendeth a great number of branches to the *Jejunum*, *Ileum*, *Cæcum*, and the right part of the *Colon*, which aſcendeth up by the right Kidney, and runs under the Liver.

It hath fourteen remarkable, tho' nameleſs Branches, and theſe are afterwards divided into innumerable ſmall Twigs. Theſe are thoſe Veins that are called the Meſaraicks, whoſe branches are ſupported by the Glandules of the Meſentery, but enter not into them; for the Glands miniſter to the *Vena Lacteæ.*

Meſenterica ſiniſtra paſſeth through the middle of the Meſentery, to that part of the *Colon* which deſcendeth from the left part of the Stomach, and to the *Inteſtinum Rectum.*

The *Uſe* of the *Porta*, before the Circulation of the Blood, and the *Venæ lacteæ* were found out, was taught to be for the carrying of Nouriſhment to the Inteſtines, and other Parts contained in *The Uſe of the* Porta.

the

the *Abdomen*, and also to bring back from the Guts the purer part of the Chyle to the Liver, to make Blood of; and a thicker feculent Part of it to the Spleen, to be excocted by it into an acid Juice; and then carry'd to the Stomach by the *vas breve venosum*, for the exciting of Hunger. As for this last Opinion, it appears by Ligature, that the *vas breve* carries its Contents from the Stomach to the *Ramus splenicus*, and it is nothing but the Blood remaining from the Nutrition of the Stomach (that was brought thither by the Arteries) which is now a conveying back to the Liver, and so to the Heart again in its Circulation. And as for the Mesaraicks carrying Nourishment to the Guts, or bringing back Chyle, those Errors have been sufficiently laid open before in the Chapters of the *Venæ Lacteæ*, and the Liver. And their true *Use* is only to bring back to the Liver, from the Guts, Caul, and other Entrails, that Blood which remains after their Nutrition, and which was carried to them by their respective Arteries.

CHAP. XIII.

Of the Vena Cava, *dispersed within the* Abdomen.

Vena cava. *Its Name.*

THE *Vena cava* is so called from its large Cavity, being the most capacious of any Vein of the whole Body; for into it, as into a River or common Channel, do all the other Veins, like Rivulets (excepting the *Pulmonaria*) empty themselves.

Rise.

Its *Root* may very properly be said to be in the Liver; for by its Capillaries it receives the Blood that is transcolated through the glandulous *Parenchyma*

renchyma of the Liver from the Capillaries of the *Porta*, and by its aſcending Trunk conveys it to the Heart. Now theſe Roots may in ſome regard be commodiouſly enough alſo called Branches; for the Roots of a Tree in the Earth, as well as its Boughs in the Air, are ſpread into many Branches; only there is this Difference, that Roots bring Sap to the Trunk, but Boughs carry it from the ſame; however we ſhall call them indifferently Roots or Branches. The Capillary Branches then of the *Cava* are ſpread through the whole Subſtance of the Liver, and not its upper or gibbous part only, as has been formerly taught; even as we ſaid before, that the Capillaries of the *Porta* were indifferently diſpers'd all over it. Betwixt theſe Capillaries (much leſs betwixt their larger Branches) there are no Inoſculations or Anaſtomoſes, but thoſe of the *Porta* being quite obliterated in the Glands or glandulous *Parenchyma* of the Liver, theſe of the *Cava* ariſe out of the ſame, and while they paſs towards the Trunk of the *Cava*, many of them meeting together make a Twig, as many Twigs in like manner concurring make a branch; which ſtill proceeding farther by the acceſſion of new twigs and branches, becomes larger and larger, and at length diſchargeth itſelf into the *Cava*. And thus do all the Roots of the *Cava* in the Liver. But they do not all meet together in one common Trunk within the Liver, as thoſe of the *Porta* do, but empty themſelves apart into the *Cava*, without the Liver. And ſtill the further diſtance the Capillaries have their Origin from the *Cava*, the larger their Chanel comes to be at their arrival at it. The ſmaller Twigs are innumerable; the larger Roots joining immediately to the *Cava*, are commonly but three, though two of them are preſently (to-

wards the Liver) divided into other two, as large each as themſelves, ſo that one may account them to be five.

Diviſion. Theſe emptying all the Blood exhauſted out of the Liver into the *Cava*, it is preſently *divided* into the aſcending and deſcending Trunk. The Aſcending forthwith enters the Diaphragm, and marches up the *Thorax*, where we ſhall leave it till we come thither, and only here ſpeak of the *Deſcending* Trunk as long as it continues in the *Abdomen*.

Its deſcending Trunk. The *Deſcending* Trunk is ſomewhat narrower than the *Aſcending*, and paſſing down along with the great Artery, it continues undivided till the fourth *Vertebra* of the Loins. But in the mean time it ſends forth divers branches from its Trunk. As,

1. The *Venæ adipoſæ*, for the Coat and Fat of the Kidneys; whereof that on the left Side goes out firſt.

2. The *Emulgents* which run to the Kidneys by a ſhort and oblique Paſſage; theſe bring back that Blood to the *Cava*, which the emulgent Arteries carried to the Kidneys with the *Serum*.

3. The *Spermaticks*, called *Vaſa præparantia*. The right ſpringeth from the Trunk of *Vena cava*, a little below the *Emulgent*; but the left from the left *Emulgent* itſelf. Of theſe more in the 20*th* Chapter.

4. The *Lumbares*, ſometimes two, ſometimes three. Theſe run in between four *Vertebræ* of the Loins, and are diſperſed through the Membranes that cloath the ſpinal Marrow.

All theſe Veins being ſent forth of the Trunk, by this time it is come to the forth *Vertebra* of the Loins, where it turns too behind the *Arteria magna*, above or before which it had thus far deſcended,

ſcended, and is divided into two equal Branches, called *Iliaci*, becauſe they paſs over the *Os Ilion*, *&c.* as they go down to the Thighs.

Juſt about the Diviſion there ſpring two Veins called *Muſcula ſuperior*, for the *Peritonæum*, and Muſcles of the Loins and *Abdomen*; and *Sacra*, which is ſometimes ſingle, ſometimes double, for the Marrow of *Os Sacrum*, or rather for the Membranes that cloath it.

Afterwards the *Iliacal* Branches are again divided each into two other; the Exterior, that is greater, and the Interior, that is leſs.

From the *interior* ariſe two Veins: *Muſcula media*, for the Muſcles of the Hip and Buttocks; and *Hypogaſtrica*, which is a notable one, ſometimes double, miniſtring to moſt parts of the *Hypogaſtrium*; as to the Muſcles of the ſtreight Gut (which Branches make the external Hæmorrhoidals;) to the Bladder and its Neck, to the Yard, and the lower ſide of the Womb and its Neck, which laſt are the Veins by which the Menſtrues were believed to paſs, before the Circulation of the Blood was found out; for ſince 'tis known that they paſs by the Hypogaſtrick Arteries, and what Blood is not ſent forth at thoſe times, or at other times is not ſpent on the Nutrition of theſe Parts, returns by theſe Veins to the *Cava*, and by it to the Heart.

From the *exteriour*, three: two before it goes out of the *Peritonæum*, and one after.

1. *Epigaſtrica*, for the *Peritonæum* and the Muſcles of the *Abdomen*; the moſt noted branch of it, aſcends under the *Muſculi recti*, towards the *Vena mammaria*, with which it has been thought to inoſculate about the Navel.

2. *Pudenda*, for the Genitals in Men and Women.

3. *Muſcular inferiour*, for the Buttocks.

And now the deſcending branches of the *Cava* are paſt out of the *Abdomen* into the Thighs, and begin to be called Crural; and of them we ſhall diſcourſe when we come to the *Limbs* in *Book* IV. *Chap.* 4.

Its Uſe. Now the Uſe of this deſcending Trunk of the *Vena cava* is not to carry any thing to any part from the Liver; but whereſoever its leſſer Twigs end into Capillaries, from thence is Blood received (being brought thither by the reſpective Arteries) and convey'd into the greater Branches, and by them into the Trunk of the *Cava*, by which it aſcends to the right Ventricle of the Heart, there to be anew inſpirited, and from thence to be ſent forth again by the Arteries, as ſhall be further explained when we come to the Heart.

For tho' the deſcending Trunk of the *Aorta*, or great Artery, paſs down the *Abdomen* along with that of the *Cava*, and ſo is contained therein as well as it; yet becauſe the Arteries have all of them their Origine from the Heart, we will forbear to ſpeak of *them* till we come to the Anatomy of it, in the *next* Book.

CHAP. XIV.

Of the Gall-bladder and Porus bilarius.

FOR the receiving and evacuating of Bile, there have been reckoned only two Veſſels or Paſſages; namely the *Gall-bladder* and *Porus bilarius*. By this latter there flows a thicker but milder; by the former a thinner, more acrimonious and fermentative Choler, into the Inteſtines. But beſides theſe, there have been lately found out a third, which we ſhall deſcribe by and by.

The

The *Gall-bladder*, called in Greek κύστις χοληδόχος, in Latin *Vesica bilaria*, or *Folliculus fellis*, is a hollow Bag placed in the under or hollow side of the Liver, and in Figure representeth a Pear. *The Gall-bladder. Its Name and Description.*

It is about two Inches in length, and one in breadth where broadest. *Bigness.*

By its upper part it adheres to the Liver, which doth afford it a Hollowness to lodge in; but the lower Part which hangeth without the Liver, resteth upon the right Side of the Stomach, and the *Colon*, and doth often dye them both yellow. *Connexion*

It hath three *Membranes*, one *common*, which is thin and outmost. This springing from the Membrane of the Liver, only covereth that Part which hangeth without the Liver. The two other Membranes are proper. *Membranes.*

The middle is thick and strong, and muscular, and hath three Ranks of *Fibres*: the outmost are transverse, the middle oblique, and the innermost streight. But some will allow only two Ranks, *viz.* The streight, that run lengthways of it, and are outer; and the transverse or annular, which are the inner.

The inmost Coat is nervous, or tendinous as it were; and to the inside of this there adhereth a kind of glandulous Coat. The Glands herein do separate from the Arteries a kind of mucous Humour, which serves to defend the *Vesica* from being irritated by the Acrimony of the Choler contained in it.

Besides these two *proper* ones, *Verheyen* affirms there is a Third, betwixt that I called *common*, and the middle; and says, it is so evident, that he wonders this quick-sighted Age has not yet discover'd it. It is interwoven with whitish Fibres, drawn diversly and irregularly; and has abundance of Nerves and Sanguiferous Vessels

running through it: whoſe chief Branches run moſtly from its Neck towards its bottom; and upon their Account this Coat may be term'd the *vaſcular*. In fat People it contains much Fat, and with a little labour is ſeparated into divers Flakes (or Plates.)

Parts. It hath two *Parts*, the *Bottom* and the *Neck*.

The *Bottom* is its larger or wider Part, that contains the Choler, and is of the ſame Colour with the Bile that is in it; whence it commonly looks yellow, but ſometimes greeniſh, blackiſh, *&c.*

The *Neck* (otherwiſe called *meatus cyſticus*) is its narrower Part, being but about as wide as a Gooſe quill, and about two Inches long. Betwixt this and the *Veſica* there is a certain fibrous Ring which much ſtraitens the Paſſage, and ſo hinders the too haſty Depletion of the *Veſica*. The other end of the Neck is joined to the *Porus bilarius*, and they both make the *Ductus communis*, or common Paſſage of the Choler, Which is inſerted into the beginning of the *Jejunum*, or the end of the *Duodenum*. *Peierus* has obſerved, that in many Birds and ſome Fiſhes this *Meatus* does not join the *Porus bilarius*, but is inſerted ſeparately into the Guts.

How the Choler is brought into it. The Ancients (whoſe Opinion is of late ſtiffly defended by Dr. **Cole*) thought that the Choler in the Gall-bladder was received in by its Neck from the *Porus bilarius*, and that it paſſed out into the common Duct the ſame way. And to obviate the Objection, that there uſes not to be Reciprocation of Humours in the ſame Veſſel (at the ſame time eſpecially) Dr. *Cole* ſuppoſes that the Gall paſſes out of the Gall-bladder only in the time of the diſtribution of the Chyle, but at all other times it is received into it from the *Porus*,

* De ſecret. Animal. *Cap.* 14.

and

and is ſtored up in it againſt the next Occaſion. But not to enter into this Diſpute, I think Dr. *Gliſſon*'s Account of it the more probable, which is this: [‘The ordinary way of filling the Gall-bladder is by its fibrous Roots that are diſperſed through the Liver. The whole Trunk of theſe Roots enters that part of the Bladder, where 'tis ſtraitened by a fibrous Ring. This Trunk indeed hardly equals the hundredth part of the Roots of the *Porus bilarius*; yet it diſtributes ſome Twigs and capillary Veſſels into the hollow ſide of the Liver. But if you open the Gall-bladder with a deſign to underſtand the manner of the Inſertion of this Trunk into it, truly you will not eaſily find it. For though this Duct do penetrate the ſaid Bladder, and the Humour contain'd in it be diſcharged therein-to; yet there is hardly any Print or Sign of this Hole in the Inſide of the Bladder; which ought not to ſeem hard to be believed by any one, if he remember the Inſertion of the Ureters into the Piſs-bladder: For tho' theſe do far exceed this Trunk in width, yet one can hardly find their Inſertion, if he cut open the Bladder, and look for it. The beſt way (that I could yet find) to diſcover the Inſertion of this Trunk, (if you will open the Gall-bladder, and ſearch for its entrance into it) is thus; namely, if you look for a certain little and ſpungy Protuberance near the Orifice of the Bladder hard by the *meatus cyſticus*; for the foreſaid Trunk, I think, is pretty plainly inſerted into that Protuberance.] This Protuberance is called a Valve by *Spigelius*. Anat. Hepat.

Beſides this, Mr. *Perrault* has found out another *new Conduit* for the Bile, which he calls *Ductus cyſthepaticus*, becauſe it is common both to the *Veſicula*, Ductus cyſthepaticus.

ficula, and the *Porus hepaticus* (or *bilarius*.) This Duct has three Roots, which being ſubdivided into numerous Twigs, are diſperſed through the Parenchyma of the Liver, amongſt the Branches of the *Vena cava* and *Portæ*: Theſe Roots grow into one Trunk, which creeping along the Surface of the hollow ſide of the Liver, has a double Implantation; one into the *Porus bilarius*, two Inches and an half before the ſaid *Porus*'s uniting with the *Meatus cyſticus*, and another into the middle of the *Veſica* (on that ſide of it which adheres to the Liver) with a Valve. This Valve ſeems to be formed of the inner *Membrane* of the *Veſica*, and alſo a proper one; and may be ſaid to be a kind of a middle Valve, between the Nature of the *Sigmoides* and *Triglottis* (or *Tricuſpis*) of the *Vena arterioſa*, and *Arteria venoſa* in the Heart. Betwixt its Inſertion into the *Porus bilarius* and this into the *Veſica*, there is about ſix Inches length. It contains a thinner Choler in it than the *Porus bilarius*.

Of the Circulation of the Bile.

Jo. Alph. Borellius (Profeſſor of the Mathematicks at *Naples*) from the continual and ſpeedy Efflux of the Bile, by the *Ductus communis*, into the *Duodenum*, believes that there is a particular Circulation of it. For he affirms, That in a Day's time, from a Perſon faſting, there paſs thirty four Pound of bilious Juice into the *Duodenum* by the common *Duct*, whereas the whole Maſs of Gall amounts not to above two Pound; from whence, as he concludes, that ſo great a Quantity of Gall cannot be produced in the Liver by way of Fermentation, but that it is ſeparated mechanically, without the help of any Ferment, only by *Cribration* from the minute Veſſels of the *Portæ*, through the Pores of the Glandules of the Liver, as the Urine is ſeparated in the Kidneys; ſo he infers that there is a particular Circulation of the

Bilis

Bilis through the *Abdomen*, perform'd by the *Venæ meſaraicæ* into the Trunk of the *Porta*, thence to the Liver, thence through the bilious Veſſels into the *Duodenum*, to return again by the Meſaraick Veins. He that would enquire more into this Novel, and (to me) improbable Opinion, may conſult his *Opus poſthumum* (pars altera) *de motu Animalium.*

The Valves of the Gall-bladder.

It has been taught by ſeveral Anatomiſts, that its Neck, or *Meatus*, has ſometimes two, ſometimes three *Valves*, to hinder the Recourſe of the Choler: But *Diemerbroeck* profeſſes he could never find any, but only that the Egreſs of the *Veſica* was very ſtrait, and its Neck wrinkled. Dr. *Gliſſon* declares alſo, that he has opened very many Veſſels of this Kind, and never yet ſaw a *Valve* in any of them. But he thinks, that the fibrous Ring (above-mentioned) did impoſe upon thoſe who have thought there was a *Valve*. Beſides, upon Trial, he has often found, that the Bile, by a light Compreſſion of the Fingers, has fluctuated to and again out of the *Cyſtis* into the *Meatus*, and on the contrary; as alſo out of the *Meatus* into the *Ductus communis*, and back again. Which certainly could not be, if there were any *Valve* in the Way; for that would hinder the one or other of theſe Motions.

Its Veſſels.

The *Veſica fellea* hath two Veins, called *Cyſticæ gemellæ*, which ſpring from the *Porta*. It hath Twigs of *Arteries* proceeding from the right Branch of the *Cæliaca*. And it hath a ſmall thread-like Sprig of a *Nerve*, from the meſenterical Branch of the Intercoſtal.

Of the Stones in it.

Many times *Stones* are found in it, which are lighter and more ſpongy than thoſe of the urinary Bladder and will ſwim above Water, which theſe latter will not do.

The

Porus bilarius. The other Paſſage, which carrieth the thicker ſort of Choler, is called *Porus bilarius*, or *Meatus hepaticus*, becauſe it paſſeth directly from the Liver to the *Ductus communis*.

Its Coats and Branchings within the Liver. Within the Liver its Trunk and Branches are inveſted with a double Coat: Its *proper* one, which it retains without the Liver alſo, and another that is *common* to it with the *Porta*, called *Capſula communis*, which it has from the Membrane of the Liver. In this *common* Coat, this *Porus* and the *Porta* are ſo cloſely enwrapped, that you would take them but for one Veſſel, till you either hold it up to the Light (which will diſcover Veſſels of two Colours in it) or very dexterouſly rip up the *Capſula*, and ſo lay them open. Its Roots within the Liver are equally divided with thoſe of the *Porta* every where, ſaving that little ſpace where the Roots of the *Veſica* are ſpread, in the ſimous and right ſide of the Liver. So that having ſpoken above of the Diviſions of the Roots of the *Porta*, I ſhall refer the Reader thither for theſe of the *Porus*. I ſhall only obſerve, that they are far larger, and more numerous, than thoſe of the *Veſica*, drawing Choler from all the Parts of the Liver (ſaving whither the Roots of the Bladder reach) and that more thick and viſcous, yet leſs acrimonious.

All Animals have it. This *Porus* ſeems to be a more neceſſary part than the *Veſica*; for many Creatures, as Harts, Fallow-Deer, the Sea-Calf, *&c.* and thoſe which have a whole Hoof, as an Horſe, *&c.* have no Gall-bladder, but there is none that is deſtitute of this.

Its Conexion with the Meatus. Without the Liver it is as wide again as the *Meatus Cyſticus*, with which it is joined at two Inches Diſtance from the Liver, and both make the *Ductus communis choledochus*.

It

It has no *Valve* in its whole Progreſs, only the *Ductus communis*, where it enters the Inteſtine, having pierced the outer Coat, paſſes betwixt that and the middlemoſt about the twelfth part of an Inch, and then piercing that, alſo marches down further betwixt it and the innermoſt Coat about half an Inch, and at laſt opens with a round mouth into the Inteſtin. So that this oblique Inſertion (as that of the Ureter into the urinary Bladder) ſerves inſtead of a *Valve*, to hinder any thing from regurgitating out of the Gut into this Duct, eſpecially the inmoſt Tunicle of the Inteſtin hanging ſo flaggy before its Mouth, that when any thing would enter in, it claps cloſe upon it, and ſtops it. *It hath no Valve,*

As to any *Anaſtomoſes* of the Roots of any of theſe Bilary Veſſels, with thoſe of the *Vena Portæ*, ſuch indeed have been much talk'd of, but without Truth, for their extreme Twigs or Capillaries terminate in the *Parenchyma* of the Liver, out of whoſe Grape-ſtone-like Glandules they imbibe the Choler there ſeparated from the Blood; even as was ſaid before of the Capillaries of the *Cava*, that they received the Blood it ſelf, imported by the *Porta* in like manner, without any Inoſculations. *Nor Anaſtomoſes with the* Porta.

The *Uſe* of all theſe *Veſſels* may ſufficiently be learned by what has already been ſaid of them. Though ſome are of Opinion, that not only Choler, but other ſuperfluous Humours are evacuated by them, eſpecially upon taking a Purge. *The Uſe of the* Veſica, Ductus cyſthepaticus, *and* Porus.

The *Uſe* of the *Bile* it ſelf appears from what we quoted above out of *Diemerbroeck*, when we were treating of the Action of the Liver, *cap.* 12. We will only further note two things.

Firſt, That ſometimes the *Ductus communis* is very irregularly *inſerted*. For in ſome it is knit *Obſerv.* 1.

to

to the Bottom of the Stomach, and then the Party vomiteth Choler, and is termed πικρόχολος ἄνω, and sometimes it is inserted into the lower End of the *Jejunum*, and then bilious Dejections follow; and such a one is termed πικρόχολος κάτω.

Observ. 2. A *second* thing is concerning the *Colour* of the Bile; that though for the most part, in a healthful State, it be yellow, yet preternaturally, and in a morbous State, it is often of several other Colours, as pale-colour'd, eruginous, porraceous, vitelline, reddish and blackish. And when it thus degenerates and corrupts, it is the Cause of most violent and acute Diseases; as the *Cholera morbus*, Dysentery, Cholick, *&c.*

CHAP. XV.

Of the Pancreas.

The Pancreas. *Its Substance.* THE *Pancreas* (as much as to say, *All-flesh*) or the *Sweet-bread*, except its Membranes and Vessels, is wholly glandulous, and is justly reckon'd amongst conglomerate Glands. For it is compacted out of many Globules, or Knots of Glands, included in a common Membrane, and join'd one to another, partly by Membranes, and partly by Vessels. Every Globule by it self is somewhat hard; but altogether (because of their loose Connexion) seem softish. It is of a palish Colour, very little tinctured with red. Its investing Membrane it has from the *Peritonæum*.

Situation, and Connexion. It is seated under the Bottom, and towards the hinder Side of the Stomach, and reaches from the *Cavity* of the Liver (namely, from that Part where the *Porta* enters it) cross the Abdomen, to the lower End of the Spleen, but is not joined to it. It is annexed (by its *Duct*) to the *Duodenum*, and some-

ſome times to the *Ductus bilarius*, to the *Rami ſplenici*, the Caul, the upper Part of the Meſentery, and upper *Nervous Plexus* of the *Abdomen*.

Its *Figure* is long and flat, broader and thicker about the *Duodenum*, but towards the Spleen thinner and ſtraiter. *Figure.*

It is leſſer than moſt of the *Viſcera*, commonly about five Finger's breadth long: where it is broadeſt, it is about two Finger's breadth, and about one Finger's breadth thick. *Bigneſs.*

Its *Veſſels* are of five Kinds. *Veins* it has from the ſplenick Branch; *Arteries* from the left Branch of the *Cœliaca*, ſometimes from the Splenick; *Nerves* from the Intercoſtal Pair, eſpecially from the upper *Plexus* of the *Abdomen*; It hath alſo many *Vaſa lymphatica*, which, as the reſt, paſs to the *Receptaculum Chyli*. *Veſſels.*

And beſides theſe Veſſels, which are common to it with other Parts, it has a proper membranous Duct of its own, which was firſt found out by *Wirtſungus* at *Padua*, near 50 Years ago. This Veſſel commonly has but one Trunk, whoſe Oriſice opens into the lower End of the *Duodenum*, or Beginning of the *Jejunum*, and ſometimes is joined to the *Ductus bilarius*, with which it makes but one Mouth into the Inteſtin. Within the *Pancreas* (according to Dr. *Wharton*) it is divided into two Branches, which ſend forth abundance of little Twigs into all the *Globuli* above ſpoken of, where they imbibe the Humour that is ſeparated by them from the Arteries, and by their Trunk tranſmit it to the Guts. This Pancreatick Humour though is never found in this Duct, becauſe it flows ſo quickly out of it into the *Duodenum* by a ſteep way; even juſt as the Urine, paſſing out of the Reins, by the Ureters, to the Bladder, is never found in them becauſe of its rapid Tranſit. *Ductus pancreaticus.*

Very

Office. Very many have been the Differences of Opinions concerning the *Office* of this Glandule. Some have thought it to be only of Uſe to ſuſtain the Diviſions of the Veſſels, and to ſerve the Stomach for a Cuſhion to reſt upon; others, that it miniſters a Ferment to the Stomach; others, that it receives the Chyle, and brings it to greater Perfection; and others, that it ſerves as a Gall bladder to the Spleen, or ſometimes ſerves in its ſtead. Which Opinions being all very unlikely, I ſhall not ſpend time to examine them.

The Nature of the Pancreatick Juice. There are three other Opinions; for the *firſt* whereof, let the Credit of the learned Author (*viz.* Dr. *Wharton*) recommend it as it can, but to me it ſeems improbable, and it is this, That it receives the Excrements or Superfluities of the ſuperiour *Plexus* of the Nerves of the ſixth Pair, (Dr. *Willis*'s Intercoſtal or ninth Pair) being united with ſome Branches from the ſpinal Marrow, and by its proper Veſſel or Duct diſcharges them into the Inteſtines. In anſwer unto which I ſhall only ſay this, That I cannot tell how thick Excrements ſhould be convey'd by the Nerves, that carry ſuch pure animal Spirits, and have no viſible Cavity; nor, ſecondly, how theſe Nerves in particular ſhould, *cum delectu*, as he ſpeaks, ſend the Excrements hither, and all the reſt be diſcharged from any ſuch Office.

The *ſecond* Opinion is ſomewhat more probable, and is defended by famous Phyſicians and Anatomiſts, as *Franc. Sylvius*, *Bern. Swalve*, *Regn. de Graef*, and *Isbrand de Diemerbroeck*, from which laſt I ſhall tranſcribe it. ['I have found, *ſaith he*, 'in the Diſſections of Brutes, both alive, and 'newly ſtrangled, a certain Liquor ſublimpid, 'and, as it were, ſalivous (ſomething auſtere 'and lightly ſubacid, and having ſometimes

'ſome-

'ſomething of Saltiſhneſs mixed) to flow out of 'the *Ductus Pancreaticus* into the *Duodenum*, 'ſometimes in a pretty Quantity. Whence I 'judged——that there is excocted in the *Pancre-as* a peculiar Humour, from the ſerous and ſal-'tiſh Part of the arterial Blood brought into it, 'having ſome few animal Spirits convey'd thither 'by ſmall Nerves mixed with it, and that this 'Liquor flowing into the *Duodenum*, and there 'preſently mixed with the Bile, and the Meat 'concocted in the Stomach, gliding by the *Pylo-'rus* into the Guts, does cauſe a peculiar Effer-'veſcency in thoſe Aliments, whereby the profi-'table chylous Particles are ſeparated from the 'unprofitable, are attenuated, and being brought 'to greater Fuſion (This Operation of it, *ſays 'he*, is ſhewn by the Diverſity of the Subſtance 'of the Aliments, concocted in the Stomach, 'and ſtill there contained from that of thoſe 'which have already flow'd into the Inteſtines: 'For the former are viſcid and thick, and 'have the various Colours of the Food taken; 'but the latter, on the contrary, are more fluid, 'leſs viſcid, and more white) are withal made 'apt to be impelled by the periſtaltick Motion of 'the Guts, through their inner mucous Coat in-'to the Lacteal Veſſels; the other thicker by 'little and little paſſing down to the thick Guts, 'to be there kept till the time of Excretion. Now 'this Efferveſcency is cauſed through the volatile 'Salt, and ſulphureous Oyl of the Bile, meeting 'with the Acidity of the Pancreatick Juice; as in 'Chymiſtry we obſerve the like Efferveſcencies 'to be cauſed by the Concourſe of ſuch Things.] Thus he. So that he will not have this Juice to be any thing excrementitious, nor to be ſo ve-ry little in Quantity, as ſome have affirmed; to de-

demonstrate which he cites the Experiment of *de Graef*, who in Live-Dissections could gather sometimes an Ounce of it in seven or eight Hours time, which he has tasted, and found it of the Taste before-mention'd, *viz.* something austere, subacid and saltish. *Vide ejus Anatomen corporis humani*, p. 73, *&c.* where you may see what Diseases it is the Cause of when distempered.

A *third* Opinion is that of *Brunnerus*, who thinks that the *Pancreas* is of the same Use with the other conglomerate Glands of the Mouth, Throat, Stomach, and Guts, and its Juice of the same Nature with the *Saliva*. That it consists of *Lympha* separated from the Arteries, and of Animal or Nitro-aereal Spirits communicated by the Nerves. That like the *Saliva* it is a Dissolvent or *Menstruum* in Concoction and Chylification, but does not ferment with the Bile, but only takes somewhat off its Acrimony. That its Juice is not of any *peculiar* sort, he endeavours to evince by repeated Experiments upon Dogs, from some of whom he cut the greatest part of the *Pancreas*, and in others cut asunder its Duct that passes from it to the Intestines, and yet they continued (after two or three Days Indisposition) to be as lively, and in every respect in the same Condition as before. From whence he concludes, that that Juice which naturally flows out of the *Pancreas*, must in these Cases be supplied from other Parts; and therefore that it is of no peculiar Nature, but of the same with that of those Parts that supply its Defect; and those can be no other than the conglomerate Glands of the Parts aforesaid. He that would be farther satisfied in the Grounds of this Opinion, or how this ingenious Author made his Experiments, may consult his Book not long since published, entituled, *Experimenta nova circa Pancreas*, &c.

CHAP.

CHAP. XVI.

Of the Spleen.

THE *Spleen* is ſo called in *Engliſh*, from the *Greek* Σπλὴν, from whence alſo the *Latin* Word *Splen* is derived. It is otherwiſe called in Latin, *Lien*; and in Engliſh, the Milt. *The Spleen. Its Name.*

It is commonly but one in Men, though ſome have found two, yea *Fallopius* three. In Dogs there are ſometimes two or three, unequal in Bigneſs, out of each of which there paſſes a Veſſel into the *Ramus ſplenicus*. *Number.*

In Infants new born it is of a red Colour: In thoſe of a ripe Age it is ſomewhat blackiſh; and in old Men it is of a leaden or livid Colour. *Colour.*

In Man it is broader, thicker, and heavier than in Beaſts; for it is about ſix Inches in Length, three in Breadth, and one in Thickneſs. Sometimes it is much larger, but the bigger the worſe. *Spigelius* has obſerved, that it is larger in thoſe that live in fenny Places, than in thoſe that live in dry; and in thoſe that have large Veins, than in them that have ſmall. *Bigneſs.*

As to its *Figure*, *Hippocrates* compares it to an Oxe's Tongue; *Ariſtotle* to an Hog's Milt. Towards the Stomach, on its inner ſide, it is ſomewhat hollow; on its outer, gibbous, having ſometimes ſome Impreſſion upon it from the Ribs. It is ſmooth and equal on either ſide, ſave where in its hollow ſide it has a ſtreight Line or Seam (ῥαφὴ) at which Place the ſplenick Veſſels enter into it. Its upper End is called its *Head*, and the lower its *Tail*. *Figure.*

It is *ſeated* in the left *Hypochondrium*, oppoſite to the Liver: (ſo *Hippocrat.* 6. *Epidem.* calleth it the left Liver; and *Ariſtot.* 3. *de hiſtor. animal.* 7. *Situation.*

the baſtard Liver) betwixt the Stomach and that End of the Ribs next the Back; in ſome higher, in others lower: but naturally it deſcends not below the loweſt Rib. Yet ſometimes its Ligaments are ſo relaxed, that it reaches down lower; yea ſometimes they quite break, ſo that it ſlips down into the *Hypogaſtrium*: So *Riolanus* tells the Story of a Woman that was troubled with a Tumour there, which was taken by her Phyſicians for a Mole; but dying of it, and being opened, it was found to be occaſion'd by the Spleen fallen out of its Place, and lying upon the Womb.

Whether it may be cut out of the Body with Safety.

And whereas it very much endangers Life when it falls out of its Place, one would think, that it could not but with great Danger be cut out of the Body. For how can one imagine, that a Part ſo difficult to come at, and that has ſuch large Veſſels inſerted into it (not to mention its Uſe) can with Safety be taken out of the Body? Wounds in it are commonly mortal; Inflammations, or but Obſtructions in it, do grievouſly afflict the Patient, and ſometimes kill him: Sure then the total Ablation of it, one would think, ſhould be very fatal. And yet (among others) the ingenious *Brunnerus*, in the Preface to his above cited Book, affirms, that he firſt took the Spleen from a Dog, and at ſome Diſtance of time by a ſecond Operation cut out the greateſt Part of the *Pancreas* from the ſame, and yet he continued to eat and drink, ſhit and piſs, and run about as briskly as if he had wanted neither of them, till about three Months after the laſt Operation he was loſt in a Crowd. And *Malpighius* relates, how having tied all the Veſſels that come into or go out of the Spleen in a young Dog (which is much the ſame thing as to cut it out) and cloſed up the Wound in his Side after the Operation, tho'

tho' hereby when the ſame Side after a good while was opened again, the Spleen was dried up almoſt to nothing; yet in the mean time the Dog was every way both as to his Stomach, Excrements, Plight, Briskneſs, *&c.* as well as before the Ligature. And *Ant. Nuck* tells us of a Dog, out of whom he cut not only the Spleen, but one Kidney alſo, having firſt faſt ty'd the Veſſels that go to and ſpring from each; and afterwards healing up the Wound, the Dog continued in good Plight.

Connexion

It is tyed to five Parts; its upper End to the Midriff (commonly) and its lower to the left Kidney by thin Membranes; by its hollow Part which giveth way to the Stomach being diſtended, to the upper Membrane of the *Omentum*, and to the Stomach by ſundry Veſſels. Its gibbous or arched Part is knit to the *Peritonæum* by thin Membranes.

Membranes.

It is cloathed with a double Membrane; the *outer*, common, being propagated from the *Peritonæum* (or as ſome will have it from the *Omentum*;) the *inner*, proper. The *firſt* is ſtrong, and contains the Spleen as in a Bag: Both Veins, Arteries and Nerves run along it, and betwixt it and the inner a great Number of Lympheducts. The Arteries that run through the inner Subſtance of the Spleen, do many of them terminate in it; ſo that when 'tis pulled off (which 'tis not hard to do) you may diſcern a great many red Specks, which are the little Mouths of the broken Arteries. The *inner* Membrane is ſmooth and ſtrong, but not ſo denſe but that Air can paſs through it, if one blow hard into the Spleen by the ſplenick Artery, after the outer Membrane is drawn off. It ſeems to be in its Nature tendinous, both the Ends of the numerous Fibres

that run overthwart the Spleen terminating in it, whence sometimes it becomes cartilaginous and even bony. Blood-Vessels run along this Coat also, as one may observe by syringing Ink into the Splenick Artery; for then they are discover'd both by their Swelling and Alteration of Colour.

Substance. The *Substance* of it is flaggy, loose and spongy, commonly held to be a concrete sanguineous Body, serving to sustain the Vessels that pass thro' it: but *Malpighius* with his Microscope has discover'd it to be (besides the Fibres to be describ'd by and by) a *Congeries* of Membranes form'd and distinguish'd into Cells, in which are included very many Glands. These Cells and Glands he describes thus in the *fourth* and *fifth* Chapters of his *Lib. de Liene*. ['Though the 'Spleen by its Colour and Looseness of Substance 'seem to be Flesh, or concreted Blood, yet if 'one tie the Artery, and blow hard by the 'Vein (or on the contrary) the Spleen will ex-'ceedingly swell; and being thus blown up, if 'it be dried, and afterwards cut, you may per-'ceive its whole Bulk to be made up of Mem-'branes forming *Sinus*'s and Cells like Honey-'Combs. They are propagated either from the 'investing Membrane, or (which he thinks 'more probable) from the venous Duct that runs 'along the Middle of the Spleen; like as the 'Cells in the Lungs, he thinks, proceed from 'the Branches of the *Trachea* growing slender. 'Their Shape is irregular; they communicate 'with one another, and gape not only into the 'extream Branches of the Splenick Duct, but al-'so into the Sides of the Trunk it self, by means 'of the Holes or Pores therein (to be described 'by and by.) They are watered with Blood-'Vessels, and within them are included nume-

'rous

'rous Bunches of Glands, or if you will, of 'Bladders or little Bags, which do exactly re-'ſemble a Bunch of Grapes. Theſe little Glands 'have an oval Figure, and are about as big as 'thoſe of the Kidneys: I never ſaw them of 'other Colour than white; yea though the Blood-'Veſſels of the Spleen be fill'd with Ink, and play 'about them, yet they always keep the ſame 'Colour. Their Subſtance looks as if it were 'membranous, but 'tis ſoft, and eaſily crumbled; 'their Cavity is ſo ſmall that it cannot be ſeen, 'but it may be gueſſed, in that when they are cut, 'they ſeem to fall into themſelves. They are 'almoſt innumerable, and are placed wonderfully 'in the aforeſaid Cells of the whole Spleen, where 'vulgarly its *Parenchyma* is ſaid to be; and 'they hang upon Fibres ariſing from their Caſe, 'and conſequently on the utmoſt Ends of the 'Arteries and Nerves, yea the Ends of the Arte-'ries twiſt about them like the Tendrils of 'Vines, or clinging Ivy——Each Bunch conſiſts 'of ſeven or eight.—Beſides the membranous 'Cells that encloſe them, they are covered with 'a bloody Subſtance, which plentifully ſtagnates 'in thoſe Cells; as appears by ſyringing Water 'by the Artery into the Spleen, for it will be 'tinged after ſeveral Repetitions, and bring a-'bundance of Blood out with it.] Thus he.

Fibres.

From the inner Membrane (according to *Malpighius*) ſpring innumerable *Fibres*, which run a-croſs the Spleen to the oppoſite Part of the ſame Membrane, or to the *Capſula*, or common Caſe of the Veſſels, which runs through the middle of the Spleen. They keep not the ſame Plane, but ever and anon being ſplit into two, they each inoſculate with others in like manner divided, and make a ſort of Net-work. The Ancients be-

lieved them to be Twigs of Blood-Veſſels; Dr. *Gliſſon* ſuppoſes them alſo to be Veſſels, but that they contain not Blood, but nervous Juice: But *Malpighius* concludes them to be only Fibres, becauſe they have neither any diſcernible Cavity, nor any Communication with Veſſels; and alſo becauſe both *Spigelius* and himſelf have obſerved the inner Membrane of the Spleen, which affords Riſe and Inſertion to them, and is framed of a *Plexus* of ſuch like Fibres, to become cartilaginous and ſometimes bony, which he thinks cannot eaſily agree with the Nature of Veſſels. Their Uſe he thinks to be only for the ſtrengthning and Conſervation of the ſoft Structure of the Spleen.

To theſe Opinions of *Malpighius* concerning the Glandules and Fibres of the Spleen have later Anatomiſts generally ſubſcribed: But Dr. *Fred. Ruyſch* has expreſs'd his Diſſent therefrom in an Epiſtle to *Campdomercus* (lately publiſhed.) He ſays, 'That the whole Fabrick of a *Man*'s 'Spleen is nothing but a certain *Congeries* of Ar- 'teries, Veins, Lympheducts and Nerves, which 'are infolded in the inveſting Membranes. But 'it is to be noted (*adds he*) that the protracted 'and extreme *Propagines* of the Arteries and 'Veins ſeem to acquire another Nature, for they 'are ſo ſoft and juicy, that they may eaſily be 'reduced in a manner (as I may ſay) to nothing; 'for their extreme Particles are diſſolved by the 'leaſt rubbing that may be; yea by only ſteeping them in fair Water till they are a little rotten, they diſſolve into a brown or black-ruddy 'Liquor. Theſe extreme Parts, I ſay, are meer '*Propagines* of the Blood-Veſſels; and there is no 'other Reaſon why they repreſent Glandules, but 'becauſe they are diſpoſed *faſciculatim* or in Clu- 'ſters, and are reduced into ſofter, more juicy

'and

'and round Bodies, which hath impoſed not only 'upon others, but till of late upon my ſelf alſo. 'But theſe *Propagines*, thus diſpoſed in Cluſters, 'are to be diſtinguiſhed from Glands, ſeeing they 'are not covered with any peculiar Membrane, 'nor conſiſt by themſelves, which is required in 'Glands; —They are placed very cloſe to one a-'nother, without any (natural) viſible empty 'ſpace between, or Cell, though *Malpighius* de-'ſcribe, and *Bidloe* draw all theſe Things.]

Thus far as to the *Glandules*: Then he proceeds to the *Fibres*, and ſays, ['That though he has 'uſed the utmoſt Diligence, he never found ſuch 'Fibres in a Man's Spleen. He confeſſes indeed, 'that the Matter is ſo in a Calf's Spleen; *viz.* that 'there are in it innumerable Fibres, betwixt which 'the aforeſaid *Propagines* or Cluſters are ſeated: 'And theſe Fibres ſeem to be of great Uſe in a 'Calf's Spleen, *viz.* that they may eſtabliſh the '*Sulci* that are found in a Calf's Spleen (that are 'in lieu of the venous Branches) that they may 'not be too much extended by the refluent Blood. 'But in a Man's Spleen that has no *Sulci*, but 'Veins, ſuch Fibres are not neceſſary.]

Laſtly, As to the *Cells* ſo often mention'd in *Malpighius*'s Deſcription of the Subſtance of the Spleen, Dr. *Ruyſch*, tho' he grant, ['That in a 'Calf's Spleen there is ſomething like Cells (for 'the Texture of the aforeſaid Fibres reſembles 'the little Holes of Cells) yet in a Man's (well 'conſtituted) he never found any ſuch thing.]

It hath *Veſſels* of all Kinds; as, 1. *Veins* from the *Ramus ſplenicus* of the *Vena portæ*. The *Ramus*, before it enter the Spleen, has two Coats, but in its Entrance its outer and thicker is received by the inner Coat of the Spleen, which (according to *Malpighius*) turning back enters into it, and *Veſſels.* 1. *Veins.*

becomes a *Capsula*, or common Cover for both Veins, Arteries, and Nerves. And whereas Anatomists did formerly teach, that this Vein, upon its Entrance into the Spleen, did presently divide it self therein into sundry Branches, and so was all equally obliterated in its Membranes and *Parenchyma*: He affirms, that there is formed out of it a large venous *Duct* or *Sinus*, that runs quite through the Spleen (somewhat like that in the *Pancreas*) into which the Blood (howsoever alter'd) is received through the Glands from the Arteries: And because he could never trace the Veins so far as the Glands, he believes that the Blood, *&c.* is convey'd into the aforesaid venous *Duct*, by such like *Tubuli* or Pipes, as the Milk is stored up in, and issues out of in Womens Breasts: and that by making some stay in these, it acquires some new Mixture and Alteration. That there are such *Tubuli*, appears from his own Observation (and from Dr. *Glisson*'s before him) that the Veins (especially the venous Duct before-mentioned) have abundance of little Holes or Pores in their Sides (every where, save on that Side under which the Arteries and Nerves run) which are extended into the *Parenchyma* of the Spleen, and constitute these little Pipes.

The venous Duct and Tubuli.

Dr. *Ruysch*, as in other things he dissents from *Malpighius*, as to the Substance of a Man's Spleen; so also in the Particular of the Holes in the Sides of its Veins; for he says a Man's Splenick Vein is not full of Holes like a Sieve, as a Calf's is, nor does it end into *Sulci* like that.

This Vein enters the Spleen, sometimes in one, and sometimes in more Branches: But whether they be one or more, they have each one a Valve which looks from the Spleen outwards, permitting the Humours to flow from the Spleen to the

Ramus

Ramus ſplenicus, but hindering them from returning back. And tho' one cannot diſcover any Anaſtomoſes of the Veins with the Arteries in the Subſtance of the Spleen, yet there is one notable one of the Splenick Artery, with this *Ramus ſplenicus*, before it enter the Spleen; whoſe Uſe muſt be partly to further the Motion of the Humours, contain'd in the *Ramus*, towards the Liver, partly that the ſuperfluous plenty of Blood, which perhaps cannot paſs quick enough thro' the narrow Paſſages of the Spleen, may return back again by help of this Anaſtomoſis, thro' the *Ramus* to the Liver. There are alſo two Veins that open into the *Ramus* at a little diſtance from the Spleen; the *one* called *Vas breve* (but ſhould rather be called *Vaſa brevia*, there being for the moſt part ſeveral) which ariſeth out of the bottom of the Stomach: (The Error of the Ancients as to the Uſe of this Veſſel was detected before, *Chap.* 12. and its true Uſe declared:) and the *other* the internal Hæmorrhoidal.

It hath two *Arteries*, one entring at its upper, the other at its lower End. Theſe commonly ſpring from the left Cœliack Branch, which is called the *Splenick Artery*; but ſometimes (ſaith *Diemerbroeck*) from a certain branch which ariſeth out of the very Trunk of the *Aorta*, and proceeds by a bending Paſſage along the ſide of the *Pancreas* to the Spleen, approaching whereto it is divided into two, and theſe branches entring it as aforeſaid, they are ſubdivided through it into a thouſand twigs, the moſt of which terminate in the oval Glands above-deſcribed, and the Remainder are ſpent partly on the Membranes that make its Cells, and partly on the inveſting Coats, as may be made appear, by filling this Artery with Ink or Air. 2. *Arteries.*

Its

3. *Nerves.* Its *Nerve* is one of the left meſenterical Branches of the intercoſtal Pair, which at its entrance into the Spleen, is ordinarily divided into two branches, which are incloſed in the common Caſe, running by the ſides of the Artery, or ſometimes above it, but under the Vein: Its Subdiviſions do inoſculate with one another, and accompany the Bifurcations of the Arteries within one Cover, thro' the whole Subſtance of the Spleen, entering the Glands with the Arteries. Contrary to what has been formerly taught, that they are all ſpent on its inveſting Membrane; which was ſuppoſed, becauſe the body of the Spleen has but a very dull Senſe: But that proceeds not from Defect of Nerves (ſeeing it has a pretty many Twigs) but probably from that *Stupor* or Numbneſs, which that acid Juice that is bred in the Spleen, may be conceived to induce upon them.

Their Capſula. *Malpighius* in his accurate Anatomy of the Spleen, hath found out a conſiderable Membrane not obſerved by former Anatomiſts, which from its cloathing or incloſing the Blood-Veſſels, and Nerves, he calls a common *Caſe* or *Capſula*. It has its riſe from the inner and proper inveſting Membrane of the Spleen (as was ſaid before in the Deſcription of the Veins) which being turned back in the Ingreſs of the Veſſels, enters too within the Spleen, and being form'd into a Pipe, incloſes the Trunks and Branches alſo of the aforeſaid Veſſels, which ſpring out of each ſide of the long *Duct* or *Sinus*, ſomewhat like the Leaves of Fern. It hath ſuch like Holes in it as the Veins before deſcribed; and the Fibres of the Spleen do very many of them either ariſe from, or elſe are inſerted into it.

4. Vaſa Lymphatica. Tho' Dr. *Wharton* in his *Adenographia*, cap 4. going about to prove the Spleen to be no Gland,

uſes

uſes this as one Argument, That there were never obſerved any *Lympheducts* to be diſtributed through this Part; yet *Olaus Rudbeck*, *Fr. Sylvius*, *Fred. Ruyſch*, *Malpighius*, &c. affirm it to have many, which ariſing from its conglobate Glands, paſs through the *Omentum* very plainly into the *Receptaculum chyli*. See them expreſs'd in the following Figure of a Calf's Spleen.

The Uſe of the Spleen.

The Ancients knowing neither the true Paſſage of the Chyle, nor the Circulation of the Blood, erred groſsly as to the *Uſe* of this Part. They thought that it attracted a more feculent and melancholick part of the Chyle, by the *Ramus ſplenicus*, from the Meſaraick Veins, which having elaborated, it ſent it out again, partly by the *Vas breve* to the Stomach, to excite the Appetite, and further the Concoction thereof; and partly by the internal Hæmorrhoidal: But it is certain, that no Chyle, nor indeed Blood, paſſeth by the *Ramus ſplenicus* to the Spleen, as neither any thing from the Spleen by the aboveſaid Veſſels; but whatever they contain, comes towards the Spleen, namely into the *Ramus*; and what is in it, goes to the Liver. One need add no further Reaſon to evince the Error of their Opinion, nor that of thoſe that would make it either a blood-making, or a blood-perfecting Bowel. Dr. *Gliſſon* (*in lib. de Hepate, cap.* 45. *pag.* 434.) thinks it to make an Alimentary Juice, or at leaſt a Vehicle for it, which being firſt imbib'd by its nervous Fibres, is from them received into the Nerves, by which it is firſt carried to the *Glandulæ renales*; where being refin'd, it is received again by the Nerves, and is carried to the Brain and ſpinal Marrow, and from thence by the Nerves again into all the Parts of the Body. We will not here enter into a Diſpute about the nutritious

tritious Juice of the Nerves; but ſuppoſing it, certainly this ſeems an odd way of conveying either it or its Vehicle thus to and again by the ſame ſort of Veſſels; not to ſay that ſo acid a Juice as is excocted in the Spleen, one ſhould think would be no very welcome Gueſt to the Nerves nor be ſuffer'd to march ſo quietly, eſpecially paſſing againſt the current of the Animal Spirits that continually flow from the Brain and ſpinal Marrow. This Opinion therefore we ſhall paſs by as very improbable, having little elſe to recommend it, ſave the Credit of its learned Author.

Velthuſius ſays, That whatever is more thick and feculent in the Chyle and Blood, is drawn to the Spleen, and there by Fermentation is brought to a ſtate of Fuſion and Volatility, from whence ſtore of Spirits are bred in the Blood; for 'tis by Fermentation alone, ſays he, that Spirits are extracted out of any Body.

Dr. *Mayow*, according to his Hypotheſis, that the Ferment of the Stomach conſiſts of nitro-aereal Particles ſupplied by the Nerves, and that the Ferments in all the other *Viſcera* conſiſt of the ſame, aſſigns theſe three Uſes to the Spleen. 1. That the Nitro aereous Particles, which paſſing through the Brain in a continued *Series*, are not ſpent on the natural or animal Function, may be reconveyed (by thoſe Nerves that go to the Spleen, and which have Communication with moſt of thoſe that are beſtowed on the *Viſcera* in the *Abdomen*) into the Maſs of Blood, and rightly mixed with it in the Spleen. 2. That the Nitro-aereous Particles may be carried in a due Plenty, and with a certain Regimen to the *Viſcera* appointed for the concoction of Meats. For accordingly as thoſe *Viſcera* are full or empty of Aliment,

liment, so they have need of a greater or less Afflux of fermentative Particles. 3. That the Nitro-aereous Particles being put in Motion and Vigour, and intimately mixed with the Salino-sulphureous Particles of the Blood in the Spleen, may excite such an Effervescency in the Mass of Blood, as may be fit to bring its Salino-sulphureous Particles to a due Volatility. Whence, seeing these Offices of the Spleen are not so necessary, but that Life may be continued without them, tho' they much conduce to the right disposition of the Animal Oeconomy, and to a perfect Health; I say, on this account he thinks it not difficult to understand how it comes to pass, that an Animal may live that has it cut out.

Blancard gives this as his Opinion, [‘The numerous Grape-stone-like Glands, without doubt ‘receive a Lymphatick Humour from the Arterial Blood, which is carried by Lymphatick ‘Vessels, plain enough to be seen on the simous ‘side of the Spleen, to the Receptacle of the ‘Chyle. The Blood, being thus deprived of a ‘too great Quantity of this Liquor, is made so ‘much the fitter to have the Bile separated from ‘it in the Liver. Thus also all the Blood that is ‘to go to the Liver, whether in the Spleen, or ‘the Intestines, or in the Stomach, does first ‘part with its too thin Juice. For this Reason ‘the Spleen is made livid, and all the Blood that ‘enters the Liver, is far blacker than that which ‘is contained in the *Vena cava*. But the young ‘Student will ask, why the Liquor is sent from ‘the Lymphatick Vessels of the Spleen into the ‘Receptacle of the Chyle? I answer, That ‘through the mixture of Liquors, whose Particles ‘are of divers Kinds, the Chyle might (by fermenting as it were, as appears in Chymical ‘Mixtures) be made the more perfect.] Dr.

Dr. *Havers* (in his *Osteologia nova*, *p.* 210, &c.) inquiring into the Generation of the *Mucilage* that lubricates the Joints, *&c.* thinks, that the Change which that part of the Blood from which it is produced, undergoes in order thereunto, is made by some Gland, and that there is none which seems so fit and likely to be concern'd in this Affair, as the Spleen, which he supposes to be the *Officina*, where Nature produces and elaborates the Mucilage, from whence it is administred to the Blood, and by that dispensed in its Circulation to all the Parts, about which 'tis necessary it should be employ'd. The Reasons of this his Opinion, the Reader may see in the Place quoted.

The last (and to me the most probable) *Use*, is this, *viz.* That it serves to make a subacid and saltish Juice of the Arterial Blood and Animal Spirits that flow plentifully into it, which passing by the *Ramus splenicus* to the Liver, serves there to make (and further the separation of) the Bile, which is the proper Action of the Liver, as was shewed before, *Chap.* 11. Now this Juice is thus elaborated: The bulk of the Spleen consisting mostly of membranous Cells enclosing Bunches of Glands, as we shewed before from *Malpighius*, into these the Arterial Blood is poured by the capillary Arteries, wherewith are mixed some Animal Spirits deposited into the same by the ends of the Nerves, which bridling the Sulphureous Spirit of the Blood, induce on it a little Acidity; and then being driven out of the Cells and Glandules, by the beating of the Arteries, and the pressure of the adjacent Parts, it is received into those *Tubuli* before spoken of, and so into the large venous Duct, from whence it flows into the *Ramus splenicus*, and by it is conveyed to the *Porta* and Liver. But it does not

pass

Fig. 1.

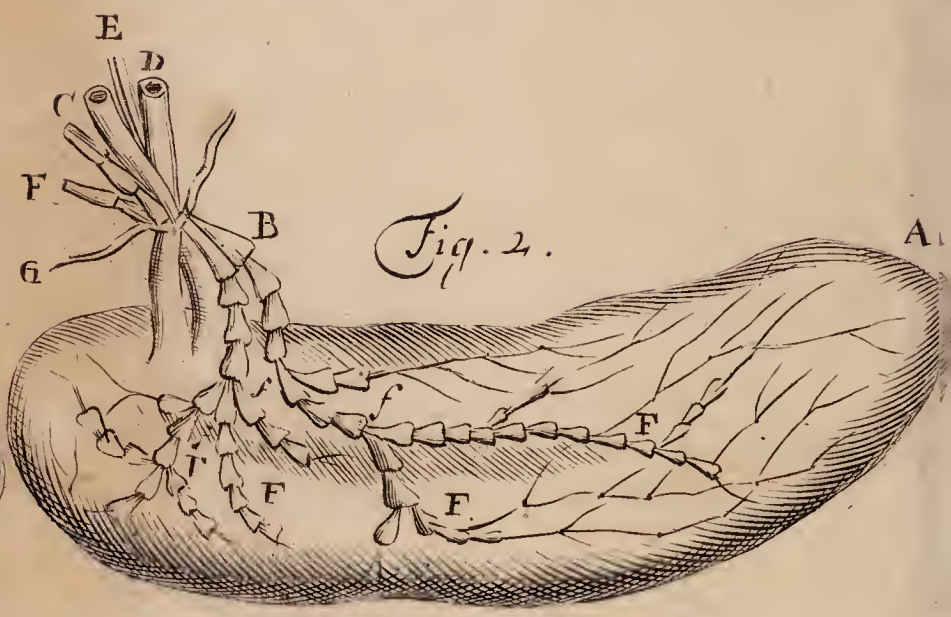


Fig. 2.

Fig 3.

paſs haſtily through the Spleen, but ſeems to make ſome ſtay in the abovementioned Cells and Pipes, and alſo in the venous Duct, that it may acquire ſome more Acidity, by its ſtagnating in them; as Wine ſtanding in a Vinegar-Veſſel ſours more and more; and as the Bile by ſtaying in the Gall-bladder gets a greater Acrimony. And this ſtay of the Blood in the *Tubuli* and venous Duct, *Malpighius* aſſigns this Reaſon of, *viz.* Becauſe they are ſo much more capacious than the Arteries that bring the Blood into them; ſo that the Current could hardly be continued in them by the Impreſs or Propulſion of the Arterial Blood, if it were not furthered by the Motions of the adjacent *Viſcera* and Inteſtines ſqueezing as it were the Spleen againſt the Ribs. That the Spleen does miniſter to the Action of the Liver, and not to Sanguification (amongſt other Reaſons) may be preſumed by this, that the Blood takes ſo long and tedious a March from that to this by the *Ramus ſplenicus*; whereas it might readily have been conveyed into the *Trunk* of the *Cava* that is hard by the Spleen, if the Juice that is elaborated in it had not been for the Service of the Liver.

Tab. IV. *Repreſents the* Pancreas, *and the Spleen with its Lympheducts.*

Fig. 1. Repreſents the *Pancreas*,

AAAA *The* Parenchyma *of the* Pancreas *opened.*
B *The Trunk of the* Ductus pancreaticus.
CCCCCCC *Its Branches.*
D *The* Ductus bilarius *joining to the Pancreatick Duct.*
E *The* Duodenum *opened.*
F *The Inſertion of theſe Veſſels.*

Fig.

Fig. 2. Repreſents the Lymphatick and Sanguineous Veſſels of the Spleen tied.

A *The Spleen of a Calf.*
B *The Sanguineous and Lymphatick Veſſels tied.*
C *The Splenick Vein.*
D *The Splenick Artery.*
E *The Splenick Nerves, whoſe Number is uncertain.*
FFFF *The Lymphatick Veſſels ariſing out of the outer part of the Spleen.*
ffff *The Valves in the ſaid Veſſels.*
G *The Ligature.*

Fig. 3. Repreſents an Oxe's Spleen.

aa *The Subſtance of the Spleen cover'd with its proper Coat.*
bb *The ſame Coat diſſected and turned back, that the Progreſs and* Plexus *of the Veſſels and Fibres may be ſhewn the better.*
c *A Portion of the* Vena Portæ.
d *Its left or Splenick Branch.*
e *This Branch opened near the Spleen, that the Valve* i *may appear.*
ffff *A Portion of the ſplenick Artery, which running through the whole Subſtance of the Spleen, doth diſpenſe into it the little Twigs* gggg.
hhhh *Certain nervous Fibres wonderfully complicated, amongſt which the Twigs of the Arteries run.*
i *The Valve in the ſplenick Branch looking outwards to the* Porta.
k *The Holes which appear in the* Ramus ſplenicus, *leading from the Subſtance of the Spleen.*
l *Nerves running along the ſides of the ſplenick Artery.*

CHAP.

CHAP. XVII.

Of the Kidneys, and the Glandulæ renales.

THE *Kidney* is called in Latin *Ren*, from ῥέω, to *flow*; becauſe the Seroſity of the Blood doth flow through the Kidneys to the Ureters, and through them to the Bladder. By the Greeks they are called νεφροὶ, *à* νίφειν, *ningere*, or *ſpargere*. *The Kidneys. Their Name.*

They are in *Number* two, both becauſe of the great Quantity of the ſerous Excrement that is to be ſeparated and diſcharged by them; and alſo, that one being ſtopped by a Stone, or otherwiſe violated, the *Serum* of the Blood might be tranſcolated by the other. *Number.*

They are *ſeated* behind the Stomach and Inteſtines in the Loins, one on each ſide of the *Verteбræ*, between the Membranes of the *Peritonæum*. Their upper End reaches to the baſtard Ribs; and their lower reſts on the Head of the Muſcle *Pſoas*, (which is one of the Movers of the Thigh) juſt where the Nerve enters into it, which is the Cauſe that a big Stone being in the Kidney, and preſſing on the Nerve, a Numbneſs is felt in the Thigh of the ſame ſide. In Man the right Kidney is loweſt, by reaſon of the Greatneſs of his Liver, and commonly bigger alſo than the left; yet it has not ſo much Fat about it as the left, by reaſon of the Vicinity of the Liver, whoſe Heat hindreth the Increaſe of Fat. *Situation.*

In *Figure* they reſemble the *Aſarum* Leaf, or a Kidney-bean: Towards the Loins, or outwards, they are gibbous; and alſo in their Ends on the inſide; but in the Middle, where the Veſſels enter in and go out, they are hollow. Their Surface in *Figure.*

grown Persons is smooth, but in the *Fœtus* and Infants it is very unequal, as may be seen in the following Figure of the Kidneys of an *Embryo*.

Connexion As for their *Connexion*; by the external fatty Membrane they are tied to the Loins; by the emulgent Vessels, to the *Vena cava*, and the *Aorta*; and by the Ureters to the Bladder. The right hath the *Intestinum cæcum* join'd to it, and sometimes the Liver; the left hath the Spleen and the *Colon*.

Bigness. They are in length about five Inches, reaching the length of three, and sometimes four *Vertebræ*; betwixt two and three Finger's breadth broad, and one Inch thick. In salacious or lustful Men, they are commonly larger than in others.

Membranes. Their *Membranes* are two. The *outer* is *common*, borrowed from the *Peritonæum*; within the Re-
1. *Common.* duplication of which the whole Kidney is wrapped; and therefore it is called *Renis fascia*. This Membrane is besmear'd with much Fat; whence it is called *Tunica adiposa*; and into it entreth the *Arteria adiposa* from the *Aorta*; as also the *Vena adiposa*, which on the right side commonly ariseth from the Emulgent, seldom from the *Cava*; but on the left, always from the *Cava*. By means of this Membrane 'tis that they are both joined to the Loins; the right to the *Cæcum*, and sometimes to the Liver; the left to the Spleen and *Colon*, as was noted before.

The Use of its Fat. Many *Uses* have been assigned to the Fat collected in this Membrane; as, to serve for a soft swathing-Band to the Kidneys; to preserve the hot and moist Temperament of them, which otherwise would necessarily be resolved by the continual Affusion of the serous Excrement, *&c.* But *Malpighius* thinks it more probable, that seeing much Fat bedaubs the Vessels that enter into the hollow

hollow ſide of the Kidneys, not only before their Entrance, but after, and that the ſame is extended to the Membranes of the *Pelvis*, and all its Pipes, that therefore its chief Uſe is, to beſmear the ſaid Veſſels, through which the Urine paſſes, that they may not be fretted and excoriated by its Acrimony and Saltneſs.

The *inner is proper*, and ſeems to be connate with them, and not propagated from any Part. It adhereth very cloſe to them, and has inſerted into it ſmall Nerves from the Intercoſtal Pair, and one Twig from that particular Branch thereof which goes to the Stomach; whence that Conſent betwixt the Kidneys and Stomach, that in the Pain of the Stone in the Kidneys, a Vomiting is cauſed. But theſe Nerves enter the *Subſtance* of the Kidneys in but very few, and thoſe ſmall Slips, whence it has but a dull Senſe. The Emulgent Veſſels as they penetrate this Membrane, are ſaid to borrow from it a *Capſula*, or common Cover, (wherein they are both included;) as the Veſſels of the Spleen, and the *Porta* and *Porus bilarius* of the Liver, do from the Coat of their reſpective *Viſcera*, as was ſhewn above in their Deſcription. But * *Bellini* ſays, that theſe Veſſels in the Kidneys borrow their *Capſula* from the Membranes of the *Pelvis*, within which they are diſperſed preſently upon their Entrance into the Kidneys, and ſpringing out of them again, run to the Cortical or ſuperficial Part of the Kidneys, clad with a common *Capſula* from thoſe Membranes. 2. *Proper.* * De ſtruct. Ren. p. 59, 60.

As to the *Subſtance* of the Kidneys (excepting the vaſcular Part) it has been thought by ſome Anatomiſts to conſiſt of concrete Blood, or a *Parenchyma*; by others, of a peculiar carnous Subſtance; by others, that it is of a double Nature *Subſtance.*

(becauſe of its different Colour;) the outer part, which is of a dull red, to be a peculiar *Parenchyma* like that of the Liver; and the inner, which looks paler, to be carnous, but fibrous. But howſoever their *Subſtance* may appear to the naked Eye, *Malpighius* with his Microſcope hath diſcovered it to be far other than it has hitherto been apprehended. He ſays (*lib. de Renibus, cap.* 1, 2, 3.) ['That the Kidneys in Men are not of one continued Frame, but conſiſt of ſeveral Globules, as ſo many diſtinct Kidneys: That though in grown Men their Superficies ſeems commonly plain, yet it is unequal in Infants new-born; and that in adult Perſons the Conjunction of Globules does ſtill appear within from the Diverſity of Colour, which, in the ſeveral Globules outwardly and towards their ſides, whereby they join one to another, is red, but more pale towards their Middle. Each Globule conſiſts of alike Parts, namely, of all thoſe which the whole Kidney partakes of, *viz.* of Blood-Veſſels, Nerves, Glands, excretory Veſſels, and a *Papilla*, in which the excretory Veſſels terminate.——If one take off the Membrane from a freſh, and as yet ſoft Kidney, there may, by a good Microſcope, be diſcovered certain round and very ſhort Bodies, roll'd about like little Worms, not unlike thoſe that are found in the Subſtance of the Teſticles being cut through the Middle, or on their Surface when their Coverings are removed: The way to diſcover them, is, to pour Ink upon them, and then gently wipe it off; by the Help whereof one may alſo diſcern, under the outmoſt Surface, wonderful Branchings of Veſſels with their Globules (or Glands) hanging at them, like Apples. But for this purpoſe, 'tis beſt to inject

'Ink

'Ink by the Emulgent Artery; for thereby all 'the Branches of the Artery will be tinged black, 'and so much of these Glandules as the Capil- 'lary Arteries run through. Hereby one may 'also discover certain continued winding Spaces 'and *Sinus*'s running through all the outward Su- 'perficies of the Kidneys. Then cut the Kidney 'in at the Back lengthways, as deep as to the '*Pelvis*, and pour Ink upon it, which gently wipe 'off with your Fingers End, and you will see 'innumerable small Pipes running from the 'Surface towards the *Pelvis* as their Centre, 'which look something like fibrous or parenchy- 'matous Flesh, but are indeed membranous and 'hollow; which Pipes make up a great Part of 'the Substance of the Kidneys, and are the ex- 'cretory Vessels of the Urine. But if you would 'plainly discover these *Tubuli*, you must have a 'special Care (in cutting of the Kidney in two) 'that you cut streightways of them, and not 'sloping, for then you cut them in two, and so 'cannot trace them in their Progress. From the 'Glands into which the Extremities of the Ar- 'teries end, the Roots of the Veins arise, and he 'thinks that the Nerves reach to them too; and 'that it is probable, that the excretory Vessels 'of the Urine are extended so far also, seeing 'this is constant in all Glands, that every little 'Globule has besides the Artery and Vein a 'proper excretory Vessel, as the Bilary in the 'Liver, *&c.* And he has observed, that those 'same Pipes, or Urinary Fibres, running streight 'from the Glands towards the *Pelvis*, do many 'of them terminate into one of the *Papillæ*, 'through which the Urine is transcolated into 'the *Pelvis*, for into it they jet out.] (These *Papillæ* shall be described by and by.) By this curious

curious and accurate Deſcription of their Subſtance, he has greatly diſpelled that Miſt of Ignorance that Anatomiſts hitherto were in concerning it. But to proceed.

Emulgents 1. *Arteries* The *Emulgent Artery*, ſpringing from the deſcending Trunk of the *Aorta*, enters the Kidney in its inner and hollow ſide, being firſt divided into two; but having entered it, theſe are ſubdivided into divers Branches, which ſpreading themſelves between the Coats of the *Pelvis*, ſhoot forth into ſmaller Twigs; and theſe with the like Twigs of the Veins borrowing a common *Capſula* from thence (according to *Bellini*, as was obſerved before) run through the whole Subſtance of the Kidney, and end in the Glands afore-mentioned. By this Artery (being large) is much Blood convey'd to the Reins, partly to nouriſh them, but chiefly that in their Glandules, a good part of the *Serum* may be ſeparated from it, which being carried by the Urinary Fibres or Pipes to the *Papillæ*, ouzes through them into the *Pelvis*.

2. *Veins.* The *Emulgent Vein* is a little larger than the Artery. It has the like branching within the Kidney as the Artery; and its Trunk, coming out hard by where the Artery enters, opens into the *Cava*, into which it diſcharges the Blood remaining from the Nouriſhment of the Kidney, now freed from a good quantity of *Serum* in the Glands. For that there paſſes nothing by this Vein to the Kidney, is plain, as from the general Office of Veins, which always carry from the Part where their Capillaries are ſpread (excepting the *Vena Portæ*, which indeed has the Office of an Artery) ſo from that notable Valve that is placed at its Entrance into the *Cava*, looking towards it from the Kidney, ſo that the Blood may freely paſs out

of

of the Emulgent into the *Cava*, but not back again. The Emulgent Vein sometimes comes divided out of the Kidney, as the Artery goes in; but both the Branches are presently united into one, and it always opens by one Orifice into the *Cava*. The left emulgent Vein is somewhat higher up than the right, according to the Situation of the Kidneys themselves, of which the left stands a little higher.

Nerves. Of the *Nerves* we have spoken before, discoursing of the proper Membrane of the Kidneys, to which we need add nothing more here.

Lympheducts. Many, particularly *Malpighius*, have endeavoured to discover *Lympheducts* in them, without Effect: But *Gasp. Bartholin* says, he can demonstrate them to the Eye, and that for the most part they run to a Gland placed below the Kidneys, on the left side, where having formed a various *Plexus* of Vessels, they tend to the Receptacle, being filled with the *Lympha* of a reddish Colour.

The Pelvis *and* Papillæ. Within the Kidney there is a membranous Cell or *Sinus*, called *Pelvis* or *Infundibulum* (*i.e.* the Bason or Tunnel) which is nothing but an Extention or Dilatation of the Head of the *Ureter*; for it consists of the same Membranes and nervous Fibres with it. It has certain Appendices which run in betwixt the *Papillæ*, which are extended into membranous *Fimbriæ*, and these parting into numerous Fibres, run towards, and are inserted into the proper Coat of the Kidneys, and serve to strengthen their Substance, and to make it more compact, so that it is not easily violated even by the most violent Motions and Contortions of the Loins, where the Kidneys are seated. The Cavity of the *Pelvis* is not round, but branches itself out into eight or ten (*Malpighius* says, twelve) open and large Pipes. Into it does the *Serum*

issue from the Urinary Siphons through the *Carunculæ Papillares* or *Mammillares*, for one of these stands at the Head of each of the said Pipes (being of an equal Number with them) and are like Glandules of a fainter Colour, but harder than the rest of the *Parenchyma*; they are about as big as a Peaſe, flattish above, but round or bunching out on that side next the *Pelvis*; Their Perforations are exceeding narrow, so that they will hardly admit the smallest Hair. Each one is the Centre to all the Urinary *Tubuli* in one Globule of the Kidneys; and through them does all the Urine ouze into the *Pelvis*, and none through any Pores of the *Pelvis*, as some heretofore have imagined.

The Action of the Kidneys.

The *Action* of the Reins is to separate and evacuate the serous Humour from the Blood, which, as was said, is brought to them together with the Blood, by the emulgent Arteries; which is done in this Order. After the two Branches of the emulgent Artery are enter'd the Kidneys, they are presently each of them divided into four or five, and those again into many more, till at last they end in the smallest Capillaries, which terminate in the Glandules, towards the outer Superficies, whereinto they infuse their Liquor. Into the same Glandules are inserted also the capillary Veins, and the Urinary Siphons, each of which imbibe thence their proper Liquor. By the Veins the Blood returns into the larger branches of the emulgent Veins, from thence into the single Trunk, and by it to the *Cava*, which conducts it to the Heart: But by the Urinary Pipes does the *Serum* drill to the *Papillæ* or *Carunculæ*, placed at the Entrance into the *Pelvis*, through which it distills into it. And this *Pelvis* being the Head of the *Ureter*, the *Serum* glides readily out of it down by the Ureter into the Bladder. But

But now it is very difficult to determine, whether this ſeparation of the *Serum* in the Kidneys be procured by any kind of Effervescency or Fermentation; or whether they ſerve meerly as a Strainer, thro' which it is ſqueezed or tranſcolated. If it be ſeparated only this laſt way, how admirable is the Configuration of the Pores, that the *Serum* with all its Contents ſhould paſs by them without the leaſt drop or ſtain of Blood, when yet often purulent Matter, brought out of the *Thorax*, and throughly mixed with the Blood, and which is far thicker than the Blood itſelf, paſſes thro' them with the *Serum*, and not any thing of Blood at the ſame time; that ſuch purulent Matter paſſes by Urine, is frequently obſerved; but whether it be abſorbed out of the Cavity of the *Thorax* by the Mouths of the Veins gaping into it, as the Ancients thought it might; or it be bred in the *Parenchyma* of the Lungs apoſtemating, as is more probable, 'tis not a fit Place here to enquire. As neither would it ſignify much to give you the Conjectures of ſome learned Men, that becauſe ſuch *Pus*, and much more becauſe Pins, Needles, an Iron Nail, *&c.* have paſſed by Urine, that therefore there muſt be ſome more direct and patent way for part of the *Serum* to be convey'd by to the Bladder; and therefore have imagined that ſome Lacteals have been inſerted into the Bladder, as others have ſuppoſed otherways: For as far as could ever be diſcover'd by Anatomiſts, there is no Footſtep of any ſuch Paſſage, how plauſible ſoever ſuch an *Hypotheſis* may ſeem; and therefore we ſhall ſay no further of it. As to the Fermentation whereby ſome ſuppoſe the *Serum* to be ſeparated from the Blood thoſe who are for it affirm, that a Ferment is ſent for this purpoſe from the *Glandulæ renales*

les (to be deſcribed preſently.) But this cannot be admitted, ſeeing there appears no way whereby ſuch Ferment can be communicated, as ſhall be further ſhewed by and by. And the want of ſuch a way may ſerve for a Refutation of that other Opinion, which ſuppoſes the Humour collected in the *Glandulæ renales*, to perform the Office of a *Coagulum* or Runnet to the Blood in the Kidneys, whereby the Serum is ſeparated from it like Whey from Milk.

Some have thought that the Kidneys, beſides the ſeparating of the *Serum*, do prepare Matter for the Seed; ſeeing the ſpermatical Veſſels ſeem to have ſome manner of Communication with the renal, the left ſpermatick Vein ariſing from the left Emulgent. But ſeeing the ſpermatick Vein returns Blood from the Teſticles to the Emulgent, and carries nothing from this to them, this opinion is exploded by the circulation of the Blood. Yet however tho' they do not prepare Matter for Seed, yet by ſeparating the Salts and other Recrements, they amend the Diſpoſition of the Blood, ſo that it becomes more capable of being elaborated into Seed by the *Vaſa præparantia* and *Teſtes*.

Whether neceſſary Parts.

It is not abſolutely neceſſary for the Conſervation of Life, that both the Kidneys ſhould be continued in a Capacity to perform theſe Actions, tho' they are better performed by them jointly. For ſometimes the Head of one Ureter is ſo plug'd up by a Stone bred in the Kidney, that not a drop of *Serum* can paſs by it, and otherwhiles the whole parenchymatous (or glandulous) Part is ſo conſumed by an Ulcer, that no Separation of the *Serum* can be made by it; and yet the *Serum* is ſufficiently carried off by the other ſound Kidney. Yea, Dr. *Ant. Nuck* tells us, That after having ſtraitly

ſtraitly tied the Veſſels coming unto and going from the Spleen and one Kidney, in a Dog, he has cut them both out; and having ſealed up the Wound in the Side, by which he performed the Operation, the Dog has continu'd as well after as if nothing had ail'd him.

Above each Kidney, at about half an Inch Diſtance there ſtands a Gland, firſt found out and deſcrib'd by *Bartholomæus Euſtachius*, by ſome called *Glandulæ renales*; by others *Renes ſuccenturiati*; by *Bartholin*, *Capſulæ atrabilariæ*; by Dr. *Wharton*, *Glandulæ ad plexum nerveum ſitæ*. Which ſeveral Names they have had given them, from the ſeveral Uſes the Impoſers have aſcrib'd to them. *Glandulæ renales.*

They are commonly but two, and are placed over (but towards the Inſide of) the Kidneys, having the Fat about the Kidney coming between. The left is nearer to the Diaphragm, ſtanding higher than the right, but the right is nearer to the *Vena cava*. *Their Situation.*

They are ſeldom of the ſhape of the Kidneys, but are of not much unlike *Subſtance*. Their *Figure* is often three-corner'd, having the Shape of a Satchel with its bottom upward. Sometimes they are oval, but flattiſh. *Figure and Subſtance.*

They are bigger in Children proportionably than in Men; for in the former they are near the bigneſs of their Kidneys (as may be gueſſed by the following Figure of the Kidneys and theſe Glands in an *Embryo*;) but they do not increaſe as other Parts do, ſo that in adult Perſons they are not above two Inches long, and one broad. Commonly the right is bigger than the left. *Magnitude.*

They are cover'd with a thin *Membrane*, which *Membrane*

is

is knit very faſt to the outer or adipoſe Membrane of the Kidneys.

Cavity. They have a manifeſt *Cavity* in their larger End, in which is contained a black and feculent Humour, that tinges the ſide of the Cavity. Into it there are a great many little Holes gaping out of the Subſtance of the Gland, according to Dr. *Wharton*; and it ſelf opens into a Vein, but has a Valve placed juſt at the Entrance, that permits the Humour contained in the Cavity to flow out by the Vein, but hinders its Return.

Veſſels. They have *Veins* and *Arteries* commonly from the Emulgents, ſometimes from the *Cava* and *Aorta*, and ſometimes from the *Vaſa adipoſa*. Their *Nerves* come from the ſtomachick Branch of the Intercoſtals, that runs to the proper Membrane of the Kidneys, and to the Spleen alſo. *Lacteals* they have none. *Bartholin* affirms they have *Lymphaticks*.

Uſe. There have been divers Conjectures of the *Uſe* of theſe Glands, but none generally conſented to as true. Dr. *Wharton*'s Gueſs is, that ſome Humour is imbib'd from the Spleen by the Nerves that are common to the Spleen, and theſe Glandules (being both from one Branch) and is depoſited in their Cavity, which being not purely excrementitious (though perhaps unprofitable to the Nerves) is reſtored again to the Veins, as being of ſome Uſe to the venal Blood. Dr. *Gliſſon* alſo thinks they receive ſomething from the Spleen, which being refin'd here is imbib'd again by the Nerves, by which it aſcends to the Brain or Spinal Marrow, and deſcends again by them, being either it ſelf a *Succus nutritius*, or elſe a Vehicle for it. *Riolanus* thinks they are of no Uſe at all in Men, but only in the

Fœtus

Tab. V.

fig. 1.

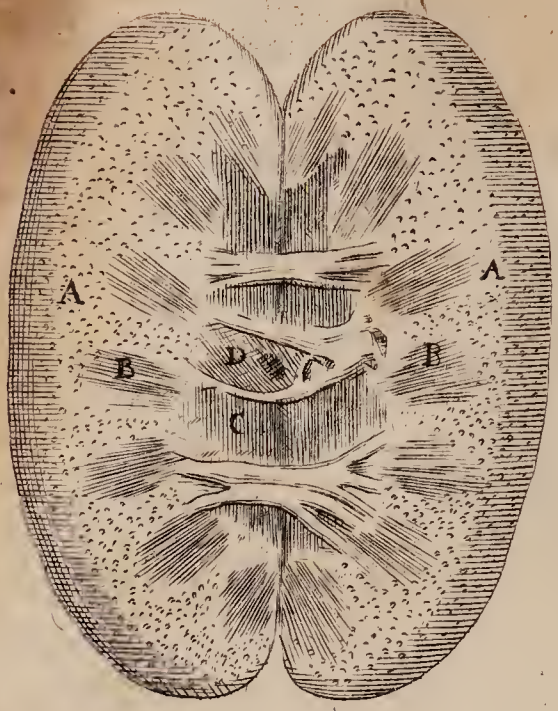


fig. 2.

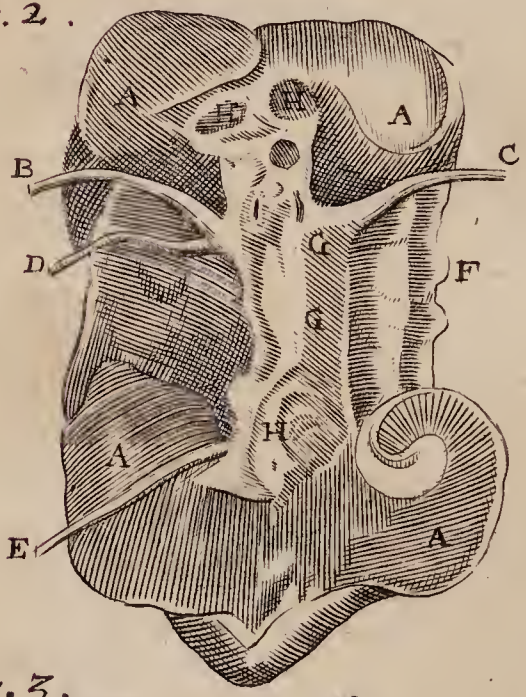
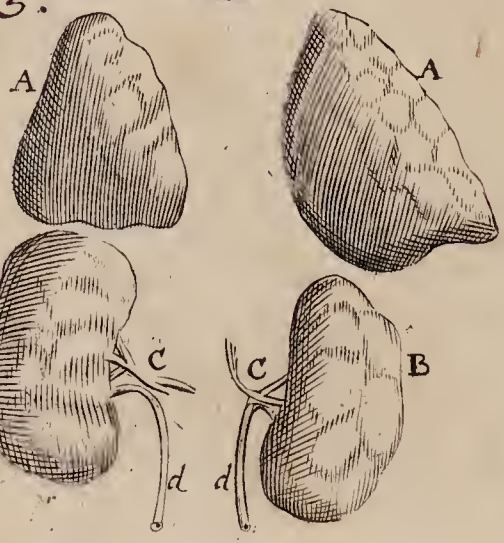


fig. 3.



The Spleen of the Same Abortion.

Fœtus in the Womb. *Veſlingius*, *Bartholin*, and many others think, that they make a Ferment, or *Coagulum* for the Uſe of the Kidneys, to help the Separation of the *Serum* from the Blood. And this indeed were a probable Uſe, if there could be found out any way whereby Ought could conveniently paſs from hence to the Kidneys. But the Veins that go out of them are inſerted either into the emulgent Vein or into the *Cava*, whoſe Blood is flowing *from* the Kidneys, ſo that it cannot paſs *to* them, unleſs one would ſuppoſe a contrary courſe of Humours in the ſame Veſſel, which ſeems abſurd. And there are no other Veſſels to ſerve this turn. *Diemerbroeck* conjectures, that their black Juice is made of the Arterial Blood, and acquires a certain fermentative Power neceſſary for the venous Blood, into which it is received by the *Cava*, from the Veins that go out of theſe Glandules. But this, ſays he, is but a Conjecture. And in Truth all the other Opinions are no more nor very probable ones neither; ſo that we muſt ſtill acknowledge our Ignorance of their true Uſe.

TAB. V.

Fig. I. Repreſents a Kidney cut in two length-ways, from the Back to the *Pelvis*.

AA *The glandulous Part of the Kidney.*
BB *The* Tubuli urinarii, *or Siphons, which convey the Urine ſeparated by the Glands, into the* Pelvis C
D *The Mouth of the* Ureter.

Fig. II. Shews the Aſpect of a Kidney cut length-ways from the *Ureter* to the *Pelvis*, from *Bellini*.

AAA *The Kidney diſſected as is ſaid.*

B *Half of the* Ureter *bent towards the right Hand.*
C *The other half of the* Ureter *bent to the left Hand.*
D *A Branch of the emulgent Vein.*
E *A Branch of the emulgent Artery.*
GG *The* Pelvis *opened.*
HHH *Some of the* Papillæ, *through which the Urine iſſues into the* Pelvis.

Fig. III. Repreſenting the Kidneys and *Capſulæ Renales*, in the ſame Proportion as they appeared in an Abortion ſuppoſed to be about five Months old, communicated to me by Dr. *E. Tyſon.*

AA *The* Glandulæ Renales, *which were rather bigger than the Kidneys themſelves.*
BB *The Kidneys, whoſe Surface is very uneven, being divided into ſeveral Bodies, as a Bullock's Kidney is.*
cc *The emulgent Veſſels.*
dd *The Ureters.*

CHAP. XVIII.

Of the Ureters.

The Ureters. THE *Ureteri*, in Latin *Meatus urinarii*, are called in Greek οὐρητῆρες, either from οὐρεῖν, *to piſs*, or ὅτι ὄρον τηρέουσι, becauſe they *keep the Urine.*

Their Origin. They ariſe out of the inner *Sinus* or *Pelvis* of the Kidneys, coming out on their inner or concave Side contiguous unto (but on the under Side of) the Emulgents.

Number. There is one on each Side.

They

They are somewhat like to Veins, but whiter, thicker, and more nervous. They reach from the Kidneys to the Bladder, not in a direct Line, but something crooked like an Italick *ſ*. They are a little above a Span long, and as thick as a Barley-straw naturally. But in such as have had large Stones descend by them from the Kidneys to the Bladder, they have sometimes become almost as wide as a small Gut. *Substance and Figure.*

Their *Coats* are almost like those of the Stomach and Guts; the inmost and outmost tendinous, and the middle carnous, made up of two Ranks of Fibres. They receive small *Veins* and *Arteries* from the neighbouring Parts. As to their *Nerves*, Dr. *Willis* saith, That after the Intercostals have sent forth all the Mesenterick Nerves, each Trunk descending sends forth three or four several Slips that are carried into the Ureters, which make the Pain so very exquisite when some viscid Matter or Stone sticks in them. *Coats and Vessels.*

As they go out of the Kidneys, they pass over the Muscles *Psoa* (which bend the Thigh) between the two Membranes of the *Peritonæum*, and descending as abovesaid, they are inserted into the lower side of the Bladder (near its Neck) running between its two proper Coats about the Length of an Inch, and are continued with the Inner. *Passage and Insertion.*

This Insertion is thus oblique, to hinder the Regurgitation of the Urine, when the Bladder is either distended with Urine, or compressed in making Water; for here is no Valve, as some have affirmed. *Why the Insertion is oblique.*

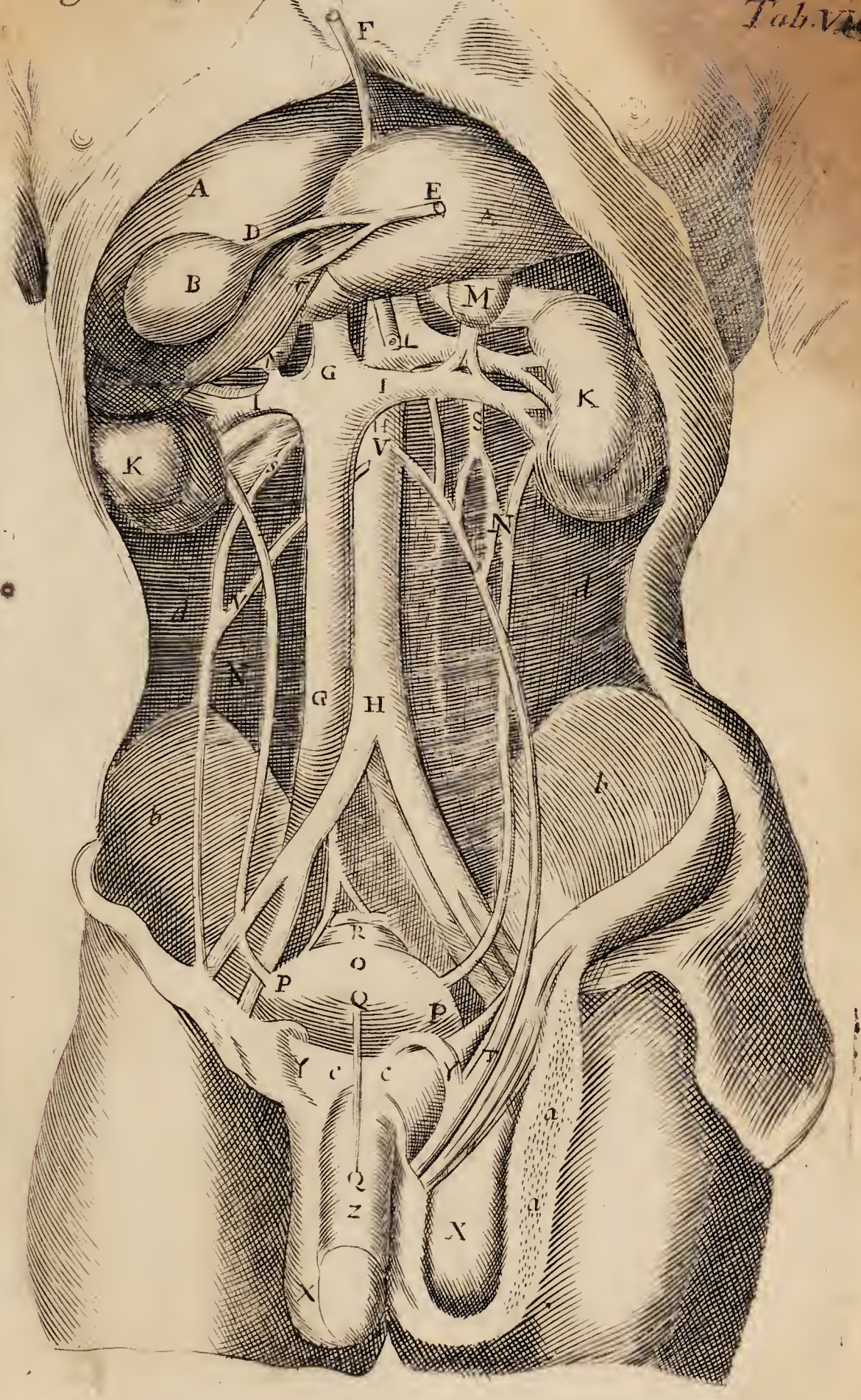
Their *Use* is to receive the Urine separated from the Blood in the Kidneys, and to convey it into the Bladder, thence at Discretion at certain times to be emptied out of the Body. *Use.*

Tab.

TAB. VI. Shews the Liver, Kidneys, Bladder, Testicles, *&c.*

AAA *The sinous or hollow Part of the Liver.*
B *The Gall-bladder.*
C *The* Ductus bilarius.
D *The Neck of the Gall-bladder.*
E *The* Ductus communis.
F *The Umbilical Vein turn'd upwards.*
GG *The descending Trunk of* Vena Cava.
H *The descending Trunk of the great Artery.*
II *The Emulgent Veins.*
KK *The Kidneys in their natural Situation.*
LL *The Emulgent Arteries.*
MM *The* Glandulæ Renales, *with the Veins that go from them to the Emulgents.*
NN *The Ureters descending from the Kidneys to the Bladder.*
O *The Bottom of the Bladder.*
PP *The Insertion of the Ureters into its sides.*
QQ *A Portion of the* Urachus.
R *A Portion of the streight Gut cut off.*
SS *The* Venæ Præparantes, *the right whereof springs out of the Trunk of the* Cava, *the left out of the Emulgent Vein.*
T *The* Corpus pyramidale *express'd on the left side.*
V *The Rise of the* Arteriæ præparantes *out of the Trunk of the* Aorta.
uu *Their Reception into one common Cover with the Veins.*
XX *The Testicles, the left whereof is divested of its common Coat.*
YY *The* Vasa deferentia, *ascending from the* Testes *to the* Abdomen.
Z *The Yard.*
aa *The Cod, that cover'd the left* Testis, *separated from it.*
bb *The* Ossa ilia.
cc *The* Ossa pubis.
dd *The Flanks.*

CHAP.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CHAP. XIX.

Of the Bladder.

THE *Bladder* is called in Latin *Vesica urinaria*; in Greek κύστις ἐροδόχος, from its Office of *receiving the Urine.* *The Bladder. Its Name.*

It is seated in the *Hypogastrium*, betwixt the two Coats of the *Peritonæum*, in that Cavity that is formed of the *Os sacrum*, *coxæ* and *pubis*, and is called *Pelvis*. In Men it lies upon the *Intestinum rectum*; in Women it adheres to the Neck of the Womb, which is placed betwixt the Bladder and the streight Gut: In both it is knit before to the *Ossa pubis*. Moreover it is knit to the Navel by the *Urachus*. *Seat and Connexion*

Its Substance is made up of three *Membranes*. *Membrane.*

The first and outmost is borrowed from the *Peritonæum*. *Riolanus* says, this Coat is a Duplicature of the *Peritonæum*, within which the Bladder lies hid, suspended like a Bottle turned the Mouth downwards. On its outside in Man it is besmear'd with Fat, but not in Beasts.

The second is thicker, and endued with carnous Fibres; yea *Aquapendens*, *Spigelius*, *Walæus*, and *Bartholin*, will have it to be a true Muscle, serving for the Compression of the Bladder, to squeeze out the Urine, as the Sphincter serveth for Constriction, to retain it.

The third and innermost is white and bright, of exquisite Sense, as those can witness who are troubled with the Stone.

Within it is cover'd with a ſlippery mucous Humour, ſuch as the Gall-bladder has on its inſide, and ſuch as the Inteſtines abound with: which without doubt muſt be ſpued out of ſome Glands in this inmoſt Coat, though they be hardly diſcernible. This doth defend it from the Acrimony of the Urine.

Fibres. Its Membranes have all ſorts of *Fibres*. And when theſe Membranes and *Fibres* are too long or too far extended with Plenty of Urine, they loſe the Power of contracting themſelves, whence there inſues a Stoppage of Urine.

Perforations. It is *perforated* in three Parts, *viz.* in the ſides, where the Ureters are inſerted, to let in the Urine; and before at its Neck, to let it out.

Parts, viz. It hath two *Parts*, to wit, the Bottom and the Neck.

Bottom. The *Bottom* comprehends the upper, wider and more membranous part of the Bladder, to which the *Urachus* being tied, reaches the Navel, which, together with the bordering Umbilical Arteries, becomes a ſtrong Ligament in the Adult, hindering the Bladder to preſs upon its Neck. But as for the Arteries, *Riolanus* * affirms, That they contribute nothing to the Suſpenſion of the Bladder, neither reaching to the Navel in the Adult, nor touching the Body of the Bladder. Of the *Urachus* ſee after, *chap.* 33.

* In animadv. ad Bauh.

Neck. The *Neck* is lower than the Bottom, thicker and ſtraiter. In Men it is longer and narrower, and being carried to the Riſe of the Yard, opens into the *Urethra*; in Women it is ſhorter and wider, and is implanted into the upper ſide of the *Vagina* of the Womb: In both it is carnous and muſcular, woven of very many Fibres, eſpecially tranſverſe or orbicular, which lie hid within the ſtreight Fibres that ſurround the whole Body

dy of the Bladder, and these make the Sphincter, which constringes the Neck of the Bladder so, as no Urine can pass out against ones Will, unless when it is affected with the Palsy, Ulcer, or other Malady, by which there sometimes happens an involuntary Pissing.

Shape Figure. The Bladder is oblong and round, in shape like unto a Pear.

Cavity. Its *Cavity* is but one ordinarily; yet sometimes it has been found to have a membranous Partition, that divides it into two; which yet had a Hole in it for the Communication of one Cavity with the other. Such a Partition was observed in the Bladder of the great *Casaubon*.

Vessels. It hath *Arteries* and *Veins* from the *Hypogastricæ*, which are inserted into the sides of its Neck, where they are immediately branched into two, whereof one is spent upon the Neck, and the other on the Bottom. *Nerves* it hath (according to Dr. *Willis*) from the lowest *Plexus* of the Intercostals in the *Abdomen*, and from the Marrow of *Os sacrum*. For the said *Plexus* sending two Nerves into the *Pelvis*, they have each of them a Vertebral Nerve joyned to them, and so make two new *Plexus*, from one of which there passes a Nerve, that being divided into many Branches, is on each side distributed into the Bladder and its *Sphincter* Muscle. Concerning which Muscle see *Book* 5. *Chap.* 19.

Use. The *Use* of the Bladder is, to receive the Urine from the Ureters, and to contain it, like a Chamber-pot, until the time of Excretion, when it is squeezed out of it by the Help partly of its own carnous Membrane, and partly of the Muscles of the *Abdomen*.

Observation. *Bartholin* quotes some Observations of *Borrichius* concerning the Bladder, worthy to be noted,

ted, *viz.* If it be boil'd in Acids, it turns into a Mucilage; If in salt Liquors, it is thickened; If in oleous, or in the Liquor of the Alkali Salts of Tartar or Herbs burnt to Ashes, it is neither thickened, nor turns into a Mucilage; but it is burnt as if it were laid on burning Coals, and may almost be crumbled to Powder. By which, says he, it appears, with what great Danger to the Bladder, Men inject into it either acid, salt, or oleous Liquors for breaking the Stone.

CHAP. XX.

Of the Vasa præparantia *in Man.*

HItherto we have handled the Parts ministring to *Nutrition*, whereby the Nutriments are prepared in the lower Belly for the Sustentation of an individual Body (and their Excrements separated and discharged out of the Body;) Now we come to the Organs of *Generation*, whereby, through Procreation, is conserved a Perennity of Mankind, which Nature hath denyed to Particulars. These Parts being not alike in both Sexes, we must necessarily treat of each apart; and first of those of Men.

The Parts of the Genitals in Man.

In Man some of these Parts afford matter for the Seed, to wit, the *Arteriæ spermaticæ*; others bring back again the Blood that is superfluous to the making of the Seed, and to the Nourishment of the Testicles, and these are the *Venæ spermaticæ*; and both these Arteries and Veins were formerly called *Vasa præparantia*: Some make the Seed, as the Stones; some convey it from thence to its Conservatory or Store-house, as the *Vasa deferentia*: Some contain the Seed till the time of Copulation,

lation, and theſe are the *Veſiculæ ſeminales*: Some diſcharge the Seed into the Matrix in Coition; this is done by the *Penis*: And ſome, laſtly, moiſten the Paſſage (*viz.* the *Urethra*) whereby the Seed iſſues, and thoſe are the Proſtates. Of all which in order. And firſt of the

Vaſa præparantia, which are ſaid to prepare matter for the Seed. Theſe are of two ſorts, *Arteries* and *Veins*. *Vaſa præparantia.*

The *Arteries* are two, and ſpring from the Trunk of the *Aorta*, commonly two Finger's breadth under the Emulgents, not from its ſide, but out of its fore part, the right whereof climbing over the Trunk of the *Vena cava*, runs obliquely to the Vein of the ſame ſide; as alſo the left marches to the Vein of that ſide. *Arteries.*

The *Veins* are alſo two. The right ariſes uſually from the Trunk of the *Vena cava*, a little below the Emulgent; the left from the Emulgent it ſelf, for otherwiſe it muſt have gone over the *Aorta*, whereby it might have been in Danger of breaking; or rather by the continual Pulſe of the Artery, the Recourſe of the Venal Blood might have been retarded. *Veins.*

Now both theſe Veins and Arteries a little after their Riſe meet, and are inveſted both in one Membrane made of the *Peritonæum*, and then run ſtreight through the Region of the Loins above the Muſcles *Pſoæ* on each ſide, and above the Ureters; as they go, beſtowing little Slips here and there upon the *Peritonæum*, between whoſe Duplicature they deſcend, and ſo arrive at its Proceſſes. The Veins divide very often into many Branches, and by and by inoſculate and unite again; but the Arteries go along by one Pipe only on each ſide, until within three or four Finger's breadth of the Stones, where each is divided into two Branches, *Their Union.*

the leſs whereof runs to the *Epididymis*, the larger to the Teſticle. And as I ſaid they deſcend betwixt the Membranes of the *Peritonæum*, ſo they paſs into the *Scrotum* between them, not perforating the inner in the Proceſſes, as in Dogs and other Creatures, wherein the Proceſſes of the *Peritonæum* are hollow like a Quill; but in Man the inner Membrane of the *Peritonæum* ſhuts the Hole, leſt the Inteſtines fall by it into the Cod; of which there is greater Danger in him (and we ſee it often happen) becauſe of his going upright. But to return to the *Vaſa præparantia*. It has been generally taught, that there are divers Inoſculations of the Arteries with the Veins in their Paſſage, whereby the Venal and Arterial Blood are mixed: But this Opinion is now exploded; for that, granting the Circulation of the Blood, it is impoſſible. For the Blood in the Arteries deſcends towards the Teſticles, and that in the Veins aſcends from them; ſo that if theſe two Veſſels ſhould open one into the other, the Blood in one of them muſt needs be driven back, or elſe, ſtagnating, diſtend and break the Veſſels. But the truth is, the Blood both for the nouriſhment of the Teſticles, and the making of Seed, flows down by the Arteries only, and that in an even undivided Courſe, without any of thoſe Windings and Twirlings like the Tendrils of Vines talk'd ſo much of (as the curious de *Graef* from his own frequent Inſpection teſtifies:) And the Veins bring back from the Teſticles what of the Blood remains from their Nouriſhment and making of Seed, and theſe indeed come out of their inmoſt Membrane by almoſt innumerable Roots, by which they imbibe the ſaid Blood, and are moſt admirably interwoven and inoſculated one with another, till about four or five Finger's breadth

breadth above the Teſticle, which Space is called *Corpus pyramidale*, *Plexus pampiniformis*, or *Varicoſus*; but theſe Veins are ſo far from preparing the Seed, as that they only bring back what was ſuperfluous from the making of it. And indeed the *Arteries* in Men do no more merit the Name of *Præparantes*, in reſpect to the Seed, than the *Gullet* in reſpect of the Chyle, or the *Ductus thoracicus chyliferus* in regard to the Blood; for their Blood acquires no ſenſible Alteration till it come to the Teſticles themſelves. But however we continue the old Names, declaring only againſt the Reaſon of them. And we will only note two things more: Firſt, That the Spermatick Veins have from their Riſe to their End ſeveral *Valves*, which open upwards, and ſo ſuffer the Blood to aſcend towards the *Cava*, but not to ſlide back again. Secondly, That though the Spermatick Arteries go ſuch a direct Courſe in Men, as has been ſaid; yet in Brutes they are more complicated and twiſted with the Veins, but without any Anaſtomoſes of one into the other.

There are *Nerves* and *Lympheducts* that accompany theſe *Vaſa præparantia*; of which in the next Chapter.

CHAP. XXI.

Of the Stones or Teſticles, the Scrotum, *and the* Epididymidæ.

THE *Stones* in Latin are called *Teſtes*, either becauſe they *teſtify* one to be a Man, or becauſe amongſt the *Romans* none was admitted to bear *witneſs* but he that had them. In Greek they are called μόρια, κύαμοι, and alſo διδυμοι, *Twins*, becauſe, according to Nature, they are always two. *The Stones, Their Name.*

They are principal Parts. They are reckoned among the principal Parts, and that justly; for though they are not necessary to the Life of the *Individual*, yet they are to the Conservation of the *Species*. Yea, and by the Loss of them the *Individual* receives very great Prejudice both as to the Strength and Activity of his Body, and as to the Acuteness of his Reason, *&c.* according to that of *Avenzoar*, *In Eunuchis malos agnoscimus mores, rationis sunt pessimæ, —— intellectûs diminuti.*

Their Substance. They have a peculiar *Substance* (such as is not in all the Body besides) whitish and soft, made up of innumerable little Ropes of Seed-carrying Vessels, which are continued (and by very thin Membranes tied) to one another, carrying the Seed in their undiscernible Hollowness. The way to make these *Vessels* visible, *de Graef* has taught us, *viz.* Tie fast the *Vas deferens* in a live Dog or other Brute, and then these internal Ropes of Vessels, otherways inconspicuous, will presently be so filled and distended with seminal Matter, as that they may be easily discerned. *Galen*, Dr. *Wharton*, and of late *Peyerus*, &c. reckon them amongst the Glands, and that with good Reason.

Number, Situation, Figure, and Magnitude. They are in *Number* two, hanging without the *Abdomen*, at the Root of the Yard in the Cod. Their *Figure* is oval, only a little flattish. Their *Bigness* differs very much in several Persons; as big as a Dove's Egg is reckon'd a mean Size. *Hippocrates* held the right to be bigger and hotter than the left, and therefore called it ἀρρηγόν, the *Male getter*, as the left θηλυγόν, the *Female-begetter*. But these are Fancies that are obsolete, and indeed seem ridiculous, seeing there is no such Difference of their Bigness, and that their Vessels are common.

They

They have *Arteries* and *Veins* (as was ſaid before) from thoſe called *Vaſa præparantia*: Which ſome have thought to reach only to the inmoſt Coat, called *Tunica albuginea*, becauſe they are not conſpicuous in the inner Subſtance of the Teſticles. But though this may be true of the Veins, which only receive the ſuperfluous Arterial Blood, and have nothing to do with the Seed; yet it is not true of the Arteries, namely, of the moſt numerous Branches of them. Indeed Blood is ſeldom ſeen in the Subſtance of the Teſticles; but that comes to paſs by Reaſon that the Arterial Blood preſently loſes its Colour, and by the ſeminifick Faculty of the Stones is turned into Seed, which being whitiſh, of the ſame Colour with the Veſſels, makes them undiſcernible. Yet in thoſe Men that have dy'd of languiſhing Diſeaſes, and whoſe *Teſtes* have their Faculty impaired, *Diemerbroeck* affirms, that he has oft diſcover'd ſanguiferous Veſſels in the inmoſt Parts of the Stones, and has ſhew'd them to many in the publick Anatomical Theatre. As for *Nerves*, Dr. *Willis* ſays, he could never obſerve more to go to them, than one from a Vertebral Pair, and that too was moſt of it ſpent upon the Muſcle *Cremaſter*. *Diemerbroeck* agrees to one Nerve, but thinks it proceeds from the ſixth Pair (which is Dr. *Willis*'s Intercoſtal, as diſtinguiſh'd from that commonly called the ſixth, but his eighth.) Others will have Branches from both theſe Nerves to go to them. Concerning the Uſe of theſe Nerves, there is great Controverſy. Dr. *Gliſſon*, *Wharton*, &c. will have them to convey a *Succus genitalis*, which makes the greateſt Part of the Seed. Dr. *Willis*, as he denies (*in Cerebri Anatome*, cap. 27.) any *Succus nutritius* to be conveyed by the Nerves to other Parts; ſo that not any

Veſſels, Veins and Arteries.

Nerves.

Succus

Succus genitalis is brought by them hither, but only animal Spirit. And whereas to ſtrengthen the former Opinion, 'tis uſually objected, That the Seed muſt needs conſiſt of a nervous Juice and Plenty of Spirits brought from the Brain, becauſe of the great Debility and Enervation that is induced upon the Brain and Nerves by the too great Expence of it: He thus anſwers, That this comes to paſs, becauſe after great Profuſions of Seed, for the Reſtauration of the ſame Humour (whereof Nature is more ſollicitous than for the Benefit of the Individual) a greater Tribute of ſpirituous Liquor is required from the Blood to be beſtowed on the Teſticles; wherefore the Brain, being defrauded of a due Income and Afflux of the ſaid ſpirituous Liquor, languiſhes; and ſo the animal Spirits failing in the Fountain, the whole nervous Syſtem becomes depauperated and flaggy. Whereto may be added, that alſo the animal Spirits themſelves that actuate the *Proſtates*, being derived from the Spinal Marrow, are much waſted by venereal Acts; ſo that for this Reaſon beſides, the Loins are enervated. In this Anſwer *Bartholin* acquieſces. And *de Graef*, *Diemerbroeck*, &c. confeſs indeed, that the ſpirituous Arterial Blood is impregnated with animal Spirits from the Nerves, but affirm, that the Matter out of which the Seed is elaborated, is only the ſaid Blood; and to theſe we ſubſcribe. *Lympheducts* they have alſo ariſing from betwixt their Coats, and aſcending upwards into the *Abdomen* with the *Vaſa deferentia*. Theſe have many Valves looking upwards, which hinder any thing from deſcending by them to the *Teſtes*, but permit the *Lympha* to aſcend, which they convey into the Chyliferous Veſſels. *Malpighius* thinks it not improbable, that ſome Fat is derived to the ſeminary Veſſels,

Lympheducts.

Veſſels for the Generation of Seed, or at leaſt to be mixt with it; ſeeing moſt Creatures grow the fatter upon being gelt.

They have two ſorts of *Coats*, proper and common. *Coats.*

The *common* inveſt both the *Teſtes*, conſtituting the *Scrotum* (or *Cod*) and are two. The outermoſt conſiſts of the *Cuticula* and true Skin (here thinner than in other Places.) It is ſoft and wrinkled, and is generally affirmed by Anatomiſts to be without Fat. On the Out-ſide it has a Suture or Seam, that runs lengthways of the Cod, and divides it into the right and left Side. The other or inner *common* Coat, is a carnous Membrane, which ſeems to be muſcular, becauſe of the Power it has to contract and wrinkle itſelf. It is called δάρτος, and adheres to the proper Coat next under it, (called *Vaginalis*) by many membranous Fibres. Common, *viz.* the Cod.

This is the common Account of this part that all Anatomiſts have uſually given: But lately Dr. *Fred. Ruyſch* affirms, [‘ That it has the *Membrana* ‘ *adipoſa* alſo under the *carnoſa*, or rather that the ‘ *carnoſa* is fatty (on the Inſide) as it is in other ‘ Parts of the Body. And beſides, *he ſays*, that ‘ in the *Scrotum* there is a *Septum* within, divi- *Its* Septum. ‘ ding it into two Parts, of which, ſays he, you ‘ have nothing in *Veſalius*, *Bartholin*, *de Graef*, &c. ‘ Men that have otherwiſe deſerved very well ‘ of Anatomy: And what Wonder? ſeeing all ‘ things about the *Scrotum* of one newly dead ‘ are ſo ſlippery and moveable, that the true ‘ Conſtitution of the *Septum* can hardly appear. ‘ Wherefore if any would demonſtrate this, the ‘ *Scrotum* is to be blown up, and to be cut open ‘ after ’tis dried, by which means the *Septum* ‘ yields itſelf to View, and has an infinite of

‘ Blood-

'Blood-Veſſels running through it.] Thus he. This *Septum*, *Verheyen* ſays, is of the ſame Subſtance with the carnous Membrane above deſcribed, from which it ſeems to ariſe in the ſame manner as the *Mediaſtinum* from the *Pleura* (deſcribed *Book* II. *c.* 3.) to each ſide of it the Stones are firmly knit by means of their outer proper Coat. And its *Uſe* is partly to ſuſtain the Stones, and to hinder them from hitting againſt one another; and partly to help the carnous Membrane to wrinkle and purſe up the Cod.

Proper Coats.

The *proper* Coats are alſo two, and theſe encloſe each Stone apart. The outer is called *Elytroides*, or *Vaginalis*; becauſe it contains the Stone *as a Sheath*. It is a thick and ſtrong Membrane, having many *Veins*. In the Out ſide it is uneven, by reaſon of the Fibres by which it is knit to the *Dartos* and *Septum*; but in the Inner Side it is ſmooth. This is nothing elſe but the Production of the *Peritonæum*, even as the *Scrotum* is of the Skin, and *Membrana carnoſa* of the *Abdomen*. Into this Coat is inſerted the Muſcle *Cremaſter*, of which preſently. The inmoſt is ὑμὴν νευρώδης, the *nervous Membrane*, called *Albuginea* from its Colour. It is white, thick and ſtrong, framed of the external Tunicle of the *Vaſa præparantia*. It immediately enwraps the Stone, towards which it is rough, but on the Out-ſide next the *Vaginalis* it is ſmooth; and between theſe two the Water is contained in an *Hernia aquoſa*.

Muſcles.

Into the outer of the proper Membranes (as was ſaid) is inſerted the Muſcle *Cremaſter*. Theſe Muſcles (to each Stone one) have their Riſe from the *Oſſa pubis*; and almoſt encompaſſing round the Proceſſes of the *Peritonæum* deſcend with them to the Teſticles; where their carnous Fibres run through the whole length of this ſame

Tunica

Tunica vaginalis, eſpecially in its lower Part, and ſo keep the Stones ſuſpended, from whence they have their Name, (from κρεμάζω, *ſuſpendo.*) from their ſpreading themſelves thus on the Outſide of the outer proper Coat. *Riolanus* reckons for them a third proper Coat, calling it *Erythroides*: And becauſe by its carnous Fibres it makes the *Vaginalis* look *red*, ſuch as take it not for a diſtinct Coat, do give the Name of *Erythroides* alſo to the *Vaginalis*, calling it by either Name indifferently. Theſe Muſcles pull up the Stones in the Act of Generation, that the Veſſels being ſlackened, may the more readily void the Seed: And at other times they help to ſuſtain their Weight.

Theſe Muſcles in Sickneſs and old Age become flaggy, and ſo the *Scrotum* relaxing itſelf, the Stones hang low.

Upon the Stones, as yet clad with the *Tunica albuginea*, are fixed the *Epididymidæ* (called alſo *Paraſtatæ*, *Standers-by*, or *Aſſiſtants*) enwrapped in the ſame Coat with the Spermatick Veſſels. They adhere cloſer to the Teſticles at their Ends than in the Midſt. *De Graef* defines them to be *Veſſels making with their various Windings, that Body that is fix'd on the Back of the Teſticles.* To find out their Subſtance, he directs us thus. ['Firſt, 'Take off the Membrane that encompaſſes them, 'and knits them to the Stones, and then there 'will appear many Windings, which with the 'Edge of a Knife may, without hurting the Veſſels, be ſo eaſily ſeparated from one another, 'that they may be drawn out into a Length like 'a thing folded: For they are only folded from 'one ſide to the other, and are kept in that ſite 'by the Membrane received from the *Tunica albuginea*, (or *Spermatick Veſſels.*) But when you 'have Epididymidæ.

'have unravel'd half of them, you must cut another very thin Membrane, and then you will see other Vessels lie just like these, and may be unlooſed like them. And the whole being unravel'd, the thicker they are by how much further from their Origin, which is implanted into the upper part of the Testicle by six or seven Ramifications: Which, having run so far as where they join into one Duct, make it as thick as a small Thread; and this by Degrees so thickens, that being encreas'd like a Cord, it makes the *Vas deferens*, (of which in the next Chapter.)

'So that (saith he) it is clear from hence, first, that the *Testes* do not differ from the *Epididymidæ* (or *Paraſtatæ*) saving that those consist of divers Ducts; but these, after their six or seven Roots that arise out of the Testicle are united (which they are in a short space) but of one, only a little thicker. Secondly, That the *Epididymidæ* differ not from the *Vaſa deferentia*, saving that the former go by a serpentine winding Passage, and these by a streight, and that those are a little softer and narrower. And so (concludes he) following this *Ariadne*'s Thread, we have happily made our way out of the Labyrinth of the *Testes* and *Epididymidæ*.

Uſes. The *Uſes* of the *Stones* are two:

The first is to elaborate the Seed by the seminifick Faculty resident in them. For they turn a good part of the Blood, which is brought by the *Arteriæ præparantes*, and impregnated with Animal Spirit, into Seed; some is spent on their own Nutrition; and what remains from both, is carried back by the Veins called *Præparantes*.

The second is to add Heat, Strength and Courage to the Body, as gelding doth manifest by the which all these are impaired.

Tab.

Fig. 1.

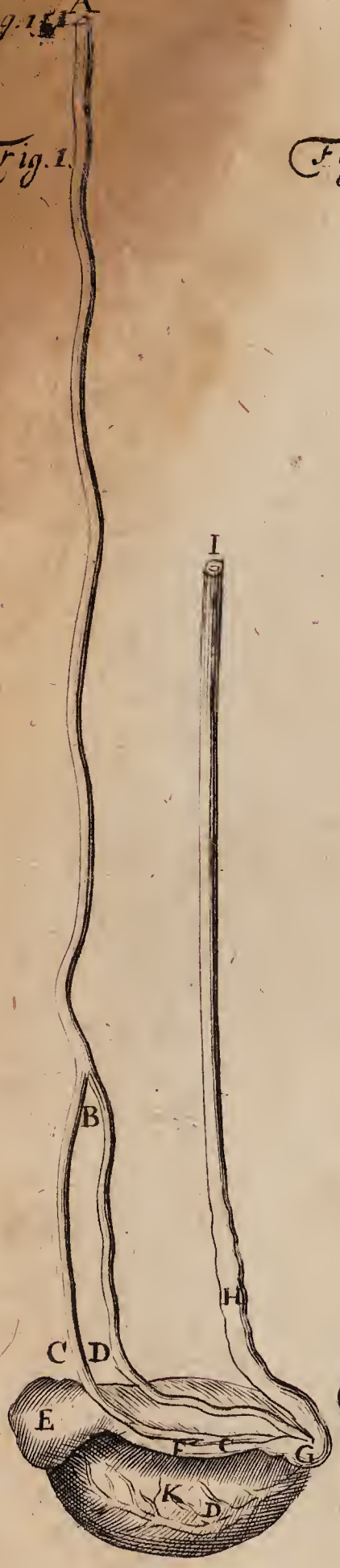


Fig. 2.

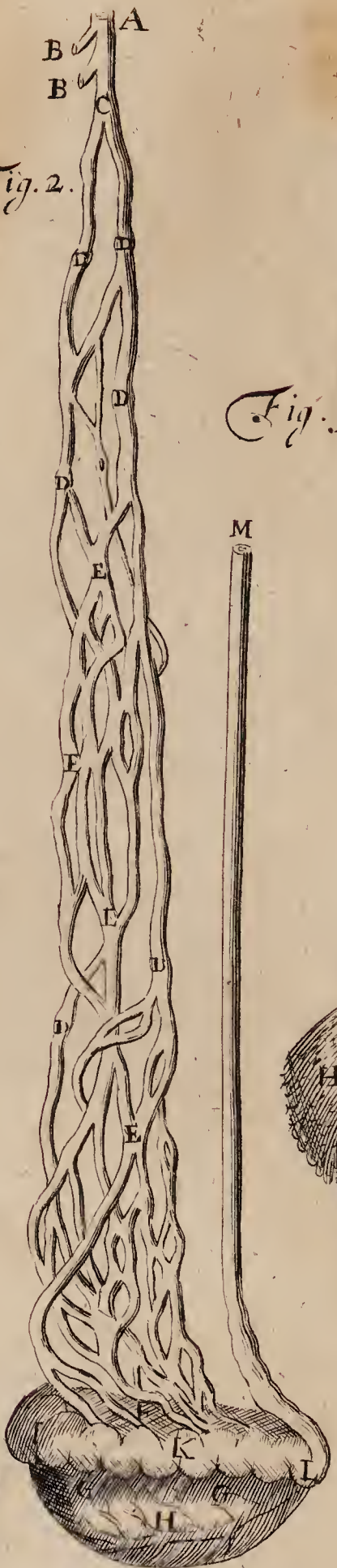


Fig. 3.

Tab. VII. Shews the *Vaſa præparantia, Teſtes, Epididymidæ, Vaſa deferentia,* &c.

Figure I.

A *The Artery preparing Seed, running from the Trunk of the* Aorta *to the Teſticle.*

B *Its Diviſion into two Branches.*

CC *The leſſer Branch thereof, which runs to the* Epididymidæ.

DD *The greater, which is implanted into the upper part of the Teſticle, and deſcends along its Back towards its lower part, to which the ſmaller end of the* Epididymis *is annexed; then it goes back again along the belly of the Teſticle, where it is divided into many Branches.*

E *The greater end of the* Epididymis *knit cloſe to the upper part of the Teſticle.*

F *The middle part of the* Epididymis *turn'd up, that the Ramifications of the Artery that run along the lower part of the Teſticle may be ſeen.*

G *The ſmaller end of the* Epididymis.

H *The end of the* Epididymis, *or beginning of the* Vas deferens.

I *The* Vas deferens *cut off, before it come to behind the Bladder.*

K *The Teſticle, placed ſo as that its Veſſels may beſt be ſeen.*

Figure II.

A *The Vein ſaid to prepare Seed, running from the Trunk of the* Vena cava *to the Teſticle.*

BB *The Branches of the* Vena præparans *tending to the Gaul and* Peritonæum.

C *The firſt Diviſion of it into two Branches which after-*

afterwards are wonderfully ſubdivided and united again.

DDDDDD *The Valves of the* Venæ præparantes, *about which the Veins being blown up, appear knotty.*

EEEE *Very many Diviſions and Unions of the* Venæ præparantes, *that the Blood, ſuperfluous from the Generation of Seed, being detained in one Ramification, may return to the Heart by the other.*

F *The upper part of the Teſticle into which the Ramifications of the* Venæ præparantes *are implanted.*

GG *The Ramifications of the* Venæ præparantes *creeping along the ſides of the Teſticles through their white Coat.*

H *The Body of the Teſticle.*

I *The bigger end,* K *the middle, and* L *the ſmaller end of the* Epididymis.

M *The* Vas deferens *cut off almoſt in the middle.*

Figure III.

A *The Preparing Veſſels cut off.*

B *The Preparing Veſſels as they run to the Teſticles.*

C *The Ramifications tending to the* Epididymidæ.

D *The greateſt Branch of the* Arteria præparans, *running along the belly of the Teſticle.*

EE *The Ramifications of the* Venæ præparantes.

F *A Dog's Teſticle ſwelled with Seed.*

G *The bigger end of the* Epididymis *turgid with Seed.*

H *The leſſer end likewiſe turgid with Seed.*

I *The end of the* Epididymis, *or the beginning of the* Vas deferens.

K *The* Vas deferens *of a Dog tied before the* Coitus, *the preparing Veſſels being unhurt, that the Seminary Veſſels being filled with Seed may be ſeen more apparently.*

CHAP.

CHAP. XXII.

Of the Vaſa deferentia, Veſiculæ ſeminales, *and* Proſtatæ.

OUT of the *Epididymidæ*, at their ſmaller End, ariſe the two *Vaſa deferentia*, otherwiſe called *Ejaculatoria*, as if in *Coitu* the Seed were ſquirted from the Stones through them; which indeed was the common Opinion till the *Veſiculæ ſeminales* were found out, which are now known to be the Store-houſes of the Seed, and not the Stones. So that the *Vaſa deferentia* deſerve not the Name of *Ejaculatory*, except it be that part of them which reaches from the *Veſiculæ ſeminales*, to the *Proſtatæ*, through which indeed the Seed is darted in Copulation. *Vaſa deferentia.*

They are white, hardiſh Bodies, like a pretty large Nerve, with a Cavity not very diſcernible, but which may be made ſo, if one open one of them ſix or ſeven Fingers breadth above the Teſticle, and then either blow into it with a ſmall Pipe, or ſquirt ſome colour'd Liquor into it with a Syringe, towards the *Teſtis*; for then the Veſſel will be diſtended and the Colour will run along its Cavity towards the *Epididymidæ*: Or if you either blow or ſquirt Liquor by a Syringe the other way towards the *Veſiculæ ſeminales*, the ſaid *Veſiculæ* will be diſtended. *Their Deſcription.*

Now from the *Epididymidæ* theſe *Vaſa deferentia* aſcend, and paſs out of the Cod into the *Abdomen*, the ſame way by which the *Vaſa præparantia* came down, *viz.* by the Proceſs of the *Peritonæum*. When they are entred the *Abdomen*, they are carried preſently over the Ureters, and turning back again, they paſs to the backſide of the Blad- *Progreſs.*

der; between which and the *Inteſtinum rectum* they march at a little diſtance the one from the other, till about the Neck of the Bladder; where they grow wider and thicker; And then juſt as they are going to meet, their Sides open into the *Veſiculæ ſeminales*, in which they depoſit the Seed; but not terminating here, but coming cloſe together, and growing ſmaller and ſmaller, they go on and end at the *Urethra* betwixt the *Proſtatæ*. At their ending, *Verheyen* (with ſome others) affirms there is a little *Septum* between them with a Caruncle (which they call a *Cocks-head*) to hinder the Seed that comes out at one Orifice to go in by the other: And the two Orifices by which the Seed is ſquirted into the *Urethra*, are called the *Eyes* of the Cock's Head.

Veſiculæ ſeminales.

Theſe *Veſiculæ* are little Cells like thoſe in a Pomegranate, or ſomething like a bunch of Grapes; *de Graef* compares them to the Guts of a little Bird diverſly contorted. They conſiſt of one thin Membrane, thro' which ſome ſmall Twigs of both Veins, Arteries and Nerves run. They are about three Fingers-breadth long, and one broad; but in ſome Places broader, and ſome narrower, as they run in and out. They are two (one for each *Vas deferens*) divided from one another by a little Interſtice; and they do ſeverally by a peculiar paſſage emit the Seed contained in them into the *Urethra*. They are very anfractuous and winding, and (as was ſaid) conſiſt of many little Cells, that they ſhould not pour out all the Seed contained in them, in one act of Copulation, but might retain it for ſeveral. They have no Communication one with another, not even in their very opening into the *Urethra*; but the Seed that is brought to the *Veſiculæ ſeminales* on the right Side by the right *Vas deferens*, iſſues by its proper Paſſage into the *Urethra*; and that

which

which is brought to the left, likewiſe. So that if by any Accident the *Veſiculæ* on one ſide be burſt or cut (as in cutting for the Stone they generally are) yet thoſe on the other being intire may ſtill ſuffice for Generation. Now when the Seed is emitted out of theſe *Veſiculæ* in the Act of Generation, it paſſes out the ſame way it came in; which in this Caſe may eaſily be (tho' otherwiſe it be unuſual there ſhould be a contrary Motion in the ſame Veſſel) for as it comes in from the *Vaſa deferentia*, it drills along *gently* without any Force; but in *Coitu*, when the Muſcles of the Yard and all the bordering Parts are much tumified, it is expreſſed or ſquirted out of them with ſome *Violence*, and paſſing along their Neck (which is a continuation of the *Vaſa deferentia*) ouzes through a Caruncle (like Quick-ſilver through Leather) into the *Urethra* or the Duct of the Yard that is common both to Seed and Urine. I ſay it ouzes from the Necks of the *Veſiculæ* through a Caruncle into the *Urethra*, for there is one plac'd as a Valve before the Orifice of each of them; partly to hinder the coming of the Urine into them; partly to hinder the involuntary Effuſion of the Seed.

Now tho' naturally the little Holes through which the Seed paſſes out of the Necks of the *Veſiculæ* into the *Urethra* be almoſt imperceptible; yet if they be either eroded by the Acrimony of the Seed (ſuch Acrimony as is contracted by impure Embraces, or in Claps as we call them) or if of themſelves they be debilitated, and ſo become more lax (as ſometimes happens to old or impotent Men that meddle too much) then there happens a *Gonorrhæa* or continual flux of Seed. And ſo *Veſalius* and *Spigelius* have obſerved them much dilated, in diſſecting ſuch as have died with a *Gonorrhæa* upon them.

Proſtatæ. The *Proſtatæ* are placed near to the *Veſiculæ ſeminales*. *De Graef* calls them *Corpus glandoſum*, ſuppoſing them to be one Body, and only divided by the common Ducts of the *Veſiculæ ſeminales* and *Vaſa deferentia* coming through the midſt of it. They are of a white, ſpongy and glandulous Subſtance, about as big as a ſmall Walnut, encompaſs'd with a ſtrong and fibrous Membrane from the Bladder, to the beginning of whoſe Neck they are joined at the Root of the Yard. In Shape they come nearer to an oval, ſave that on their upper and lower Sides they are a little depreſs'd; and in that end by which the *Vaſa deferentia* enter, they are ſomething hollow like a Tunnel. The Sphincter Muſcle of the Bladder encompaſſes them, ſo that for ſo far as they cover the Neck of the Bladder, the Sphincter touches it not, they coming between. They have all ſorts of Veſſels, which run moſtly on their outer ſide. In their inner part they have ten or more ſmall Ducts, which all unload themſelves into the *Urethra*, by the ſides of the Caruncle, thro' which the Seed paſſes from the *Veſiculæ* into the *Urethra*; and themſelves have each one a ſmall one to ſtop its Orifice, leſt the Liquor that is contain'd in the Proſtates ſhould continually flow out, or the Urine ſhould flow in. And theſe ſmall Ducts I ſuppoſe are continued from thoſe *Veſiculæ* which appear in the Proſtates of thoſe that die (any way) ſuddenly, after having had to do with a Female. For in ſuch, the ſpongy part of the *Proſtatæ* is very turgid with a ſerous Liquor, and in their inner part may be found theſe ſame *Veſiculæ*, like to *Hydatides*, which if you preſs upon, they will diſcharge themſelves into the aboveſaid Ducts.

What

What the Liquor they contain ſhould be, or what is their Uſe, there is great Variety of Opinions. Some think that the Seed that flows from the Teſticles, is further elaborated here. But that cannot be; for that the *Vaſa deferentia* depoſit nothing in them, but all into the *Veſiculæ ſeminales*. Others think that from the Blood there is ſeparated in them an acrimonious and ſerous Humour, which ſerves for Titillation, or cauſing the greater Pleaſure in Venery. As to this, *de Graef* appeals to the Taſte of it, which has nothing of Acrimony. Dr. *Wharton* thinks they make a particular kind of Seed, as the Teſticles do another, and the *Veſiculæ ſeminales* a third. That theſe laſt make a Seed different from that made in the Teſticles, is grounded on a Miſtake in Anatomy, *viz.* That the *Vaſa deferentia* have no Communication with the *Veſiculæ*, whereas they apparently open into them, and depoſit in them all the Seed they contain. That the *Proſtatæ* make a peculiar ſort, he endeavours to prove, becauſe gelded Animals emit ſome Seed. But that is but precarious; for tho' they emit ſomething, 'tis not neceſſary it ſhould be any true Seed. Or if it be, it may well be ſuppoſed to proceed from the *Veſiculæ ſeminales* that have been full when the Animal was gelt. For, for this Reaſon it has been obſerved, that preſently after gelding, they have ſometimes got the Female with young, but not afterwards when that Stock was ſpent. *Bartholin* with many others, thinks they make an oily, ſlippery, and fatty Humour, which is preſſed out as there is need, to beſmear the *Urethra*, whereby to defend it from the Arimony of the Seed and Urine, and leſt it ſhould dry up. This Humour *Malpighius* thinks to be conveyed hither by *Ductus adipoſi*; and

Their Uſe.

quotes *Severinus*, affirming that he has obſerved a plain Veſſel in the Fat of the Kidneys, tending to the ſpermatick Veſſels. He aſcribes the ſame Uſe to it as *Bartholin*, &c. *Diemerbroeck* confeſſes that it is neceſſary the inſide of the *Urethra* ſhould be kept moiſt and ſlippery, but thinks that that is done here as in the Bladder, Inteſtines, and many other Places, namely from ſome mucid part of the nouriſhment of the *Urethra* itſelf; and concludes that the *Vaſa deferentia* depoſit not all the Seed into the *Veſiculæ ſeminales*, but carry a ſmaller Part to theſe *Proſtatæ*. *De Graef* denies that the *Vaſa deferentia* convey any thing to them, or have any Communication with them; and therefore believes, that the Humour that is ſeparated in the *Corpus glandoſum* (as he calls the *Proſtatæ*) ſerves for a *Menſtruum* or Vehicle of the Seed, which flowing but in ſmall Quantity through ſmall Pores into the *Urethra*, it was neceſſary that this Humour ſhould be mix'd with it, that it might better reach the Womb. Whatever this Humour be, it is ſqueezed out partly by the Intumeſcence and Erection of the *Penis*, and partly by the Compreſſion of the Sphincter of the Blodder that girds the *Proſtatæ* about.

Theſe Proſtates are often (at leaſt partly) the Seat of the *Gonorrhæa*; and the Humour that they contain, that which is ſhed; for, if it were true Seed, Men could never endure a *Gonorrhæa* ſo long, without more notable weakning and emaciating, the Flux being ſo large as ſometimes it is.

I ſhall here omit all Philoſophical Enquiries into the Nature of the Seed, contenting myſelf purely with the Anatomical part. How far it contributes to the Generation or Formation of

the

the *Fœtus*, ſhall be ſhewn afterwards, *Chap.* 30. *of a Conception.*

The Diſtance betwixt the Root of the *Cod* and the *Podex*, is called *Perinæum*, *à περιέω, circumfluo*, becauſe it is generally moiſt with Sweat. By the Latins it is named *Interfemineum*, becauſe it is placed *inter femora*, between the Thighs. In ripe or grown Perſons this Part, the *Pubes*, *Scrotum*, and the Circuit of the *Podex* are clad with Hair, which ſerves as a Veil to cover theſe obſcene Parts. *Perinæum.* *Why theſe Parts in Men are hairy.*

CHAP. XXIII.

Of the Yard.

THE Seed being elaborated and treaſured up in the aforeſaid Organs, there was need of a peculiar Inſtrument whereby it might be conveyed into the Womb of the Female; and to this purpoſe Nature has furniſhed the Male with a *Yard*, which we come now to Anatomize. *The Yard.*

It is called in Latin *Penis*, *à Pendendo*, becauſe it hangeth without the Belly. Alſo *Virga*, *Membrum virile*, *Veretrum*, *Mentula*, and by many other Names invented by luſtful Perſons, and laſcivious Poets. *Its Name.*

It is an Organical Part, long and round, yet ſomewhat flat on the upper Side, ſeated under the *Oſſa Pubis*; appointed partly for making of Water, but principally for conveying the Seed into the Matrix. *Deſcription.*

As to its Thickneſs or Length, it differs much in divers Men. But it is generally obſerved to be larger in ſhort Men, and ſuch as are not much given to Venery; alſo in thoſe that have high *Magnitude.*

and long Noſes, and that are ſtupid and half-witted.

Subſtance. It is neither bony, as in a Dog, Fox, Wolf; nor griſtly, nor fleſhy; but is framed of a peculiar Subſtance, ſuch as might moſt conveniently admit of Diſtention and Relaxation.

Parts. The *Parts* of it are either *common* or *proper*.

The *common* are three, the Cuticle, the Skin, and the *Membrana carnoſa*, which we ſhall not need to deſcribe.

Why it hath no Fat. It hath no *Fat*, for firſt that would have hindred its Erection into that ſtiffneſs that is neceſſary; and ſecondly would have occaſion'd it to grow too bulky; and laſtly, would have dull'd that great Pleaſure that in Venery the Male is affected with in this Part.

The *proper* Parts are theſe: The two nervous Bodies, the *Septum*, the *Urethra*, four Muſcles, the *Glans*, the *Præputium*, two Ligaments and the Veſſels.

The nervous Bodies and their Septum. The *nervous Bodies* (called by Mr *Cowper*, *Corpora cavernoſa*) are two oblong *Capſulæ* or Caſes, encompaſſed with a thick, white, nervous, and very firm Membrane (like an Artery) but their inner Subſtance is ſpongy, being moſtly a Contexture of Veins, Arteries and nervous Fibres, woven one with another like a Net.

They ſpring from the lower ſide of the *Oſſa pubis* at diſtinct Originals, where they appear like two Horns (called by ſome *Crura*) or are of a Figure reſembling the Letter Y, that the *Urethra* may have room to paſs between them. When they leave the *Oſſa pubis*, they are each covered with a ſeveral Membrane, and are afterwards joined together with only the *Septum* between, which the nearer it comes towards the *Glans*, is the thinner, ſo that before it come to the middle of the *Penis*,

its

its Fibres extend towards the Back of the Yard from the *Urethra* in order like a Weaver's Slay, and while it ſtill goes further, its Fibres by Degrees grow ſo very ſmall, that near the *Glans* the *Septum* is almoſt obliterated, and the two nervous Bodies ſeem to grow into one. Whence it is that the *Penis* is equally erected; for if the *Septum* had exactly diſtinguiſh'd one part from the other, it might ſometimes have ſo happen'd by the Compreſſion or Obſtruction of the Arteries of the one or the other ſide, that one part of it would have been extended, and the other remain flaggy.

Dr. *Wharton* affirms, theſe Nervous Bodies have glandulous Fleſh within them, which keeps the Yard ſomething plump even when it is not erect. But *de Graef* denies this, and demonſtrates, that they have no other Subſtance than beforeſaid, thus. Let the Yard be prepared thus: Firſt gently ſqueeze the Blood out of it, which it always has in greater or leſſer plenty, and then put a little Tube into the ſpongy Subſtance, namely in at that end which is next to the *Os pubis*; and let the Cavity of the *Penis* be half fill'd with Water by the help of a Syringe, and ſhake the *Penis* with the Water in it; pour out that bloody Water, and fill it again with clear, and ſo three or four times till the Water is no longer ſtain'd with Blood. Then betwixt two Linnen Cloths ſqueeze out what Water is in the nervous Bodies, and at length blow up the *Penis* ſo long till it have its natural Bigneſs; in which Poſture if you will keep it, you muſt tie it hard. When the *Penis* is thus diſtended and dried, you may examine it as you pleaſe, and will find no other Subſtance than was mentioned. *Diemerbroeck* ſays, that their Subſtance is not a meer Texture of Veſſels, but is fibrous, fungous and cavernous (ſuch

(ſuch as is the Subſtance of the Lungs) receiving in their hollow Interſtices Blood and Spirits out of the Veſſels that are diſperſed through their Subſtance.

Mr. *Cowper* (after *Columbus*) ſays, there is great Analogy between the internal Structure of this and that of the Spleen: In both which the Veins have large Apertures or Cells, which moſt plainly appear in the *Bulbus* of a Dog's *Penis*, as he calls the upper Part of the *Urethra* that lies between the *Crura* of the Nervous Bodies.

The Urethra. Below theſe nervous Bodies lies the *Urethra*, being of a much like Subſtance to them, ſaving that its ſpongy Part, which is outer and lower, hath leſs Pores, becauſe of its ſmaller and more plentiful Fibres. This Part does tumifie whenſoever the Nervous Bodies do. Its inner Part is membranous, round and hollow, and exceeding ſenſible. It is of an equal width from one end to the other, ſave in its fore-part, where the *Glans* is joined to the nervous Bodies, for there it hath a ſmall Cavern, into which the acrimonious Urine lighting in the Stone of the Bladder, while it wheels about in it, cauſeth Pain, and is a great Sign of the Stone. Sometimes alſo the acrimonious eroding Liquor in a *Gonorrhœa* ſtaying here, doth cauſe a moſt tormenting Ulceration.

It is continuous to the Neck of the Bladder, but has not its Riſe from it, nor is of the ſame kind of Subſtance. If you boil the Bladder and it, it will eaſily ſeparate, and appears of a clear other Subſtance and Colour. It begins at the Neck of the Bladder, and reaches to the end of the *Glans*, which it ſeems to beſtow a Membrane upon from its own inner one, for it is plainly continued from it.

Its

Its *Uſe* is to convey along the Seed and Urine. And to that end there open into it ſmall Pores that tranſmit the Seed into it from the Necks of the *Veſiculæ ſeminales* (of which in the foregoing Chapter;) and alſo the Neck of the *Veſica Urinaria* which pours out the Urine into it. *Its Uſe.*

The *Muſcles* are two on each ſide, and ſo four in all. Of theſe one Pair are called by ſome, Collateral Muſcles, by others *Erectores*. Theſe are ſhorter and thicker, and ſpring from the *Appendix* or external Knob of the *Coxendix*, under the Beginning of the nervous Bodies, and are inſerted into their thick inveſting Membrane, a little from their Beginning. Theſe ſerve for Erection of the *Penis*. *Muſcles.*

The ſecond Pair is longer and ſmaller, proceeding from the Sphincter of the *Anus*. Theſe paſs ſtreight by the Sides of the *Urethra*, and are inſerted into it about its middle; they ſerve to dilate it for Miction and Ejaculation of the Seed, and are called *Dilatantes*, Wideners, and *Acceleratores*, Haſteners.

Theſe have been generally held to be the Uſes of theſe Muſcles, but *de Graef* (as alſo *Swammerdam, not. in prodr. p.* 35.) aſſigns a clear contrary Uſe to them, and that with great ſhew of Reaſon. For ſeeing the Action of a Muſcle is Contraction, how ſhould the former Pair extend the *Penis*, and not rather draw it back towards their Original? Or how ſhould the latter ſerve to dilate the *Urethra*, and not rather ſtraiten it, ſeeing in the Action or Contraction of a Muſcle its Belly or Middle ſwells? Therefore he ſays, that the Muſcles only contribute thus far or in this reſpect to the Extenſion or Erection of the *Penis*, inaſmuch as by their ſwelling (partly by Blood and Spirit flowing into them, partly by their proper Action) they

they ſerve to ſtraiten and compreſs the Roots of the nervous Bodies, and the ſpongy Part of the *Urethra*, and ſo drive the Blood that flows in by the Arteries towards the *Glans*, and hinder its returning back again by the Veins; a reſemblance whereof may be exhibited by a piece of a Gut, which if we fill with Wind or Water, and then compreſs that end by which they enter'd (the other being tied) we ſhall ſee the other ſtrut out and be more diſtended.

Mr. *Cowper* will not have the Intumeſcence of the Bellies of theſe Muſcles to be the principal Cauſe of Erection; but explains it thus: The *Penis* is approximated (he ſays) to the *Oſſa pubis* when theſe Muſcles act, by means of the *Ligamentum ſuſpenſorium* (by and by to be deſcribed) whereby the Blood is not only driven forwards towards the *Glans* in greater plenty, and its Veins diſtended, but their great Trunks running over the *dorſum Penis*, are compreſt under the *Ligamentum tranſverſum* of the *Oſſa pubis*. The like cannot happen in the cavernous Body of the *Urethra*, ſince there is no Bone whoſe Poſition can have that effect upon its Veins, as the *Oſſa Pubis* have upon the *Penis* it ſelf. Wherefore the *Muſculi acceleratores* compreſſing its Veins do that Office. Whence it happens, in an imperfect Erection the *Glans* is not equally extended with the *Penis* it ſelf, and at other times is ſooneſt relaxed.—The Blood thus hinder'd in its return, diſtends the *corpora nervoſa* and *Urethra*, which are thereby erected. See his *Append. ad Myotom. reformat.* p. 241, 242.

Glans. The End or Head of the *Penis* is called *Glans*, and *Balanus*. Into this the nervous Bodies terminate; and being a little thicker (on that ſide next them) than they, it forms a kind of a Circle

On

On its fore-part it is ſmaller and ſharper. It has a peculiar Subſtance (Dr. *Wharton* ſays glandulous) ſoft and ſpongy, and being covered with a very thin Membrane produced from the internal one of the *Urethra* (which coming out of its hollow, dilates it ſelf ſo as to cover all the *Glans*) it thereby, and from its proper Subſtance much interwoven with Nerves, becomes moſt exquiſitely ſenſible, and is the principal Seat of Pleaſure in Copulation. Which if it had not been very great, who would have taken delight in ſo brutiſh a thing as Venery? as *Andreas Laurentius* elegantly Expoſtulates (*Anat. lib.* 7. *cap.* 1. *q.* 7.) 'Who (moſt ſtrange!) would have ſolicited 'or accepted of ſo vile and filthy a thing as lying 'with a Woman? With what Face would Man, 'that divine Animal, full of Reaſon and Counſel, 'have handled the obſcene Parts of Women pol-'luted with ſo much Filth, which is diſcharged 'into this low Place as into the common Sink of 'the Body? On the other ſide, what Woman 'would have accepted of the Embraces of a Man, 'conſidering the Toil and Tediouſneſs of going 'nine Months with Child, the moſt painful and 'often fatal bearing of it, and its Education full 'of Care and Anxiety, unleſs the Genitals had 'been affected in the Act of Coition with tranſ-'porting Pleaſure?

Some take the *Glans* to be only a Continuation of the *Corpora nervoſa*, and not of a Subſtance diſtinct from them.

The *Glans* is covered with the *Præputium*, or Fore-skin, which is framed of the Reduplication of the Skin. Præputium.

It is called *Præputium*, becauſe it is placed *præ pudendo* before the Yard: or rather *à Præputando*, from being cut off, for this is that which the *Jews* cut

cut off in Circumciſion, from whence they are called *Apellæ* and *Recutiti*. And it is reported by divers Perſons from their own Inſpection, that in Jewiſh Children it is ſix times as large as in Chriſtians, and hangs a great way over the *Glans*, before it be cut off.

Its Glandulæ odoriferæ.

In that Part where the Prepuce is contiguous to the *Glans*, Dr. *Tyſon* (as reported by Mr. *Cowper*) has diſcovered certain ſmall Glands; which from the great Scent their ſeparated Liquor emits, he calls *Glandulæ odoriferæ*. They are very conſpicuous in moſt Quadrupeds, particularly in Dogs and Boars; in the latter of which their ſeparated Liquor is contained in a proper Cyſt, at the Verge of the Prepuce, out of which there is a large Aperture, whereby 'tis remitted again to lubricate the *Penis*.

Frænum.

The Prepuce is tied to the lower ſide of the *Glans* by a *Ligament*, called *frænum*, the Bridle. This in ſome is ſo ſhort, that 'tis neceſſary to cut it, to procure a compleat Erection.

Ligamentum ſuſpenſorium.

Beſides this Ligament, I cannot but mention another, firſt (I think) obſerved by the ingenious Mr. *Cowper*, which (from its Uſe) he calls *Ligamentum ſuſpenſorium*. It ariſes, he ſays, from the fore-part of the *Oſſa pubis*, and is fix'd to the *Dorſum penis* on each ſide the great Vein that runs along it.

The Veſſels.

Of the *Veſſels*, ſome are *cutaneous*, ſome paſs to the *inner* parts of the *Penis*.

Veins and Arteries.

The *cutaneous Arteries* ariſe from the external Branch of the *Iliack*, and running from the Root of the Yard towards and along its Back, divide themſelves into many Branches. They are called *Pudendæ* from the Parts they miniſter to; as are alſo the *Penis*, which ſpring from the exteriour Iliack, and keep the ſame courſe with the Arteries.

The

The Veins and Arteries that are beſtowed on the *inner* Parts of the *Penis*, ſpring from the inner (hypogaſtrick) Branch of the Iliack, and after they have ſent ſome Twigs to the Muſcles of the *Penis* and *Anus*, they enter the *Penis* juſt at the meeting of the two nervous Bodies, through whoſe Length they run, and are moſtly diſperſed in them and in the fungous part of the *Urethra*, ſending forth little Twigs at the ſides.

Nerves. It has two Nerves from the loweſt Vertebral. The greater of them that is very large and long, is diſtributed into the nervous Bodies, *Urethra*, and *Glans*; the leſſer is beſtowed upon it's Muſcles. Concerning which Dr. *Willis* thus diſcourſes: ['This Member (ſaith he) having only 'Nerves from the ſpinal Marrow, ſhould only 'have a ſpontaneous Motion according to our 'Hypotheſis, (*viz.* that the Nerves from the 'Brain ſerve for Natural, and the Vertebral for 'voluntary Motion.) And yet through the Tur-'geſcency of the Genital Humour, it is often 'erected and filled with Spirit againſt one's 'Mind; which is from hence, becauſe from this 'Vertebral Pair, whence the Nerves of the *Penis* 'ſpring, a Sprig is reached forth to the Vertebral 'Pair next above it, *viz.* to that in which is ra-'dicated the *Plexus* that is placed in the *Pelvis*, 'and beſtows Nerves on the *Proſtatæ*, into which '*Plexus* alſo a notable Nerve is implanted from 'the Intercoſtal Pair. Seeing therefore there is 'a Communication between the *Proſtatæ* (which 'depend much on the Intercoſtal Nerves) and 'the *Penis* it ſelf, by reaſon of the Inſertion of 'the foreſaid Sprig into the *Plexus*, from whence 'the *Proſtatæ* have their Nerves: Hence it 'comes to paſs that it acts accordingly as they 'are affected. But they, *viz.* (the *Proſtates*) are

'not

'not only apt to be moved by the Turgescency 'of the Seed; but by the Communication of the 'Intercostal Nerve, according to the Impressi- 'ons made on the Senses or Brain, are wont to 'be irritated by too importune an Action, into 'Consent, wherewith the *Penis* is presently ex- 'cited.

Lympheducts. Mr. *Cowper* has observed *Lympheducts* in this Part, running under the common Integuments, accompanying the cutaneous Veins and emptying themselves into the *Glandulæ inguinales.* 'Which, 'says he, may serve to inform us, how the mor- 'bid Matter comes to be conveyed more parti- 'cularly to those Glands in Venereal Cases, and 'cause those Tumours that frequently happen 'on that Occasion, commonly called *Bubo*'s. See his before-cited Book, *p.* 227.

Use. Its principle *Use* is to convey the Seed into the *Uterus* of the Female; and its Use to Piss withal is but secondary, for many Creatures (as Fowls in general) make no Water by it, yet have a *Penis* for the Use aboveSaid.

Pubes *and* Inguina. That Part that is next above it towards the Belly, is called the *Pubes*; and its lateral Parts are called *Inguina*, the Groins.

Tab. VIII.

Fig. I. Shews the *Vasa deferentia*, Seed-bladders, and Prostates.

AA *Parts of the* Vasa deferentia, *which appear thick, but have only a small Cavity.*

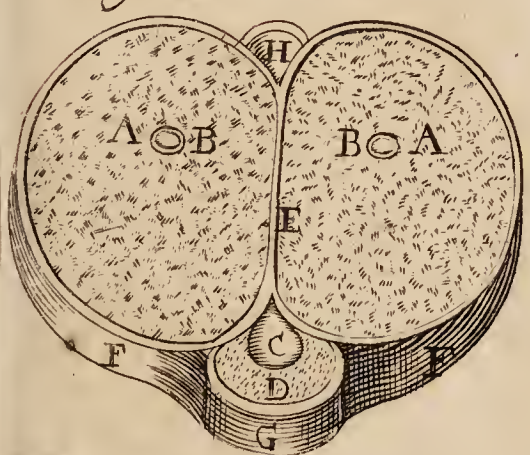
BB *The Parts of the* Vasa deferentia *of a thin Substance and large Cavity, being widened.*

CC *The Extremities of the* Vasa deferentia *narrowed again, and gaping each with a little hole into the Neck of the Seed-bladders.*

Fig. II.

Fig. I.

Fig. III.



DD *The Neck of the Seed-bladders parted from each other by a Membrane going between, ſo that the Seed of one ſide cannot be mixed with that of the other, before it come to the* Urethra.

EE *The* Veſiculæ Seminales, *or Seed-bladders blown up, that their wonderful Widenings and Narrowings may be ſeen.*

FF *Veſſels tending to the Seed-bladders.*

GGG *The Membranes whereby the Seed-bladders and* Vaſa deferentia *are kept in their Places.*

HH *The ſanguinary Veſſels running by the ſides of the* Vaſa deferentia.

I *A Caruncle reſembling a Cock's Head, through whoſe Eyes, as it were, the Seed iſſues into the* Urethra.

KK *The Ducts of the* Corpus glandoſum, *or* Proſtatæ *opening into the* Urethra, *by the ſides of the Caruncle.*

LL *The* Corpus glandoſum *divided.*

MM *The* Urethra *open'd.*

Fig. II. Shews the Bladder, *&c.* the *Penis*, and its Veſſels, *&c.*

A *The upper or fore-part of the Bladder.*

B *The Neck of the Bladder.*

CC *Portions of the* Ureters.

DD *Portions of the* Vaſa deferentia.

EE *The Veſſels running to the Seed-bladders.*

FF *The* Veſiculæ ſeminales, *or Seed-bladders.*

GG *The fore-part of the* Proſtatæ, *or* Corpus glandoſum.

H *The* Urethra *adjoining to its ſpongy part.*

KK *The Muſcles called the Erectors, or Extenders of the* Penis.

LL *The beginnings of the nervous Bodies ſeparated from the* Oſſa pubis, *which puff up like Bellows when the Yard is erected.*
MM *The Skin of the* Penis *drawn aſide.*
NN *The Duplicature of the Skin making the* Præputium.
OO *The Skin that was faſten'd behind the* Glans.
PP *The back of the* Penis.
Q *The* Glans.
R *The urinary Paſſage whereby the* Glans *is perforated in its fore-part.*
SS *The Nerves running along the back of the* Penis.
TT *The Arteries running along the back of the* Penis.
U *The nervous Bodies meeting together.*
WW *Two Veins which unite together, and run along the back of the* Penis *in a remarkable Branch.*
X *The vein opened, that the valves in it may be ſeen.*

Fig. III. Shews the *Penis* cut aſunder tranſverſly.

AA *The ſpongy or fibrous Subſtance of the nervous Bodies.*
BB *The two Arteries that march along the nervous Bodies.*
C *The urinary Paſſage of the* Urethra.
D *The ſpongy Subſtance of the* Urethra.
E *The* Septum *between the two nervous Bodies.*
FF *A very ſtrong Membrane of the nervous Bodies.*
G *A very thin Membrane, containing the ſpongy Subſtance of the* Urethra.
A *A notable vein creeping along the back of the* Penis.

Of

Of the GENITALS *in Women.*

CHAP. XXIV.

Of the Vasa præparantia.

HAving now done with the Parts ministring to Generation in *Men*, we next proceed to those of *Women*; in describing of which it has been the Method of divers Anatomists to begin first with the outer Parts of the Privity; but because we would observe as much as may be, the same Order in Women as we have in Men, we shall first begin with the Spermatick Vessels, which are of two sorts, *Arteries* and *Veins*.

Spermatick Arteries.

The *Arteries* are two, as in Men. They spring from the great Artery a little below the Emulgents (very rarely either of them from the Emulgent itself) and pass down towards the *Testes*, not by such a direct Course as in Men, but with much twirling and winding amongst the Veins, with which yet they have no Inosculation, as has been generally taught. But for all their winding, when they are stretch'd out to their full Length, they are not so long as those of Men; because in them they descend out of the *Abdomen* into the *Scrotum*, but in Women they have a far shorter Passage, reaching only to the *Testes* and Womb within the *Abdomen*.

Veins.

The *Veins* are also two, arising as in Men, the right from the Trunk of the *Cava*, a little below the Emulgent; the left from the Emulgent itself. In their descent they have no more windings than in Men, and therefore are considerably shorter.

Both the *Arteries* and *Veins*, as they pass down, are cover'd with one common Coat from the *Peritonæum*; and near the *Testes* they are divided into two Branches, the upper whereof is implanted

into the Teſticle by a triple Root; and the other is ſubdivided below the *Teſtes* into three Twigs, one of which goes to the bottom of the Womb, another to the *Tuba* and round Ligament, the third creeping by the ſides of the Womb under its common Membrane, ends in its Neck, where it is interwoven with the Hypogaſtrick Veſſels like a Net. By this way it is that the *Menſtruæ* ſometimes flow in Women with Child for the firſt Months, and not out of the inner Cavity of the *Uterus*; but yet that Blood does not flow at that time ſo much by the Spermatick Arteries, as by the Hypogaſtrick.

Their Uſe. The *Uſe* of theſe Spermatick Veſſels is to miniſter to the (Generation of Seed, according to the ancient Doctrine, but) Nutrition of the Eggs in the *Ovaria* or *Teſtes* (according to the new) the Nouriſhment of the *Fœtus*, and of the Womb itſelf, and the Expurgation of the *Menſes*; inaſmuch as Blood is conveyed by the Arteries to all thoſe Parts to which their Ramifications come, in which Parts they leave what is to be ſeparated according to the Law of Nature, the remaining Blood returning by the Veins.

CHAP. XXV.

Of the Teſticles, or Ovaria.

Womens Teſtes. WOmens *Teſticles* differ much from Mens, both in their Situation, Figure, Greatneſs, Coverings, Subſtance, and alſo Uſe.

Firſt, Their *Situation* is not without the Body, as in Men, but in the inner Cavity of the *Abdomen*, on each ſide two Fingers breadth Diſtance from the bottom of the Womb, to whoſe ſides however they are knit by the intervention of a ſtrong

strong Ligament, that has us'd to be called and accounted the *Vas deferens*; as if the Seed were carried by it from the *Testes* to the Womb. Of which afterwards.

They are flat on the sides; in their lower part oval, but in their upper (where the Blood-vessels enter them) more plain. Their Superficies is more ruggid and unequal than in those of Men. They have no *Epididymides*, nor *Cremaster* Muscles. *Figure.*

They differ in bigness according to Age. In those newly come to Maturity, they are about half as big as those of Men; but in those in Years they are less and harder. Preternaturally they sometimes grow to a vast bigness from Hydropical Tumours, in which several Quarts of serous Liquor have been found to be contain'd. *Greatness.*

They have but one Membrane that encompasses them round; but on their upper side where the *Vasa præparantia* enter them, they are about half way involv'd in another Membrane that accompanies these Vessels, and springs from the *Peritonæum*. *Tunicle.*

When this Cover is removed, their *Substance* appears whitish, but is wholly different from the Substance of Mens Testicles. For Mens (as was said above) are composed of Seminary Vessels, which being continued to one another, are twenty or thirty Ells long, if one could draw them out at length without breaking; but Womens do principally consist of a great many Membranes and small Fibres loosely united to one another, amongst which (in the outer Superficies of the *Testes*) there are several little Bladders (like to *Hydatides*) full of a clear Liquor, through whose Membranes the Nerves and *Vasa præparantia* run, and are obliterated in them. *Substance.*

Whether they elaborate Seed.

The Liquor contained in these Bladders had always been supposed by the Followers of *Hippocrates* and *Galen*, to be Seed stored up in them, as if they supplied the Place of the *Vesiculæ seminales* in Men. But from Dr. *Harvey* downwards, many learned Physicians and Anatomists (according to *Aristotle*) have denied all Seed to Women. Of which the said Dr. *Harvey* thus discourses: *De Ovi materia, Exercit.* 34. ['Some Women e-'mit no such Humour as is called Seed, and yet 'is not Conception thereby necessarily frustra-'ted; for I have known several Women (says he) 'that have been fruitful enough without such 'Emission; yea some that after they begun to 'emit such Humour, though indeed they took 'greater Pleasure in Copulation, yet grew less 'fruitful than before. There are also infinite 'Instances of Women, who though they have 'Pleasure in *coitu*, yet send forth nothing, and 'notwithstanding conceive. *Miror maxime*, adds he, *eos, qui emissionem hanc ad generationem necessariam putant, non animadvertisse, humorem illum foras ejici, & circa clitoridem vulvæque orificium ut plurimum profundi, raro intra vulvam, nunquam verò intra uterum, ut cum maris spermate misceatur, essetque consistentiâ serosum sive ichorosum, ad modum urinæ; non autem genituræ instar, lentum atque unctuosum; ut tactu facilè innotescit. Quorsum autem foras ejiciatur, cujus usus necessario intus requiritur? Debuitne humor ille, ceu utero valedicturus, ad limen vulvæ amandari; ut majore cum gratia ab utero retraheretur denuo?*] So that both from the Place of its emission, and from its Consistence, he concludes, that the Humour emitted cannot be Seed. To strengthen which Opinion, two Reasons may be added, why it cannot be the Humour contained in these *Vesiculæ*, and consequently that it cannot be Seed; first, because

cause it is sent forth in greater Quantity than that it can be supplied from them; and secondly, because the *Vesiculæ* are destitute of any such Pore or Passage, whereby the Liquor contained in them might issue out; for if you press them never so hard, unless you burst them, there will nothing pass out of them.

We must therefore subscribe to that new, but necessary Opinion, that supposes these little Bladders to contain nothing of Seed, but that they are truly Eggs, analogous to these of Fowl and other Creatures; and that the Testicles (so called) are not truly so, nor have any such Office as those of Men, but are indeed an *Ovarium*, wherein these Eggs are nourished by the sanguinary Vessels dispersed thro' them, and from whence one or more (as they are fecundated by the Man's Seed) separate, and are conveyed into the Womb by the *Tubæ Fallopianæ*; of which by and by. *They are Ovaries.*

That these *Vesiculæ* are analogous to the little Eggs in the *Ovarium* of Fowl; *de Graef* evinces by this Experiment; That if you boil them, their Liquor will have the same Colour, Taste, and Consistency with the White of Birds Eggs. And their difference in wanting Shells is of no moment; for even the Eggs of Fowls while they are in the Ovary (yea after they have descended into the *Uterus*) have no Shell: And tho' when they are laid, they have one, yet that is nothing essential to them, but only a Fence that Nature has provided (upon their Exclusion) to preserve them from external Injuries, while they are hatched without the Body; whereas these of Women being fostered within their Body, have no need of other Fence than the Womb, by which they are sufficiently defended. Only let it be noted, that besides these *Ova*, there are sometimes other Bladders larger than they, which are a sort of *Hydatides*,

des, and whoſe contained Liquor is thinner than that of the *Ova*, and will not coagulate by boiling.

Having compared theſe *Veſiculæ* to the Eggs of Fowls, I might here follow the Method of Dr. *Harvey* and *de Graef*, and deſcribe the *Ovarium*, *&c.* in Hens, *&c.* that from thence theſe in Women might the better be conceived of and apprehended; but to the curious and learned Reader I ſhall recommend the ſaid Authors for Satisfaction, and avoiding all unneceſſary and (to this Epitome) unſuitable Excurſion, I ſhall only further note two things: Firſt, that theſe Eggs in Women are commonly towards the Number of twenty in each Teſticle or *Ovarium*, of which ſome are far leſs than others. And ſecondly, that the Objection of the *Galeniſts* againſt the *Ariſtotelians*. (*viz.* that the *Teſtes* of Females muſt needs make Seed, becauſe when they have been cut out, Barrenneſs always follow'd) will be ſufficiently obviated by this new *Hypotheſis*, that agrees to the Neceſſity of the Teſticles, ſo far as to affirm, that the *Veſiculæ* contained in them become (when they are impregnated by the Maſculine Seed) the very Conceptions themſelves, which therefore it would be in vain to expect, if the Female were caſtrated.

Beſides the *Vaſa præparantia*, and *Nerves*, (of which laſt in the 27th Chapter) they have alſo *Lympheducts*, according to Dr. *Wharton*.

CHAP. XXVI.

Of the Vaſa deferentia *in Women, or their Oviducts.*

Galen, with moſt of the Ancients, reckoned thoſe ſhort Proceſſes or *Ligaments* that go ſtreight from the *Teſtes* to the Bottom of the Womb,

Womb, to be *Vasa deferentia*; and that the Seed was emitted from the *Testes* through them into the *Fundus Uteri*. And *Fernelius*, *Riolanus*, *&c.* thought they found a small Pipe passing on each side out of these Processes, by the sides of the Womb, to its Neck, into which they were inserted and opened near its Orifice. By the former it was supposed Women not with Child did emit their Seed into the Bottom of the Womb, and by these latter such as were already impregnated: For that, if it should have issued into the *Fundus* where the Conception was, it would there have corrupted, to the great Prejudice of the *Fœtus*.

But as to these latter Ducts, *Vesslingius*, *Diemerbroeck*, *de Graef*, and many other accurate Anatomists, have not been able to find the least Footstep of them. And as for the former, seeing they are not previous, nor have any Cavity (and therefore can neither contain nor convey any thing of Seed) we must conclude with *de Graef*, that they are only Ligaments of the Testicles, to keep them in their Place; which he evinces further, by observing that they come not to the inner Cavity of the *Uterus*, but are knit only to its outer Coat: for he says, there are only two Holes in the *Fundus Uteri* that admit a Probe, and those lead to the *Tubæ Fallopianæ*, and not to these Ligaments.

Seeing therefore that those which have been accounted *Vasa deferentia*, either are not to be found at all, or are found uncapable of such an Office; and having withal rejected the Opinion of Women's having Seed, and affirmed, that that which makes the Conception, is one of those *Vesiculæ* in the *Testes*, dropping from thence, and conveyed into the Womb, we must enquire by what way these can pass. For if the above-said Ligaments (reputed *Vasa deferentia*) have no Passage whereby even the *Semen*, if there were any, might be

Tubæ Fallopianæ.

con-

conducted; much leſs could one of theſe *Veſiculæ* be conveyed that way. And therefore for *Vaſa deferentia* we aſſign thoſe Ducts that *Fallopius* in his Anatomical Obſervations calls *Tubæ*, and deſcribes thus: [‘ They are very ſlender and narrow Ducts, nervous and white, ariſing from the ‘ Horns (or Sides) of the Womb, and at a little ‘ Diſtance from it they become larger, and twiſt ‘ like the Tendril of a Vine, till near their End, ‘ where ceaſing their Winding, they grow very ‘ large, and ſeem membranous, and carnous, ‘ from their red Colour. Which End is very ‘ much torn and jagged, like the Edge of rent ‘ Cloaths; and has a large *Foramen*, which (ſays ‘ he) always lies cloſed, becauſe thoſe Jags fall together; but yet being opened carefully, they ‘ are like the utmoſt Orifice of a braſs Trumpet.] But *de Graef* ſays, though they grow very large towards their End, yet of a ſudden the very extream Part is narrowed before it is divided into the aforeſaid Jags, which he reſembles unto Leaves. Who alſo appeals unto Experiment for theſe *Tubæ*'s being pervious, affirming, that if one put a little Tube into the Beginning of one of theſe ſame Trumpets, and blow it, the Wind will preſently break through it, which, he ſaith, he has obſerved in all the Kinds of Animals that he has diſſected.

[‘ Theſe *Tubæ* (according to Dr. *Harvey*) are ‘ the ſame in Women that the *Cornua* or Horns ‘ of the Womb are in other Creatures. For they ‘ anſwer to thoſe both in Situation, Connection, ‘ Amplitude, Perforation, Likeneſs, and alſo ‘ Office: For as other Animals always conceive ‘ in the *Cornua*, ſo it has been ſometimes obſerved (as by *Riolanus* from others; and by Dr. *Harvey* himſelf) ‘ that a Conception has in a Woman been contained in one of the *Tubæ*.] Which

muſt

must have happened, when the *Ovum* being received out of the *Testes* into it, has been stop'd in its Passage to the Womb, either from its own Bigness, or some Obstruction in the *Tuba*.

Their *Substance* is not nervous (as *Fallopius* in the above-recited Description affirms) but membranous. For they consist of two *Membranes*, the *outer* and *inner*. The *inner* springs from (or at least is common with) the inmost Membrane of the Womb; but whereas it is smooth in the Womb, it is very wrinkled in the *Tubæ*. The *outer* is common with the outmost of the Womb; and this is smooth. *Their Substance.*

The *Capacity* of these Ducts varies very much; for in the Beginning as it goes out of the Womb, it only admits a Bristle; but in its Progress where it is largest, it will receive ones little Finger. But in the outmost Extremity, where 'tis divided into Jags, it is but about a quarter so wide. *Width.*

They are very uncertain also in their *Length*; for from four or five, they sometimes encrease to eight or nine Finger's breadth long. *Length.*

Their *Use* is, in a fruitful Copulation, to grant a Passage to a more subtile Part of the Masculine Seed (or to a seminal Air) towards the *Testes*, to bedew the Eggs contained in them; which Eggs (one or more) being by that Means fecundated (or ripened as it were) and dropping off from the *Testis* (in the manner as shall be described, *Chap.* 30.) are received by the Extremity of the *Tubæ*, and carry'd along their inner Cavity to the *Uterus*. For Dr. *Harvey* affirms, that they have a worm-like or peristaltick Motion, like that of the Guts (*de Cervarum & Damarum Utero, Exercit.* 65.) And the same is affirmed by *Swammerdam*, *Not in Prodr.* *Use.*

Against this *Use* two *Objections* may be made: First, That the End of the *Tuba* not adhering close *Objections against their Use answered.*

close to the *Testis*, when one of the *Vesiculæ* (or *Ova*, as we think they are) shall drop off from the *Testis*, it would more probably fall into the Cavity of the *Abdomen*, than light just pat in the Mouth of the *Tuba*. Secondly, that when it is received by it, its Duct is so narrow, that 'tis hard to conceive how it can pass by it.

As to the *first*; the same Objection may lie against the Use of the Oviduct or *Infundibulum* in Hens, for neither in them does it join quite close to the *Ovarium* (as *Swammerdam*, &c. truly observes) and yet it is certain, that the *Vitelli*, or little Youlks (or Rudiments of the Eggs) do all pass by them to the *Uterus*. The same *Swammerdam* observes also in Frogs, in one of whom there are many hundreds of Eggs, which all pass one after another from the *Ovarium* by the Oviduct or *Infundibulum*, and yet the Mouth of the Oviduct is almost two Finger's breadth from the *Ovarium*, and besides is immoveable, whereas the *Tubæ* in Women are at Liberty (and are more than long enough) to embrace the *Ovarium* with their Orifice: And we may reasonably believe that they do so when a Conception is made; for it is not improbable, that when all the other Parts of the Genital are turgid in the Act of Copulation, these *Tubæ* also may be in some Measure erected, and extend their opened Mouth to the Testicle, to impregnate the *Ova* with the seminal Air steaming through their Duct, and if any one be fecundated and separate, to receive it afterwards by its Orifice.

As to the *second Objection*, which urges the Narrowness of these *Tubæ*; He that considers the Straitness of the inner Orifice of the Womb, both in Maids and in Women with Child, and yet observes it to dilate so much upon Occasion, as to permit an Egress to the Child out of the Womb,

cannot

cannot wonder, that to ſerve a neceſſary End of Nature, the ſmall Duct of the *Tubæ* ſhould be ſo far widen'd, as to give Paſſage to an *Ovum*, ſeeing its Proportion to their Duct is many times leſs, than of the Child to the uſual Largeneſs of the ſaid Orifice.

Of the Uterus, *or Womb, and its Neck.*

CHAP. XXVII.

HAving treated of the *Vaſa præparantia* (ſo called) that bring Nouriſhment to the *Teſtes* or *Ovaria*, as alſo of theſe and their *Ova*; and, laſtly, of the *Tubæ* through which the *Ova* paſs to the *Uterus*; we now come to the *Uterus* it ſelf which receives the *Ova*, and in which the Conception is formed, and the *Fœtus* nouriſhed, till it acquire its due Maturity, and be fit for the Birth.

The Womb. The *Uterus*, or Womb is uſually divided into four Parts, the *Fundus* or Bottom, *Os internum* or *Cervix*, the *Vagina*, and the *Sinus pudoris*, or outward Privity. Of each of theſe in Order. And firſt of the *Fundus*.

Its Name. This in a ſpecial manner is called the Womb, becauſe all the reſt ſeem to be made for its ſake. It is alſo called the *Matrix*, from its being as a Mother to conſerve and nouriſh the *Fœtus*; and likewiſe *Utriculus*, from its Shape reſembling a *Bottle*; though it is not quite round, but a little flat, like a Spaw-water Bottle, to which *Verheyen* compares it. *Shape.*

Situation. It is ſeated in the *Hypogaſtrium*, or loweſt Part of the *Abdomen*, in the middle of that large Hollow that is called *Pelvis*, and is formed by the *Oſſa Ilii*, *Coxæ*, the *Oſſa pubis*, and the *Os ſacrum*. In this Cavity it is placed between the Bladder and

and the ſtreight Gut; ſo that Man being bred betwixt Piſs and Dung, if he would but conſider his Origin, might hence draw an Argument of Humility.

Connexion Its hindmoſt Part is looſe, that it might be extended as the *Fœtus* encreaſeth. But its ſides are tied faſt by two Pairs of *Ligaments*.

Liga-ments. The *firſt Pair* are further from the *Os internum*, and are broad, ariſing from the *Peritonæum*. They have a membranous, looſe, and ſoft Subſtance, and for their Shape are reſembled to Bats Wings. They tie the ſides of the *Fundus*, the *Teſtes*, and a good Part of the *Tubæ* together, and are faſtened to the *Oſſa Ilii*, whereby the Womb is kept from falling down upon its Neck. But if they be either immoderately relaxed, or by any Violence broken, then the Womb deſcends, and ſometimes falls out (turning inſide outward) if the Subſtance of the Womb happen to be relaxed alſo.

The *ſecond Pair* ariſe nearer to the inner Orifice of the *Vagina*, about where the *Tubæ* do, and are called the round Ligaments, or worm-like. From their Origin, which is broad, they aſcend on each ſide, between the Duplicature of the *Peritonæum* toward the Groins, and running out of the Cavity of the *Abdomen*, become round, and then paſs obliquely above the *Os pubis* towards the Fat of *Mons Veneris*, in which they terminate near the *Clitoris*, being divided into many Parts or Jags, as may be ſeen in the following Figure. They conſiſt of a double Membrane, the inner whereof has all ſorts of Veſſels, Nerves, Arteries, Veins, and *Vaſa Lymphatica*; and are about a Span long. *Veſlingius*, *Diemerbroeck*, &c. ſay, that they receive a ſmall ſeminal Veſſel from the *Teſtes* and *Tubæ*, which they conduct to the *Clitoris*, into which they are inſerted, and ought rather to be accounted *Vaſa deferentia* than Ligaments.

So

So that what ſome Women emit from about the *Clitoris* in Coition, they think to be true *Semen*, conducted hither by thoſe ſeminal Ducts. But *de Graef* denies any ſuch Ducts, and affirms that theſe Ligaments reach not the *Clitoris*, but are terminated in the aforeſaid Fat. And that Humour which Women emit (ſometimes) he thinks doth iſſue out of the *Lacunæ* in the Orifices of the *Vagina* and urinary Paſſage, or alſo from the *Meatus*'s in the Neck of the Womb: Which Humour is ſupply'd to the former Parts from the thick and membranous Body that is about the urinary Paſſage; and to the latter, from the nervoſe membranous Subſtance of the Neck of the Womb; but he thinks it does not partake of the Nature of Seed, but ſerves only for the lubricating of the *Vagina*, to cauſe the greater Pleaſure *in Coitu*. But to this purpoſe more before.

Its *Subſtance* is whitiſh, nervous, or rather membranous; denſe and compact in Virgins, but in Women with Child a little ſpongy and ſoft. *Subſtance.*

It is compoſed of three *Membranes*. The *outmoſt* (which is common to it with all the *Viſcera* in the *Abdomen*, as being derived from the *Peritonæum*) is very fibrous, compact, and tough, without any diſcernible Vein or Artery. The *Middle* is much thicker, and endued with carnous Fibres, and, as ſome think, ought rather to be called the proper Subſtance of the Womb, than a Membrane. It is full of Blood-Veſſels, very remarkable at all times, but eſpecially in the Flux of the *Menſes*, or in the time of Geſtation. During this latter time, this Coat (with the *inmoſt*) imbibes ſo much of the nutritious Humours that then flow hither, that the more the *Fœtus* encreaſeth, and conſequently the more diſtended the Womb, the more fleſhy and thick doth it grow. And yet (which is ſtrange) within ſixteen or twenty *Membranes.*

twenty Days after a Woman is brought to Bed, it becomes as thin as before, and the whole Womb contracts into so little a Compass, as to be held in ones Hand.

The *inmost* likewise abounds with Blood-Vessels, propagated into it from the middle one, and is full of Pores, by which the Blood in the menstrual Flux is extravasated out of the Arteries into the Womb, and upon Impregnation the *Succus nutritius* exsudes into the same, and by which also, both Blood and Chyle are conveyed into the *Placenta uterina*, after the Formation thereof.

Bigness. In Virgins it is about two Fingers breadth broad, and three long. In those that have lain with a Man it is a little bigger, and something larger yet in those that have born Children.

Cavity. In Maids its *Cavity* is so small, that it will hardly hold a large Hazel-nut. In those that have had Children it will hold a small Walnut. It is divided into no Cells, as it is in most viviparous Brutes, but only into the right and left side by a Suture or Line that goes lengthways, much like that on the outside of the *Scrotum* in Man. Its Cavity is not quite round, but jets out a little towards each side; which Jetting some call its Horns, but improperly: For though *Galen* (and many after him) having never dissected any Woman, presuming that her Womb was like that of other viviparous Creatures, attributed *Cornua* thereto; yet in truth she hath none; but the *Tubæ Fallopianæ* (as was noted before) answer to them in many respects. Only in Brutes (*viz.* such as have *Cornua*) the Conception is always formed in the *Cornua*, as being the greatest Part of the *Uterus* (which from the very Orifice of its *Fundus* is presently divided into them, as when one parts the fore from the middle Finger as wide as one can) but very rarely in the *Tubæ* in Women,

men, but moſt an end in the *Fundus* itſelf. Of which more in *Chap.* 30.

Its *Arteries* ſpring partly from the Spermatick or *Præparantes*, and partly from the Hypogaſtrick. Theſe two Arteries do on each ſide by a notable Branch inoſculate one with the other. And both their Branches that run on one ſide the Womb, do inoſculate with thoſe of their own Stock on the other. Which may plainly be ſeen by blowing into the Trunk of either of them on which ſide you will; for then the Branches on the other ſide will be puffed up as well as thoſe on that ſide you blow. *Arteries.*

They run along the Womb, not with a ſtreight or direct Courſe, but bending and winding, that they may be extended without Danger of breaking, when the Womb is enlarged to ſo great a Bulk by the *Fœtus*. By theſe Arteries it is that the *Menſes* flow, in greateſt quantity, out of thoſe that open into the *Uterus* itſelf; but in leſſer, out of thoſe Branches that reach and open into the *Cervix* or Neck of the Womb, and in leaſt (if at all) out of the *Vagina*.

As to the Reaſon of the menſtrual Flux, 'tis not likely that the redundance of Blood is the ſole Cauſe of it; for then would the Term of the Flux come ſooner or later, accordingly as the Diet ſhould be more full, or more ſparing. Whereas Experience ſhews, that let a Woman feed never ſo high, and ſo breed never ſo much Blood, this Flux comes never the ſooner (tho' perhaps it may be larger:) or let her uſe the moſt ſpare Diet (and if ſhe be healthful) it will be never the longer a coming. Wherefore, beſides a ſufficient Stock of Blood, there ſeems requiſite alſo a Fermentation therein, to the producing this Flux. Which Fermentation, by what it ſhould be cauſed, is hard to determine. Thoſe who grant Seed to

Women, derive it thence; becauſe as ſoon as Girls come to Puberty, and deſire and become fit for Coition, the *Menſes* begin to flow. But concluding, according to the Moderns, that Women have no Seed, the ſame can be no Cauſe hereof. Aſtrological Reaſons I account vain, ſeeing there are menſtruous Women at all Seaſons; and the ſame Women have their *Menſes* in proceſs of time, at all Ages of the Moon. Other Reaſons may by the Curious be offered, but all thoſe I have met with are unſatisfying. Waving them therefore, but ſuppoſing a Fermentation in the Blood to be the principal Cauſe, we ſhall only add a Word of the immediate Reaſon or Manner of the Flux: When through this Fermentation the Blood flows ſo plentifully into the Uterine Arteries, that the Veins (which are fewer than the Arteries) cannot return it all back again by the Circulation, it burſts forth of the Extremities of the Arteries ſo long, till the too great Quantity of the Blood be leſſen'd, and the Fermentation ceaſes, which it does ordinarily after three or four Days, and ſo the Flux ſtops till the next period. In Women with Child they ſeldom flow, either becauſe the redundant Blood is then beſtowed on the Nouriſhment of the *Fœtus*, according to the old Hypotheſis; or according to the new, becauſe it is defrauded of a conſiderable part of the Chyle (or nutritious Juice) which is conſumed by the *Fœtus*, whereby it becomes diminiſhed and depauperated, which is the Reaſon why Nurſes alſo ſeldom have them.

Veins. The *Veins* do likewiſe ſpring from the *Præparantes*, and from the Hypogaſtrick. There are many Anaſtomoſes of theſe Veins one with another (as there was noted of the Arteries) but eſpecially in the ſides of the *Uterus*, which do more readily appear, by blowing of them up,

than

than those of the Arteries above spoken of. The Blood brought hither by the Arteries, that is not spent on the ordinary Nutrition of the Womb, or is not cast out when the *Menses* flow, returns by these Veins back to the Heart.

It has Nerves from the *Plexus mesenterii maximus* of the Intercostal Pair, and from the lowest Plexus of the same; as also from the Nerves of *Os sacrum*; and the same run also to the *Testes* or *Ovaria*. Now it is these *Plexus* of Nerves that are chiefly affected in the Hysterical Passion, or Fits of the Mother. For these Fits are merely convulsive, and often happen without any fault of the Womb at all. And that Symptom that in such fits is usual, namely, when something like a Ball seems to rise from the bottom of the Belly, and to beat strongly about the Navel (which is usually taken by Women for the rising of the Womb or Mother) is nothing but the Convulsion of these *Plexus* of Nerves: which one will the rather believe, when he considers that some Men are afflicted with the same Symptom. Of which see more in Dr. *Willis* (in *Cerebr. Anat.* p. 201.) who derives the pain of the Cholick also from the same Cause. *Nerves.*

De Graef says, there are many *Lympheducts* that creep through the outer Substance of the *Uterus*, which one after another meeting into one, empty themselves into the common Receptacle: And these, he says, *Bartholin* mistakes for *Venæ lacteæ*. *Lympheducts.*

The Use of the Womb is, to receive into its Capacity the Principles of the Formation of the *Fœtus*, to afford it Nourishment, to preserve it from Injuries, and at length when it is grown to maturity, and requires the Light, and a freer Air, to expel it forth. *Use.*

The *Cervix*, or *Os internum* of the Womb being continuous to it, and coming betwixt it and the *Vagina*, *The Neck of the Womb.*

Vagina, we will treat of it in this Chapter. It ſeems to be a part of the *Fundus*, or of the Womb, properly ſo called, only it is much narrower, for its Cavity is no wider in Virgins than a ſmall Quill, and in Women with Child, its inner Orifice doth either quite cloſe its Sides together, or is daub'd up with a ſlimy yellowiſh Humour, ſo that nothing can then enter into the Womb, unleſs in very luſtful Women it be ſometimes open'd in ſuperfœtation. It is an Inch or more in length. Its Cavity as it opens to the *Vagina*, is compared to the Mouth of a Tench. *Galen* likens its Paſſage to that in the *Glans* of a Man's *Penis*; for it is not round, but long and tranſverſe. It is wrinkled, and has many ſmall Ducts opening into it, out of which one may preſs a pituitous ſerous Matter. It has the ſame Membranes and the ſame Veſſels with the *Uterus* itſelf. *De Graef* ſays, that amongſt its wrinkles he has often obſerved *Hydatides*, or little watry Bladders; and thinks that the aboveſaid ſerous Matter ſerves only to moiſten the *Vagina*, &c. and to excite to Venery.

CHAP. XXVIII.

Of the Vagina *and its Contents*, viz. *The* Hymen, *and* Carunculæ myrtiformes.

Vagina. *Its Name.* CONtinuous unto the *Cervix* is the *Vagina*, ſo called, becauſe it receives the *Penis* like a *Sheath*. It is called alſo the *Door of the Womb*, and its *greater Neck*, to diſtinguiſh it from the leſſer juſt now deſcribed in the foregoing Chapter.

Deſcription. It is a ſoft and looſe Pipe, uneven on its inſide, with orbicular Wrinkles, of a membranous but ſomewhat ſpongy Subſtance (which Luſt cauſeth to puff up a little, that it may embrace the Yard

Yard more closely) about seven Fingers breadth long, and as wide as the streight Gut: All which yet, both Length, Width and Looseness, differ in respect of Age, *&c.* and as a Woman is enflam'd more or less with Lust. So also the aforesaid Wrinkles are much more numerous and close set in Virgins, and in Women that seldom accompany with a Man, and that have never born Children, than in those that have born many Children, and in Whores that use frequent Copulation, or those that have long laboured under the *Fluor albus*, for in all these three sorts they are almost obliterated. Its Thickness on the other side, (according to *de Graef*) is about a Straw's breadth; but on its lower it is twice as thick. *Stockbamer* says, it consists of a spongy and glandulous Substance, thro' which not only plentiful Branches of Veins and Arteries (*viz.* from the hypogastrick and hemorroidal) are dispersed, as also Nerves from the *Os sacrum*; but it has also proper excretory Ducts, which gape like Pores into its inner Cavity, and are most numerous near the urinary Passage. And this Substance, he says is contained between two Membranes, of which the inner is nervous and wrinkled; the outer, carnous.

Vessels.

It hath very many *Arteries* and *Veins*, some of which inosculate one with another, and others not: By the Arteries that open into it do the *Menses* sometimes flow in Women with Child that are plethorick; for they cannot come from the Womb itself, unless Abortion follow, as sometimes it does. These Vessels bring plenty of Blood hither in the venereal Congress, which heating and puffing up the *Vagina*, encreaseth the Pleasure, and hinders the Man's Seed from cooling before it reach the *Uterus*. They spring not only from the Hypogastrick, but also from the

Hemorrhoidal, but these latter run only thro' the lower part of the *Vagina*. Its Nerves Dr. *Willis* thus describes: From the lowest *Plexus* of the *Abdomen* two Nerves are sent into the *Pelvis*, where each receives a notable vertebral Nerve; and so they make two *Plexus*, one on each side, from which there arise two ascending Nerves that run to the *Intestinum Rectum*; and two descending, that are carried to this Part we are speaking of.

Glands. *Casp. Bartholin* relates, that in a Cow's *Vulva* he was shewn by *Jos. du Verney*, a Gland on each side of it, somewhat on the hinder part, each of which has a Duct running from it opening into the *Vulva*, but at its Orifice has a notable *Papilla* placed which closes it, so that no Liquor can pass out but by the protuberating and unclosing of the *Papilla* in *Coitu*. He says, he has not yet observed them in Women, but inclines to believe they are not wanting in them; and thinks that that Liquor which is sometimes emitted by them with Pleasure, issues a great part of it from hence. The Glands, he says, are of the conglomerate kind, and are invested round with peculiar and proper carnous Fibres, which seem to arise from the Sphincter of the Bladder, as those which incompass the *Prostatæ* in Men do, according to the Observation of *de Graef*; and therefore he thinks these Glands in Females are in lieu of the *Prostatæ* in Men.

The Insertion of the Neck of the Bladder. Near its outer End, between the *Nymphæ* (of which in the next Chapter) in its fore and upper part, it receives the Neck of the urinary Bladder encompassed with its Sphincter; opposite whereto in its hinder or lower part it is strongly knit to the Sphincter of the streight Gut. The urinary Passage, or *Urethra*, is not above two Fingers breadth long from the Neck

of

of the Bladder to its end, and about as wide as a Gooſe-quill.

The *Hymen* is a thin nervous Membrane inter- Hymen.
woven with carnous Fibres, and endowed with many little Arteries and Veins, ſpread acroſs the Duct of the *Vagina*, behind the Inſertion of the Neck of the Bladder, with an Hole in the midſt that will admit the Top of one's little Finger, by which the *Menſes* flow. It is otherwiſe called the Zone or Girdle of Chaſtity. Where it is found in this Form deſcribed, it is a certain Note of Virginity; but upon the firſt Congreſs with a Man, it is neceſſarily violated, which is uſually accompanied with an Effuſion of Blood; which Blood is called the *Flower of Virginity*; and of this the holy Text makes mention in *Deut.* 22. *verſe* 13——21. And when once it is broke, it never cloſes again.

But tho' this Effuſion of Blood upon Coition, from the Rupture of this Membrane (or perhaps of capillary Veſſels in the *Vagina*) be a certain Token of Virginity; yet it will not follow on the contrary, that where it is wanting, Virginity is alſo wanting. For the *Hymen* may be corroded by acrimonious fretting Humours flowing through it with the *Menſes*; or may be violated by the falling out or inverſion of the *Uterus*, or the *Vagina* at leaſt, which ſometimes happens even to Maids; or laſtly, perhaps the indiſcreet and unwary Bride has had her *Menſes* a Day or two before, in which Caſe both the *Hymen* and the inner wrinkled Membrane of the *Vagina* are ſo flaggy and relaxed, that no ſuch Rupture, and by conſequence no ſuch Effuſion may happen.

In ſome there naturally wants a *Foramen* in the *Hymen*, by which means there being no *Exit* for the *Menſes*, ſuch are in great Peril of their Life,

if they be not relieved by Surgery. *viz.* By opening it with some sharp Instrument.

Caruncul. myrtiformes.

Close to the *Hymen* lie the four *Carunculæ myrtiformes*, so called from their resembling Myrtleberries. The largest of them is uppermost, standing just behind the Mouth of the Urinary Passage, which it helps to shut. Opposite to this in the bottom of the *Vagina*, there is another, and on each side one, so that they stand in a Square. But of these there is only the first in Maids, the other three are not indeed Caruncles, but little Knobs made of the angular Parts of the broken *Hymen*, roll'd into a Heap by the wrinkling of the *Vagina*, according to *Riolanus* and *Diemerbroeck*. These three, when the *Vagina* is extended in a Woman's Labour, lose their Asperity, and become smooth, so that they disappear, until it be again contracted to its natural Straitness.

The Sphincter Muscle.

De Graef affirms, [‘That the *Vagina* near its ‘outer Orifice, has a Sphincter Muscle almost ‘three Fingers broad, that upon occasion con‘stringes or contracts it.] Which Constriction is more particularly described by *Stockbamer*, who says, [‘It is performed partly by means of the ‘Fibres that run thro' the outer carnous Coat ‘of the *Vagina*; and partly by this Sphincter ‘Muscle, and two Net-like *Plexus*, which in their ‘Composition are like the nervous Bodies of the ‘*Penis*, or of the *Clitoris*, for they consist of Ves‘sels and Fibres water'd with black Blood, and ‘clad with a thin Membrane; they climb on ei‘ther side of the *Vagina* near its outer Orifice, ‘and notably help to constringe it when they ‘are puft up with spirituous Blood in Coition; ‘for by their swelling they drive the sides of the ‘*Vagina* inwards; which that they may the bet‘ter do, the Sphincter Muscle (ascending from ‘the Sphincter of the *Anus*) doth outwardly co‘ver

'ver these *Plexus*, that by its Constriction it may 'hinder them to swell outwardly.] The outer Orifice of the *Vagina* in Virgins, especially the younger, is very narrow, much straiter than the rest of the *Vagina*.

Having thus described the Parts of the *Vagina*, its *Use* is easily declared, *viz.* to receive the Man's Yard, being erect, to direct and convey the Seed into the Womb, to serve for a Conduit by which the *Menses* may flow out, and to afford a Passage to the *Fœtus* in its Birth, and to the After-birth. *The Use of the Vagina.*

CHAP. XXIX.

Of the Pudendum Muliebre, *or Woman's Privity.*

THE Parts that offer themselves to View without any Diduction, are the *Fissura magna*, or great Chink, with its *Labia* or Lips, the *Mons Veneris*, and the Hairs. These Parts are called by the general Name of *Pudenda*, because when they are bared, they bring *Pudor*, or Shame upon a Woman.

The great *Chink* is called *Cunnus* by *Galen*, ἀ κύειν, to conceive; by *Hippocrates*, *Natura*. It is also called *Vulva*, *Porcus*, *Concha*, and by many other Names that Fancy has imposed upon it. Fissura.

It reaches from the lower side of the *Os Pubis*, to within an Inch of the *Anus*; being by Nature made so large, because the outer Skin is not so apt to be extended in Travail as the membranous *Vagina* and *Collum minus* are. It is less and closer in Maids, than in those that have born Children. Its Length makes the *Perinæum* not to be above an Inch long. It has two Lips, which towards the

the *Pubes* grow thicker, and more full or protuberant, and meeting upon the Middle of the *Os pubis*, make that Rising that is called *Mons Veneris*, or the Hill of *Venus*.

Mons Veneris. The inner Substance of this Hill, which makes it bunch so up, is most of it Fat; and under the Fat lies that Sphincter Muscle that we spoke of in the last Chapter, that constringes the Orifice of the *Vagina*, and springs from the *Sphincter ani*.

By a little drawing aside the *Labia*, there then appear the *Nymphæ*, and the *Clitoris*.

Nymphæ. The *Nymphæ* are so called because they stand next to the Urine, as it spouts out from the Bladder, and keep it from wetting the *Labia*. They are called also πτερύγια, or Wings. They are placed on each side next within the *Labia*, and are two carnous, soft and spongy Productions, beginning at the jointing of the *Ossa pubis*, or upper Part of the Privity (where they are joined in an acute Angle, and make that wrinkled membranous Production that cloaths the *Clitoris* like a *Præputium* or Fore-skin) and descending close all the way to each other, when the *Pudendum* is shut, reaching but about half the Breadth of the Orifice of the *Vagina*, and ending each in an obtuse Angle. They are almost triangular, and therefore, as also for their Colour, are compared to the Thrills that hang under a Cocks Throat.

Their Substance. They have a red *Substance*, partly fleshy, partly membranous; within soft and spongy, loosly composed of thin Membranes and Vessels, so that they are very apt to be distended by the Influx of the Animal Spirits and Arterial Blood. Animal Spirits they have from the same Nerves, that run through the *Vagina*, and Blood from that Branch of the inner iliacal Artery, that is called *Pudenda*: Veins they have also from the *Venæ pudendæ*, which carry away the Arterial Blood from them

them when they become flaccid. They are larger in grown Maids than in younger, and larger yet in those that have used Venery, or born Children.

Their *Use* is to defend the inner Parts, to cover the Urinary Passage, and a good Part of the Orifice of the *Vagina*. And to the same Purposes serve the *Labia* above described. *Use.*

Above, betwixt the *Nymphæ* in the upper Part of the *Pudendum*, does a Part jet out a little, that is called *Clitoris*, from χλειοζίζω, that signifies lasciviously to grope the *Pudendum*. It is otherwise called *Virga*, for it answers to a Man's Yard in Shape, Situation, Substance, Repletion with Spirits, and Erection; it has nervous Bodies, a *Septum*, a *Glans*, Muscles, and the like Vessels with the *Penis*. But it differs therefrom, first in Magnitude; for this is very small in respect to that, as being not to be blown up to the Thickness of ones little Finger. Secondly, the forked Roots or *Crura* of the nervous Bodies that lie hid within the Fat of the *Pubes*, are twice as long as that part of it which is united into one Body with the *Septum* between; whereas on the contrary, in the *Penis* the united Part is four times as long as the forked. Thirdly the *Clitoris* wants an *Urethra*, and its prominent *Glans* wants a *Foramen*. Fourthly, it has only one Pair of Muscles. In some its united Part grows to that length, as to hang out from betwixt the Lips of the *Pudendum*: Yea there are many Stories of such as have had it so long and big as to be able to accompany with other Women like unto Men, and such are called *Fricatrices*, or otherwise Hermaphrodites; who, it's not probable, are truly of both Sexes, but only the *Testes* fall down into the *Labia*, and this *Clitoris* is preternaturally extended. But in most it jets out so little as that it does not appear, but by drawing aside the *Labia*: And its ordinary Bigness is Clitoris.

like

like that of the *Uvula* (or *Columella*) not relaxed, to which *Verheyen* compares it.

Its Substance. It is a little long and round Body, consisting (like a Man's *Penis*) of two nervous, and inwardly black and spongy Parts, that arise on each side, from the Bunching of the *Os Ischium*, and meet together at the Jointing or Conjunction of the *Ossa pubis*. It lies under the Fat of *Mons Veneris*, in the Top of the great Fissure. In Venery, by means of the two nervous Bodies, it puffs up, and straitning the Orifice of the *Vagina*, contributes to the Embracing of the *Penis* the more closely.

Glans. Its outer End is like to the *Glans* of a Man's Yard, and has the same Name (as also *Tentigo*) And as the *Glans* in Men is the Seat of the greatest Pleasure in Copulation, so is this in Women; whence it is called *Amoris dulcedo*, and *Oestrum Veneris*. It has some Resemblance of a *Foramen*, but it is not pervious. It is most of it cover'd with a thin Membrane, from the Conjunction of the *Nymphæ*, which for its Likeness to the *Præputium* in Men, is also called so.

Muscles. The *Clitoris* has formerly been affirmed to have two Pair of *Muscles* belonging to it. The upper are round, and spring from the Bones of the *Coxendix*, and passing a little way along the two nervous Bodies above-described, are inserted into them. These, by straitning the Roots of the said Bodies, do detain the Blood and Spirits in them, and so erect the *Clitoris*, even as those in Men do the *Penis*. And this is the only Pair which we suppose belong to the *Clitoris*. As for the other which arise from the *Sphincter ani*, they are those we mention'd above in the End of the foregoing Chapter: For though they have been thought to serve for the Erection of the *Clitoris*, yet we think, with *de Graef*, that they are rather of the

Nature


Fig. 1.
Fig. 2.

Nature of a Sphincter, and contribute to the purſing up or conſtringing the outer Orifice of the *Vagina*.

It has *Veins* and *Arteries* from the *Pudendæ*, and *Nerves* from the ſame Origin with the *Vagina*, which are pretty large. *Veſſels.*

Its *Uſe* may be known from what has already been diſcourſed. And we will only note further, that in ſome Eaſtern Countries it uſes to be ſo large, that for its Deformity, and the Hindrance it gives to Copulation, they uſe to cut it quite out, or hinder its Growth, by ſearing it, which they improperly call Circumciſion. *Uſe.*

TAB. IX.

Fig. I. Repreſenteth the Genital Parts of a Woman taken out of the Body, and placed in their natural Situation.

AA *The Trunk of the great Artery.*
BB *The Trunk of the* Vena cava.
C *The right emulgent Vein.*
D *The left emulgent Vein.*
E *The right emulgent Artery.*
F *The left emulgent Artery.*
GG *The Kidneys.*
HHHH *The Ureters as they riſe from the Kidneys, and are inſerted into the Bladder, but their middle part cut off.*
III *The right Spermatick Artery.*
KK *The left Spermatick Artery.*
LL *The right Spermatick Vein.*
MM *The left Spermatick Vein.*
NN *The Iliack Arteries.*
OO *The Iliack Veins.*
PP *The inner Branches of the Iliac Artery.*
QQ *The outer Branches of the Iliac Artery.*

RR *The*

RR *The inner Branches of the Iliack Vein.*
SS *The outer Branches of the Iliack Vein.*
TT *The Hypogaſtrick Arteries carried to the Womb and* Vagina.
UU *The Hypogaſtrick Veins accompanying the ſaid Arteries.*
XX *The Branches of the Hypogaſtrick Artery tending to the urinary Bladder.*
YY *The Branches of the Hypogaſtrick Vein carried to the Bladder.*
ZZ *Portions of the Umbilical Arteries.*
a *The* Fundus uteri *cloathed with its common Coat.*
bb *The round Ligaments of the Womb, as they are joined to its* Fundus.
cc *The* Tubæ Fallopianæ *in their natural Situation.*
dd *The* Fimbriæ, *or Jags of the* Tubæ.
ee *The* Foramina *of the* Tubæ.
ff *The Teſticles in their natural Situation.*
g *A Portion of the ſtreight Gut.*
h *The Neck of the Womb diveſted of its outer Coat, that the Veſſels may be better ſeen.*
i *The fore-part of the* Vagina *of the Womb, freed from the urinary Bladder.*
k *The urinary Bladder contracted.*
ll *The Blood-Veſſels running through the Bladder.*
m *The Sphincter Muſcle conſtringing the Neck of the Bladder.*
n *The* Clitoris.
oo *The* Nymphæ.
p *The urinary Paſſage.*
qq *The Lips of the* Pudendum.
r *The Orifice of the* Vagina.

Fig. II. Exhibiteth a Woman's Teſticle or *Ovarium*, with the end of the *Tuba* annexed to it.

A *The Teſticle opened lengthways in its lower Part.*
BB *Eggs of divers Bigneſs contained in the membranous Subſtance of the* Teſtis.

CC *The Blood-Veſſels in the middle of the* Teſtis, *proceeding plentifully from its upper Part, as they run to the Eggs.*

D *The Ligament of the Teſticles, whereby they are knit to the Womb, cut off.*

E *A Part of the* Tuba Fallopiana *cut off.*

F *The Cavity of the* Tuba *cut off.*

GG *The Hole that is in the End of the* Tubæ.

HH *The leavy Ornament of the* Tubæ.

I *The leavy Ornament of the* Tubæ *knit to the* Teſtes.

CHAP. XXX.

Of a Conception.

HAving deſcribed all the Parts that ſerve for *Generation*, both in Man and Woman, Order would that we ſhould ſpeak of the *efficient Cauſes*, *Matter* or *Principles*, from whence that which is generated by and in them doth proceed. And in the firſt Place there occurs the Man's Seed, which is the *active Principle*, or *efficient Cauſe* of the *Fœtus*; but when we diſcourſed of the *Teſtes*, we ſhewed what the *Matter* of it was, *viz.* Arterial Blood and Animal Spirits; and as to the Manner of its fecundating the *Ovum*, we omit that, as being too Philoſophical for this Place. In the next Place therefore we muſt come to the *Matter* or *paſſive* Principle of the *Fœtus*, and this is an *Ovum* impregnated by the Man's Seed. And here, becauſe in Women it cannot be obſerved by what Degrees, and in what time an *Ovum* in the *Ovarium* or *Teſtis* becomes a Conception in the *Uterus*, we muſt be forced to gueſs at that by the Analogy in other Creatures. To this Purpoſe

Dr.

Dr. *Harvey*, *de generatione Animalium*, is worthy to be read of the curious; especially concerning the Manner and Order of the Generation of the Parts of a Chicken in an Hen's Egg, in his *Exercit.* 56. But when he comes to apply this to the Conceptions of viviparous Animals, being ignorant that there was any formal *Ovum* pre-existing in them, and only then fecundated, he runs into great Errors and odd Notions about Conception; imagining an Analogy betwixt the Brain's forming its Phantasms or Conceptions (which he calls *Animal*) and the Womb's forming hers, which he calls *Natural*. He rightly indeed rejects the Hypothesis of the Woman's having true Seed, as also the Notion that the Man's Seed is any Part of the Conception; but then he gives an unsatisfactory Account of it, when he says, it is formed of the primeval albugineous Humours that transude into the *Cornua* in Brutes, or *Uterus* in Women, after they are impregnated or matur'd, as he speaks. For those albugineous Humours (as shall be shewn more fully afterwards) are not the first Principle from which the *Fœtus* is formed, but the Matter whereby its Lineaments, first drawn within the *Ovum*, receive their Encrease and Perfection. I shall not therefore rehearse the History of Generation in Harts that he has given us, for an analogical Explication of that in Women; but shall transcribe the Observations of the Curious *de Graef*, concerning the Generation of Rabbets, as being more adapted to our Purpose, and more consonant to Truth.

'We made the first Tryal (*says he*) on a Female Rabbet, that had not yet accompanied 'with the Male. Dissecting which, we observed 'a very wide *Vagina*, and about eight Finger's 'breadth long; which being opened lengthways, there stood out two narrow Mouths in

'its

'its upper Part, divided with a ſemilunar Partition, namely, the Beginning of each *Cornu*: 'for the Womb in Conies is preſently from the 'very *Vagina* divided into two Parts, one of 'which bends towards the right Hand, the other 'towards the left, about three Finger's Breadth 'aſunder, where they are preſently contracted 'and continued with the Oviducts, which in 'theſe Animals have a peculiar Situation (or 'Make;) becauſe if you lightly blow up the '*Cornua*, theſe will not ſwell, nor the Wind penetrate them, becauſe of ſome looſe *Fimbriæ* or 'Jags cloſing like the Valve of the Gut *Colon*. 'Theſe Oviducts being ſmall at their riſing from 'the *Cornua*, for five Finger's Breadth run with 'a winding Duct beyond the Teſticles, widening more and more by Degrees, and then they 'turn back towards them, and end in the Form 'of a Tunnel.—The Teſticles are ſmall, but 'contain very many limpid Eggs, which being 'cut open, there iſſued out a clammy Liquor like 'the White of an Egg. This being premiſed,

'We opened another half an Hour after the '*Coitus*, the *Cornua* of whoſe *Uterus* look'd a little 'redder, but the *Ova* in the Teſticles were not 'yet changed, unleſs they had remitted a little 'of their Clearneſs; but neither in the *Vagina*, 'nor in the *Cornua*, could we perceive any Seed, 'or any thing like it.

'About ſix Hours after the Coupling, we diſſected another, in whoſe Teſticles the *Folliculi* '(or Caſes) of the *Ova* inclined to Redneſs, 'out of which being pricked with a Needle, a 'clammy and clear Liquor iſſued firſt, but Blood 'followed, flowing out of the ſanguinary Veſſels 'diſperſed through the *Folliculi*. We could find 'no Seed neither in this Coney.

'Four and twenty Hours after the *Coitus*, we

'opened another, in one of whoſe Teſticles we 'found three, and in the other five *Folliculi* of 'the *Ova* very much changed; for being before 'limpid and colourleſs, they were now turn'd 'duskiſh, and of a faint red, in the middle of 'whoſe Superficies a little *Papilla* (or Teat) as 'it were, diſcover'd it ſelf: When the *Folliculi* 'were cut open, there appeared a little limpid 'Liquor in their Middle, and in their Circum-'ference a certain thicker and reddiſh Matter.

'Twenty ſeven Hours after the *Coitus*, we in-'ſpected another, the *Cornua* of whoſe *Uterus*, 'with the Oviducts, looked more bloody; alſo 'the Extremity of the Oviducts did on every ſide 'embrace the *Teſtes* like a Tunnel; in the middle 'Superficies of the *Folliculi*, as in thoſe before, 'there ſtood out little *Papillæ*, through which, 'by preſſing the Subſtance of the Teſticles, 'there iſſued a limpid Liquor, which was fol-'lowed by another redder and thicker. Opening 'the *Cornua* of the Womb, we found no Eggs, 'but the inner wrinkled Tunicle of the *Cornua* 'was a little more tumid.

'Eight and forty Hours after the *Coitus*, we 'examin'd another, in one of whoſe Teſticles 'we found ſeven, in the other three *Folliculi* 'changed, in whoſe middle the *Papillæ* were 'ſomething more eminent, through which, by 'preſſing the Subſtance of the Teſticles, there iſ-'ſued a little Liquor like the White of an Egg; 'but the remaining reddiſh Subſtance of the *Ova*, 'being now become ſome-what thicker, was not 'ſo eaſily preſſed forth as in thoſe before.

'Two and fifty Hours after the *Coitus*, we 'view'd another, in one of whoſe Teſticles we 'found one, in the other four *Folliculi* altered; 'cutting open which we found a glandulous-like 'Matter, in the middle of which there was a

'little

'little Cavity, wherein finding no notable Li-
'quor, we began to ſuſpect whether or no their
'limpid Subſtance, which is contained in proper
'Membranes, were burſt forth or expelled:
'Wherefore we ſearched carefully both the Ovi-
'ducts and the *Cornua*, but we could find no-
'thing; only the inner Tunicle of the *Cornua*,
'being much puff'd up, ſhined.

'Seventy two Hours (or three Days and
'Nights) after the *Coitus*, we inſpected another,
'which exhibited a far other and moſt wonder-
'ful Change; for the *Infundibulum* did embrace
'the Teſticles on every ſide moſt cloſely, which
'being pull'd off, we found in the Teſticle of
'the right ſide three *Folliculi* a little greater and
'harder, in the middle of whoſe Superficies we
'ſaw a Tubercle, with a little Hole in it like a
'*Papilla*; but diſſecting the ſaid Caſes through
'the middle, their Cavity was quite empty:
'Wherefore we ſearched the Ways through which
'the *Ova* muſt paſs, again and again, and found
'in the middle of the right Oviduct one, and in
'the outer end of the *Cornu* of the ſame ſide two
'very ſmall Eggs, little bigger than ſmall Pins-
'Heads, which notwithſtanding their Smallneſs
'are cloathed with a double Coat; out of theſe
'Eggs, being pricked, there iſſued a moſt limpid
'Liquor.— In the very Beginning of the *Cornu*
'of the left ſide we found only one Egg, juſt like
'thoſe ſmall ones of the other ſide; whence it is
'clear, that the *Ova* excluded out of the *Teſtes* are
'ten times leſs than thoſe that yet ſtick in the *Te-
'ſtes*; which ſeems to us to come to paſs, inaſ-
'much as thoſe that are ſtill in the *Teſtes* contain
'as yet another Matter, namely, that of which
'the glandulous Subſtance of the Caſes is made.

'The fourth Day from the *Coitus*, we opened
'another, in one of whoſe Teſticles we found

'four, in the other three Globules or Cases emp-
'tied; and in the *Cornua* of the respective sides
'we found as many Eggs, greater than the for-
'mer, which did not stick in the Oviducts or
'Beginnings of the *Cornua*, but were now rolled
'on towards their middle. In their Cavity we
'beheld as it were another Egg swimming far
'clearer than in the other before. ——

'The fifth Day from the *Coitus*, we dissected
'another, in whose *Ovaria* or Testicle we told
'six emptied *Folliculi*, that had each a notable
'*Papilla*, through whose *Foramen* we easily put
'an ordinary Bristle into their Cavity: We found
'also the same Number of Eggs (bigger than
'those the Day before) in divers Parts of the
'*Cornua*, in which they lay so loosely, that by
'blowing only, one might drive them this way
'or that way. The inner Tunicle of these (or
'the Egg within an Egg as it were) was become
'yet more conspicuous.

'The sixth Day after the *Coitus*, we examin'd
'another, in one of whose Testicles we observ'd
'six Cases emptied, and in the *Cornu* of the same
'side we could light of but only five Eggs near
'the *Vagina*, brought as it were upon a Heap;
'and in the Testicle of the other side we found
'four *Folliculi* emptied, and in the *Cornu* of that
'side only one Egg: The Cause of which Diffe-
'rence we suppose to be, either because some
'Eggs by the wave-like Motion of the *Cornua*
'(not unlike the peristaltick Motion of the Guts)
'being carried downwards towards the *Vagina*,
'were driven forth; or because, being consu-
'med in the *Folliculi*, they came not to the *Ute-*
'*rus*; or light on some other Mischance. These
'Eggs were as big as small Pease.

'The seventh Day from the *Coitus*, we examin'd
'another, in whose *Ovaria* we found some *Folli-*
'*culi*

'*culi* emptied, that were greater, redder, and 'harder than the foregoing, and saw as many 'transparent Tumours or Cells in divers Parts of 'the *Uterus*; out of which being opened, we tur-'ned *Ova* as big as Pocket-Pistol Bullets, in 'which we beheld nothing but the inner Tunicle 'very conspicuous, and a most limpid Humour. 'It is to be wonder'd at, that in so short a Space 'of time the Eggs should imbibe so great Plenty 'of Liquor, that whereas before they might easi-'ly be taken out of the Womb, now they could 'very difficultly.

'The eighth Day from the *Coitus*, we opened 'another, in the right *Cornu* of whose *Uterus* we 'saw one, in the left two Cells; one of these 'was almost twice as big as the other; for Na-'ture doth sometimes so vary, that there are 'Eggs of divers Bigness found not only in divers 'Animals of the same Species, dissected at the 'same Distance from the *Coitus*, but also in one 'and the same Individual. In the Horns of the 'Womb being opened, we saw the Eggs a little 'bigger than the Day before, but all of them, 'their Tunicles breaking, poured out their clear 'Liquor before we could take them quite out: 'For which reason we tried another, dissected 'likewise the eighth Day after the *Coitus*; the 'right *Cornu* of whose *Uterus* we saw swelled up 'into two, and the left into four transparent 'Tumours or Cells, out of which that we might 'take the *Ova*, we used the greatest Diligence 'and Attention; but as soon as we came to them, 'their Tunicles were so very tender, that they 'burst as the former: Which when we saw, the 'Eggs that remained, we boiled with the *Uterus*, 'whereby their Contents harden'd like the 'Whites of Hen's Eggs. The inner Substance 'of the Cells on that side whereon it receives

'the Hypogaſtrick Veſſels, was become more 'tumid and red.

'The ninth Day after the *Coitus*, we diſſected 'another that was old; the Teſticles of this were 'almoſt as big again as thoſe of younger: In 'the right we ſaw two; in the left five *Folliculi*, 'lately emptied; and beſides theſe, others that 'look'd very pale, which we judg'd to be thoſe 'that had been emptied the *Coitus* before this, 'although for the moſt Part they leave only 'ſome paliſh Points or Specks, to which the 'Encreaſe of the Teſticles is owing. The *Folli-* 'culi of the laſt *Coitus* were each beſet with a '*Papilla*, but the others were ſmooth. In the 'right *Cornu* there were two, and in the left 'five Cells, whoſe Subſtance being more rare and 'pellucid than the other Parts of the *Uterus*, was 'interwoven with many Twigs of Veins and Ar- 'teries. Opening ſome of theſe Cells, we could 'ſee the *Ova*, but could not take them out whole; 'wherefore being compelled to examine the 'Contents of the Eggs in the very Hollow of the 'Cells, we found it clear like Cryſtal; in the 'Middle whereof a certain rare and thin Cloud 'was ſeen to ſwim, which in other Conies, diſ- 'ſected likewiſe on the ninth Day after the *Coi-* '*tus*, for its exceeding Fineneſs, eſcaped our 'Sight. The inner Subſtance of the Cells, name- 'ly, that which receives the Hypogaſtrick Veſ- 'ſels, being more tumid than the reſt, exhibited 'the Rudiments of the *Placentæ*.

'The tenth Day after the *Coitus* we inſpected 'another, in whoſe right Teſticle we found one 'only *Folliculus* emptied, which by reaſon of the 'ſanguineous Veſſels diſperſed plentifully through 'it, was redder, and had a leſs *Papilla*. In the 'Middle of this pale Subſtance there appear'd 'as yet a very ſmall Cavity: But in the left

'Teſticle

'Testicle we found six such *Folliculi*. In the *Cornua* 'of the *Uterus* we found also so many Cells, 'namely one in the right, and six in the left, 'distant a Finger's Breadth one from another; in 'the Middle of which Cells lay a rude mucila- 'ginous Draught of the *Embryo*, like a little 'Worm. One might also plainly discern the '*Placenta*, to which the Egg by means of its *Cho-* '*rion* was annexed. The Matter of the Eggs 'boil'd with the Womb harden'd like the White 'of an Egg, and tasted like the boiled congealed 'Substance of the Eggs in the Testicles.

'The twelfth Day after the *Coitus* we opened 'another, in one of whose Testicles we found 'seven, in the other five *Folliculi* emptied, and 'as many Cells in the *Cornua*, much bigger and 'rounder than the foregoing, in the Middle of 'which the *Embryo* was so conspicuous, that one 'might in a sort discern its Limbs. In the Regi- 'on of its Breast two sanguineous Specks, and as 'many white ones did offer themselves to View: 'In the *Abdomen* there grew a certain mucilagi- 'nous Substance, inclining here and there to red, 'We could not discern more in this shapeless 'little Animal, because of its Tenderness.

'The fourteenth Day after the *Coitus* we dis- 'sected another, the Cells of whose *Uterus* we 'beheld to be yet greater, and their sanguineous 'Vessels more and more turgid: We also noted, 'that the Cells, the larger they grew, came also 'nearer to one another, and their Interstices 'were lessened. The Membranes *Amnios* and '*Chorion* were knit together, which though they 'appear thicker and stronger, are yet more hard 'to be separated from one another, than in the 'Ova taken entirely out of the Womb; tearing 'these, we saw an *Embryo* with a great and pellu- 'cid Head, with the *Cerebellum* copped; its

'goggle Eyes, gaping Mouth, and in some sort 'its little Ears might be discovered also. Its 'Back-bone was drawn out, of a white Colour, 'which bending in about the *Sternum*, resembled 'a Ship; by whose sides most slender Vessels run, 'whose Ramifications were extended to the Back 'and Feet. In the Region of the Breasts two san-'guineous Specks, greater than the foregoing, ex-'hibited the Rudiments of the Ventricles of the 'Heart; at the sides whereof were seen two 'whitish Specks for Lungs. In the *Abdomen* be-'ing opened, there first shew'd it self a reddish 'Liver, then a white Body, to which was knit a 'mucilaginous Matter, like a writhed Thread, 'being the Rudiments of the Stomach and Guts. 'All which, in those that we dissected afterwards, 'had acquired only a greater Bulk and Perfecti-'on. And therefore, to prevent Tediousness, by 'repeating the same Things, we will on purpose 'pass by all the other Dissections we made in this 'kind of Creature, excepting only one, which 'we made the Day before the kindling; that 'those things that in the former were only con-'fusedly discerned, may appear plain in this.

'At length, on the twenty ninth Day after the '*Coitus*, we inspected another, that had kindled 'six Weeks before, and in the *Coitus*, by which 'she was impregnated, had voided all the thick-'er part of the Seed of the Male, which in some 'measure did resemble the Consistence of a most 'limpid Jelly. In her *Ovaria* we found eleven 'little whitish *Folliculi*; and besides these, others 'far less, little or nothing differing from the 'Substance of the *Testes*. The *Folliculi* of the '*Ova* in the *Testes* seem not to vanish wholly, 'but to leave a certain Speck in them; whence 'it certainly comes to pass, that Conies, the oft-'ner or the more young Ones they bring forth,

'have

'have the greater and whiter Testicles; so that 'one may guess by only viewing the *Testes*, whether they have had many young Ones, or often. Having viewed the *Ovarium*, we past to the *Uterus*, which we found no longer distinguished into Cells, but all along distended like a Pudding; which was so agitated with a Wave-like Motion, like the Peristaltick of the Guts, that the young ones neareſt the *Vagina*, as yet included in their Membranes, were excluded, and that so hastily, that if we had not cut out the whole *Uterus*, they had all certainly gone the same way. The Womb was no thicker than when they are not with Young, otherwise than we have said it to be in Women. In its Cavity we saw eleven *Fœtus* sprawling, which were all so closely coupled together by the Membrane *Chorion* (wherein all are severally involved) as if they had all been included in one and the same *Chorion*.——

Thus much I thought fit to translate of that accurate Anatomist's Observations concerning the Generation of this sort of Animal, because it gives so very great Light into the manner of the Generation of an humane *Fœtus*. For there is an exact analogy betwixt them, abating some Circumstances: As *First*, That in Women the Conception is not formed in the *Cornua*, seeing her Womb has none; nor in the *Tubæ* very seldom, and according to Nature, for they are only the *Infundibula*, or Oviducts, to convey the *Ova* from the *Testes* to the *Fundus Uteri*, tho' they bear some Resemblance to the *Cornua* in Brutes; I say the Conception is not formed in these, but in the *Fundus Uteri*, or Womb properly so called, whereinto the *Ovum* being received, presently begins to swell and grow bigger, and there appears as it were an Egg within an Egg, by means

of

of the two Membranes with which it is cloathed; which Membranes are originally in the *Ovum*, while it is in the Teſticle, and imbibe the Moiſture that is ſent now plentifully into the Womb, even as the little Youlks in Hens, *&c.* gather the White about them in the Oviduct and *Uterus*, which they have none of in the *Ovarium*; or as Seeds in the Ground do imbibe the fertile Moiſture thereof to enable them to ſprout. *Another* conſiderable Circumſtance wherein they differ, is the ſlow procedure of the Formation of the *Fœtus* in Women, in compariſon of that in Conies now deſcribed. For ſeeing theſe go with Young but 29 or 30 Days, and Women 9 Months, we muſt imagine that the *Embryo* is as perfectly formed in the former on the tenth Day, as in the latter in the tenth Week, or longer. But, I ſay, abating theſe, or if there be any other ſuch like Circumſtances, there is ſo great a likeneſs betwixt the one and the other, that, without inſiſting more on the Matter or Manner of the Conception, we ſhall paſs on to the Deſcription of the Parts that encompaſs the *Fœtus*, then ſhew how it is nouriſhed; and laſtly, what Parts there are in a *Fœtus* that differ from thoſe in a Child born.

CHAP. XXXI.

Of the Placenta Uterina, *or Womb-Liver, and* Acetabula.

Placenta uterina.

UPon the cutting open the Womb of a Woman with Child, the firſt thing that offers itſelf, is the *Placenta uterina*, or Womb-cake, otherwiſe called *Hepar uterinum*, or Womb-liver, from the likeneſs of Subſtance, and alſo Uſe, according to thoſe that impoſed the Name.

Its

Its *Subſtance* is very like that of the Spleen, only that is more brittle, and this more tough and tenacious, ſo that it cannot ſo eaſily be ſeparated from the Veſſels. It is ſoft, and has innumerable Fibres and ſmall Veſſels. Its *Parenchyma* is partly, if not altogether glandulous. *Its Subſtance.*

Dr. *Fred. Ruyſch* affirms (as he does of the Spleen) that it has no Fibres, no peculiar Glands, nor Cells, with Blood-veſſels placed between; but that its whole Fabrick is only an *Aggeries* of Arteries and Veins. Of which Opinion you may ſee more before, in *Chap.* 16. *Of the Spleen.*

It is of very different *Shapes* in ſeveral Creatures; but in Women it is circular, yet with ſome Inequalities in its Circumference. It is two Fingers breadth thick in its Middle (but thinner near the Edges) and a Span, or a quarter of a Yard over, from one ſide to the other, when the *Fœtus* is come to Maturity, ready for the Birth. On that ſide next the *Fœtus*, it is ſmooth, and ſomething hollowiſh like Navel-wort, and grows every where firmly to the *Chorion*; but on that next the Womb it is very unequal, having a great many Tubercles or Bunchings, whereby it adheres faſt and immediately to the Womb. But to what part of it, is not agreed among Anatomiſts, ſome affirming it to grow to the fore-part, ſome to the hinder-part; ſome to the left-ſide, others to the right. Dr. *Wharton* (aſſenting to *Fallopius*) ſays, it always adheres to one of the two Corners of the Womb (that anſwer in ſome manner to the *Cornua* in Brutes) whereinto the *Foramen* of the *Tuba* opens; ſo that he ſays, the ſaid *Foramen* is as it were the Center to the *Placenta*. *De Graef* thinks it is moſt commonly faſten'd there, but not always, becauſe the *Ovum*, for a while being looſe in the Cavity of the *Uterus*, may be tumbled to this or the other part; *Shape and Connexion.*

and

and wherever it fixes, there it is join'd to the Womb by the *Placenta*.

Number. When there is but one *Fœtus* in the Womb, it is but one; but if there be Twins, then, according to Dr. *Wharton*, *&c.* are there two *Placentæ*, either distinct in Shape, or if they appear in the Shape of one, then are they separated by a Membrane one from the other; and a particular Rope of Umbilical Vessels is inserted into each from each *Fœtus*. But Dr. *Needham* affirms, that there is generally but one *Placenta*, even when there are two or more *Fœtus*. Nor does that Line that seems to divide the *Placentæ* from one another, really do so. For the Vessels of the right-hand *Fœtus* extend beyond this Line to the left-side of the *Placentæ*; and on the contrary. 'Tis but seldom, says he, that the *Placentæ* are multiplied according to the number of the *Embryo's*.

Origin. It grows not out of the Womb originally, but its first Rudiments appear like a woolly Substance on the outside of the outer Membrane that invests the *Embryo* (called *Chorion*) about the eighth or ninth Week, upon which, in a short while a red, carnous and soft Substance grows, but unequally, and in little Knobs, and then it presently thereby sticks to the Womb, and is very conspicuous about the twelfth or thirteenth week. Till now the *Fœtus* is encreased and nourished wholly by the Apposition of the crystalline or albugineous Liquor, wherein it swims loose in the inner Membrane (called *Amnios*) having no *Vasa umbilicalia* formed, by which to receive any thing from the *Placenta*. But when it waxes bigger, and begins to need more Nourishment, the Extremities of the Umbilical Vessels begin to grow out of the Navel by little and little, and are extended towards this *Placenta*; that out of it, as Plants by their Roots out of the Earth, they may draw a more

more firm nutritive Juice, and carry it to the *Fœtus*. But of this more in the 33*d* Chapter.

It has *Veſſels* from a double Origin; ſome from the Womb, and ſome from the *Chorion* immediately, but mediately from the *Fœtus*. The former are of four Kinds, Arteries, Veins, Nerves, and Lympheducts: All which, though they be very large and conſpicuous in the Womb, and are ſo even in that very Place where the *Placenta* is joined to it; yet they ſend but the ſmalleſt Capillaries into the *Placenta* itſelf, and are deſperſed only through the ſide of it that is next the Womb. Thoſe that come from the *Chorion* are Arteries and Veins, and Dr. *Wharton* ſuppoſes alſo Lympheducts. The Arteries and Veins that come from the Womb ſpring from the Hypogaſtricks, and alſo that Branch of the Spermaticks that is inſerted into the bottom of the Womb. Thoſe that come from the *Chorion* are the Umbilical Veſſels of the *Fœtus*. Of the Uſe of both the one and the other, we ſhall ſpeak in *Chap.* 33. when we come to diſcourſe how the *Fœtus* is nouriſhed; as alſo of the Uſe of the *Placenta* itſelf, of which we ſhall only obſerve this further here, That after it is joined to the Womb, it ſticks moſt firmly to it for the firſt Months, as unripe Fruit do to the Tree: But as the *Fœtus* becomes bigger, and riper, and nearer to the Birth, by ſo much the more eaſily will it part from the Womb; and at length like to ripe Fruit, after the Child is born, it falls off from the Womb, and makes part of the After-birth. *Veſſels.*

It was an old Tradition, continued for many hundred Years, that the *Placenta* adheres to the Womb by certain Parts call'd *Cotyledones*, or *Acetabula*. That there are ſuch in ſome Creatures it is certain; Dr. *Needham* ſays, they are only properly ſo called in Sheep and Goats, in whom being *Acetabula.*

being with Young, the Uterine Glands are hollow like a Saucer, or an Acorn-cup, and are adapted to the little Prominences (or *Digituli*) of the *Placentulæ* that grow on the *Chorion* (though *Diemerbroeck* says, that on the contrary the *Placentulæ* are hollow (and so are truly the *Acetabula*) and the Uterine Gland, protuberant) and doubts not but these Names were first given by those that dissected these kinds of Creatures, and were afterwards applied in following Ages to other Animals. So that no wonder there have been so great Contests even about the Signification of the Word *Cotyledon*, (which is the Greek Word for the Herb *Umbilicus Veneris*, or Navel-wort) and what that was that was so called in the several Creatures that were said to have them. But because such Controversies are now obsolete, and that 'tis generally confessed that Women have them not, we shall not in this Epitome run out into needless Disputes; but only observe one singular Opinion of *Diemerbroeck*, who ascribes *Cotyledones* to Women. He thinks that each Woman (unless she go with Twins) has but one *Cotyledon*, and that the foresaid *Placenta uterina* is it. And indeed it must be confess'd that it resembles much the Shape of that from which the *Cotyledones* have their Name; and therefore seeing he formed this Opinion to defend our great Master *Hippocrates*, who had ascribed them to Women (that is, as *Diemerbroeck* expounds it, one *Cotyledon* to one Woman) we shall not oppose it, but confess it to be, if not true, yet both ingenious and ingenuous.

CHAP.

CHAP. XXXII.

Of the Membranes involving the Fœtus, *and of the Humours and Air contained in them.*

NExt to the *Placenta* follow the two *Membranes* that involve the whole *Fœtus*, *Chorion* the outer, and *Amnios* the inner; betwixt which two, after the *Fœtus* is perfectly formed, Dr. *Needham*, &c. affirms there is a third, *viz. Allantoides*, which in Women likewise includes the whole *Fœtus**. Of each of these in their Order, with the Liquors they contain.

**Needh.* de formato fœtu, *p.* 59.

The outmost *Membrane* is called *Chorion*: It is pretty thick, smooth on the Inside, but without something unequal or rough, and in that part of it that adheres to the *Placenta*, and by it to the Womb, has very many Vessels which spring from the *Placenta* itself and from the Umbilical Vessels. Those which spring from the *Placenta* are dispersed through it before the *Fœtus* is shaped (as *Diemerbroeck* affirms;) but the latter not till the Navel rope is grown out to a just length, at which time they enter it, and intermix with the former, and from this Membrane are inserted into the *Placenta*, to which the *Chorion* adheres. It is but one, even when the Mother goes with Twins; for, as in a nut that hath two Kernels in it, they are both included within the same Shell, but are each invested in their proper Membrane; so Twins are both enclosed in one *Chorion*, but have each a particular *Amnios*. It invests the *Ovum* originally, which *Ovum* being brought into the Womb, and becoming a Conception, this Membrane imbibes the Moisture that bedews the Womb plentifully at that time, For whiles the Conception is loose in the Womb, and has no

Chorion.

Vessels

Veſſels that reach out of itſelf, nor is faſten'd to any part, it muſt have its encreaſe after the ſame manner as the Egg has in Hens, ['which while it 'is in the *Racemus* or Knot, conſiſts of no other 'Subſtance but Youlk; and when it drops off from 'thence, and deſcends through the *Infundibulum*, 'it receives no Alteration; but when it comes 'into the Cells of the Proceſs of the *Uterus*, it 'begins to gather a White, although it ſtick to 'no part of the *Uterus*, nor has any Umbilical 'Veſſel; but (*ſays my Author*, the immortal *Harvey**) as the Eggs of Fiſhes and Frogs do 'without, procure to themſelves Whites out of 'the Water; or as Beans, Peaſe, and other Pulſe, 'and Bread-corn being ſteep'd in Moiſture ſwell, 'and thence acquire Aliment for the Bud that is 'ſpringing out of them: So in like manner out 'of the *Plicæ* or wrinkles of the Womb (as out of 'a Dug or Womb-cake) does there an albugine-'ous Moiſture flow, whence the Youlk (by that 'vegetative and innate Heat, and Faculty where-'with it is endued) gathers and concocts its 'White. And therefore in thoſe *Plicæ*, and the 'hollow of the Womb, does there plentifully 'abound a Liquor reſembling the Taſte of the 'White. And thus the Yelk deſcending by little 'and little, is encompaſſed with a White, till 'at laſt in the outmoſt *Uterus*, having aſſumed 'Membranes and a Shell, it is perfected.] Thus, I ſay, does the *Chorion* imbibe that albugineous Liquor that from the firſt Conception encreaſes daily in it (and tranſudes thro' the *Amnios* wherein the *Embryo* ſwims) till the Umbilical Veſſels and the *Placenta* are formed, from and through which the *Fœtus* may receive Nouriſhment.

*De generat. Animal. exercit. 9. de generat. Ovi.

Its Liquor. This Liquor that it imbibes, I take to be nutritious Juice that ouzes into the Cavity of the *Uterus*, out of the capillary Orifices of the Hypogaſtrick and

and Spermatick Arteries, and is of the same Nature with that which afterwards is separated in the *Placenta*, and carried to the *Fœtus* by the Umbilical Vein, and with that also which abounds in the *Amnios*, even till the Birth. For the plastick or vegetative Virtue is only in the *Ovum* it self, and the Augmentation that the first Lineaments of the *Embryo* receive, is only by Apposition of this nutritious albugineous Juice. But this Membrane *Chorion*, by that time the Umbilical Vessels and *Placenta* are formed, is grown so dense and compact, that it is not capable of imbibing more; but that which at this time is in it, does in small time transude into the *Amnios*, and so itself becomes empty, and gives way to the Encrease of the *Allantoides*, (which thenceforwards begins to appear) whose Liquor augments daily as the *Fœtus* grows nearer and nearer to the Birth. This is my Conjecture, which I submit to the Censure of the Learned.

The *Amnios* is the inmost Membrane that immediately contains the *Fœtus*. It is not knit to the *Chorion* in any Place save where the Umbilical Vessels pass through them both into the *Placenta*. It is very thin, soft, smooth, and pellucid, and encompasses the *Fœtus* very loosely. It has Vessels from the same Origins as the *Chorion*. It is something of an oval shape. *Amnios.*

Before the *Ovum* be impregnated, this Membrane contains a limpid *Liquor*, which after the Impregnation, is that out of which the *Embryo* is formed. In it resides the plastick Power, and the Matter also out of which the first Lineaments of the *Embryo* are drawn. But because its Liquor is so very little, there transudes through this Membrane presently part of that nutritious albugineous Humour that is contained in the *Chorion*, which it had imbibed out of the *Uterus*, as was *Its Liquor.*

but even now ſhewn. And by the juxta-Appoſition or Addition of this Humour to the undiſcernible Rudiments of the *Embryo*, it receives its Encreaſe. But tho' the *Amnios* have its additional nutritious Liquor at firſt only by Tranſudation; yet when the Umbilical Veſſels and the *Placenta* are formed, it receives it after another manner: For then this Liquor being ſeparated from the Mother's Arteries by the *Placenta*, and imbibed by the Umbilical Vein of the *Fœtus*, it paſſes directly to its Heart, from whence being driven out by the *Aorta*, it is ſent forth again, a great part of it by the Umbilical Arteries, out of whoſe Capillaries, diſperſed plentifully through the *Amnios*, it iſſues into its Cavity, even as far more groſs and viſcid Juices in taking a Purge (or ſometimes critically) ouze into the Inteſtines out of the ſmall Mouths of the Arteries; tho' indeed it be here by the Intervention of Glands, which 'tis hop'd the Curious will ſometime diſcover alſo in the *Amnios*.

There are ſome that think they have obſerved *Venæ lacteæ* to come directly to the *Placenta*, and that out of it (as out of the Glands in the Meſentery) there ariſe others, that paſſing along with the other Umbilical Veſſels convey the Chyle into the *Amnios*: And this indeed were a plauſible Opinion, if it were grounded on any certain or frequent Obſervation of ſuch Lacteals, and were not rather invented to avoid ſome Difficulties, with which the former Opinion ſeems to be preſſed.

Note, That tho' the Liquor contained in both the *Chorion* and *Amnios* be in Colour and Conſiſtence very like the *Serum* of the Blood; yet it plainly differs in its Nature from that, for being held over the Fire in a Spoon, it will not coagulate as the *Serum* will.

A third *Membrane* which inveſts the whole *Fœtus* (according to Dr. *Needham*, *&c.*) is that called *Allantoides*, tho' improperly as to Women. For it is ſo called from its likeneſs to a Pudding (ἁμᾶς ἄϊλος, *farcimen*,) which indeed it does reſemble in Sheep, Does, Hogs, *&c.* but in Women, as alſo in Mares, it has the ſame Figure as the *Chorion* and *Amnios*, betwixt which it is placed in their whole Circumference, as the ſaid obſerving Anatomiſt affirms; and to him both *de Graef* and *Bidloo* conſent. Now though it muſt be ſuppoſed that this as well as the other two, is originally in the *Ovum*; yet there is no Appearance of it till after the Umbilical Veſſels and *Placenta* are formed, and the albugineous Liquor (ſo often mentioned) ceaſes to be imbibed by the *Chorion* out of the *Uterus*. But as ſoon as the *Fœtus* begins to be nouriſhed by the Umbilical Veſſels, and the *Urachus* is perineable, then preſently this Membrane begins to ſhew itſelf, containing a very thin Liquor, which is the Urine of the *Fœtus* brought into it by the *Urachus* from its Bladder; and with which it is filled daily more and more till the Birth. It is very thin, ſmooth, ſoft, and yet denſe. It may be known from the *Chorion* and *Amnios* by this, that they have numerous Veſſels diſperſed through them, but this has not the leaſt viſible Vein or Artery. It is very hard to ſeparate the *Chorion* from it, becauſe when it appears, the *Chorion* becomes void of all Liquor, and ſo claps cloſe to it. But towards the Birth of the *Fœtus* it becomes ſo turgid with Urine, that the *Amnios* (immediately containing the *Fœtus* (ſwims in it, and ſo may moſt eaſily be diſtinguiſhed and ſeparated from it. *Allantoides.*

The *Liquor* that it contains is (as has been ſaid) the Urine of the *Fœtus* brought hither by the *Urachus*. For as ſoon as the *Fœtus* is perfectly *Its Liquor.*

formed, its Kidneys muſt needs perform their Office of ſeparating the *Serum* from the Blood, for otherwiſe it would be affected with an *Anaſarca* or other ſort of Dropſy. I ſay, the *Serum* is ſeparated in the Kidneys, and glides down from thence into the Bladder, in which it is found pretty plentiful, when the *Fœtus* is five or ſix Months old. Now it flows not out of the Bladder by its Neck, becauſe at that time the Sphincter is too contracted and narrow, and if it ſhould paſs that way, it would mix with that nutritious Juice, in which the *Fœtus* ſwims in the *Amnios*, and wherewith, by taking it in by its Mouth, it is partly nouriſhed, and ſo would defile and corrupt it, and make it unfit for Nouriſhment. Nature therefore has provided it another *Exit*, by the *Urachus*, inſerted into the bottom of the Bladder; which though after the Child is born, it grow ſolid like a Ligament, like as the *Vena umbilicalis* does; yet, while the *Fœtus* is in the Womb, it is always pervious, and conveys the Urine into the *Allantoides*, that is placed betwixt the *Chorion* and *Amnios*, where it is collected and preſerved till the Birth.

Beſides theſe three Membranes, Dr. *Needham* has obſerved a fourth in Cats, Bitches, and Coneys, containing a nutritious Liquor; but I ſhall not here deſcribe the ſame, becauſe it is not my Deſign to be ſo copious, as to treat of any part in other Animals, whereto there is not ſomething anſwerable in an humane Body.

Air in the Membranes.

Note, that according to Dr. *Needham*'s Obſervation, theſe Membranes are not only filled with Liquors, but contain a pretty deal of Air. For if one take a Secundine up in his Hand, he ſays, one may obſerve in the uppermoſt part of the the Membranes, a pretty Diſtance between the Membrane and the Liquor contained in it. And

he

he thinks, that the *Vagitus uterini* (of which he gives an Inſtance not to be denied) are a clear Demonſtration, that there is Air, at leaſt in the *Amnios*. And the pipping of Chickens in the Egg, before either the Shell or the Membranes be broke, evince the ſame. And ſeeing there appears no way whereby the Wind ſhould enter from without, he is of Opinion that it is bred in the Membranes themſelves. That is, that the Liquor, which is pretty ſpirituous, and fitted for the Fermentation and Concoction of the *Fœtus*, and therefore well repleniſh'd with Air, may well be ſuppoſed to yield plenty of Exhalations; by the interpoſition whereof, the Membranes ſtanding at diſtance from the Humours, are kept ſo lax, that they may yield to all the Motions both of the *Fœtus* and of the Mother, without danger of burſting. For this Air does not ſo diſtend the Membrane, but that by blowing, it will widen to thrice as large a Dimenſion as the Liquor it contains, and the Air too, if you do extend it.

CHAP. XXXIII.

Of the Umbilical Veſſels, and of the Nouriſhing of the Fœtus.

HAving opened the Membranes that enwrap the *Fœtus*, there appears the *Navel-String* or *Rope*, which is membranous, wreath'd and unequal, ariſing out of the middle of the *Abdomen* (*viz.* the Navel) and reaching to the Womb-liver, or *Placenta*, of a notable Length, being three Spans or half an Ell long, and as thick as ones Finger. It was convenient to be ſo long and lax, that when the *Fœtus* in the Womb grows ſtrong, it might not break it by its ſprawling and *The Navel-ſtring.*

tumbling about; and after it is born, the Secundines or After-birth might be drawn out the better by it.

Its Situation. The way that passes from the Navel to the *Placenta* is very unconstant; for sometimes it goes up on the right Hand to the Neck, which having encompassed, it descends to the *Placenta*, and sometimes it goes on the left Hand up to the Neck, *&c.* sometimes it comes not to the Neck at all, but goes first a little up towards its Breast, and then turns round its Back, and from thence passes to the *Placenta*.

Vessels. The *Vessels* contained in this String (and which are enwrapped in a common Coat call'd *Funiculus*, or *Intestinulum*) are four; one Vein, two Arteries, and the *Urachus*. For as for the Nerves which *Verheyen* suspects to be contained in it, or the lacteal Vessels, which *Bidloo* thinks he has observed, I shall not reckon them among these Vessels, because these Authors speak but faintly of them.

Vein. The *Vein* is larger than the Arteries, and arises from the Liver of the *Fœtus* (*viz.* out of its Fissure) by the Trunk of the *Vena portæ* (of which it seems to be but a Branch) and from thence passing out of the Navel it runs along the *Funiculus* to the *Placenta*, into which it is implanted by innumerable Roots; but in its Passage it sends some little Twigs into the *Amnios*.

Its Use. The *Ancients* that thought the *Fœtus* was nourished by the Mother's Blood only, taught the sole *Use* of this *Vein* to be, to carry Blood from the *Placenta* to it: And since it has been found out, and believed that it is nourished also (if not only) by Chyle, or *Succus nutritius*, some have continued the same Office to this Vein, and think that the Chyle is brought by Lacteal Vessels arising out of the *Placenta*, as (they say) it was brought thither by the Mother's Lacteals. And indeed

indeed if any certain Discovery had been made of these same *Lacteæ*, we should have embraced this Opinion as the most probable. But we are not to form Hypotheses out of rational Notions only, but much rather from what appears to the Eyes of the Dissecter. We do affirm therefore, that the Umbilical Vein serves for conveying to the *Fœtus* the nutritious Juice separated in the *Placenta* from the Mother's Arteries. How this Separation is made, and how it is first of all turned into Blood, we shall consider by and by.

But, together with this Juice, there returns so much of the Arterial Blood (that comes from the *Fœtus*,) as is not spent upon the Nourishment of the *Placenta*, or of the *Chorion* and *Amnios*. which Liquors thus mixed, tho' by the Umbilical Vein they are poured into the *Sinus* of the *Porta*; yet are they not distributed through the Liver by the usual Channels thereof only, but by the Venal Duct (described before, *Chap.* 12.) is the greatest part thereof conveyed in a direct Course and full Stream into the *Cava*, above the Liver.

Besides this Vein, which is common to all Creatures, there have been observed in Whelps and Coneys (and may perhaps in others) too small Veins more, that, arising from the fourth involving Membrane peculiar to them, pass directly from the *Umbilicus* to the Mesentery of the *Fœtus*, as the other great one does to its Liver; which may strengthen the Opinion, that the Chyle or *Succus nutritius* is brought to the *Fœtus* by the Umbilical Vein (or Veins.) These Veins Dr. *Needham* calls *Omphalo-mesentericæ*.

In the *Funiculus* are included also two *Arteries*, which are not both of them together so big as the Vein. They spring out of the inner iliacal Branches of the great Artery; (Dr. *Needham* judges *Arteries.*

them to be derived immediately from the Extremity of the *Aorta*, before its Division) and passing by the sides of the Bladder, they rise up to the Navel, out of which they are conducted to the *Placenta*, in the same common Cover with the Vein and *Urachus*, with which they are twined and wreathed, not unlike a Rope. I say, they are inserted into the *Placenta*, and with the Vein make a most admirable Net-like Texture. But there is one Branch of each of them, which is manifestly inserted into the *Amnios*. Dr. *Harvey* says, the Vein is conspicuous a pretty while before these Arteries appear.

In the Creatures mention'd in the foregoing Paragraph there are besides these Arteries others answering to and accompanying the Veins called *Omphalo-mesentericæ*, above-mention'd.

Their Use. Blood and Vital Spirit are not carried by them from the Mother to the *Fœtus*, as many, from *Galen* have taught; but on the contrary spirituous Blood is driven from the *Fœtus*, by the beating of its Heart, to the *Placenta* and the Membranes, for their Refection and Nourishment; from which what Blood remains circulates back again into the Umbilical Vein, together with the *Succus nutritius*, afresh imbibed by its Capillaries, dispersed in the *Placenta*. But besides Arterial Blood there flows out of the Navel by them, part of the *Succus nutritius* that was imported by the Umbilical Vein, namely, that of it which is more crass and terrene, which by one Circulation thro' the Heart (or it may be many) could not be changed into Blood: This part I say flows out by these Arteries, which by their Branches that are dispersed through the *Amnios*, disembogue it by their little Mouths into it; for what Use shall be declared presently.

But besides these Uses, which are commonly ascribed

aſcribed to theſe Umbilical Veins and Arteries by Anatomiſts, *Verheyen* (with ſome Probability) aſſigns another. Says he, It is worth Inquiry, for what Purpoſe the Blood of the *Fœtus* is ſent in ſuch great Quantity, out of its Body, into the *Placenta*; ſeeing, without doubt, a far leſs Quantity of Blood would ſuffice for its Nouriſhment: For no part in the whole Body, if you except the Lungs and Liver, has ſuch abundance of Blood-Veſſels as the *Placenta*. This muſt needs be for a certain common Uſe, which we judge to be a-kin to the Uſe of the Lungs in thoſe, who being born, enjoy a freer Air: Namely, that as theſe do, by the Help of the Lungs, plentifully draw in from the Air a certain Matter, highly neceſſary for feeding the vital Flame; ſo in the *Fœtus*, where the Lungs lie idle, ſuch like Matter being received into the Mother's Blood by her Reſpiration, is ſeparated therefrom by help of the *Placenta*, and mixt with the Blood of the *Fœtus* (in the Umbilical Vein, *&c.*) And as in the Lungs of breathing Perſons, ſome heterogeneous Matter is continually ſeparated from the Blood; ſo in the *Placenta*, certain Recrements of the Blood are depoſited out of the Umbilical Arteries into the Veins of the Mother.

How the Veſſels paſs through the Membranes.

And here I ſhall tranſcribe a material Objection with the Anſwer to it, out of *Diemerbroeck*: *Object.* 'How can theſe Veſſels (Veins and Arteries) when they have grown from the Belly of the *Fœtus* to that length, as to reach the Membranes, penetrate and paſs through them to the *Placenta*? *Anſw.* This is done in the ſame manner as the Roots of Herbs, Shrubs and Trees, penetrate into the hard Ground, yea often into thick Planks, Walls and Stones (which Water cannot enter) and root themſelves firmly in them. For juſt ſo the firſt ſharp-pointed and moſt fine Ends of the Umbilical Veſſels inſinuate

'nuate themſelves by little and little into the 'Pores of the Membranes (for the Figuration 'of thoſe Pores are fitted for their Entrance) 'and paſs through them, and yet the Liquors 'contained in theſe Membranes cannot flow out 'by them: And when thoſe Veſſels inhering in 'the Pores grow more out into Length, by lit-'tle and little the ſaid Pores are more and more 'widened (according to the Encreaſe of the 'Veſſels) and are inſeparably united unto, and 'grow in them.

Urachus. The fourth Umbilical Veſſel is the *Urachus*, or Urinary Veſſel. This is a ſmall, membranous, round Pipe, endued with a very ſtrait Cavity ariſing from the Bottom of the Bladder up to the Navel, out of which it paſſes along within the common Cover, and opens into the *Allantoides*. It is more apparently pervious in many of the larger Brutes than it is in Man, in whom ſome have denied it any Cavity; but that it is hollow in him, is confirmed by many Hiſtories of Perſons adult, who having the ordinary Urinary Paſſage along the *Penis* ſtopt, the Paſſage in this Veſſel has been unlocked, and they have made Water by the Navel, which could not have been imagin'd to have happen'd, if it had been originally a Ligament without any *Meatus*. *Bartholin* and others have affirmed, that the *Urachus* in Men reaches no farther than the Navel; How then comes that Humour into the *Allantoides* that has perfectly the ſame Taſte with the Urine in the Bladder? But their Errour ſprung from hence, that they thought a human *Fœtus* had no *Allantoides*, and that Humour that is found in it, they thought had been contained in the *Chorion*. But this is in ſhort refuted above, but more fully and accurately by Dr. *Needham*, *Lib. de formato Fœtu*, *Chap.* 3. As to the Perviouſneſs of the *Urachus*,

I ſhall add this farther, That in Abortions of five or ſix Months old, the Bladder of the *Embryo* is always full of Urine, out of which if in the following Months it ſhould not be emptied by the *Urachus*, the Bladder would ſoon burſt, ſeeing there is daily ſome *Serum* ſeparated from the Blood in the Kidneys, and ſent to the Bladder; and the more the *Fœtus* encreaſes, the more muſt needs be ſeparated. Yea, Dr. *Needham* affirms, that one may either preſs the Liquor contained in the *Allantoides* by the *Urachus*, into the Bladder, or with a Pipe blow Wind out of the Bladder, by the ſame Way into the *Allantoides*.

Its *Uſe* has been ſufficiently declared in the preceding Paragraph; as alſo above, when we delivered the Uſe of the *Allantoides*, which we ſhall not repeat. *Its Uſe.*

Theſe four Veſſels (as has been ſaid above) have one *common Cover*, which alſo keeps each of them from touching other. It is called *Inteſtinulum*, and *Funiculus* (by which it, with its Veſſels, is ſometimes underſtood.) It is membranous, round and hollow, indifferent thick, conſiſting of a double Coat (the inner from the *Peritonæum*, and the outer from the *Panniculus carnoſus*.) Sometimes it ſelf only is wreath'd about like a Rope, the Veſſels included in it running ſtreight along its Cavity; and ſometimes they are wreathed together with it. **Funiculus**

It has ſeveral *Knots* upon it here and there, which Dr. *Wharton* thinks to be *Papillæ*, or little Glands, through which the lacteal (or nutritious Juice) diſtils out of the Capacity of the *Funiculus* into the Cavity of the *Amnios*. I cannot tell whether this be ſo or no; but that Uſe that doting Midwives make of 'em, to gueſs by their Number how many Children more the Mother ſhall have, and by their Colour, whether thoſe Children *Its Knots.*

ſhall

ſhall be Male or Female, is moſt ridiculous and ſuperſtitious.

How to tie the Navel-ſtring, and cut it off. When the Infant is born, this Navel-rope is uſed to be tied about one or two Finger's breadth from the Navel, with a ſtrong Thread caſt about it ſeveral times, and then about two or three Finger's breadth beyond the Ligature to be cut off. What is not cut off, is ſuffered to remain till it drop off of its own accord. Which the longer or ſhorter while it is a doing, the longer or ſhorter liv'd Women propheſy the Children will be.

Of the Nutrition of the Fœtus. There have been great Diſputes among both Philoſophers and Phyſicians, with what, and by what way the *Fœtus* is nouriſhed. Some affirm, by Blood only, and that received by the Umbilical Vein. Others by Chyle only, received in by the Mouth; each of which are in an extream. The Truth is, according to the different Degrees of Perfection, that an *Ovum* paſſes from a Conception to a *Fœtus* ready for the Birth, it is nouriſhed diverſly.

Firſt, by Appoſition. For firſt, as ſoon as an *Ovum* impregnated is deſcended into the Womb, it preſently imbibes through its outer Membrane, ſome of that albugineous Liquor that at this time plentifully bedews the internal Superficies of the *Uterus*; ſo that as ſoon as the firſt Lineaments of an *Embryo* begin to be drawn out of that Humour contained in the *Amnios*, they preſently receive Encreaſe by the Appoſition of the ſaid Liquor filtrated out of the *Chorion* through the *Amnios* into its Cavity. And this ſame Liquor that thus encreaſeth the firſt Rudiments of the *Embryo*, is called by Dr. *Harvey*, *Colliquamentum*. That this Way of Nutrition or Augmentation of the *Embryo* is poſſible, need not be doubted by him that conſiders, that the *Fœtus* of a Sow have no other poſſible way of being nouriſhed, till ſhe is near half gone with Pig:

['] For even till then, ſaith Dr. *Needham*, the *Cho-* ' *rion* cleaves not to the Womb; but look, as ma- ' ny *Fœtus* as there are, there are ſo many Eggs ' as it were without Shells, neither ſticking to ' the Womb, nor to one another; but when one ' opens the Matrix, they all tumble out of their ' own accord. There are no Glandules, nor ' *Placenta*. But the *Chorion*, which is ſoft and ' porous, does like a Sponge imbibe or ſuck up ' the ſerous Liquor that ſweats out of the inmoſt ' Membrane of the *Uterus*, to be afterwards ' ſwallowed by the Veins;] (I ſuppoſe he means the Mouths of the Umbilical Vein, after the ſaid Vein is ſo perfectly formed as to receive it.) But of this more in the Beginning of the foregoing Chapter.

2. *By the Umbilical Vein.*

But when the Parts of the *Embryo* begin to be a little more perfect, and the *Chorion* becomes ſo denſe, that not any more of the ſaid Liquor is imbibed by it, the Umbilical Veſſels begin to be formed, and to extend to the Side of the *Amnios*, which they penetrate, and both the Vein and Arteries paſs alſo through the *Allantoides* and *Chorion*, and are implanted into the *Placenta*, that at this time, firſt gathering upon the *Chorion*, joins it to the *Uterus*. And now the Hypogaſtrick and Spermatick Arteries, that before ſpued out the nutritious Juice into the Cavity of the *Uterus*, open by their Orifices into the *Placenta*, where (whether by meer Percolation through it, or by ſome ſort of Fermentation alſo, I will not determine, but) they depoſit the ſaid Juice, which is abſorbed by the Umbilical Vein, and by it conveyed firſt to the Liver, then to the Heart of the *Fœtus*, where the thinner and more ſpirituous Part of it is turned into Blood. But the more groſs and terrene part of it deſcending by the *Aorta*, enters the Umbilical Arteries, and by

thoſe

thoſe Branches of them that run through the *Amnios* is diſcharg'd into its Cavity. They that will laugh at this Paſſage of the nutritious Juice, becauſe it is made by this Doctrine to chooſe its way, as if it were ſome Animal or even Rational Creature, let them avoid the like Treatment if they can, while they deliver, that the Chyle paſſes immediately either from the Meſentery, the *Receptaculum*, or *Ductus communis*, to the *Placenta*, when a *Fœtus* is in the Womb. Pray how ſhould the Chyle know, or the Lacteals, by which it paſſes, that there is any *Fœtus* in the Womb, that the one ſhould offer to go that way, and the other give it way to go thither at that time, whereas the Paſſage is ſhut at all other times? Yet this my Opponents maintain. As alſo, How comes the Chyle preſently to turn its Courſe after the *Fœtus* is born, and inſtead of deſcending to the *Uterus*, aſcend to the Breaſt? What mechanical Cauſe can be aſſigned to theſe, and many other the like *Phænomena*? We muſt therefore be content to reſolve ſome things into the admirable and unintelligible Diſpoſal of our wiſe Creator.

But there lies another Objection againſt this Opinion, Becauſe it allows none of the Mother's Blood to be received by the *Fœtus* through the Umbilical Vein, but only *Succus nutritius*; how ſhould Blood be firſt bred in the *Fœtus*, ſeeing it has Blood before the Liver or Heart, or any other Part that conduce to Sanguification, are in a Capacity to perform their Office?

I confeſs, it is inexplicable by me, how Blood ſhould be made ſo ſoon; but that it may be, and is made, out of the *Succus nutritius*, or *Colliquamentum*, without the Mixture of any from the Mother, is apparent from the moſt accurate Obſervations of Dr. *Harvey*, concerning the Order of the

the Generation of the Parts in a Chicken (which from first to last receives nothing from the Hen.) Says he, * [‘ There appears at the very first, a ‘ red leaping *Punctum* or Speck, a beating Bladder, and Fibres drawn from thence, containing Blood in them. And as much as one can ‘ discern by accurate Inspection, Blood is made, ‘ before the leaping Speck is formed; and the ‘ same is endued with vital Heat, before it is ‘ stirred by the Pulse: And as the Pulsation begins in the Blood and from it; so, at length, at ‘ the Point of Death, it ends in it.—— And because the beating Bladder, and the sanguineous ‘ Fibres that are produced from it, appear first ‘ of all; I should think it consentaneous to Reason, that the Blood be before its Receptacles; ‘ namely, the Content before its Container; and ‘ that this is made for the sake of the other.] He confesses it to be a *Paradox*, that Blood should be made and moved, and endued with vital Spirit, before any sanguifying or motive Organs are in being; and that the Body should be nourished and encreased, before the Organs appointed for Concoction (namely, the Stomach and Bowels) are formed: But neither of these are greater Paradoxes, than that there should be Sense and Motion in the *Fœtus* before the Brain is composed; and yet, says he, [‘ The *Fœtus* moves, con- Exercit. ‘ tracts, and stretches out it self, when there is 57. ‘ nothing conspicuous for a Brain but clear Water.] I say, if all these unlikely things do certainly come to pass in an Egg, that has nothing to set the vegetative or vital Principle thereof on Work, but the Warmth of the Hen that sits upon it; why should we think it strange that nutritious Juice, impregnated with the vital Spirits of the arterial Blood, with which it circulated through the Mother's Heart (it may be more than

* De generat. Animal. Exercit. 51.

than once) ſhould be turned into Blood in an human *Fœtus* (foſter'd with ſuch kindly Warmth in the Womb) though it neither receive any Humour under the Form of Blood from the Mother, nor have it ſelf as yet any Organs of Sanguification ſo perfect, as to perform their Office? But to proceed:

3. *By the Mouth.* The groſſer nutritious Juice being depoſited by the Umbilical Arteries in the *Amnios*, as ſoon as the Mouth, Gullet, and Stomach, *&c.* are formed ſo perfectly that the *Fœtus* can ſwallow, it ſucks in ſome of the ſaid Juice, which deſcending into the Stomach and Inteſtines, is received by the *Venæ lacteæ*, as in adult Perſons.

That the *Fœtus* is nouriſhed this way, *Diemerbroeck* evinces by theſe Reaſons.

'1. Becauſe the Stomach of the *Fœtus* is never 'empty, but is found poſſeſt of a milky whitiſh 'Liquor; and ſuch like is contained even in its 'Mouth.

'2. Becauſe there are *Fæces* contained in the 'Inteſtines (which Philoſophers call *Meconium*) 'which the Infant, as ſoon as 'tis born, voids by 'ſtool. Without doubt theſe are the Excrements 'of ſome Aliment taken in by the Mouth.

'3. Becauſe the Stomach could not preſently 'after the Birth perform the Function of Con'coction, if it had not at all been accuſtomed 'to it in the Womb.

His 4th Reaſon, ſuppoſing the *Fœtus* to be nouriſhed in part by the Mother's Blood, I ſhall not recite, becauſe I think that to be an erroneous Opinion, as I think to make appear by and by.

'5. Becauſe the Infant, as ſoon as it is born, 'knows how to ſuck the Breaſt, which it could 'not be ſuppoſed to be ſo dextrous at, if while 'it remained in the Womb, it had taken nothing 'by Suction.

'6. Be-

'6. Becauſe many Infants, as ſoon as they 'are born, before they have ſucked any Breaſt, 'or taken any thing by the Mouth, vomit up a 'milky Aliment; which therefore muſt needs be 'received into their Stomach in the Womb. This he gives an Inſtance of in one of his own Children.

The Fœtus is not nouriſhed at all by the Mother's Blood.

Theſe Arguments I think ſufficient to prove what they are alledged for; but when he would afterwards prove, that the *Fœtus* is alſo nouriſhed by the Mother's Blood conveyed by the Umbilical Vein, I think his Reaſons are invalid. For he ſays it muſt be ſo, *Firſt*, Becauſe the ſaid Vein is implanted into the *Placenta*; (but this is but begging the Queſtion, for 'tis neceſſary it ſhould be implanted into it, though it receive nothing from it but nutritious Juice.) *Secondly*, Becauſe of the great Quantity of Blood that will iſſue out of the Umbilical Vein, if one tie the Navel-rope, and then open the ſaid Vein betwixt the Ligature and *Placenta*: For he ſays, there will flow out four times as much Blood as could be ſuppoſed to be contained in the ſmall Arteries on that ſide the Ligature next the *Placenta*. I anſwer, that firſt one ſhould be well ſatisfied that the Ligature was made ſo ſtrait, that there could no Blood paſs through it from the *Fœtus* to the *Placenta*. And ſecondly, it cannot exactly be gueſſed how much Blood may be contained in the *Fœtus*'s Arteries in the *Placenta*, ſo as that one ſhould be certain, that there does four times more flow out by the Vein. But laſtly, ſuppoſe there do four times as much more Blood iſſue out of the Vein as is contained in the *Fœtus*'s Arteries, that are on that ſide the Ligature next the *Placenta*, and this Blood come from the Dam's Hypogaſtrick and Spermatick Arteries; I ſay, there will not only four times, but forty times as much iſſue there-

from, for all the Blood of the Dam might then be drawn out this way. Wherefore I think this Experiment makes much more againſt his Opinion than for it. His *third* Reaſon is, the Neceſſity of it; becauſe as the *Fœtus* encreaſes, it needs much Aliment, and its weak Bowels can concoct but little, it muſt therefore have ſome purer Aliment, and which is already concocted (he means Blood) to nouriſh it, and by its Commixture, to help forward the changing the Aliment received by the Mouth into Blood. *Anſw.* This Reaſon himſelf invalidates in the next Paragraph, * where he confeſſes, that the *Fœtus* in the Womb is nouriſhed in the ſame Manner as the Chicken in an Egg, which receives Encreaſe, firſt by the *inner* White (as he diſtinguiſhes) by way of Appoſition: Secondly, it receives Nouriſhment in by the Mouth from the *outer* White, and at the ſame time its Umbilical Veſſels enter the Youlk (to draw Nouriſhment from thence) which, he ſays, indeed, reſembles the Mother's Blood; but ſeeing it has not the leaſt Form of Blood, why would it not be more plauſibly ſaid, that it is inſtead of the *Succus nutritius* that the *Fœtus* in viviparous Animals receives by the Navel-Vein? And ſeeing theſe ſeveral Liquors are turned, part of them, into Blood in a Chicken, without any of the Hen's Blood to *ferment* them (as he ſpeaks;) why ſhould not the ſame Power be granted to the vegetative or animal Soul of the *Fœtus* in the Womb, without any Aſſiſtance from the Mother's Blood? To which I ſhall add another Argument (out of Dr. *Harvey*) taken from Cæſarean Births, when living Infants are cut out of the Mother's Womb, after ſhe is dead. For if it had its Life and Heat from the Mother's Blood; ſurely it ſhould die as ſoon as ſhe at leaſt, if not ſooner: For when Death approaches,

* Anat. corp. hum. p. 367.

proaches, the ſubordinate Parts do languiſh and grow cold before the Principal; and therefore the Heart fails laſt of all. Wherefore the Blood of the *Fœtus* would firſt looſe its Heat, and become unfit for its Office, if it were derived from the Mother's Womb; ſeeing her Womb is deſtitute of all vital Heat, before her Heart. But enough of this.

The Reaſon why Women with Child want their Menſes.

But ſome may object, if the *Fœtus* be nouriſhed by none of the Mother's Blood, why ſhould her *Menſes* be ſtopt all or moſt of the while ſhe is with Child? To which I anſwer, That 'tis for the ſame Reaſon that Nurſes that give Suck commonly want them alſo, for as in Nurſes the Chyle paſſes in a great Proportion to the Breaſts, whereby the Blood, being defrauded of its due and wonted Share, does not encreaſe to that Degree, as to need to be leſſened by the flowing of the *Menſes*; ſo in Women with Child, there is ſo great a Quantity of the *Succus nutritius* (which is only Chyle a little refined and impregnated with vital Spirit) that paſſes to the *Placenta* by the Hypogaſtrick and Spermatick Arteries, for the Nouriſhment of the *Fœtus*, that unleſs the Mother be very ſanguine, her *Menſes* intermit after the firſt or ſecond Month.

I ſhall conclude therefore, that the *Fœtus* is nouriſhed three ſeveral Ways, but only by one Humour: Firſt, By Appoſition of it whiles it is yet an imperfect *Embryo*, and has not the Umbilical Veſſels formed; but after theſe are perfected, it then receives the ſame nutritious Juice by the Umbilical Vein, the more ſpirituous and thin Part whereof it tranſmutes into Blood, and ſends forth the groſſer Part by the Umbilical Artery into the *Amnios*, which the *Fœtus* ſucks in at its Mouth, (after the Parts of the Mouth, the *Gula*, Ventricle, *&c.* are formed ſufficiently for ſuch an Acti-

on) and undergoing a new Concoction in its Stomach, is received out of the Inteſtines by the *Venæ lacteæ*, as is done after the Birth.

Obſervation. The now generally received Opinion of the *Fœtus*'s receiving Nouriſhment by the Mouth in the latter Months, may, beſides the Reaſons above-recited from *Diemerbroeck*, be further confirmed by the following Obſervation. About *November*, 1696. I was ſent for to an Infant that could not ſwallow. The Child ſeem'd very deſirous of Food, and took what was offer'd it in a Spoon with Greedineſs but when it went to ſwallow it, it was like to be choaked; and what ſhould have gone down, returned by the Mouth and Noſe, and it fell into a ſtruggling convulſive ſort of Fit upon it. It was very fleſhy and large, and was two Days old when I came to it, but the next Day died. The Parents being willing to have it opened, I took two Phyſicians and a Surgeon with me. Opening the *Abdomen* firſt, the Guts had ſome of the *Meconium* remaining ſtill in them, though the Child had gone two or three times to Stool. The Stomach had in it a pretty deal of a ſlimy ſort of Liquor (or Jelly rather) ſomewhat like pretty thick (ſtrained) Water-gruel. I ſhall not mention any Obſervations upon other Parts in the *Abdomen*, as being not to our preſent Purpoſe.

Then we cut open the *Thorax*, and taking out the Gullet (with the Wind-pipe, Lungs, *&c.*) continued to the Stomach; we blew by a Pipe down the Gullet, but found no Paſſage for the Wind into the Stomach. Then we made a Slit in the Stomach, and put a Pipe into its upper Orifice, and blowing we found the Wind had a Vent, but not by the Top of the Gullet. Then we carefully ſlit open the back-ſide of the Gullet from the Stomach upwards, and when we were

gone

gone a little above half way towards the *Pharynx*, we found it hollow no further. Then we begun to slit it open from the *Pharynx* downwards, and it was hollow till within an Inch of the other Slit, and in the imperforated Part it was narrower than in the hollowed. This *Isthmus* (as it were) did not seem ever to have been hollow, for in the Bottom of the upper, and the Top of the lower Cavity, there was not the least Print of any such Thing, but the Parts were here as smooth as the Bottom of an Acorn-cup.

Then searching what way the Wind had passed when we blew from the Stomach upwards, we found an oval Hole (half an Inch long) on the Fore-side of the Gullet, opening into the *aspera arteria*, a little above its first Division, just under the lower part of the *Isthmus* above-mentioned.

Now, I say, this is a plain Confirmation of the *Fœtus*'s being nourished by the Mouth; for the *Gula* being impervious, Nature had formed this Hole in the Wind-pipe and Gullet, for the Liquor contained in the *Amnios* to pass into the Stomach, which it might do without Prejudice, or any Fear of choaking in the Womb, while the Child breathed not; but when it was born, and came to breath, there could be no longer any Passage this way, and so the Infant was necessarily famished.

CHAP. XXXIV.

What Parts of a Fœtus *in the Womb differ from those of an adult Person.*

HAving delivered the History of the *Fœtus*, we will only farther shew, in what Parts a *Fœtus* in the Womb differs from an adult Person. And this we cannot do more exactly than in the manner that *Diemerbroeck* has reckon'd them,

whom therefore we ſhall here tranſlate, with little Alteration.

This Diverſity, he ſaith, conſiſts in the Difference of Magnitude, Figure, Situation, Number, Uſe, Colour, Cavity, Hardneſs, Motion, Excrements, and Strength of the Parts.

Now this Diverſity is conſpicuous either in the whole Body, or in the ſeveral Ventricles, or in the Limbs.

There is conſiderable in the whole Body,

1. The Littleneſs of all the Parts.

2. The reddiſh Colour of the whole.

3. The Softneſs of the Bones; whereof many are as yet griſtly and flexible: and that by ſo much the more, by how much the *Fœtus* is farther from Maturity.

In the Head there are ſeveral Differences. As,

1. The Head, in reſpect to the Proportion of the reſt of the Body is bigger, and the Shape of the Face leſs comely.

2. The Bones of the Scull are ſofter, and the Crown is not covered with Bone, but only with a Membrane.

3. The Bone of the Fore-head is divided, as alſo that of the Under Jaw; and the *Os cuneiforme* is divided into four.

4. The Bone of the *Occiput*, or hinder part of the Head, is diſtinguiſh'd into three, four or five Bones.

5. The Brain is ſofter, and more fluid, and the Nerves very ſoft.

6. The Bones that ſerve the Senſe of Hearing, are wonderfully hard and big.

7. The Teeth lie hid in the little Holes of the Jaw-bone.

8. There is no leſs Diverſity in the *Thorax*. For,

1. The Dugs ſwell, and out of them in Infants new-born, whether Male or Female, a ſerous Milk

Milk iſſues forth ſometimes of its own Accord, ſometimes with a light Preſſure; yet there are no Glandules very conſpicuous, but there is ſome Faſhion of a Nipple.

2. The *Vertebræ* of the Back want their ſpinous Proceſſes, and are each one made of three diſtinct Bones, whoſe mutual Concourſe form that Hole whereby the Spinal Marrow deſcends.

3. The Heart is remarkably big, and its *Auriculæ* large.

4. There are two Unions of the greater Veſſels, that are not conſpicuous in adult Perſons, *viz.* 1. The *Foramen ovale*, by which there is a Paſſage open out of the *Cava* into the *Vena pulmonaris*, juſt as each of them are opening the firſt into the right Ventricle, and the latter into the left Ventricle of the Heart. And this *Foramen* juſt as it opens into the *Vena pulmonaris*, has a Valve that hinders any thing from returning out of the ſaid Vein into the *Foramen*. 2. The *Canalis arterioſus*, which, two Fingers Breadth from the *Baſis* of the Heart, joins the *Arteria pulmonaris* to the *Aorta*. It has a pretty large Cavity, and aſcends a little obliquely from the ſaid Artery to the *Aorta*, into which it conveys the Blood that was driven into the pulmonary Artery out of the right Ventricle of the Heart, ſo that it never comes in the left Ventricle; even as that Blood that is ſent out of the left Ventricle into the *Aorta*, never came in the right (except a little that is returned from the Nutrition of the Lungs) but paſſed immediately into it out of the *Vena cava*, by the *Foramen ovale*. So that the Blood paſſes not through both the Ventricles, as it does after the *Fœtus* is born; for then it muſt have had its Courſe through the Lungs, which it cannot have, becauſe they are now very denſe, and lie idle and unmoved. Yea,

they are ſo denſe and heavy, that if one throw them into Water, they will ſink; whereas if the *Fœtus* be but born, and take only half a dozen Breathes, they become ſo ſpongy and light, that they will ſwim. Which (by the Way) may be of good uſe to diſcover whether thoſe Infants that are killed by Whores, and which they commonly affirm were ſtill-born, were really ſo or no. For if they were ſtill-born, the Lungs will ſink; but if alive (ſo as to breath never ſo little a while) they will ſwim.

5. The Gland *Thymus* is notably large, and conſiſts as it were of three Glands.

In the lower Belly there are theſe Differences.

1. The Umbilical Veſſels go out of the *Abdomen*.

2. The Stomach is narrower, yet not empty, but pretty full of a whitiſh Liquor.

3. The Caul is hardly diſcernible, being almoſt like a Spider's Web.

4. The Guts are ſeven times longer (or more) than the Body.

5. In the ſmall Guts the Excrements are pituitous and yellow; but in the thick, ſomewhat hard and blackiſh, ſometimes greeniſh: The *Cæcum* is larger than uſual, and often filled with *Fæces*.

6. The Liver is very large, filling not only the right Hypochondre, but extends it ſelf into the left ſide, and covers all the upper part of the Stomach. It has a Paſſage now more than in the adult, called *Canalis venoſus*, which ariſing out of the *Sinus* of the *Porta*, carries the greateſt part of what is brought by the Umbilical Vein directly, and in a full Stream, into the *Cava* above the Liver; but as ſoon as the Infant is born, and nothing comes any longer by the ſaid Vein, this *Canalis* preſently cloſes, as the Vein it ſelf turns to a Ligament; as alſo do the *Urachus*, and the two Umbilical Arteries.

7. The

7. The ſpleen is ſmall.

8. The Gall-bladder is full of yellow or green Choler.

9. The Sweet-bread is very large and white.

10. The Kidneys are bigger and unequal in their Superficies, and look as if they were compounded of a Collection of very many Glandules.

11. The *Renes ſuccenturiati* are exceeding large; they do not only border upon the Kidneys, as in the adult, but lie upon them, and embrace their upper part with a large *Sinus* as it were.

12. The Ureters are wide, and the Bladder diſtended with Urine.

13. In Females the *Uterus* is depreſſed, the *Tubæ* long, and the *Teſtes* very large.

The Difference in the Limbs conſiſts,

1. In the Tenderneſs and Softneſs of the Bones.

2. The little Bones of the Wriſt and Inſtep are griſtly, and not firmly joined together.

CHAP. XXXV.

Of the Birth.

THE *Fœtus* ſwimming in the Liquor of the *Amnios*, and the Navel-rope being ſo long, it muſt needs have ſcope enough to change its Situation, and that is the Reaſon that Anatomiſts differ ſo much about it. But according to Dr. *Harvey*, its uſual Poſture is thus:

The Poſture of the Fœtus in the Womb.

'Its Knees are drawn up to the Belly, its 'Legs bending backwards, its Feet a-croſs, and 'its Hands lifted up to its Head, one of which 'it holds to the Temple or Ear, the other to 'the Cheek; where there are white Spots on the

'the Skin, as if it had been rubb'd upon. The 'Back-bone turns round, the Head hanging 'down towards its Knees. Its Head is upwards 'and its Face commonly towards the Mother's 'Back.

At its Birth. But towards the Birth (ſometimes a Week or two before) it alters its Situation, and tumbles down with its Head to the Neck of the Womb, with its Feet upwards. Then the Womb alſo ſettles downward, and its Orifice relaxes and opens. And the *Fœtus* being now ill at eaſe, ſprawls and moves itſelf this way and that way, whereby it tears the Membranes wherein it is included ſo that the Waters (as they call them) flow into the *Vagina*, which they make ſlippery for the eaſier Egreſs of the Infant; tho' ſometimes the Membranes burſt not, but come forth whole (as they do commonly in Brutes.) At the ſame time the neighbouring Parts are looſened, and become fit for Diſtention; the Jointings of the *Os ſacrum* and *Pecten*, with the *Coxendix*, as alſo of the *Oſſa pubis*, are ſo relaxed, that they yield very much to the Paſſage of the *Fœtus*. And its Motion gives that Diſturbance to the *Uterus*, that preſently the animal Spirits are ſent plentifully by the Nerves to its conſtrictory Fibres, and the Muſcles of the *Abdomen*, which all contracting together, very ſtrongly expel the *Fœtus*, which (in the moſt natural Birth) goes with the Head foremoſt; and if the Feet or any other Part (beſides the Head) do offer itſelf firſt, the Travail is always more painful and dangerous.

The Term of going with Child. The ſeveral ſorts of Creatures have ſundry Terms of going with young: The ſtated and moſt uſual time of Women is nine Months, tho' ſome bring forth ſome Weeks ſooner, and others later. But when it is given out, that perfect and ſprightly Infants are born at ſeven Months end,

it

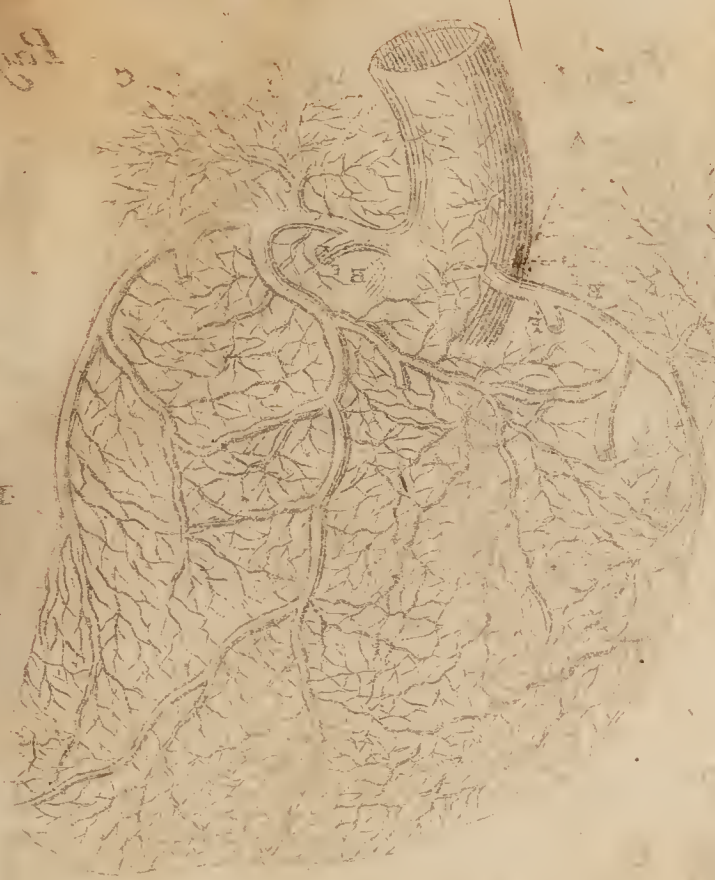
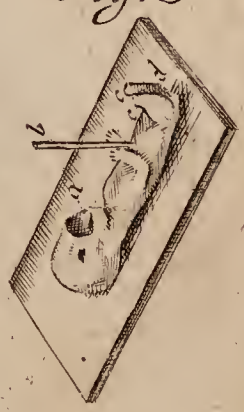


Fig. 2.

Fig. 1.

Fig. 3.



it is either to hide the Faults of ſome new-married Woman, or from the miſtake of the ignorant Mother. As alſo when ſometimes the Mother has affirmed herſelf to go eleven Months, or upwards, it is either through Miſtake, or to keep faſt ſome fair Eſtate, when the pretended Father's dead without an Heir, for which the cunning Widow plays an After-game.

Divers Reaſons are given why the *Fœtus*, at the ſtated time of Birth is impatient of ſtaying any longer in the Womb; as the Narrowneſs of the Place, the Corruption of its Aliment, or the Defect of it, the too great Redundance of Excrements in the *Fœtus*, and the neceſſity of Ventilation or Breathing. All theſe are plauſibly defended by their ſeveral Authors. But without blaming ingenious Men for exerciſing their Wits on ſuch a Subject, we chuſe however rather to be content with reſolving all into the wiſe Diſpoſal of the great Creator, whoſe Power and Wiſdom were not more eminent in creating Man at firſt out of the Duſt of the Earth, than out of thoſe Principles and in that Method, whereby he is produced in ordinary Generation. *The Reaſon of the Birth.*

TAB. X.

Fig. I. Repreſenteth the uſual Situation of the *Fœtus* in the Womb.

A *Its Head hanging down forwards, ſo that its Noſe is hid betwixt its Knees.*

BB *Its Buttocks, to which its Heels cloſe.*

CC *Its Arms.*

D *The Umbilical Rope paſſing by its Neck, and wound round over its Fore head.*

Fig. II.

Fig. II. Sheweth the *Fœtus* taken out of the Womb, and as yet tied to the *Placenta*, the Umbilical Veſſels being ſeparated at their Riſe.

AAA *The* Abdomen *opened.*
B *The Liver of the* Fœtus.
C *The Urinary Bladder.*
DD *The Inteſtines.*
E *The Umbilical Vein.*
FF *The Umbilical Arteries.*
G *The* Urachus.
H *The Umbilical Veſſels united and inveſted in their common Coat.*
III *The* Funiculus umbilicalis *reaching to the* Placenta.
KKKK *The Veins and Arteries diſperſed through the* Placenta.
LLL *The* Placenta *of the Womb.*

Fig. III. Sheweth an *Embryo* in its juſt Dimenſion, (communicated to me by Dr. *E. Tyſon.*)

a *Its wide Mouth, with a Tongue in it.*
b *The Umbilical Rope.*
c *The Thighs and Legs, with the* Coccyx d *appearing like a Tail.*

The End of the Firſt Book.

The

The Second BOOK.

OF THE MIDDLE CAVITY, CALLED THORAX.

CHAP. I.

Of the common containing Parts of the Thorax *or Breaſt.*

The Breaſt

HItherto of the loweſt Cavity or *Abdomen*, and of the Parts contained in it, whether appointed for *Chylification* (and in ſome reſpect for *Sanguification*) or for *Procreation*. Now it followeth, that we deſcribe the middle Cavity, called *Thorax*, which containeth the Organs of Reſpiration, and thoſe that elaborate the Blood and vital Spirits, with the Trunks of the Veſſels whereby theſe are diſtributed into all the Parts of the Body, for their Refection, and the Preſervation of their natural Heat.

Its Bounds.

This Cavity is bounded above by the *Clavicu læ*, or Chanel-bones; below by the Diaphragm

or

or Midriff (whereby it is severed from the *Abdomen*;) in the Fore-part by the Breast-bone and Cartilages; in the Sides by the Ribs; behind by the *Vertebræ* of the Back.

Figure. The *Figure* of it is in a manner oval, somewhat flat before and behind, whereas in Beasts it is somewhat sharp; so that only Man lieth on his Back.

Parts. The *Parts* whereof it is composed, are either *containing*, or *contained*. The Parts *containing* are either *common* or *proper*.

The common containing Parts. The *common containing Parts* are in Number five, viz. *Cuticula*, *Cutis*, *Pinguedo*, *Membrana carnosa*, and the common Membrane of the Muscles. Of which having at large discoursed in *Book* I. *Ch.* 3. when we treated of the *common containing Parts* of the lower Belly, we shall not here repeat what is there delivered, but pass on to the *proper*.

CHAP. II.

Of the proper containing Parts; and, first, of the Dugs.

The proper containing Parts. THE *proper containing Parts* are either *external* or *internal*. The *external* are in Number Three; the Breasts, the Muscles, and the Bones. The *internal* proper containing Parts are three in like manner; the *Pleura*, the *Mediastinum*, and the Diaphragm.

The Paps. *Dugs* are granted to both Sexes, and are seated in the Middle of the *Thorax*, on each side one, upon the pectoral Muscle that draweth the Shoulder forwards.

1. *Of Men.* In Men they are framed of the *Cutis*, the *Membrana carnosa*, Fat, and the Nipple, and serve only for Beauty, and are called *Mammillæ*.

In

In Women, besides these Parts, they have remarkable Vessels, Glandules, and Pipes, to contain the Milk separated by the Glandules, and are called *Mammæ*. 2. *Of Women.*

They differ much as to their Bigness in several Women, and in the same Woman, in regard of Age and other Circumstances: For before they have their *Menses*, and when they are very old, they bunch out but very little. And in the Middle or Flower of their Age, when they give Suck, or are with Child, they are bigger than at other times. *Their Bigness.*

They are made up of many *glandulous* Bodies of a different Bigness, and are not of one continued glandulous Substance (as Dr. *Wharton* affirmeth, *lib. de Gland.* p. 236.) There is one Gland in the Middle, just under the Nipple, that is bigger than the rest. The Spaces between the Glands are filled up with Fat, and there are abundance of Vessels that go from one to another. They are all inclosed by the *Membrana carnosa*, and make up as it were an half Globe. They are whiter of Substance in Women than in Brutes. Through these Glands the Milk is separated from the Blood, being nothing but the Chyle issuing out of the left Ventricle of the Heart with the Blood (to which it is not as yet assimilated) and driven hither along the Thoracick Arteries: Unless we will admit *Venæ lacteæ* to come thither, which Opinion we shall examin afterwards. *Glands.*

Upon the middle great Gland standeth the *Papilla* or Nipple, which is round and of a spongy Substance, covered with a very thin Skin, and has many little Holes in it for the Milk to distil out by, when the Child sucketh it. It is of an exquisite Sense, and resembles something the *Glans* of a Man's *Penis*, in that by handling or sucking, it becomes erect or stiff, being otherwise *Papillæ.*

wise commonly flaggy. It is red in Virgins, livid in those that give Suck, and blackish in old Women. All the *Tubuli lactiferi*, or Milk-Conduits end in it.

Its Bigness. It differs in *Bigness*, being as big in some as a Mulberry, in others as a Rasberry, in others less: When Women give Suck, it is longer than at other times.

Use. Its *Use* is to be like a Pipe or Tunnel, through which the Child (taking it in its Mouth) may suck the Milk out of the Breast: And it is of exquisite Sense, that the Milk passing through it, may cause a kind of Titillation, whereby Mothers and Nurses may take the greater Delight and Pleasure to suckle their Infants.

Areola. There is a little Circle that surrounds it, called *Areola*, which in Virgins is pale and knotty; in those that are with Child, or give Suck, brown: and in old Women, black.

Their Vessels. The Breasts have all sorts of Vessels, Veins, Arteries, Nerves, Lymphedu&cts, which are common to them with other Parts; and *Tubuli lactiferi* proper to themselves, and according to some, *Venæ lacteæ*. Of all these in order.

Veins. The *Veins* are of two sorts, for some are *external*, some *internal*. The *external* spring from the *Axillar* Branch, and run only under the Skin which covereth the Breasts, and are called *Thoracicæ superiores*, or the uppermost Breast-Veins. And these are they that look so blue in the Breasts of fine-skin'd Women. The *internal*, called *Mammariæ*, spring from the *Rami subclavii*: They are in Number two, on each side one. These enter in among the Glands of the *Mammæ*, where they send forth a great many Branches; but descending thence by the *Mucronata cartilago*. they pass out of the Breast, and go downward under the *Musculi recti*. When they are come

almost

almost to the Umbilical Region, they are said to be joined by sundry Inosculations with the *Venæ epigastricæ*, which meet them there; though most late Anatomists deny any such Inosculation.

These *Venæ epigastricæ* spring from the external *Ramus iliacus*, and by a streight way pass upward under the aforesaid Muscles. And from the internal Branch of the said *Ramus* spring the *Venæ hypogastricæ*, which are inserted into the Neck and Bottom of the Matrix. Of which in Book I. when we treated of the Womb.

They have the same Number of *Arteries* as *Veins*, and of the same Denomination, *viz. Arteriæ thoracicæ superiores*, which are sent forth from the *Axillar*, and *Arteriæ mammariæ*, in like manner, which spring from the Subclavian, and from the Breasts descend to about the Navel. Whither when they are come, they are said (but erroneously) to be united by Inosculation with the *Arteriæ Epigastricæ* ascending. This Inosculation being rejected, principally, because it is opposite to the Circulation of the Blood, seeing the Blood in the descending Arteries runs a Course directly contrary to that which is contained in the ascending; Dr. *Highmore* suggests, [‘That the Mammary Arteries do not inosculate with the Epigastrick Arteries, but with the Epigastrick Veins, and accordingly the Mammary Veins with the Epigastrick Arteries: Whence supposing (according to the old Opinion) that Milk is made of Blood, he thinks he has found a ready Way whereby the Blood may pass to the Womb in pregnant Women, for the Nourishment of the *Fœtus*, and whereby it may ascend to the Breasts in Nurses. For by the Epigastrick Arteries, he says, Blood is derived from the Iliack Branches, and consequently from the Womb to the Mammary Veins, so

Arteries.

'that that Blood which in those that do not give 'Suck, or are not with Child, uses to stagnate 'about the Vessels of the Womb, or to be eva- 'cuated by the *Menses*, does in those that give 'Suck, ascend by the Epigastrick Arteries to the 'Breasts, which it causes to swell, and is turned 'into Milk: And on the contrary, when the 'Child is weaned, that Blood which used to be 'carried to the Breasts by the Mammary and 'Epigastrick Arteries, is conveyed to the Womb, 'and evacuated Monthly.] And for the Confirmation of his Opinion, in his *Tab.* 17. he gives a Scheme of such Inosculation, as if he had really observed it in his tracing these Vessels. But not to mention, that it is contrary to Truth, that Milk is made of Blood; later Anatomists have wholly rejected any Anastomosis of Veins and Arteries with one another; so that his Hypothesis which is built thereupon, falls to the Ground. As for the true Use of both Veins and Arteries, that shall be shewn by and by, when we come to the *Use* of the Breasts.

erves. They have *Nerves* (according to *Spigelius*) from the fourth vertebral Pair of the *Thorax*, which about the Middle of the Rib, perforating the Intercostal Muscle, is divided into four Branches, which are sent afterward to the pectoral Muscle, and so into the Breasts, the thickest passing to the Nipple. Dr. *Needham* says, that they have several Nerves from the Axillary: And supposes from their many Nerves, that some spirituous Juice is brought unto the Breasts by them, which being mixt with the nutritious Mass, endows it with a nutritive Vertue; or perhaps it supplies a Ferment for the Separation thereof from the Blood. But I believe they serve only for the more exquisite Sensation, that Nurses may take the greater Delight in giving their Children such.

They

They have very many *Lympheducts*. Dr. *Wharton* saith, they are very conspicuous and numerous in the *Ubera* of Cows, but one can hardly trace them into the *Parenchyma*. Wherefore (saith he) 'tis likely that they carry back all the Exhalations resolved into Sweat by help of the Membranes,——which they rather minister to than to the *Parenchyma*. But this is contrary to the now received Opinion, that the Lympheducts receive their *Lympha* only by the Mediation of Glands. *Lympha-ducts.*

Besides these four sorts of Vessels that are common to them, with most other Parts of the Body, they have proper to themselves certain *lactiferous* (or Milk-carrying) *Pipes*, which are the Store-houses wherein the Milk is reserved, and thro' which, as by Conduits, it flows to the Nipple, when the Child sucks. *Bartholin* has observed ten or more of them, full of Milk in Women giving suck, with their outer Ends encompassing the *Papilla* circular-wise, each of which, as they pass farther into the Breasts, are divided into sundry Branches, which end in the Mammary Glands (above spoken of) from whence they bring the Milk, and discharge it through the Pores of the *Papilla*. Dr. *Nuck* observes, that these Pipes, before they arrive at the *Papilla*, are joined one with another by *Anastomoses*, that the Milk which is separated in the *Mammæ*, and stored up in the Pipes, when one or other of them is obstructed, may pass to the *Papilla* by the other Ducts that are open. *Tubuli lactiferi.*

The several Branches of these *Tubuli* amongst the Glands many do take for true Lacteals, and therefore do believe that there are some *Venæ lacteæ*, that conduct the Chyle directly to the *Mammæ*. But from whence those Lacteals have their Origin, is not agreed among the Defenders *Venæ lacteæ.*

of that Opinion. Some affirm them to rise from the Stomach, some from the *Receptaculum Chyli*, some from the *Ductus thoracicus*, and some from the *Womb*. The Truth is, it is no Wonder they should not agree concerning their Rise, seeing the Opinion is grounded more upon rational Conjecture, than ocular Discovery; though some of each of these Opinions have pretended it. For, as was said in the former Book (*Chap.* 32.) discoursing of the *Venæ lacteæ*, their being said to convey the Liquor into the *Amnios*, That that were a plausible Opinion, if such could be demonstrated by Anatomy; so we may say as to their conveying the Chyle to the Breasts, where it comes to be called Milk. But with all due Respect and Deference to the Espousers of this Hypothesis (such as the most learned Sir *George Ent*, *Caspar Martianus*, *Diemerbroeck*, &c.) we must crave Leave to dissent therefrom (with *Steno*, Dr. *Wharton*, Dr. *Needham*, &c.) till there shall be observed more certain Footsteps of such Vessels.

Ductus adiposi. From the great Quantity of Fat that is collected in the Breasts, *Malpighius* contends for another sort of Vessel, besides all the foregoing, namely, *Ductus adiposi*; and believes, that the Fat here has a nobler Use than to fill up the Interstices of the Glands, so as to make the Breasts round and plump, namely, that therefrom issues at least all the buttery Part of the Milk. It cannot be denied, but that Fat and Butter are very much of the same Nature; but it seems not so probable, that Nature should separate the oily or fatty Particles from the Chyle, to the end only that they may be mixed with the same again, and so issue under one Form out of the Body; but granting that the same Matter out of which Fat is generated, is an Ingredient in the milky Mass, I am inclin'd to believe, that both the serous, caseous, and

and butyrous Particles of the Milk continue in one another's Embraces, thro' all the Ways by which they pass, from their first Entrance into the *Lacteæ*, to their *Exit* by the *Papilla*.

The *Use* of the Breasts in Women is to prepare or separate Milk for the Nourishment of the Child. Which how it is done, we shall shew in as few Words as may be. *The Use of the Mammæ.*

It was an old Opinion, that Milk was made of Blood, sent from the Womb by the Epigastrick Vessels ascending, and, as was thought, inosculating with those Branches of the *Mammariæ* that descend towards the Navel. But as later Anatomists have found those Anastomoses only imaginary (invented to serve an Hypothesis) so it is generally denied, that Blood, either sent from the Womb, or from wheresoever, is the true Matter out of which Milk is made. For not to mention (which yet is very considerable) that it is incredible that the Mother could every Day endure the Loss of so much Blood (suppose a Pound and half) as the Child sucks daily Milk from the Breasts; I think the Argument urged by Dr. *Wharton* may satisfy any Man, *viz.* ['Nature does 'nothing in vain; she goes not forward and 'backward by the same Path. But if she make 'Blood of Chyle (*which is certain*) and then make 'Chyle of Blood again, she goes so. For Chyle 'is a sort of Milk, as appears by the opening of 'the lacteal Veins. If therefore that Chyle be 'first excocted into Blood, and then return again 'to the nature of Milk, Nature should certainly 'frustrate her first Work.] We shall not therefore spend farther time to refute so improbable (and now obsolete) an Opinion; but shall avow, that Chyle is the true Matter out of which Milk is made, which is done after this Manner.

How Milk is made. The Chyle being received into the common Receptacle from the *Venæ lacteæ* of the Mesentery, ascends up by the *Ductus Thoracicus*, and by it is conveyed into the subclavian Veins, where it is mixed with the Blood, and from whence it is circulated with it through the Ventricles of the Heart. And when it comes out of the left Ventricle by the *Aorta*, a good part of it (as yet not assimilated to the Blood) is sent to the Breasts by the Mammary and Thoracick Arteries, whose Capillaries are inserted into the Glands, through which it is strained or filtrated into the *Tubuli lactiferi*, even as the *Serum* of the Blood is separated from *it* by the Glands of the Kidneys into their *Tubuli* or *Siphons*. And as those *Siphons* of the Kidneys carry the *Serum* into the *Pelvis*, so do these of the *Mammæ*, the Milk into the common Duct of the Nipple. As for the Blood that came along with the Chyle to the Glands, that returns back again into the Subclavian and Axillar Veins, and so to the Heart.

Besides this Matter of the Milk (*viz.* Chyle) Dr. *Wharton* (suitable to his Hypothesis of the *Succus nutritius* of the Nerves) thinks, that the Nerves contribute their Share, which he calls Spermatick, for the Nourishment and Encrease of the Spermatick Parts of the Child. But if it should be supposed that the Nerves have such *Succus* in them (which we do not believe) what Weakness must it needs induce upon the Mother to have so much of it (with the Animal Spirits) daily drain'd out of them? Whereas we see that many Women are more chearful and healthful when they give suck, than at other times. We cannot therefore consent to that Opinion.

And here a most difficult Question may arise, Why the Chyle (whether it be brought by some *Venæ lacteæ*, or by the Arteries) flows only to the

the Breasts at some certain times, and not always, seeing the Vessels that carry it are not obliterated, nor it self exhausted?

Why it flows to the Breasts at some times only.

They that taught, that the Milk was made of Blood, and that that Blood was derived from the Womb, by the Hypogastrick Vessels into the Epigastrick, which latter they believed to inosculate with the Mammary; these, I say, deriving the Milk from the Menstrual Blood, as its Matter out of which it is made, thought that the stopping of the *Menses* (as commonly happens to Nurses, unless very plethorick) occasion'd the Regurgitation of the Blood by the said Vessels up to the Breasts, where so free a Vent was found for it, after it was first changed into Milk by their Glandules. They assigned the same Blood for the Nourishment of the *Fœtus* in the Womb, and thought that after the Birth it ascended up to the Breasts. But having in the former Book (*Ch.* 33.) shewn that the *Fœtus* is not nourished at all by the Mother's Blood, as also in this Chapter that Milk is not made of it, we need not (though it were easy to) shew how ill this Hypothesis would satisfy the Question, if Blood should be supposed the Matter out of which Milk is made. And indeed it is far easier to invalidate the Reasons that have been urged for it, than to draw any from the new that are more satisfactory. So that as above in (*Book* I.) discoursing of the Manner and Matter of the nourishing the *Fœtus* in the Womb, we scrupled not to expose our selves to the Smiles of our so over-sagacious *Virtuosi*, in resolving all into the wise Disposal of the Creator; so we shall not be ashamed to profess our (I think invincible) Ignorance here also, without giving this Question any other Resolution, than that it is so, because Providence has order'd it so to be. However, we will not

omit to give *Diemerbroeck*'s Opinion, which if it cannot satisfy, may for its Ingeniousness delight.

['The Cause of it (says he) is a *strong Imagination*, or an intense and often thinking of Milk, Breasts, and their Suction, which worketh wonderful things in our Bodies; not indeed simply of it self, but by Mediation of the appetitive Power, or of the Passions of the Mind, which induce various Motions on the Spirits and Humours. So the Imagination and thinking of a great Danger, maketh a Man tremble, fall, be cold, fall into a Swoon; yea, hath sometimes turned his Hair grey in a short time: The Imagination of a joyful Matter, causeth Heat and Animosity of the Body; thinking on a shameful thing, or a View of it, causeth Blushing; thinking on a terrible thing, Paleness; on a sad thing, Cold: Lustful Thoughts make the Body hot, relax the strict Genitals of Women, erect the *Penis*, and do so open the seminary ways that are otherwise invisible, that Seed issueth out of its own Accord in involuntary or nocturnal Pollution. The same intense Imagination (*adds he*) and a desirous Cogitation of suckling the Infant, is the Cause that the Chyliferous Vessels (*by which he means* Venæ lacteæ *properly so called*) are loosened and opened towards the Breasts, especially if some outward Causes tending that way favour and further incite that strong Imagination, as wanton handling of the Breasts, the moving of the *Fœtus* in the Womb, the sucking of the *Papilla*, &c. For according to the different Influx of the Animal Spirits, the Parts are sometimes straitned, sometimes relaxed, as every one knows; and according to that different Constriction or Relaxation, the Blood, and other impelled Humours flow sometimes more, sometimes

'times less into the Parts, and sometimes beget 'Heat, Softness, Redness; sometimes Constri-'ction, Cold, and Paleness. Amongst these im-'pelled Humours is the Chyle, *&c.*——] To confirm this Opinion, he gives several Instances wherein nothing but Imagination could move the Chyle to tend to the Breasts. His first is that known Story of *Santorellus*; ['That a poor 'Man's Wife dying, and not having Means e-'nough to hire a Nurse for the Infant she had 'left behind her, he used (to still it a little) 'often to lay it to his Paps (without doubt '(says *Diemerbroeck*) with a great desire to yield 'it some Milk) and so at length by that intense 'and continual Thought, and often repeated 'Sucking of the *Papilla*, his Breasts afforded 'Milk enough for the suckling the Infant.] (which by the way, seems to make much against his Opinion of the Chyle's being conveyed to the *Mammæ*, by the *Venæ lacteæ*; for seeing Men, according to Nature, give no Suck, to what purpose should *Venæ lacteæ* be distributed to their *Mammillæ*? And yet here is an Instance of a Man's giving suck, and therefore the Chyle is more likely to be brought by the Arteries, which Men have as well as Women; unless we will grant that Force to Imagination, to make *Venæ lacteæ*, as well as to send the Chyle by them, which would be an equal Force of Imagination to imagine. But to proceed: He tells another Story of an old Woman that came to give suck; and he delivers it with such Circumstances, as may create a Belief of the Truth of it.

'At *Vyanen*, a Town not far from us (*viz.* 'from *Utrecht*, in which Province it is) about 'thirty Years ago, there was an Hostess that kept 'the Boar's-Head Inn without the Gate, who 'was brought to Bed a little after her Husband's

'Death,

'Death, and died in Child-bed, or very soon 'after, leaving a healthful Child behind her; 'and having left very little Estate, her Mother, 'whose Name was *Joan Vuyltuyt*, being also poor, 'and not able to put it out to Nurse, yet had 'such Pity on her Daughter's Child, as to un-'dertake to Nurse it; and she was now three-'score and six Years old. Now having some-'times used with the greatest Commiseration, 'to hold it to her Breasts when it cried, and of-'fered it the Nipple to suck; by that strong I-'magination and desirous Cogitation of nursing 'the Infant, her Breasts begun to give Milk, and 'that in a few Days so plentifully, as was abun-'dantly sufficient to feed the Child, so that it 'had scarce any need of other Sustenance: And 'so to the Admiration of all, the Infant was 'well nourished with the Milk of this old Wo-'man, whose Breasts for many Years had been 'wither'd and flaggy, but now became plump 'and full like a young Woman's. There are 'many still alive in that City that remember the 'thing very well.] I confess the Story is very odd, but whether to be resolved into the Force of Imagination, I leave the Curious to meditate. However, he very plausibly answers several Objections that may be made against it, which it will be worth the while for the Latin Reader to peruse in his *Anat. corp. human. lib.* 2. *cap.* 2. *p.* 409, 411, *&c.*

The two other *external* proper containing Parts of the *Thorax*, are the *Muscles* and the *Bones*. But of these we shall omit the Description here, having thought it more convenient to treat of all the *Muscles*, and all the *Bones* of the whole Body in two distinct Books, *viz.* of the *Muscles* in the *fifth*, and of the *Bones* in the *sixth*: And as for these of the *Thorax* in particular, the *Muscles* are de-

described in *Chap.* 15. of *Book* V. and the *Bones*, in *Chap.* 11, 12, 13. of *Book* VI.

CHAP. III.

Of the internal proper containing Parts, viz. *The* Pleura, Mediastinum, *and* Diaphragm.

THE *internal* proper containing Parts are in Number three, the *Pleura*, the *Mediastinum* (with the *Thymus* growing to it) and the *Diaphragm*.

The *Pleura* hath its Denomination from the Ribs, which it cloaths on their inside (for a Rib is in Greek called πλευρὰ,) and so it may be termed in English the *Costal Membrane*. Pleura.

It is membranous, white, thin, and hard, resembling the *Peritonæum*, and lining all the Cavity of the *Thorax*. *Its Substance.*

Spigelius de human. corp. fabr. lib. IX. *cap.* 3. will have it to be thicker and stronger than the *Peritonæum*, contrary to the Opinion of *Riolanus*, who affirmeth the *Peritonæum* to be the thicker and stronger, because it is appointed for sustaining the Weight of the Guts.

It consists of a double Membrane, of which the inner, or that next the Cavity, is thickest. This is smooth on its Inside, and bedewed with a watery Humour, that the Lungs might play against it without any Prejudice. Sometimes on one side, and sometimes on both, it sends forth (on its Inside) certain nervous Fibres (even in healthful Persons) which being inserted into the investing Membrane of the Lungs, do so fix them in their Place, as to hinder that liberty of Ascent and Descent in Respiration, which is natural to them, and yet many times without any notable *Parts.*

Injury

Injury to their Breathing: Tho' sometimes (as *Spigelius* has observed) they tie the Lungs so very close to the Sides, as to cause a continual and incurable *Dyspnœa*. As to that wateriſh Humour that bedews the inside of this Membrane, it seems to proceed from Vapours raised from the Blood, and condensed by the (comparative) coldness of this Membrane. The outer Membrane is thinner, and rough on its outer Surface, that it might cleave the more firmly to the Ribs and Muscles, by the Intervention of their proper Membrane.

Figure. As for its *Figure*, without, it is arched; within, hollow; above, it is narrower; below, broader, being chiefly widened side-ways.

Holes. Above, it is perforated in six or seven Places, to give way to the *Vena cava* descending, and the *Aorta* ascending, the *Gula*, the Wind-pipe, Lacteals, Lympheducts, and Nerves. Below, where it covereth the Midriff, it is perforated in three Places, to give way to the *Vena cava* ascending, and the *Aorta* descending, as also to the *Gula*.

Rise. It is said to have its *Rise* from the Membranes covering the *Spinalis Medulla*: However, it adheres very close to the *Vertebræ* of the Back, from whence it comes forward on each Hand by the Sides to the Breast-bone, under which the Membranes of each side are joined together, and so becoming double, it goes back again streight from the middle of the Breast to the Back, dividing the Cavity of the *Thorax* into two parts, like a Partition-Wall and one Lobe of the Lungs from the other; and this is called *Mediastinum*, of which by and by.

Veins. Its *Veins* spring from the superior Intercostal Branch, and from the *Vena sine pari*.

Arteries. The *Arteries* in like manner, proceed from the superior

ſuperior Intercoſtals (which ariſe from the Subclavian) and theſe deſcend to about the fourth Rib, below which it has its Arteries from the hinder part of the *Aorta* deſcending.

It hath *Nerves* from twelve vertebral Pair, *viz.* from all the Pairs of the *Thorax*; for from betwixt each of the twelve *Vertebræ* of the Back, there ſprings a Pair of Nerves, and each is immediately divided into the *fore* and *hinder Branches*. The *fore-Branches* are they which ſerve the Intercoſtal Muſcles, external and internal, and alſo the *Pleura*. As for the *hinder*, they are beſtowed upon the Muſcles which lie on the Back, *&c.* *Nerves.*

The Veins and Arteries, according to *Spigelius*, run between the two Membranes of the *Pleura*, and therefore he thinks, that when an Inflammation of the *Pleura* (called a Pleuriſy) Impoſthumates, the Matter is rather gathered betwixt its Membranes, than betwixt the Intercoſtal Muſcles and it.

The ſecond *internal* proper containing Part, is the *Mediaſtinum*: ſo called, becauſe it ſtandeth in the middle of the Breaſt, and divideth its Cavity into two Partitions, *viz.* a right and left. *Of the* Mediaſtinum.

It ſpringeth from the Membranes of the *Pleura*, meeting at the *Sternum* (as was ſaid before;) ſo that at its Riſe it conſiſts of four Membranes, becauſe the *Pleura* of the Duplicature whereof it is made, conſiſts of two. But as the *Mediaſtinum* tends from the *Sternum* through the middle of the *Thorax* towards the Back, its duplicated Membranes are ſo ſevered, that the Heart with its *Pericardium* are contained in the Cavity that is formed by their Separation. Yet when they arrive near the Back, they join one to another again as cloſe as they did at the Breaſt, though they preſently part again (ſaith *Diemerbroeck*) and make another narrower Cavity, but as long, *Its Riſe.*

for

for the Gullet, *&c.* to descend by. Some have formerly imagin'd a third Cavity, at its Origin, under the *Sternum*, as in particular Dr. *Highmore*, who says, the Interstice betwixt the Membranes is large, and yet (he says) the are knit to one another by certain Fibres. In this Cavity he thinks there are thick Vapours and *Flatus* sometimes contain'd, which cause very acute Pains there, by retching the Membranes and violating the Fibres that knit them together. But in Truth there is no such Cavity, nor consequently any such Vapours, or Pain depending thereupon. For tho' indeed, if the Dissection be begun at the *Sternum*, when one has pull'd it off from the *Mediastinum*, one would think, at first Sight, that there were as great a Distance betwixt the Membranes of the *Mediastinum*, as the *Sternum* is broad; yet if one begin the Section at the Back, and loose the Ribs there, and so come to the *Sternum*, he will see the *Pleura* doubled, knit close to the *Sternum* without any Cavity.

Substance. The *Substance* of it is like that of the *Pleura*, from which it springs; only where it is parted, it is thinner and softer than the *Pleura*. The outter side towards the Lungs is smooth, but the interior is rough, by Reason of the Fibres whereby it adheres to the *Pericardium* in some Places, and by which its own two Membranes at their Meeting are united. It is sometimes pretty well stored with Fat, especially about its Vessels, somewhat like the Caul in the *Abdomen*.

Veins. Arteries. As for its Vessels: *Veins* and *Arteries* it hath from those called *Mammariæ internæ*; but small; and *Veins* besides from *Vena sine pari*.

It hath moreover one special *Vein*, called *Mediastina*, which springeth from the lower Side of the *Ramus subclavius*.

Nerves. The *Nerves*, called *Phrenici*, and *Stomachici*, springing

ſpringing from the ſixth Pair (Dr. *Willis*'s eighth) deſcend betwixt its Membranes, and ſend forth ſmall Twigs into it.

Bartholin ſays, it has *Lympheducts*, which riſing here and there in many Rivulets, enter the *Ductus thoracicus* at laſt in one Channel. Theſe (he ſays) imbibe the Water that is condenſed betwixt its Duplicature, and convey it into the ſaid Duct. *Lympheducts.*

It hath three *Uſes*: *Firſt*, It divideth the Breaſt and Lungs into two Parts, that one Part being wounded, or any way hurt, the other might perform the Office of Reſpiration. *Uſe.*

Secondly, It holdeth up the Heart incloſed in the *Pericardium*, ſo that it may not reſt upon the Back-bone, when we lie upon our Back; or fall upon the Breaſt-bone, when we bend ourſelves towards the Ground; or touch the Ribs, when we lie upon our Sides.

Thirdly, It giveth a ſafe Paſſage to the Veſſels which paſs by it, and holdeth up the Diaphragm, ſo that it is not pulled too much down by the Weight of the Bowels that hang by it, *viz.* the Liver and the Stomach.

To the upper part of the *Mediaſtinum* at the Throat, there groweth a glandulous Body, called *Thymus*, ſeated between the Diviſions of the Subclavian Veins and Arteries. It is a whitiſh, (but lightly tinctur'd with Blood) ſoft ſpongy Body, (in ſhape reſembling a Thyme-Leaf, from which it has its Name) It is larger in Children and Women than in Men. In Infants it conſiſts of three Glands, and is in Subſtance ſomething like the Sweet-bread (and in Calves we call it ſo,) but in adult Perſons, it dries up and contracts into one continued Subſtance. It has no proper Duct, whereby any thing is conveyed into any peculiar Cavity, and therefore it is to be reputed in the Number of conglobate Glands. Thymus.

The

Its Veſſels. The Jugular *Veins* and *Arteries* paſs through it as they go up to the Neck, but if they ſend forth any Twigs into it, they are ſo ſmall as not to be diſcover'd in diſſecting it. Dr. *Wharton* ſays, it has Nerves from the ſixth Pair (Dr. *Willis*'s eighth) and from the Subclavian *Plexus*, which depoſit their *Succus nutritius* in it, whoſe ſuperfluous or impurer Parts are ſeparated from it in this Gland, and conveyed away by the Lympheducts, and the refined Liquor is reſumed by the Nerves diſperſed in it, for the Uſe of the nervous parts of the whole Body. And becauſe he foreſaw how open this Opinion (which himſelf calls *ſcrupoſa Sententia*) lay to the Objection, that it is very improbable, that the Nerves ſhould bring the *Succus nutritius* to this Part, and after Depuration ſhould reſorb it; he anſwers, that either the Nerves muſt do it, or it cannot be done at all, ſeeing there are no other Veſſels fit for the reſuming of it. But he had better have ſuſpected his ſuppoſed Office of the *Thymus*, when he ſaw himſelf ſo hard ſet to maintain it. For it is more probable, that when there is found any whitiſh Liquor in it (as there is in Infants and in Calves, *&c.*) that Liquor is Chyle, which is brought thither by Lacteals, and deſcends from thence into the Subclavian Veins; ſeeing if one kill a Calf about two Hours after it has been plentifully ſuckled, the *Thymus* abounds with this Juice, as *Diemerbroeck* affirms; who alſo denies that there are any perceptible Nerves inſerted into it, but grants Lympheducts, which empty themſelves into the Subclavian Vein.

Uſe. Its *Uſe* are, Firſt, To prop and ſtrengthen the Diviſions of the Veſſels, namely, of the *Vena cava* and aſcending *Aorta*; and, Secondly, To defend them from Compreſſion by the *Claviculæ*, in ſtooping forward. In adult Perſons it ſeems to be

be of little other Use; but in Infants, in whom it is larger, and has Liquor like Chyle in it, it seems to contribute something towards the refining or Depuration of it.

Verheyen ascribes two more Uses to it; *viz.* 1. to be a *Diverticulum* (or short Lodging) for the Chyle coming too plentifully by the thoracick Duct, lest it should be mixed all at once as it were with the Blood. For the Heat and Motion of the Blood in Infancy is very weak, and so easily suffocable by a great Plenty of Chyle; and in the mean time the Aliment of the Infant is very fluid, and as it were before-hand chylified in the Body of the Mother, which therefore stays not long in its Stomach, but quickly passes by the Lacteal Veins to the thoracick Duct; whence one may suspect, that the weak Fermentation of the Blood would be hurt by the Abundance of the Chyle, unless its hasty Motion were retarded.

Now, says he, a certain Portion of the Chyle may be brought to the *Thymus* by the Branches of the thoracick Duct, and perhaps, when the Chyle has ceas'd coming, by the same Branches, it may regurgitate into the Duct it self, or be poured leisurely by a small Passage into the Subclavian Vein.

And because the said Reason ceases in those who are fed with more solid Aliments and whose Blood is hotter, and more strongly fermented, therefore in them the *Thymus* is contracted and extenuated.

2. Another Use he suggests, is, that perhaps it may separate that Humour that is contained in the *Pericardium*.

The third and last *internal* proper containing part is the *Midriff* or *Diaphragm* (derived ἀπὸ τῦ διαφράττειν, *to distinguish*, because it divides the Trunk of the Body into two Ventricles, the *Abdomen*

The Diaphragm.

domen and *Thorax.*) It is also called φρὴν, or φρένες, the *Mind*, because when it is enflam'd, or otherwise much distempered, the Mind and Senses are disturbed, through the great Consent it has with the Brain, as being a very nervous Part. The Latins call it *Septum transversum*, for the same Reason as the Greeks call it *Diaphragma.*

Now this Part being truly Muscular, and assisting Respiration, we might on that Account have deferred to treat of it, till we come to describe the Muscles of the *Thorax*: But because it is wholly an internal Part, and serves to compose the Cavity of the Breast, we rather chuse to discourse of it here, and omit it in the Treatise of Muscles.

Its Figure and Situation. It is almost round (excepting its two Appendages, whereby it is fastened to the *Vertebræ* of the Back and Loins) and is seated transversly, or across the Body, only sloping a little backwards. It is as broad as the Width of the *Thorax*, for its Edges are fastened to the lower Part of the *Sternum*, to the Ends of the lowest Ribs, and to the lowest *Vertebra* of the *Thorax.*

Substance. Its *Substance*, as was said but now, is muscular, consisting of carnous and tendinous Fibres, like other Muscles. But whereas it has constantly been described by all former Anatomists as one Muscle, *Casper Bartholin* has demonstrated it to consist of two, an upper and a lower (or a fore and an hinder) to which Discovery he was partly directed by *Steno*'s Observations, who first question'd the generally supposed Fabrick of this Part.

It consists of two Muscles. I say, it consists of two Muscles, an *upper* and a *lower*; which are thus described by the aforesaid Author:

['The *upper* Muscle by one End (*viz.* its 'Head) adheres circular-wise to the Ribs, and

'to

'to the *Appendix* of the *Sternum*; the other paſ-
ſeth into the *Tendon*, which makes the *nervous*
'*Centre* of the *Diaphragm* (as they call it) and is
'ſpent on (or continued unto) the Fleſh of the
'lower Muſcle, and ſo the whole Midriff be-
'comes like one Digaſtrick, or double-bellied
'Muſcle.] Nay, the ſaid Author makes it a tri-
'gaſtrick one, inaſmuch as he has obſerved (in
'*Oxen*) that the fore-part of the upper Muſcle
'ſhoots forth a Tendon to every baſtard Rib, on
'each ſide the *Sternum*, to which Ribs the upper
'part of the tranſverſe Muſcles of the lower
'Belly alſo adheres, ſo that he thinks they are
continued one into the other. Of what Uſe he
makes this Union, ſhall be ſhewed in *Book* V.
Chap. 17. *Of the Muſcles of the* Abdomen.

['The *lower* ſprings from the *Vertebræ* of the
'Loins, and neither proceeds from the other,
'nor touches it, but by the Mediation of the
'Tendon (for though the Fibres of each Muſ-
'cle ſeem ſometimes to mix a little one with ano-
'ther on the under ſide, yet that is only by Me-
'diation of each of their Tendons.) Thoſe two
'*Appendices* (as they are called) of this lower
'Muſcle, whereby it adheres to the *Vertebræ*,
'have by all Anatomiſts been repreſented as if
'they were of the ſame Length; whereas indeed
'they are not ſo; for the right is both longer
'than the left, and very much exceeds it in the
'Number of carnous and tendinous Fibres. Yea
'the right ariſes from (or rather terminates into)
'the firſt, ſecond and third *Vertebræ* of the Loins,
'as from ſo many Heads; whereas the left ad-
'heres to the laſt, and laſt but one of the Back.

As to the Courſe of the *Fibres* of both theſe Muſcles, becauſe they are better apprehended by the View, than they can be by the Deſcription, I ſhall wave this latter, and content my ſelf with

exhibiting to the Eye of the Reader a Scheme of these Muscles, in *Tab.* 13. *Fig.* 2, & 3. from the said Author.

Membranes. The upper side of the Midriff is cloathed with the *Pleura*; and its lower with the *Peritonæum*. To the upper Membrane the *Mediastinum* and *Pericardium* are knit; and sometimes the lowest Tips of the Lobes of the Lungs, but that Connexion is preternatural.

Holes. It is perforated on the right Hand, in or near the Nervous Center, by the Trunk of *Vena cava*, ascending from the Liver; and on the left Hand, a little more backwards, its lower Muscle in its upper or fore-part (before it is become tendinous) is perforated by the Gullet and two Stomachick Nerves springing from the *par vagum*. At which latter Perforation, the Fabrick of the Diaphragm is remarkable; for there (as you may see in the aforesaid Figures) the Fibres which are next to the upper Orifice of the Stomach, run not streight as in other Parts of it, but crooked like a Bow, encompassing the said Orifice, and by their Contraction so constringing it, that the continual Motion of the Diaphragm causes no Regurgitation of any thing out of the Stomach, nor is the Ascent even of Vapour permitted, except when it is violently burst open by Belching or Vomiting. In the hinder Part of this lower Muscle, *viz.* betwixt its two Appendages or Productions, whereby it is knit to the *Vertebræ*, there descend the *Aorta*, a Branch of the *Vena azygos*, and the Intercostal Nerve (distinguish'd from the *par vagum* by Dr. *Willis*) for the Use of the Parts of the *Abdomen*.

Vessels. It has been said to have two *Arteries*, called *Phrenicæ*, from the *Aorta* descending, and as many *Veins* from the Trunk of *Vena cava* ascending through it. But the above-mentioned *Bartholin* says,

ſays, that the lower Muſcle has peculiar Blood-Veſſels. ['For beſides thoſe Veins that ſpring 'from the *Cava* (which provide for the upper 'Muſcle, and middle Part of the lower) this 'lower has on each ſide peculiar and notable 'ones, which ariſe from the *Vena adipoſa*, to which 'as many Arteries anſwer in like manner, ſpring-'ing from the *Lumbares*, yet at a different Ori-'gin from thoſe other that accompany the a-'bove-mentioned Veins that ſpring from the '*Cava*.] *Verheyen* ſays, ['It has (beſides theſe) 'two little Veins, and as many ſmall Arteries from 'above, deſcribed by no Body before himſelf. 'The Veins ſpring on each ſide from the Begin-'ning of the Subclavian, as alſo the right Artery '(but he has not diſcover'd the Riſe of the left 'Artery ſo well) and in their Deſcent they do 'here and there beſtow certain Twigs on the *Pe-'ricardium* and *Mediaſtinum*, whereinto they are 'immerſed; and at length entring the Diaphragm 'they are oft inoſculated with the former Veins 'and Arteries.] It has a peculiar *Nerve*, which 'ſprings from the *brachial Nerves*, with a double or triple Root; namely, two or three Slips, proceed-ing from the aforeſaid Nerves, grow into one Trunk, which is the *Nerve* of the *Diaphragm*. The firſt and chiefeſt Slip is produced from the ſecond vertebral Nerve: And the Trunk that is made up of all the three, deſcends down the Neck, and through the Cavity of the *Thorax*, without any Ramification, as far as the Midriff, where being divided again into two or three Slips, on each ſide it is inſerted into its fleſhy or muſcular Part. Now becauſe the Intercoſtal Pair, according to Dr. *Willis*, has Communication with the Verte-bral, from whence this Nerve of the Diaphragm ſpringeth, yea, with this Nerve it ſelf (for he ſays, that two or three Nerves are ſent from the

cervical *Plexus* of the Intercoſtal into the Trunk it ſelf of the Nerve of the Diaphragm) that learned Author very ingeniouſly gives a Reaſon of the great Conſent of the Midriff with the Heart, Brain and Face, when a Man laughs. ['For, *ſays he*, as often as the Imagination is affected 'with ſome pleaſant or wonderful Conceit, the 'Heart would preſently fain triumph (*ovare*) 'and be lighten'd by throwing off its Burthen, as 'it were: Wherefore, that the Blood may the 'quicklier be emptied out of its right Ventricle 'into the Lungs, and conſequently out of the 'left into the *Aorta*, the Diaphragm being inſti-'gated by the Nerves that go to it from the 'aboveſaid *Plexus*, is drawn upwards with a 'more rapid *Syſtole*, and often repeating its 'Jumps, as it were, it bears up the Lungs, and 'cauſes them the quicker and frequenter to diſ-'charge the Air and Blood: And then inaſmuch 'as the ſame Intercoſtal Nerve, that communi-'cates below with the Nerve of the Diaphragm, 'is alſo continued above with the Maxillar 'Nerves, when a Cackling is begun in the 'Breaſt, the Geſtures of the Mouth and Face pa-'thetically anſwer thereto.] And when the Diaphragm is wounded in its nervous Part, then the Muſcles of the Face ſuffer Convulſions, and the Laughter, called *Riſus Sardonicus* (which is involuntary) is cauſed. Beſides the aboveſaid peculiar Nerve, it has, *Secondly*, ſmall Twigs from the Stomachick Nerves and Intercoſtal, as they deſcend through it.

Uſe. Its *Uſe* is, *Firſt*, to divide the *Thorax* from the *Abdomen*, that noiſom and impure Vapours may not aſcend from the more ignoble Parts (as the Guts) to offend the more noble (as the Heart, *&c.*) *Secondly*, To help the Muſcles of the *Abdomen* in excluding the Excrements, and (in Women)

men) the *Fœtus*. But, *Thirdly*, Its chief Use is to assist Respiration, in which as * *Steno* observes, [‘ It self rather becomes less Convex than its Com- ‘ pass contracted. For, *says he*, all the Lines which ‘ you please to conceive from the *Vertebræ*, to ‘ the rest of its Circumference, both when it is ‘ relaxed, and when it is stretched out and be- ‘ comes stiff, are crooked in some part of them, ‘ looking towards the *Thorax* with their Convex ‘ Side, and towards the *Abdomen* with their Con- ‘ cave. These Lines, the less they are extended, ‘ the more convex they are; whereby the *Abdo- ‘ men* is so much the larger, and the *Thorax* the ‘ straiter; and the more they are contracted, by ‘ so much the Surface of the Diaphragm is the ‘ less convex, whereby the *Thorax* is so much the ‘ larger, and the *Abdomen* the straiter: And so ‘ the Bottom of the *Thorax* (*viz.* the Diaphragm) ‘ in Inspiration is more depressed, but in Expi- ‘ ration ascends.] Thus far *Steno*, to whom (the often-mentioned) *Bartholin* assents, who says, [‘ That its first Motion is performed down- ‘ wards, which the Lungs following, draw in ‘ the Air; and by and by it is moved upward, ‘ whence the Lungs being compressed, the Air, ‘ with the Vapours that are mix'd with it, are ‘ excluded. So that from a convex Laxity it ‘ comes to Plainness (in Inspiration) but is not ‘ at all extended. Notwithstanding in Expira- ‘ tion (which *Diemerbroeck* has well observed) ‘ it is first of all stretched as it were with Vio- ‘ lence, but it is presently relaxed again, and by ‘ drawing the Ribs together with that Tension, ‘ it begins Expiration with some Force; and ‘ then the Ribs following it, its Tension pre- ‘ sently ceases, and it becomes lax. Which Pro- ‘ cedure *Diemerbroeck* illustrates with a pretty

* De Musc. & Gland. p. 11, 12.

'and pat Similitude, when he affirms it to be 'done in the ſame manner as when Bells are 'rung with long Ropes; in which Action the 'Rope is firſt ſtretch'd with Violence; but be-'cauſe the Bell doth preſently follow that Vio-'lence, hence the Rope forthwith becomes lax, 'until the Bell being turn'd about to the other 'ſide, the Ringer does again ſtretch the Rope 'with the like Violence, and draw it back a-'gain.] At length *Bartholin* concludes, ['When 'the Diaphragm is compreſſed into the *Abdo-'men* (in Inſpiration) the *Thorax* is elevated, 'otherwiſe than others think, who ſuppoſe the 'Depreſſion of the Diaphragm to cauſe a De-'preſſion of the *Thorax*. But in Expiration, the 'Diaphragm being driven upwards, the Breaſt 'is contracted; the Breaſt being contracted, 'preſſes the included Air, the Air the Surface of 'the Lungs, that the Air may be driven from 'the *Veſiculæ* into the Branches of the *Trachea*, 'whither as ſoon as it come, the Rings of the '*Trachea* are contracted by the intermediate 'Fibres, and drive forth all the Air; and on 'this manner doth Reſpiration proceed; all the 'Cells of the Lungs being filled again by and 'by in Inſpiration.

The Nature of its Motion.

Its *Motion* ſeems to be a kind of mixt Motion, but rather *Animal* than *Natural*; for though we move it in our Sleep, and ſo it may ſeem natural; yet ſeeing when we awake we can ſtop, ſlacken, or haſten its Motion as we pleaſe, it ſeems to be voluntary or animal.

And thus much of the Parts *containing*, now to the Parts *contained*.

CHAP.

CHAP. IV.

Of the Pericardium, *and the Humour contained in it.*

THE *Parts contained* are either *Viscera* or *Vasa*, Bowels or Vessels.

The Bowels are the *Heart* and *Lungs*. But the Heart being enclosed in a membranous Cover, called *Pericardium*, we will first treat of it, in this Chapter. Pericardium.

It is called *Pericardium*, because it is placed, περὶ τὴν καρδίαν, *about the Heart*. It is called also *Capsula cordis*, the Heart-case; and *Involucrum*, the Cover, *&c.* *Its Name.*

It consists of two Membranes; the inner seems to have its Origin from the Coats that cloath the common Vessels of the Heart; and the outer from the *Mediastinum*. It encompasseth the whole Heart, whose Shape it therefore resembles, but is larger, both to grant a free Motion to the Heart, and to contain its proper Liquor. *Substance and Figure*

It has *five Holes*, according to the Number of Vessels that go in or out of the Heart. As first, one made by the ascending Trunk of the *Cava*, another by the descending, both which enter the right Ventricle of the Heart, from whence there goes out *Vena arteriosa* into the Lungs, which makes a third Hole. A fourth is made by the *Arteria venosa*, entring the left Ventricle of the Heart; and a Fifth, by the *Arteria magna* going out of the same. *Holes.*

Its outside *adheres* to the *Mediastinum* by many Fibres, and is continued to it at the Basis of the Heart, where the Vessels perforate it. Its lower End is knit firmly to the Center or nervous Part of the Diaphragm (which *Bartholin* says) is peculiar to Men, for in all other Creatures it hangs loose. *Connexion.*

It

Veſſels. It has *Veins* below from the *Phrenicæ*, above from the *Axillares*. Its Arteries are ſo exceeding ſmall, that ſome have almoſt denied it to have any; but Dr. *Ruyſch* ſays, [‘That in Bodies he ‘had kept above two Years, he has ſhewed them ‘as plain as any thing can be ſeen in the Body, ‘and that there are very few, if any, membra- ‘nous Parts that are furniſh'd with greater ‘plenty of *Arteries*.] See his Anſwer to *Gaubius*'s ſecond Letter, where he deſcribes them as derived from four or five ſeveral Origins. It receives *Nerves* from the eighth Pair (heretofore reckon'd for the ſixth.) Dr. *Willis* ſays, [‘It ‘has a great many Twigs of Nerves from that ‘*Plexus* of the *par vagum* that is overagainſt the ‘firſt or ſecond Rib, and that it has ſo many for ‘this Reaſon, *viz.* That ſeeing it is appointed ‘for a Defence to the Heart, as often as any ‘offenſive Matter invades or beſets it (ſelf) it ‘may be able to contract itſelf, and ſhake off its ‘Enemy; for it is likely that *Tremors* and *inordi- ‘nate Vibrations* of the Heart, which in truth do ‘manifeſtly differ from its *natural Pulſe*, do pro- ‘ceed from the violent Succuſſion of this Mem- ‘brane.] *Bartholin* affirms it to have *Lymphe-ducts* alſo: which is very probable; that they may abſorb part of the Liquor contained in it, leſt it abound too much, ſeeing it receives continual ſupply; for I am not of Opinion that this Liquor is ſpued out of the Lymphe-ducts, as *Steno* thinks, but that they rather imbibe it, and convey it to the *Ductus thoracicus*.

Its Liquor. It contains in it a *ſerous Liquor*, that in healthful Bodies is a little reddiſh, much like Water wherein Fleſh has been waſh'd. It is bred of Vapours exhaling from the Heart, which are ſtopt by this denſe Membrane, and condenſed into Humour. Dr. *Lower* oppoſing this Opinion, brings for

for Argument, that if it were collected this way, because it would be continually a gathering, it would soon encrease so much, that this *Capsula* could not hold it. But the abovesaid *Lymphe-ducts* absorbing what is superfluous, wash away this Objection; which if they did not, his own Opinion, that it drops out of the Glands seated at the Basis of the Heart, would be liable to the same Inconvenience. For such Distillation would be as continual as this Condensation is supposed to be. And *Verheyen*'s Opinion, that it is separated by the *Thymus*, lies as open to the same Objection. Naturally it is not in quantity above two Spoonfuls, (though it differ much according to the Temperament of the Party, the Hot having a smaller, and the Cold a larger Quantity.) But in diseased Persons it is sometimes increased to half a Pound, yea, to a whole Pound, as *Diemerbroeck* has oft observed. This is that Liquor that is supposed to have flown from the Side of our Saviour when the Soldier pierced it with a Spear, for saith the Text (*John* 19. 34.) *There came forth Blood and Water.* Sometimes Worms have been observed to breed within this Bag, and such Persons, when they were alive, have been subject to Palpitation of the Heart and Swoonings.

Their Uses.

The *Pericardium* is some sort of Fence to the Heart, but it seems to be chiefly made for the sake of the Liquor it contains, which serves for the moistening of the Heart, and making its Superficies slippery, that it may move more glibbly.

CHAP.

CHAP. V.

Of the Heart in general, and of the Reaſon of its Motion.

The Heart. THE *Heart* (in Latin *Cor*, in Greek κῆρ, or κέαρ *à* καίω, to *burn*, becauſe it is the Source of *vital Heat*) is the principal Bowel of the whole Body, which no perfect Animal does want, nor can long ſurvive its Wounds. Vital Spirit and Natural Heat are communicated from it to all the Parts of the Body, tho' they are not ſo much owing to its Subſtance as to the Ebullition or Accenſion of the Blood and Chyle in it; as ſhall be diſcourſed hereafter.

Its Situation. It is *ſeated* in the middle of the Breaſt, encompaſſed with the *Pericardium* and *Mediaſtinum*, its lower Tip or *Mucro* bending a little to the left Side. Neither its *Mucro* nor Sides are knit to any Place, but it hangs looſe in its Caſe, only ſuſpended by the Veſſels that go in and out of its upper part or Baſis, to which the *Pericardium* adheres. Its Situation in Beaſts that feed upon Graſs, is near the middle of the whole Body, reckoning from the Head to the Tail; But in Man (and moſt carnivorous Animals which generally have ſhorter Necks than others) it is nearer the Head; whereof the learned Dr. *Lower* gives an ingenious Reaſon, ['Seeing, *ſays he*, the 'Trajection and Diſtribution of the Blood de- 'pends wholly on the *Syſtole* of the Heart, and 'that its Liquor is not driven of its own Nature 'ſo readily into the upper Parts as into Veſſels 'even with it, or downwards into thoſe under it: 'If the Situation of the Heart had been farther 'from the Head, it muſt needs either have been 'made ſtronger, to caſt out its Liquor with greater

'er Force; or else the Head would want its 'due Proportion of Blood. But in Animals that 'have a longer Neck, and which is extended to-'wards their Food as it were, the Heart is seated 'as far from the Head as from the other Parts; 'and they find no Inconvenience from it, be-'cause they feed with their Head for the most 'part hanging down, and so the Blood, as it has 'farther to go to their Head than in others, so 'it goes a plainer, and often a steep way.]

It has a firm, thick, dense *Substance*, thinner and softer in the right Side, thicker and more dense in the left, but most compact and hard at its Tip; only on the left Side of the Tip it is thin, as consisting mostly of the Concourse of the inner and outer Membrane. Its *Parenchyma* is for the greatest part made up of Muscular Fibres, so that itself may truly be reputed a Muscle. *Substance.*

Its *Fibres* are a few of them streight, but far more oblique. Both are inserted into a Tendon that is spread over its Basis under the Auricles; part of which Tendon, at the Egress of the *Aorta*, in some Creatures becomes bony, as in a Stag, *&c.* On the outer Superficies of the right Ventricle, there run a few slender Fibres streight upwards, and are terminated in its Basis. In which also terminate the oblique ones next under these, ascending from the left Side towards the right, spiral-wise. The Fibres that lie under these, hold a clean contrary course. For they arise every where from the right side of the Heart, whence being carried obliquely towards the left and having embraced each Ventricle of the Heart, they ascend to the Basis of the left side spiral-wise as the other. But they run not all of them the whole length from the Basis of the Cone; for then would the Heart be as broad or thick at the lower end as the upper; but some reach not above half *Fibres.*

half way, others a little farther, *&c.* and some to the very *Apex.* The Fibres of the left Ventricle differ not from those of the right as to kind, only they are considerably stronger. Which they are for this Reason, that whereas the Right Ventricle only promotes the Circulation of the Blood thro' the Lungs, the left must cast it forth with that Force, as that it may circulate through the whole Body.

The curious Reader may find a most accurate Description of these Fibres in Dr. *Lower*'s Treatise *de Corde*, whither I refer him; for, to insist too long on such minute similar Parts, would not be suitable to this Epitome of Anatomy. Tho' by a View of those Figures that I have borrowed of him, their Structure may be pretty plainly apprehended.

Figure. Its Shape is like a Boy's Top (save that it is flattish behind) or a Pyramid turn'd topsy turvy; whence it is divided into its Basis, which is its broader Part and upper; and into its Cone or *Apex*, or narrower and lower Part, which ends in a Tip or *Mucro.*

Bigness. It is bigger in Men than in other Creatures, considering the Proportion of their Bodies. It is lesser, but more dense, in hot and bold Men than in the cold and cowardly. In adult Persons it is commonly six Fingers breadth long, and four broad at the Basis.

Coat. Outwardly it is covered with a proper *Coat*, which is thin, but strong and dense, and very hard to separate from it; it is the same with the outer Coat of the great Artery, as that which cloaths the Ventricles on the Inside is continued unto and common with that thin Skin that covers the inside of the Arteries like a *Cuticula*; and hence 'tis likely (says *Diemerbroeck*) that the Arteries borrow these Coats of the Heart, as

the

the Nerves borrow their two Tunicles from the *Pia* and *Dura Mater* of the Brain. Upon this Membrane that inveſts the Heart, there grows ſome hard Fat about the Baſis, which ſerves to moiſten it.

It is not nouriſhed by the Blood or Chyle that are received into its Ventricles, but by Veſſels running through its *Parenchyma*. *Veſſels.*

Its *Arteries* are two, ſpringing out of the *Aorta*, before it paſs out of the *Pericardium*, and are called *Coronariæ*, becauſe their Trunks do not preſently enter into the *Parenchyma* of the Heart, but fetching a Circuit on its Surface, the better to branch out themſelves towards its Cone, they encompaſs its Baſis like a Diadem. And tho' at their Riſe they turn one on one Side, and t'other on the other of the Heart, yet at their ends they meet again, and inoſculate one with the other; ſo that if one inject any Liquor into one, it will run into the other. *Arteries.*

It has alſo two *Veins* called *Coronariæ*, which encompaſs its Baſis in like manner, and communicate one with the other. Theſe receive and carry back the Arterial Blood that remains from the Nutrition of the Heart, and refund it into the *Cava*, juſt at its entrance into the right Ventricle. *Veins.*

Its *Nerves* do ariſe chiefly from the *Plexus cardiacus* of the *par vagum*, or eighth Pair, into which *Plexus* many Twigs do enter from the Intercoſtal. But a little below this *Plexus*, after the recurrent Nerve has parted from the Trunk of the *par vagum*, the *par vagum* ſends forth on each ſide a notable Branch; which being carried towards the Heart, and creeping along its Baſis behind, meet one another, and in all their Progreſs ſend forth Twigs thro' the whole Surface of the Heart, eſpecially on its Back-ſide, as thoſe *Nerves.*

Branches

Branches which proceed from the *Plexus cardiacus*, are dispersed chiefly on its Fore-side, as Dr. *Willis* affirmeth.

of the Motion of the Heart.

Great Controversy hath been, and still is, about the *Motion* of the Heart, *whether* it depend on the Influx of the animal Spirits, or on the Accension and Dilatation of the Blood in its Ventricles, *or* partly on one, partly on the other. Plausible Arguments are produced on every Side, but such as rather tend to shew the Shortness and Insufficiency of the contrary Opinions to solve this *Phænomenon*, than pretend to demonstrate any certain Reason of it. That the immediate Instruments of its Motion are its Fibres, none can doubt; but what sets these Fibres on work is all the Question. That it cannot be the Animal Spirits conveyed by the Nerves (*only*) is apparent, *First*, Because the Heart moves in the *Embryo* before either Brain or Nerve are so perfectly formed, that the Animal Spirits can be elaborated out of the Blood by the former, or transmitted to the Heart by the latter; yea, seeing they are made of Arterial Blood that must be sent to the Brain by the Pulsation of the Heart before they can be generated. And *Secondly*, Because the Heart of the living *Fœtus*'s (as of young Puppies) and of Eels, being cut out of the Body, and from all the Nerves, by which any Animal Spirits should flow into it, will continue beating as long as 'tis warm; yea, when it has ceas'd beating, if one throw warm Blood, or but warm Water upon it, it will recover some kind of Pulsation again. Which may serve also to convict the second Opinion of Error; for if its Motion depended only on the Dilatation or Rarefaction of the Blood, it would cease as soon as the Blood flows no longer into its Ventricles.

And for a further Confutation of the second Opinion,

'Opinion, which ſuppoſes the Accenſion (and conſequent Dilatation) of the Blood as the Cauſe of this Pulſation, Dr. *Lower*'s Experiment, or his Obſervation, ſeem argumentative beyond Contradiction. His *Experiment* is this: ['He drew 'out of the *Jugular Vein* of a Dog about half of 'his Blood away, injecting by Turns into the '*Crural Vein* a like Quantity of Beer mixt with 'a little Wine; and this he repeated alterna-'tively ſo often, till inſtead of Blood there 'flow'd out of the Vein only a paler Tincture 'like Water wherein Fleſh had been waſh'd, or 'Claret diluted with very much Water; and yet 'the Heart in the mean time remitted but a lit-'tle of its former Pulſation.——His *Obſervation*, which he had from a Phyſician worthy of Credit, is this: ['A Youth about ſixteen Years old, 'continuing bleeding for two Days together, 'his Friends, and thoſe that waited on him, 'gave him good Store of Broth to keep up and 'recruit his Spirits; which he ſwallowing down 'greedily, his Bleeding was now and then en-'creas'd thereby, ſo that at length having pou-'red forth almoſt the whole Maſs of his Blood, 'that which now run out was dilute and pale, 'neither of the Nature nor Colour of Blood, 'but liker the Broth he had drunk ſo much of; 'and this kind of Flux continued a Day or two, 'the Heart the mean while retaining its Pulſa-'tion) till at length being ſtopt, the Youth was 'reſtored by Degrees to entire Health, and 'grew to a robuſt and luſty Fellow.] This Experiment and Obſervation, I ſay, do make it apparent, the Motion of the Heart depends not on the Accenſion and Dilatation of the Blood, for then when in the firſt the Beer and Wine, in the ſecond the Broth, flow'd into its Ventricles inſtead of Blood, its Motion muſt either have been

more notably alter'd, or rather have quite ceas'd, these Liquors being so far distant from the Nature of Blood, especially the Broth.

And lastly, That this Motion is not caused partly by the Influx of the animal Spirits, and partly by the Accension and Rarefaction of the Blood, may be evinced by the Arguments produced against each Opinion apart: And yet if a Reason could be given, this seems the most probable. Namely, That the Blood distilling into the Ventricles of the Heart, is in them accended and rarefied, so that requiring a larger Space, it bears against their Sides; whereby the Heart being molested, it calls in the animal Spirits for Help, which coming in, in convenient Plenty, contract its muscular Fibres, and so by straitning its Ventricles, drive forth the Blood contained in them into the Arteries. But we had rather ingenuously confess our Ignorance of the Reason of so admirable an Action, and profess with Dr. *Lower*, that it is too hard for Man to conceive of; and that it is the Prerogative of God only, who *searcheth the Secrets of the Heart*, to know the Reason of its *Motion* also.

CHAP. VI.

Of the Pulse, and the Circulation of the Blood.

The Pulse. THE *Motion* of the Heart is called in Greek σφύξις; in Latin, *Pulsus*, Pulse, or beating. And this is performed by *Diastole*, or Dilatation, in which it receives Blood into its Ventricles; and *Systole*, or Contraction, by which it expels it out of them.

Systole *and* Diastole. Contraction being the proper Motion of a Muscle, the *Systole* is the proper Motion of the Heart; and the *Diastole* is but a ceasing or Restitation

tation from that Motion. For in the *Diastole*, the Fibres of the Heart are relaxed, during which the Blood distils down into its Ventricles out of the Auricles; whereby when they are filled, and in some measure distended, the Fibres both streight and oblique begin to contract themselves, and compress or straiten the Cavities of the Ventricles, not only by constringing their Sides, but also by drawing up the Cone or Tip of the Heart nearer its Basis, whereby their Cavity is shortned, so that the Blood is expelled with Force out of them into the Arteries; which Motion is called the *Systole*. But why the Heart should keep such stated turns of *Systole* and *Diastole*, and continue them for (it may be) fourscore Years together, *that* (as we said above) we cannot conceive the Reason of, but admire the Wisdom and Power of the Creator, in beginning and continuing such a Motion.

Whether the Pulsation of the Arteries depend wholly on that of the Heart.

At the same time as the Heart beats, there is a Pulsation of all the Arteries to be felt in the extream Parts of the Body. Whence may arise a Dispute, whether the Arteries be not also endued with a pulsifick Faculty. I encline to the Negative, and think their Pulsation is meerly passive, and that as for other Reasons, so upon the account of these two Experiments, *viz.* 1. That if an Artery be cut in sunder, and a Pipe be put into each End of the divided Artery, whereby the Blood may be conveyed out of one into the other, the Pulsation will continue beyond the Pipe, as well as on that side next the Heart. And 2. That in Transfusion of Blood out of one Animal into another, though the Blood be received into a Vein, yet that Vein will have a Pulsation answering to that of the Artery in the other Animal whence the Blood issueth. So that the Pulsation of the Artery seems wholly owing to

the repeated *Impetus* of the Blood, poured into it out of the Heart in each *Syſtole*.

The Circulation of the Blood

Now, ſeeing by the continual Reciprocation of the Pulſe, there is a conſtant Expulſion of Blood from the Heart into the Arteries, and as continual an Influx of Blood *into* it out of the *Cava*; and ſeeing the *Cava* from whence the Supply is, is never drawn dry, nor on the other Hand, the Arteries that receive the Blood continually from the Heart, unduly ſwell'd with it; it neceſſarily follows, that this Motion proceeds *circularly*, *viz.* That the Blood is continually driven out of the Heart into the Arteries, out of theſe into the Parts to be nouriſhed; from whence it is reſorbed by the Capillary Veins, which conduct it back through the larger into the *Cava*, and ſo at length it returns to the Heart again. The Invention of which Circulation is owing to our Countryman Dr. *Harvey*, and may be proved undeniably by theſe Reaſons.

1. The great Quantity of Blood that is driven out of the Heart into the Arteries at every Pulſe. For though the Ancients who knew not this Circulation, imagin'd that only a Drop or two was expelled by every *Syſtole*, which they were neceſſitated to ſuppoſe, to avoid the great Diſtenſion that the Arteries muſt be liable to, if any conſiderable Quantity iſſued into them; yet it is certain and demonſtrable, that there muſt needs an Ounce or more be driven into them each time. For (taking it for granted, that there is no other Way for any Liquor to paſs from the Stomach to the Kidneys, but through the Heart, along with the Blood) ſeeing if ſome Men at ſome times drink three Pints of Drink, they ſhall piſs it out again in half an Hour, yea more of *Tunbridge* Waters in that Space; and ſeeing, ſecondly, that there is commonly as much Blood

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as *Serum* that flows to the Kidneys (the Blood returning back by the Emulgent Veins) it is clear, that by the two Emulgents (which are none of the largeſt Arteries) there muſt paſs, in half an Hours time ſix Pounds of Liquor, all which muſt come from the Heart; and how much more then may we conceive to be driven through all the other Arteries that run through the whole Body? This is more accurately evinced by Dr. *Lower*'s Experiment, which is this: [‘I cut a-‘ſunder (*ſays he*) both the *Cervical* Arteries in ‘a large Dog; and at the ſame time through an ‘Hole made in the left ſide of his Breaſt, over ‘againſt the Heart, I compreſt the Trunk of the ‘*Aorta* below the Heart with my Finger, to ‘hinder any Blood from deſcending by it; and, ‘laſtly, I took Care alſo to ſtraiten the *Brachial* ‘Arteries under the *Axillæ*, by which means al-‘moſt all the Blood was driven out of the Heart ‘through the *Cervicals* (beſides that which was ‘ſent into the *Vertebrals*) and which is wonder-‘ful to be related, within the twentieth Part of ‘an Hour, the whole Maſs iſſued out; ſo that it ‘is not to be denied, but that it all paſs'd thro' ‘the Heart in that ſpace.] And though it may be granted, that amidſt ſuch Wounds and Tortures, the Heart does beat ſomewhat quicker than at other times; yet the ſame thing is partly evident from Wounds in the Limbs when ſome notable Artery is cut aſunder, for 'tis ſtrange in how ſmall a time a Man will bleed to Death even at that one Artery. Yea, we may give a great gueſs how much Blood is ſent out at every Pulſe, even from the ordinary opening of one *Vein* in the Arm, from whence a notable Quantity of Blood will iſſue in a ſhort time; how much then may we ſuppoſe would flow out of all the Veins, if they were opened at one time? Seeing then

'tis evident that so great a Quantity of Blood is expelled out of the Heart at every *Systole*, and that for all that the Arteries are not unduly distended, nor any Part swell'd by it, neither yet the *Cava* and other *Veins* emptied, 'tis certain that the Blood that is driven into the Arteries flows back to the Heart by the Veins, in a constant Circulation.

2. A second Argument to prove it, may be taken from the Valves in the Veins, which are so framed, that Blood may freely flow through them out of the lesser Veins into the greater (and so into the *Cava*) but not on the contrary out of the greater into the less. Yea if one blow into the *Cava* through a Pipe, there will no Wind pass into the smaller Veins; but on the contrary, if you blow up the lesser Veins, the Wind will readily pass to the larger, and so to the *Cava*.

3. And, lastly, The same thing is most clear, by the Ligature in Blood-letting. For whether you let Blood in the Arm or Foot, you always tie the Fillet above where you intend to make the Orifice, and then the Vein below the Ligature will presently fill and grow tumid, but above, it will fall, and almost disappear. Which must needs be from hence, for that the Blood, being driven along the Arteries towards the extreme Parts, returns by the Veins, and ascends upwards, which coming to the Ligature, and being stopt there, swells the Vein below the Ligature, and spurts out as soon as the Orifice is made: But when the Fillet is loosed again, the Blood flows no longer out thereat, but holds on its wonted Channel, the Vein and the Orifice closes up again.

Having sufficiently demonstrated the Circulation of the Blood, we will shew two things farther: *First*, How the Blood passes out of the Arteries into the Veins; and, *Secondly*, in how long

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a time the whole Mass of Blood may be supposed to pass through the Heart in its ordinary Circulation.

As to the *first*, it was the Opinion of *Riolanus*, that the Blood circulated only through the larger Vessels, by Anastomosis or Inosculation of the Veins with the Arteries; and that that which run into the smaller, was all spent on the Nutrition of the Parts. But it is clear, that there must be a Circulation even in the smallest, from the great Quantity of Blood that will flow out of the least Artery in the Hand or Foot, when it is cut; which it were very absurd to imagine to be all spent on the Nourishment of the respective Part. Now there are but two ways whereby the Blood can be supposed to pass out of the Arteries into the Veins, *viz. either* by the former's being continued to, or opening into the latter by Inosculation; *or* else by the capillary Arteries letting out their Blood into the Pores of the Substance of the Parts, on whose Nutrition part is spent, and the Remainder imbibed by the gaping Mouths of the capillary Veins. That it is necessary to admit of this *latter* way, is evident, because if part of the Arterial Blood did not issue into the Substance of the Parts, they could not be nourished by it; for while it is in the Vessels, it may add Warmth indeed to the Parts thro' which it flows, but cannot nourish them, seeing even the Vessels themselves are not nourished by that Stream of Blood that glides along their Cavity, but by Capillaries running through their Coats; and if the Blood be driven into the Substance of the Parts, and that in a greater Quantity than suffices for their Nourishment (as was just now shewn that it is) what is superfluous, must needs enter the Mouths of the Capillary Veins, from which it goes forward to the larger, and so to the Heart;

How the Blood passes out of the Arteries into the Veins.

But seeing this way of transfusing the Blood through the Substance of the Parts, has seemed to some not to answer to that hasty Circulation of it we above demonstrated; they have thought it necessary also to admit of the former way, namely, Anastomoses, by which the Veins are continued to the Arteries, and that not only in their larger Branches (as that notable one of the Splenick Artery with the Splenick Vein) but also in their smaller Twigs in the extreme Parts. But we must consider, that in a living Body the solid Parts are infinitely more porous and permeable than in a dead; so that though the Anatomist find their Substance so dense and close, as to make it seem almost impossible they should permit so quick a Passage to the Blood through them: Yet he should rather believe it, than suppose such Anastomoses as he cannot discover, though it were not difficult to find them out if they had an Existence. For abating that single one of the Splenick Artery, with the *Ramus splenicus* of the *Porta* (and perhaps some of the *Arteria* with the *Vena pulmonaris* in the Lungs) none of the latest most accurate Anatomists have been able to find out any. And as for that mentioned, it seems rather to be of an Artery with an Artery (such as are frequent in several Parts of the Body, as are also of one Vein with another) than of an Artery with a Vein; for the *Porta* from which this *Ramus* is propagated, is generally reputed rather an Artery than a Vein, for the Reasons alledged in *Chap.* XII. of *Book* I. where we described this Vessel.

In what space of time the whole Mass circulates.

And, *Secondly*, as to the Space of Time in which the whole Mass of Blood may ordinarily circulate through the Heart, it is probably much shorter than many have imagined. For supposing that the Heart makes two thousand Pulses an Hour (which

(which is the leaſt Number any ſpeak of, and ſome have told twice as many) and that at every Pulſe there is expelled an Ounce of Blood (which we may well ſuppoſe, ſeeing the Ventricles are wide enough to contain two Ounces, and that it is probable, both that they are filled near full in the *Diaſtole*, and that they are near, if not quite, emptied by the ſtrong Conſtriction of the Heart in the *Syſtole*) ſeeing the whole Maſs uſually exceeds not four and twenty Pound, it will be circulated ſix or ſeven times over thro' the Heart in the ſpace of an Hour. And by ſo much the oftner, by how much the Blood comes ſhort of the ſuppoſed Quantity, or the Pulſe either naturally, or by a Fever, ſpirituous Liquors, or violent Motion is rendered more frequent. By which quick Motion the Blood itſelf is kept from Coagulation and Putrefaction, and the Parts are cheriſhed with vital Heat, which Heat of the Parts is much according to the Slowneſs or Rapidneſs of the Circulation: So when we ſit ſtill, and the Pulſe is ſlow or rare, we grow cold; but when upon running, or any violent Exerciſe, the Pulſe becomes more frequent and quick, we become hot.

CHAP. VII.

How Blood is made of Chyle; of its Heat and Colour; and whether the Body be nouriſhed by it.

ACcording to Dr. *Harvey*'s Obſervations, there appears in an *Embryo*, a *Punctum ſaliens*, or red beating Speck, which is Blood, before any the leaſt Lineament of the Heart. So that whatever Inſtrument of Sanguification the Heart may appear to be afterwards, it contributes

butes nothing to the making of the first Blood; but it seems rather to be made for the Blood's sake, to transmit it to all the Parts of the *Embryo* or *Fœtus*, than the Blood to be made by it. But it must be confest, that things proceed in the grown *Fœtus* far otherwise than they do in the first Formation. For the Parts of an *Embryo* are nourished and encreased before it hath a Stomach to concoct any thing; and yet in a perfect *Fœtus* none can deny that the Stomach does concoct and prepare Nourishment for it; So it moves before the Brain is formed so perfectly, as to be able to elaborate animal Spirits; and yet after it is perfected, every one knows that the Brain does elaborate such Spirits, as being sent into all the Parts of the Body by the Nerves, enable them to move. In like manner, tho' there be Blood in the *Embryo* before the Heart be formed, yet after it is perfected, nothing will hinder, but it may, at least, contribute something to Sanguification.

We will suppose then, that as all the other Parts are formed by the *Vis plastica*, or generative Faculty of the (first) vegetative and (then) animal Soul, seated in the *Ovum*, and receive their first Encrease by the Assimilation of the *Colliquamentum*; but, as soon as they are perfected, and the *Fœtus* excluded, are nourished by the Blood: So the Blood itself, being at first made in like manner, as soon as the Veins, Heart and Arteries are compleated, so as it can circulate by them, may not improperly be said to be nourished by the Chyle or nutritious Juice, the Heart assisting the Assimilation of the one into the other. And this is done in this manner: The Chyle ascending by the *Ductus thoracicus* (as was described, *Book* I. *Chap.* 10.) and flowing into the Subclavian Vein, together with the returning venal Blood, is poured

How Chyle is turned into Blood.

poured by the *Vena cava* into the right Auricle, and ſo into the right Ventricle of the Heart in its *Diaſtole* or Relaxation; then by its *Syſtole* or Contraction it is driven out from thence into the Lungs, from whence it aſcends again into the left Auricle firſt, and then into the left Ventricle of the Heart, out of which it is expelled thro' the *Aorta*, and paſſing along with the Blood thro' the Arteries of the whole Body, returns again with it by the Veins to the Heart. For it undergoes many Circulations before it can be aſſimilated to the Blood. Which is evident, both becauſe it in the Chyle (but little alter'd) that is ſeparated in the *Placenta uteri* for the Nouriſhment of the *Fœtus*, and in the Breaſts for the Infant to ſuck, in the form of Milk; and alſo from hence, that if one be let Blood four or five Hours, (or later) after a full Meal, there will a great Quantity of the milky Chyle itſelf ſwim a-Top of the coagulated Blood. But every time the new infuſed Chyle paſſes thro' the Heart with the Blood, the Particles of the one are more intimately mixed with thoſe of the other in its Ventricles, and the vital Spirit, and other active Principles of the Blood work upon the Chyle; which being full of Salt, Sulphur and Spirit, as ſoon as its *Compages* is looſened by its Fermentation with the Blood in the Ventricles of the Heart (eſpecially, but alſo in the Arteries) the Principles having obtained the liberty of Motion, do readily aſſociate themſelves, and are aſſimilated with ſuch parts of the Blood as are of a like and ſuitable Nature; ſo that at length all the Maſs of Chyle that is capable of being turned into Blood is ſanguified, and what is not, is evacuated by Urine or Stool, or other proper Emunctory.

It is a very difficult Queſtion, By what means the

How the Blood becomes hot.

the Blood acquires its *Heat?* In order to the Resolution whereof, it will be necessary to consider how many ways a *liquid Body* is capable of being heated, and those (according to Dr. *Willis*) are three. ["*First*, by setting it to something that is 'hot; so Water is made hot by being set on the 'Fire, or in the Sun, or a Stove, or by dissolving 'Lime in it. *Secondly*, When Saline Corrosives, 'which are of a contrary Nature, being mix'd 'with one another, or with sulphureous, act one 'upon another, and by the great Struggling and 'Agitation of their Particles do often excite 'Heat, yea, sometime Smoke and Burning: As 'when Spirit and Butter of Antimony, or when '*Aqua stygia* and Oyl of Turpentine are mixed 'together; also when corrosive Liquors eat into 'metalick Bodies, they often grow hot. *Thirdly*, '(which is the only way besides that a Liquid 'grows hot) when some Humour abounding 'with Sulphur, or much Spirit, is set on fire by 'holding a flame to it, and so grows hot by De-'flagration, as Brandy, *&c.* There are other ways 'indeed of Calefaction, as *Fermentation*, *Putrefa-'ction* and *Attrition*, whereby *thicker* or *solid Bodies* 'often grow hot, but in *liquid* they produce no 'such Effect. Thus Leaven becomes (somewhat) 'hot by *Fermentation*, and Dung or wet Hay by '*Putrefaction*; but neither way will a *liquid Body* 'wax hot: For tho' Wine, Cyder, *&c.* ferment 'so much as to burst the sides of the Hogshead, 'yet they are not actually hot; nor will Blood 'become so, when it is let out of the Body, dis-'pose it how you will in fit Glasses to ferment or 'putrefy. Indeed the Blood within the Body 'is fermented, and is thereby depurated, but 'it is not heated by such Fermentation, as nei-'ther is any other Liquid. Neither does the 'heating by *Attrition* agree to it; for though so-

'lid

'lid Bodies are heated by being rubb'd one a-
'gainſt another; yet ſhake and agitate Liquids
'as much as you will, they ſhall be never the
'warmer for it. Therefore ſeeing there are on-
'ly thoſe three ways firſt mentioned, whereby
'actual Heat can be produced in any Liquors,
'let us ſee to which of them the Incaleſcence
'of the Blood ought to be aſcribed.

'*Firſt*, Both the Ancients, and ſome Moderns,
'are of Opinion, that the Blood is heated the firſt
'way, *viz.* by the Admotion of ſomething that
'is hot. Thus the former have taught, that the
'*innate Heat*; and the latter, that the *vital Flame*
'is lodged in the Heart, and heats the Blood as
'it paſſes thro' it: But both theſe Opinions fall
'to the Ground, ſince it is clear that the Heart
'is a *meer Muſcle*, and contains no fit Fewel for
'perpetuating a Flame, or I know not what im-
'planted Heat: For tho' it muſt be acknowled-
'ged, that the Circulation of the Blood depends
'on the continual Motion of this Bowel; yet
'the Heart derives its Heat wholly from the
'*Blood*, and not the *Blood* its from the *Heart*.

'*Secondly*, This Heat cannot be cauſed in the
'Blood the ſecond way, becauſe its Liquor, in a
'natural State, is always homogeneous; and
'tho' it abound with Salt, yet that is only vola-
'tile, mild and benign. Nor can any one diſ-
'cover either in the *Heart*, or in any other *Fo-*
'*cus*, a ſaline, or otherwiſe heterogeneous Mine-
'ral, by acting whereupon, or corroding whereof
'the ſanguineous Liquor ſhould conceive Heat.

'*Thirdly*, As to the third way, whereby Li-
'quids grow hot, tho' it ſeem an hard ſaying,
'that the *Blood is accended*; yet ſeeing we can at-
'tribute its Incaleſcence to no other cauſe, why
'ſhould we not impute it to this? eſpecially ſee-
'ing the *proper Paſſions of Fire and Flame* agree to
'the *Life of the Blood*.

'For

'For the chief and most essential Requisites to 'continue a Flame, are these three: *First*, That a 'free and continual access of Air be granted to 'it as soon as it is kindled: *Secondly*, That it en- 'joy a constant sulphureous *Pabulum* or Fewel; 'and *Thirdly*, That it be ventilated, whereby as 'well its fuliginous, as thicker Recrements may 'be continually amanded from it: And seeing 'these agree to the *vital Flame*, as well as to an 'elementary, it seems very rational to affirm, 'That *Life itself is a kind of Flame.*] Thus far that learned Author, whom the Latin Reader will do well to consult, discoursing farther on this Subject, in his *Exercit. medico-physica de sang. incalescentia sive accensione.*

Dr. *Henshaw* thinks that ['The Dissimilitude of 'Parts between the Chyle and Blood is so great, 'that it becomes immediately the Cause of an ex- 'traordinary Ebullition upon their Mixture to- 'gether; which is very much encreased by the 'reciprocal Motion of the Lungs, whereby the 'Blood is wrought almost into a Froth or Foam, 'by that time it gets into the left Ventricle of 'the Heart. Which sudden excess of Heat, is not 'unlike what happens upon the mingling seve- 'ral chymical Liquors together, as Spirit of 'Wine, Spirit of *Turpentine*, and other such-like, 'where the Heat becomes so great, that it often 'endangers the Vessels they are contained in. He affirms (contrary to Dr. *Willis*, and I think to the Truth) that 'new Wine or Must, while it 'ferments, is hot; and that if Juice newly pres- 'sed out of the Grapes were added to it, as it 'begins to cool, it would again renew its Ebul- 'lition, and its Warmth would be continued so 'long as one should persist to do so: In like man- 'ner he thinks is the Warmth in the Blood con- 'tinued by the new affusion of Chyle, which

'renews

'renews its Fermentation, and consequently 'invigorates its Heat.

Diemerbroeck is of Opinion, that ['The *vital* 'Spirit (by which he understands the more sub-'tile part of the Blood) while through its great 'Volatility it always endeavours to fly away, 'does continually agitate the other thicker Par-'ticles of the Blood, with which it is intangled 'and detained from Flight, and is diversly vibra-'ted by them, and beat back; and so the whole 'Mass being kept in a continual fermentative 'Motion, there is produced in it a Heat, which 'in a great Agitation is great; in a mean, mean; 'and in a small, small.]

I might cite other Opinions concerning the Reason of this *Heat*, but they generally fall in with some of these mentioned; of which I shall not make my self an Umpire, but think that Dr. *Willis* has said enough in his above-cited Exercitation, to evince that it is not caused either of these latter ways, *viz.* by Fermentation, or by Agitation of the Particles of the Blood, in the manner *Diemerbroeck* describes it; and whether the Accension of the Blood be a more probable Reason of it, let the Reader judge.

The Colour of the Blood.

Why the Blood should be of a *red Colour* rather than any other, no satisfactory Reason (I think) can be given, but the Will of the Creator, tho' some attribute it to the Heart, others to the Mixture of salt and subacid Juices with sulphureous, because from such a Mixture there results a red Colour, as appears in the Distillation of Sal nitre, (which contains many sulphureous Particles in it) or by the pouring Oil of Vitriol upon Conserve of Roses, or any other thing that is of a *paliſh* Red (if it contain any thing of Sulphur) for it will be thereby made of a most *deep* Red. We will not spend time to shew in how many Respects these

theſe Inſtances differ from the *Phænomenon* under Conſideration, but ſhall content our ſelves with inquiring from whence the difference of Colour ariſes between the Venal and Arterial Blood. Every one knows, that when Blood is let out of a Vein into a Porringer, the *Coagulum* is of a florid ſcarlet Colour in its Surface, but of a dark red from the Superficies to the Bottom; and of ſuch a Colour it appears, as it ſtreams out of the Orifice of the Vein. But if any Artery be cut, the Stream then looks of a far brighter Colour, like the Superficies of the venal Blood when it is coagulated in a Porringer. Now the Arterial Blood receives not this florid Colour in the Heart, but in the Lungs. For if it receiv'd it in the Heart, then might the right Ventricle be ſuppoſed to give it as well as the left; but that it does not do ſo is clear by this Experiment of Dr. *Lower*'s; If you open the *vena Arterioſa*, which receives the Blood out of the right Ventricle, the Blood differs nothing in Colour from the Venal, but its curdled Part looks every whit as black; but if one open the *Arteria venoſa*, as it is entring into the left Ventricle, it has the perfect Colour of Arterial Blood, which ſhews, that as it owes not that Colour to the left Ventricle any more than to the right (being not yet arrived at it) ſo it muſt receive that Alteration of Colour in the Lungs, in which the nitrous Air being diffuſed through all the Particles of the Blood is intimately mixed with it, and (if you will) accends it. For if there be any ſuch thing as a *Flamma vitalis* (properly ſo called) in Animals, though the Blood (or Chole rather) be to it inſtead of the Oil, or other Matter whereon it feeds; yet it oweth the Continuance of its burning to the Air, without the continued Inſpiration of which the Animal cannot live, but inſtantly dies, even as a

Candle

Candle is presently extinguished, if you put it in a close Place where the Air cannot come to it, or by some Engine be suck'd from it. But this by the bye. For I must confess that (how plausible soever this Opinion may seem on other Accounts) this Alteration of the Colour of the Blood by the Air in the Lungs, is no sufficient Argument to prove any such vital Flame, seeing the Arterial Blood being extravasated, retains its florid Colour, when no doubt if there ever was any Accension, the Flame is extinguished. But this scarlet Colour is owing meerly to the Mixture of the Particles of the Air with the Blood in the Lungs, from which it transpires, in a great measure, through the Pores of the Skin, while the Blood circulates in the Habit of the Body out of the Arteries into the Veins, whence the Venous Blood becomes so much darker in Colour than the Arterial. And yet the Venous Blood it self, when extravasated, appears of a scarlet Dye in its Surface, which is meerly from its being exposed to the Air; for if one turn the congealed Blood in a Porringer upside down, the Bottom, which at the turning is blackish, will in a little while turn to a lighter red.

Whether the Body be nourished by Blood.

Though we have confessed that the Chyle does circulate through the Body several times before it be perfectly assimilated to the Blood; yet we do not think that it passes into the Nourishment of the Parts in the Form of Chyle. And therefore when speaking of the Nutrition of the *Fœtus* in the Womb (*Book* I. *Chap.* 33.) we often mention'd a *nutritious Juice* (which was Chyle a little alter'd) we did not call it so with respect to the solid Parts of the *Fœtus*, but to the Blood it self, whose *Pabulum* or Nourishment it is, as soon as the Umbilical Vein is formed, as the Blood is of the Body. For as to the Encrease of the first

delineated Parts of an imperfect *Embryo*, that is far different from ordinary Nutrition.

The Blood then consisting of Particles of a different Nature, each Particle passes into the Nourishment of that part which is of the same Nature with it. So the salt and sulphureous Particles being equally mix'd, are agglutinated and assimilated to the fleshy or musculous Parts; the oily and sulphureous to the Fat; the salt and tartareous to the Bones, *&c.* Now this is not done by any Election or Attraction of the Parts, as if they pick'd and choos'd (with a kind of Discretion) such Particles of Blood as are suitable to their own Nature; for the Mass of Blood is equally and indifferently carried to all the Parts: But there is that Diversity of Figure both in the several Particles of the Blood, and in the Pores of each Part, that in the Circulation through the Habit of the Body some stick in these, and others in those, where they are fasten'd and united to the Substance of the respective Parts; and those which through their peculiar Figure are unapt to adhere to one or other, return again to the Veins, and so to the Heart, where they receive some new Alteration. So that *as the Life of the Flesh is in the Blood* (according to *Levit.* 17. 11.) so has it its vital Heat and Nourishment from it also.

CHAP. VIII.

Of the Parts of the Heart, viz. *the* Auriculæ, *the Ventricles, and the* Septum *that divideth them.*

HAving treated of the *Heart* in general, and of its *Action, &c.* we now come to discourse of the Parts which it consists of, *viz.* its two *Auriculæ*, two Ventricles, and the *Septum*.

The

The *Auriculæ* or *Ears* of the Heart are so called from some Similitude of Shape they have with those of the Head; for they rise from a long Basis, upon the Basis of the Heart, and end in an obtuse Point, making an obtuse Triangle. They are as it were two Appendages of the Heart, seated at its Basis over the Ventricles. They are of the same Fabrick and Use, being both Muscles, and made up of the same Order of Fibres, which are carried into opposite Tendons, whereof that at the Basis of the Heart is common to it and these *Auriculæ*, and the other runs along their upper Part. The right is larger and softer; the left is less, but more firm. Their Superficies is smooth when they are filled, but when empty, it is wrinkled, and the left more than the right. When they are cut open, there appear in their Cavity many fleshy Columns running from the upper to the lower Tendon, and betwixt them there are pretty deep Furrows or long Cavities, but fewer in the right than the left. *Auriculæ.*

They are dilated and contracted in like Manner as the Heart, but at different times; for the *Systole* of the Ventricles is at the same time with the *Diastole* of the *Auriculæ*; and on the contrary, the *Systole* of the *Auriculæ* with the *Diastole* of the Ventricles. So that the *Auriculæ* are a receiving their Blood from the Veins, while the Ventricles are expelling theirs into the Arteries; and when the Ventricles are relaxed and empty in their *Diastole*, the Auricles force their Blood into them by their *Systole*. *Their Motion.*

They are not nourished by the Blood that comes into and goes out of their Cavity, but they have a great many Branches of Arteries running through them for this Purpose, which spring from the *Arteria coronaria*, and are called by Dr. *Ruysch* (I think the first Observer of them) *Arteriæ Auriculares*; *Arteries.*

riculares; and must also, no doubt, have Branches of Veins from the *Cava* to attend them. These *Arteriæ Auriculares* you have represented in the next Table, *viz.* XI.

Use. They serve to receive the Venal Blood immediately out of the *Vena Cava* and *Pulmonaris*, and to measure it, as it were, into the Ventricles. Whither, that they may expel it with the greater Force, the internal Fibres or Columns of their Cavity arising from their Root where they are joined to the Basis of the Heart, reach directly outward towards the *Vena Cava* and *Pulmonaris*, and in the *Systole* of the *Auriculæ* grasp the Blood contained in their Cavity like so many Fingers, and squeeze it into the Ventricles whilst they are relaxed in their *Diastole*.

The Ventricles. The Heart hath two Cavities, called *Ventricles*, whereinto it receives the Blood from its two Auricles, and out of which it expels it into the *Aorta* and *Pulmonaris* and *Aorta*. They will either of them hold four or five Spoonfuls of Liquor. They are not altogether like one another; for the right is wider, and in Shape almost semicircular, nor reacheth it down to the *Mucro* or Tip of the Heart; whereas the left is almost round, and reacheth down to the very Tip. Now tho' the outside of the Heart be smooth, yet these Ventricles are very unequal, having their Sides hollowed into divers Interstices or Furrows, and interwoven with carnous Fibres, reaching this way and that way. They are more numerous in Men's Hearts, than in those of any other Animal; though such as are big, as Horses and the like, have them larger. These Fibres or fleshy Columns serve to straiten or constringe the Ventricles, and the Clefts or Furrows betwixt them help their Sides to close more exactly in their *Systole* than they could have done, had they been smooth.

ſmooth. The Fibres are more and ſtronger, and the Furrows deeper in the left Ventricle than in the right, yea they are alſo in that Side of the *Septum* that makes part of the left, though that Side that looks to the right be well nigh ſmooth. For there was need of greater and ſtronger Conſtriction in the left than in the right; ſeeing the right expels the Blood to no greater Circuit than through the Lungs, but the left to the extremeſt Parts of the Body.

They are divided from one another by the *Septum*, which is a carnous and denſe Partition, that ſtands like a Wall betwixt them. It is hollow towards the left Ventricle, and (as was juſt now ſaid) has ſuch like Fibres and Clefts, as the reſt of the Cavity; but towards the right it is convex or bunching out, and has but very little Inequality. Many have been of Opinion, that it has ſome wider Pores, through which Part of the Blood does paſs immediately out of the right into the left Ventricle; but he that ſearches for them diligently will find none, unleſs he firſt make them with his Probe. And indeed if there were any in grown Perſons, we may much more ſuppoſe them to be in *Fœtus*'s in the Womb, in whom are ſeveral Paſſages that after the Birth are obliterated. But if theſe were in the *Fœtus*, then ſhould Nature have made thoſe two other Paſſages in vain, namely, the *Foramen ovale*, whereby the Blood paſſes out of the *Cava* into the *Vena Pulmonaris*, as it is entring the left Ventricle; and the *Canalis arterioſus*, which carries the Blood out of the *Arteria Pulmonaris* into the *Aorta*, I ſay, if the Blood could have paſſed out of one Ventricle into the other (without going through the Lungs) by any Pores that perforate the *Septum*, theſe other Paſſages had been ſuperfluous. And therefore we may ſuppoſe, that as in grown Septum.

Persons they cannot be found by any Probe or Bristle, so they were not there even while the *Fœtus* was in the Womb, seeing there was no Occasion for them.

As to the *Use* of the Ventricles, it may be learned partly by what has been discoursed in the three former Chapters, and partly by what shall be said farther in the following, wherein we are to describe the Vessels opening into and out of them, Whither also we transfer the treating of their *Valves* that are placed at their Orifices.

CHAP. IX.

Of the Ascending Trunk of Vena Cava.

BEcause the Vessels contained in the *Thorax*, either open into the Heart, or run out of it, having finish'd the Description of *It*, we shall discourse next of *them* as Appendages to it. But waving the Repetition of what we discoursed, *Book* I. *Chap.* 10. of the *Ductus chyliferus thoracicus*, that runs up the *Thorax* by the Spine, and opens into the Subclavian Vein, and referring the Reader thither for the Description of that Vessel; I shall here only meddle with the Sanguiferous Vessels, that are four in Number, *viz. Vena cava*, *Vena arteriosa*, (or *Arteria pulmonaris*) *Arteria venosa* (or *Vena pulmonaris*) and the *Aorta*, or *Arteria magna*; and in this Chapter of the first, *viz. Vena cava*.

Vena cava.

In the former Book, *Chap.* 12, and 13. where we discoursed of the Vessels contained in the *Abdomen*, we supposed (with the *Galenists*) that both the *Vena portæ* and *cava* had their Rise from the Liver, not dogmatically asserting it, but supposing it for Method's Sake. And in *Chap.* 13. describing the Branches of the *Cava* in the *Abdomen*,

men, we found it presently dividing it self (after its Rise out of the upper Part of the Liver) into the *Ascending* and *Descending* Trunk: The Description of the Branches of the *latter* (in the lower Belly) we there finished; but traced the *Ascending* Trunk no farther than its penetrating through the Midriff up into the *Thorax*, deferring the farther Prosecution of it till this Place, that we come to treat of the Vessels contained in the *Thorax*.

As it ascends through the Midriff, it sends forth a small Sprig on each Side, called *Venæ Phrenicæ*; these run through the Midriff to the *Mediastinum* and *Pericardium*. If at any time Matter gather'd in the Cavity of the *Thorax* be afterwards discharged by Urine (which many Physicians have affirmed) it is probable that it is absorbed by the Mouths of these Veins gaping in the upper Side of the Diaphragm (upon which such Matter must be supposed to fluctuate) whereby it is brought into the *Cava*, and so in the Circulation is separated by the Kidneys out of the Emulgent Arteries, and descends by the Ureters to the Bladder. Venæ Phrenicæ.

From the Diaphragm it passes undivided to the right Auricle of the Heart, but before it enter it, having pierced the *Pericardium* it sends forth sometimes one, sometimes two Twigs, called *Venæ coronariæ*, which compassing the *Basis* of the Heart, bring back into the *Cava* the Blood that is superfluous from its Nutrition. As these open into the *Cava*, there is a *Valve* placed, which permits the Blood to return by them into the *Cava*, but hinders any to pass out of the *Cava* into *them*. Venæ coronariæ.

Before this Trunk of *Vena Cava* open into the Auricle, it is joined to that other Trunk that descends from the *Caviculæ*, (tho' for Method's Sake we must consider *tha* as a Continuation

of *this* by and by) and both of them discharge the Blood contained in them by one Mouth, first into the Auricle, and then into the Ventricle of the Heart. As they are going to join, there comes a Tubercle or Protuberance betwixt them, that hinders the one from opening into the other in a direct Line, but makes them both go obliquely towards the left hand, as they enter the *Auricula*; without which Provision, that Blood that is a descending from the *Claviculæ*, would have fallen so full on that which is ascending by this Trunk of the *Cava* we have been a describing, as must have made it either to stagnate (if not regurgitate) or however would have retarded its Motion.

Now immediately beyond this Protuberance, out of the united Trunk there goeth a Passage (called *Foramen ovale*) along the *Basis* of the Heart to the *Vena pulmonaria*, in *Fœtus*'s in the Womb, which as soon as they are born, closes up, and is obliterated. The Reason of this Passage of the Blood in them, is, because their Lungs having either none, or but a very obscure and imperfect Motion, the Blood does but little of it pass thro' them, but a good part of it thro' this *Foramen*, out of the *Cava* into the *Vena pulmonaria*, just as it is entring into the left Auricle, through which this Blood is discharged into the left Ventricle, together with that little that is returning by the said *Vena pulmonaria*, from the Nutrition of the Lungs. For tho' there be expelled out of the right Ventricle a pretty Quantity of Blood at every Pulse into the *Arteria pulmonaris*, yet there is but a little of it that goes to the Lungs (tho' all do in adult Persons, that it may be there impregnated with Air) but the greatest part by a Pipe arising from this Artery, called *Canalis arteriosus*, runs into the *Aorta*, which

Pipe

Pipe does degenerate into a Ligament after the *Fœtus* is born. So that the *Fœtus* in the Womb liveth after the manner of Fiſh or other Creatures that have no Lungs, and but one Ventricle of the Heart; for there is but very little of its Blood that paſſeth any more than one of its Ventricles in one Circulation, that which circulateth thro' one miſſing the other. But to return:

The united Trunk of the *Cava* opens by one large Orifice into the left Ventricle of the Heart (as moſt Anatomiſts have taught, but *Steno* affirms, it goes no further than the Auricle) into which is poured all the Blood that returns from all the Parts of the Body (except the Lungs) in its Circulation. And leſt in the *Syſtole* or Conſtriction of the Heart, the Blood ſhould be expelled the ſame way it comes in, at the Orifice of the *Cava* there grows a membranous Circle, which is cleft into three membranous *Valves*, looking inwards, called *Tricuſpides* (or three-pointed) which permit the Blood to come in, but not to go out. And this Office theſe Valves perform in this manner (as is moſt ingeniouſly deſcribed by D. *Lower*.) Out of the ſides of the right *Ventricle* there grow certain *Papillæ*, or round and long Caruncles (called before fleſhy Columns) from whoſe Top there proceed certain tendinous Fibres that are knit to theſe membranous *Valves*. Now theſe Membranes encompaſs the Orifice of the *Cava* round about, ſo that whereas the *Mucro* or Tip of the Heart is in every *Syſtole* drawn up towards the *Baſis*, the *Papillæ* being alſo moved upwards, do ſlacken their Fibres (like Bridle-Reins) whereby it comes to paſs that the Membranes (or *Valves*) alſo, to which they are tied, hanging looſe, are driven upwards (like Sails filled with Wind) by the Blood that is ſqueezed in every *Syſtole* of the Heart, and thereby they ſhut the Inlet into

Valvulæ Tricuſpides.

the

the Heart so closely, that not a Drop of Liquor can flow back again into the *Auricula* or *Cava*, but is expelled all into the *Arteria pulmonaris*, whose Orifice is now open: But, as in every *Systole* of the Heart (its Tip being brought nearer its *Basis*) the *Papillæ* do much relax their Fibres; so in the *Diastole*, the Tip receding from the *Basis* again does also draw down the *Papillæ*, and their Fibres with it: Whence it comes to pass that the *Membranes* or *Valves*, being also drawn down, do presently uncloſe this Orifice, and open the Door as it were for more Blood to come in, what came in before being expelled in the last *Systole*.

The two Trunks of the *Cava* having thus discharged themselves by one Orifice into the right Ventricle, that Trunk which ascends towards the *Claviculæ* (for so we must consider it for Order's sake, tho' in Truth it descends from thence) as soon as it is gone out of the *Pericardium*, sendeth forth a notable Branch called *Vena sine pari*, (or ἄζυγος) because it is but one, having no Fellow.

Vena sine pari.

It ariseth out of the hinder part of the *Cava*, but more towards the right Hand, and descends thro' the right Side of the Cavity of the *Thorax*. After its Rise, which is betwixt the fourth and fifth *Vertebra* of the Breast, it bends a little forwards toward the right Hand, till it be descended as far as the eighth or ninth *Vertebra*, where it begins just to keep the middle. It sends forth on each side Intercostal Branches to the Interstices of the eight lowest Ribs; and at the eighth Rib it is divided into two branches: One whereof being the larger, descends toward the *left Hand* betwixt the Processes of the Diaphragm, and is inserted sometimes into the *Cava* above or below the Emulgent, but oftner into the Emulgent itself: The other being the *right*, is joined also to the *Cava*, commonly a little above the Emulgent, but seldom into the Emulgent itself. It

It was formerly held, before the Circulation of the Blood was found out, that in an *Empyema* of the *Thorax*, the Matter was absorbed by the Mouths of this Vein, and carried directly to the Emulgent Veins, where it was separated with the *Serum* by the Kidneys. But seeing the Blood does indeed ascend from the Emulgents by this Vein, and that at its Insertion into them, there is commonly a Valve that hinders any thing from issuing out of the *Vena sine pari* into the Emulgent, but permits the contrary; it is certain, that if this Vein be at any time an instrument to evacuate such *Pus*, it must first ascend to the *Cava*, and pass thro' the Heart, and so be carried to the Kidneys by the *Aorta* and the Emulgent Arteries arising out of it. But tho' it is difficult to conceive how the Mouths of this Vein should open so wide into the Cavity of the *Thorax*, as to imbibe slimy ropy *Pus*, and yet not let forth the Blood that is more fluid; so that one would hardly assign this Office to it; yet when the *Pus* is collected betwixt the *Pleura* and intercostal Muscles, and the Tumour does not burst, I see not why it may not be supposed that the Intercostal Branches of the *Vena sine pari* do imbibe the Matter out of the Tumour, and carry it that way which was just now spoken of. And if ever *Pus* be imbibed out of the Cavity of the *Thorax*, because it floats upon the Diaphragm, the *Venæ phrenicæ* are liker to do it than this, as was noted before in this Chapter, when we described those Veins. But the Truth is, 'tis more probable, when such Matter is voided by Urine, that it is absorbed by neither of these Vessels, nor from the Places mention'd, but rather by the *Vena pulmonaria* out of the Lungs when they apostemate.

How Pus collected in the Thorax is voided by Urine.

Of

Of this *Vena sine pari* we shall say no more, but that at its rise out of the *Cava* it has a *Valve* that opens towards the *Cava*, which having sent forth this Vein, ascends on towards the *Claviculæ*; strengthned and sustained by the *Mediastinum* and *Thymus*, and before it is divided into the two *Rami subclavii* (sometimes after) sends out yet two other small Veins called,

Intercostales superiores.

The *superior Intercostals*, on each side one, each of which has a *Valve* where it joins to the *Cava*, permitting the Influx of the Blood into the *Cava*, but hindring its Relapse. These run along the Interstices or Intervals of the three or four uppermost Ribs. Yet sometimes the *Vena sine pari* sends twigs to these four Interstices of the Ribs as well as to the eight lower and then these superior Intercostals are wanting.

Venæ subclaviæ.

Afterwards the Trunk of the *Cava* is divided into two large Veins, one of which goes to the right Hand, the other to the left. These, while they are within the Breast, are called *Venæ subclaviæ*, running along the under side of the *Claviculæ*; but as soon as they are gone out of it, *Axillares*. They send forth several Branches both *upwards* and *downwards*. Sometimes the superior Intercostals just now mentioned (tho' seldom) arise out of them. Next, the

Branches arising from them.
1. Mammariæ.

Mammariæ descend from them (though these sometimes spring out of the Trunk of the *Cava*; so uncertain is the Origin of some of these Veins.) These send forth double Branches, Internal and External. The *Internal* run to the gristly Ends of the Ribs, and their Intercostal Spaces, and some of their Twigs also are terminated in the Glands of the *Mammæ*. The *External* pass down on the Out-side of the Breast, and send many Twigs into the said Glands; and marching farther by the sides of the *Cartilago ensiformis*, descend out

of

of the *Thorax*, continuing their Course down the *Abdomen*, under the streight Muscles thereof, till about the Navel, where it hath been an old Tradition that they inosculate with the *Venæ epigastricæ*; but this was a Mistake, as has been noted more than once already. *Bartholin says*, that sometimes there is but one *Mammaria*.

The second Vein that ariseth out of the Subclavian, is the *Mediastina*; this sends Twigs to the *Mediastinum* (from which it hath its Name) to the *Pericardium*, and to the Gland called *Thymus*. This also sometimes springeth out of the Trunk of the *Cava*. 2. Mediastina.

The third is *Cervicalis* or *Vertebralis*; this turns backwards towards the *Vertebræ* of the Neck, into whose lateral Holes it enters by some small Twigs, which disperse themselves through the Membrane that invest the Marrow contained in these *Vertebræ*; and other Twigs it bestows upon the Muscles that lie next upon the *Vertebræ*. 3. Cervicalis.

The fourth is *Muscula inferior*; this is spent upon the lower Muscles of the Neck, and the upper of the *Thorax*. It riseth sometimes from the external Jugular. 4. Muscula inferior

All these spring from the lower side of the Subclavian Veins; but these that follow, from the *upper*. As,

The *Muscula superior*, which is dispersed thro' the Muscles of the Neck. 5. Muscula superior.

Then the *Jugulars*, which are double, *External* and *Internal*. As these go out of the Subclavians, there is placed sometimes one thin Valve, sometimes two, to hinder the return of the Blood out of the Subclavians into them. 6. Jugulares.

The *External* ascend on the Outside of the Neck, and these are they which are opened when one is let Blood in the neck for any Distemper of the Head. or Quinsey, *&c.* They ascend but

just

just under the Skin, and provide for the outward Parts of the Neck, Chaps, Head and Face. They make the Temple-veins and the Forehead-vein, both which are wont sometimes to be opened: Yea, they send small Capillaries through the Sutures of the Skull, into the Membranes that cover the Brain.

The *Internal* in Men are larger than the *External*. They ascend from the Subclavian by the sides of the Wind-pipe, on which they bestow small Twigs. As soon as they are come to the *Basis* of the Skull, they are each divided into two, the greater and less: The greater is carried backwards, and by that Hole of the *Os occipitis* by which the sixth Pair of Nerves (Dr. *Willis*'s eighth) comes out of the Head, they enter in, and are dispersed through the *Dura Mater*, &c. The less enters in by the Holes made for the third and fourth Pair of Nerves, and is also bestowed on the *Dura Mater*, &c.

When the Subclavian Veins have sent forth all these Branches, they then pass out of the *Thorax*, and begin to be called *Axillar*; of which we shall treat in the Fourth Book, *Chap.* I.

Into the *Vena subclavia* are inserted also the *Ductus chyliferus thoracicus* (of which in the First Book, *Chap.* 10.) and *Lymphaticus Ramus*, which returns the *Lympha* from the Arms, Neck, *&c.* but sometimes this opens into the Jugular.

CHAP. X.

Of Vena arteriosa, *and* Arteria venosa.

Vena arteriosa.

THe second Vessel in the Breast is commonly call'd *Vena arteriosa*, but more properly *Arteria pulmonaris*, both because it performeth the Office of an Artery, in carrying Blood out of the

the right Ventricle of the Heart to the Lungs; and also, because its Coat is double like that of other Arteries.

As it riseth out of the right Ventricle of the Heart, there stand at its Orifice three membranous *Valves* looking outwards, called *Semilunares*, because they make as it were a half Circle, as also *Sigmoides* or *Sigmoideæ*, from the Shape of the Greek Letter *Sigma*, which of old was of the same Figure with an English C. These Valves are made of the Tendons of the Fibres of the Heart, as *Steno* affirms; yea, the same Tendons, he says, pass into the Substance of the Artery it self. In the *Systole* of the Heart they open, and permit the Blood to issue out of the Ventricle into this Artery; but in the *Diastole* they shut, so that none can return back again. A little beyond these Valves in a *Fœtus* in the Womb, there springs out of this Artery a Pipe called *Canalis Arteriosus*, that runs a-cross the Breast to the *Aorta*, into which it conveys the greatest part of the Blood out of this Artery, without its passing thro' the left Lobe of the Lungs, or the left Ventricle of the Heart; but as soon as the Child is born, it closes up, and turns ligamentous, as was said before of the *Foramen ovale*. *Its Valves.*

As soon as it is past out of the *Pericardium*, it bends towards the *Aspera Arteria* or Wind-pipe, and is divided into the right and left Branch, which applying themselves to the like Branches of the *Aspera Arteria*, do every where accompany them on the under Side, and as they run along send out very many Twigs on every Side, which presently associate with those of the Wind-pipe, and of the *Vena pulmonaris*. And where the small Pipes of the *Aspera Arteria* end into the little round Cells (which we shall describe in the Chapter of the Lungs) the Twigs of this Artery, being interwoven with those of the Vein, do embrace *Branchings in the Lungs.*

them

them like a Net. Whence one may gueſs, that the Reaſon why the ſanguiferous Veſſels do ſo exactly accompany all the branches of the Wind-pipe, and its annexed little Bladders, is, that the whole Maſs of Blood paſſing this way, may be inſpired or impregnated with the Particles of the nitrous Air. For there is but a very little ſpent on the Nutrition of the Lungs, but the greateſt part of it is received by the ſmall Twigs of the *Vena pulmonaria*, which accompany thoſe of this Artery in all its Ramifications.

Arteria venoſa. The third Veſſel is called *Arteria venoſa*, otherwiſe *Vena pulmonaria*; this has but a ſingle Coat, as the other Veins have. After it has accompanied the Wind-pipe and *Arteria pulmonaris* in all their branchings in the Lungs, and by its ſmall Twigs has received the Blood (by *Anaſtomoſes* as moſt affirm) out of the Artery, all theſe Twigs are united firſt into two Trunks (*viz.* the right and left) afterwards into one, which opens into the left Ventricle of the Heart.

Its Valves. At its Orifice there are placed two Membranous *Valves*, called *Mitrales*, becauſe when they are joined together, they do in ſome manner reſemble a Biſhop's Mitre. They are of a ſtronger Contexture than thoſe called *Tricuſpides*, at the Orifice of the *Cava* in the right Ventricle; and ſo are the Fibres that aſcend to them from the *Papillæ* or fleſhy Columns, ſtronger. For ſeeing the Blood is expelled more impetuouſly out of the left Ventricle than out of the right (for the Blood ſent out of the one, is to circulate only thro' the Lungs, but that out of the other, thro' the whole Body) it was convenient that the Valves and Fibres ſhould be ſtronger, to ſuſtain the violent Motion of the Blood, and hindring it from returning into this Vein again, to direct its Courſe into the *Aorta*, whoſe Orifice opens in the *Syſtole* of the Ventricle. Juſt

Just as this *Vena pulmonaria* is entring into the left Auricle, there is, in a *Fœtus* in the Womb, a Pipe called *Foramen ovale*, that opens into it coming from the *Cava*, as was noted above. To which we shall here add, that at its Orifice into this *Vein* there is a Valve placed, that hinders any Blood from returning into the *Foramen* out of the *Vein*.

And here there is one thing worth noting concerning the Pulmonary *Artery* and *Vein*: That whereas in all the other Arteries and Veins through the whole Body besides, the Blood contained in the Arteries is of a bright scarlet Colour, and that in the Veins of a black Purple; on the contrary, the *Arteria pulmonaris* containeth black purple Blood, and the Vein scarlet-coloured. The Reason whereof was shewn before, *Ch. 7. viz.* That the scarlet Colour of the Blood is wholly owing to the mixture of Air with it in the Lungs. And therefore that Blood which the Pulmonary Artery brings into the Lungs out of the right Ventricle of the Heart, being the Venal Blood that was brought thither from the Circulation by the *Cava*, changes not its Colour till it passes out of the small Twigs of the said Artery, into those of the pulmonary *Vein*, where the airy Particles insinuate themselves into it, and so alter its Colour.

The pulmonary *Vein* hath no Valve in it, except that at its opening into the left Ventricle. Of which Dr. *Willis* gives this Reason, That the Blood within the *Præcordia* may always, because of the *Impetus* of the Passions, freely fluctuate and regurgitate both ways, backwards and forwards. And lest the left Ventricle of the Heart should at any time be suffocated by the Blood rushing too impetuously into it, the fleshy Fibres in the Root of the Vein (so both this and the *Cava* have

such there, which seem to make a kind of Sphincter) by the Instinct of Nature contracting themselves, invert its Course, and make it flow backward towards the Lungs.

CHAP. XI.

Of the Aorta, *or great Artery.*

Aorta. THE fourth Vessel is the great Artery called *Aorta* (*Arcula*, a little Chest) and by way of Eminency *Arteria Magna*, because it is the greatest Artery of the whole Body, from which all others (except the Pulmonary) are derived.

Its Valves. It springeth out of the left Ventricle of the Heart, and at its Rise hath three *Valves* looking outwards, called *Semilunares*, being altogether like those at the Orifice of the *Arteria pulmonaris* in the right Ventricle. And these, with the *Aorta*, according to *Steno*, are both of them constituted of the Tendons of the Fibres of the Heart, as well as the *Sigmoideæ* and *Arteria pulmonaris*, of which in the former Chapter. These hinder the Blood from returning out of the great Artery into the Heart again. The Orifice of the *Aorta* (or rather the Tendon of the Heart that is continuous to it) in some Creatures (especially in Harts) does often grow bony; and sometimes in Men, according to the Observations of *Bartholin* and *Riolanus*.

As soon as the *Aorta* is gone out of the Heart, it ascends not in a direct Course towards the Head; for if it had, seeing it openeth streight upward out of the Ventricle, it would have poured the Blood (especially in lying along) in too rapid a Stream into the Brain, and the lower parts of the Body would have been defrauded of their due Share: But it first bends arch-wise, so that its

bowed

bowed Corner sustains the first *Impetus* of the expelled Blood, and directs the greatest Torrent towards its descending Trunk, and a lesser Quantity passes up by the ascending, being to convey the Arterial Blood to fewer and smaller Parts.

In a *Fœtus* in the Womb there comes a Pipe out of the *Arteria pulmonaris* into the *Aorta*, called *Canalis arteriosus*, which brings out of it the greatest part of the Blood that was expelled out of the right *Ventricle*; little more passing into the Lungs than may serve for their Nourishment; of which we have given the Reason in the two former Chapters, as also in *Book* I. *Ch.* 34. After the *Fœtus* is born, the *Canalis* degenerates into an impervious Ligament, as was also noted before.

Before the *Aorta* come out of the *Pericardium*, it sendeth forth sometimes one, but oftner two small Arteries, from each side one, which compass the *Basis* of the Heart like a Garland, in their Circuit sending down divers Twigs length-ways of the Heart: They are called *Coronariæ*. When these two small Arteries have encompassed the *Basis*, and meet, they inosculate with one another, but not with the *Veins*. At their Rise out of the *Aorta* there is a *Valve* placed, that permits the Blood to flow out of the great Artery into them, but hinders its Reflux.

These (as was above observed from Dr. *Ruysch*) send Branches to the Auricles of the Heart, and also to the Whole Substance of the Heart itself: Yea, according to the same Author, to the Coats of the Root of the Trunk of the *Aorta* itself also.

When it hath pierced the *Pericardium*, and bended a little arch-wise backwards, it is divided into two Trunks, whereof the one is called *Truncus ascendens*, the ascending Trunk; the other *descendens*, the descending. *The Division of the* Aorta *into the ascending and descending Trunk.*

Of these two, the *descending* is largest, because it ministreth to more Parts.

The but just now quoted Dr. *Ruysch*, does not approve of this Division, but says, [‘ That the ‘ Trunk of the *Aorta* coming forth of the left *Si-* ‘ *nus* of the Heart, tends upwards indeed, but ma- ‘ king an Arch, is presently bended downwards; ‘ and as it so bends, it sends forth some Branches ‘ to the Parts situated above the Heart, and espe- ‘ cially the subclavian and *Carotides* (and which is ‘ to be noted) on the right side, for the most ‘ part, if not always, the *Carotis* and subclavian ‘ Artery are for a little space at their Rise join- ‘ ed into one, otherwise than in the left side, ‘ where for the most part they come separately ‘ out of the *Aorta*. So that the *Aorta* is not divi- ‘ ded by Nature properly into two Trunks, for ‘ both the ascending and descending Trunk is ‘ the same. But if any be minded to call this ‘ *Aorta* as it ascends, the ascending; and as it de- ‘ scends, the descending, I will not be against it; ‘ but I have by no means found it in Man so ‘ separated and divided into two Parts, that the ‘ one Part should ascend, and the other descend, ‘ as it is represented in the Figures of divers Au- ‘ thors.]

Thus he, and because he is a Person very curious, I have here inserted his Figures, lately published in his Answer to *Gaubius*'s third Letter.

Tab. XI.

Fig. I. A *The Root of the Trunk of the* Aorta, *out of each side of which spring,*

The coronary Arteries, BB.

CC *The Arteries running through the Auricles of the Heart.*

D *The little Branches of Arteries springing out of the* Arteria coronaria, *and dispersed through the Coat of the Root of the* Aorta.

Tab. XI.

Pag. 31

Fig. 1.

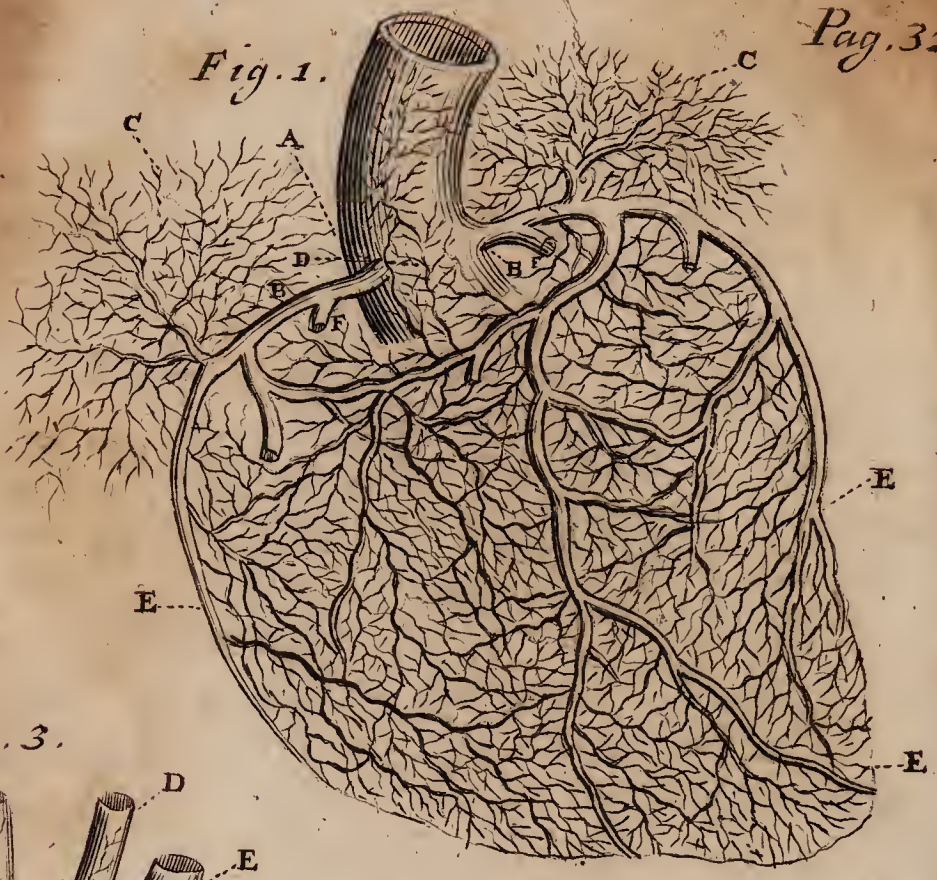


Fig. 3.

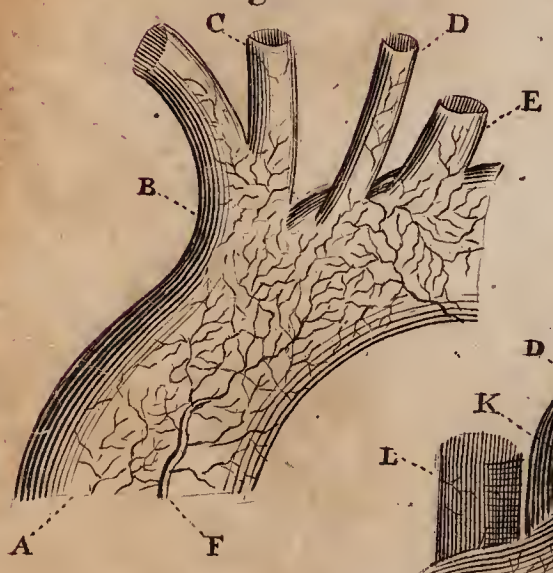
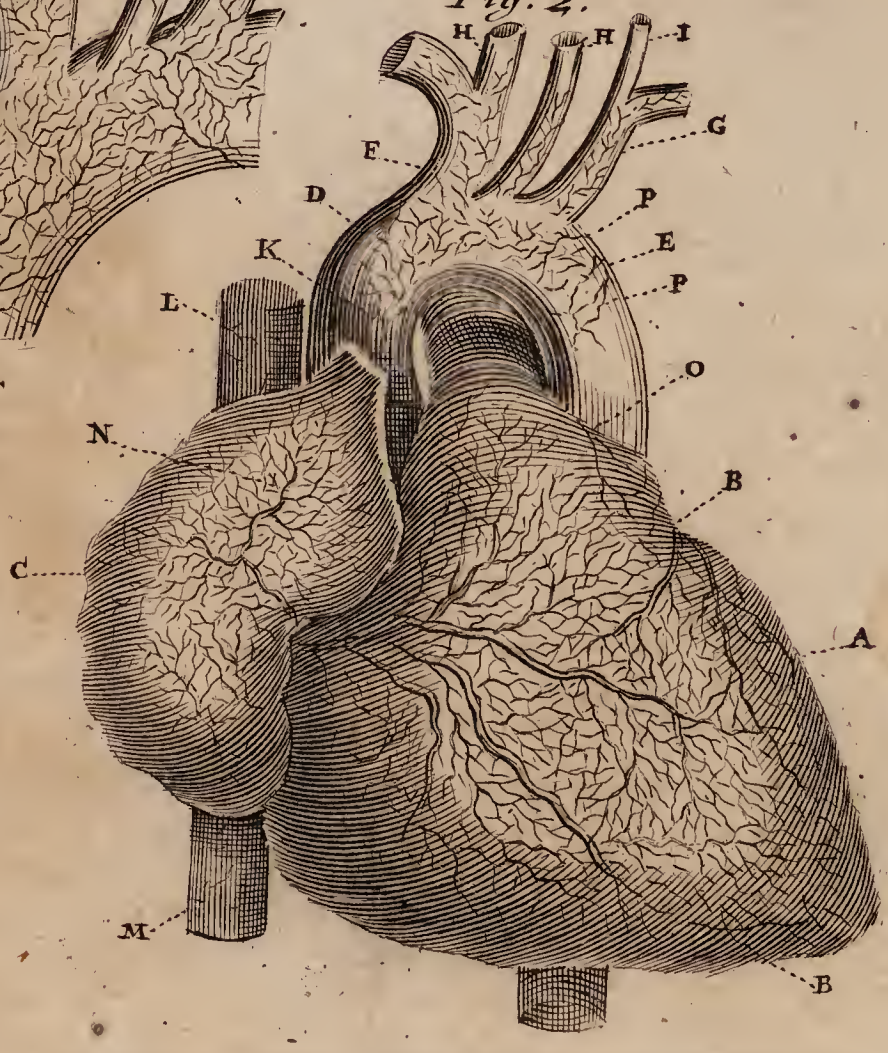


Fig. 2.



EEE *Very numerous Sprigs of Arteries ſpread through the Subſtance of the Heart.*

FF *The Trunks of the coronary Arteries cut off, deſigned for the backſide of the Heart.*

Fig. II. A *The Heart of a Boy about ten Years old.*

BB *The Arteries diſperſed through the Subſtance of the Heart.*

C *The right Auricle of the Heart.*

D *The Trunk of the* Aorta *emerging and riſing up out of the left* Sinus *of the Heart.*

E *The deſcending Trunk of the* Aorta.

F *The right ſubclavian Artery united for a little ſpace to the right Carotid.*

G *The left Subclavian Artery coupled to the cervical Artery, and is leſs in Diameter than the foregoing.*

HH *Each Carotid Artery.*

I *The left cervical Artery.*

K *The little Arteries ſpringing from the coronary Artery, furniſhing the Coats of the Root of the* Aorta.

L *The aſcending Trunk of the* Vena cava.

M *The deſcending Trunk of the* Vena cava.

N *The Arteries diſtributed through the right Auricle of the Heart, and ariſing out of the coronary Artery.*

O *The Root of the pulmonary Artery coming forth of the right* Thalamus *of the Heart.*

PP *The little Arteries ſpringing from the internal mammary Arteries, and diſtributed through the Coats of the* Aorta.

Fig. III. A *The Trunk of the* Aorta *of an adult Man.*

B *A Branch of the right ſubclavian Artery, out of which the right carotid Artery ſpringeth, noted by the Letter* C.

D *The carotid Artery of the left Side,*

E *The left ſubclavian Artery.*

F *The Branches of Arteries that ſpring from the* Arteria coronaria.

Now tho' I must needs acknowledge, That what this curious Anatomist speaks against the dividing the *Aorta* into its ascending and descending Trunk, has much Reason in it, as appears by the second Figure; yet having his Leave, I shall adhere to the usual Division, and proceed to observe the *ascending* and *descending* Trunks of the *Aorta* in their several Off-springs, as they have been hitherto described.

The Branches of the Trunk ascending.

The *ascending* Trunk then running up under the *Vena cava*, lies upon the Wind-pipe, and presently sendeth forth two large Branches, whereof one passeth to the right, the other towards the left Arm: They are called *Rami subclavii*, because they march under the *Claviculæ*; and as soon as they are gone out of the Breast, are called *Axillares*. The right is the larger, and rising higher, goes a more direct way towards the right Arm; the left is less, and rising lower, ascends more obliquely towards the left Arm. They send out several Branches both from their *lower* and *upper* side.

1. Subclavia.

2. Intercostalis superior.

From the *lower* proceeds the *superior Intercostal*, which runs along the Interstices or Intervals of the four uppermost Ribs, and sends Slips to the neighbouring Muscles and spinal Marrow. These sometimes are propagated from the cervical Arteries coming out thro' the Holes of the *Vertebræ*.

3. Mammaria.

From the upper side of each Subclavian springs first *Mammaria*, which descends towards the Breasts thro' the Muscles that fill up the Interstices of the Cartilages of the true Ribs; and a considerable branch of each descending out of the *Thorax* by the sides of the *Cartilago ensiformis*, run down the *Abdomen* under the *Musculi Recti*, spreading there into many Twigs; which are said to inosculate with the Extremities of the like Twigs of the epigastrick Artery ascending. But

that

that Opinion is ſo oppoſite to the Circulation of the Blood, that it is impoſſible to be true. For no Blood can aſcend by the *Mammariæ*, nor deſcend by theſe aſcending Twigs of the *Epigaſtricæ*.

The next is *Cervicalis* (otherwiſe called *Vertebralis*) which ſendeth Slips to the *Vertebræ*, and Muſcles of the Neck, at whoſe ſeventh *Vertebræ* it enters in by the Holes of the tranſverſe Proceſſes, and pierceth the Membrane that inveſts the ſpinal Marrow, beſtowing Twigs both on the Membrane and Marrow, and runs up therewith in at the great Hole of the *Occiput*, and being enter'd the Skull, both Branches (the right and left) join under the *medulla oblongata*, and then are divided into innumerable moſt ſmall Twigs, which make wonderful Net-like *Plexus* in the *Pia Mater* about the *Cerebellum*, and run into the Subſtance of the *Cerebellum* itſelf; and ſome of them being united with thoſe of the *Carotides*, make part of the very *Rete mirabile*. 4. Cervicalis.

The third Artery that riſes out of the *upper* ſide of the Subclavian, is *Muſcula*, which is ſpent on the Muſcles of the Neck, and ſometimes alſo on ſome of the Arm. 5. Muſcula

After the *Subclavians* have had all theſe Pairs of Arteries going out of them, they paſs out of the *Thorax*, and begin to be called *Axillar*, of which in *Book* IV. *Chap.* 2.

At the ſame Place, or very near, where the aſcending Trunk of the *Aorta* ſends out the Subclavians ſide-ways, the Remainder of it is divided into two, called *Carotides*, which aſcend directly upwards (though the right ſometimes ariſes from the right Subclavian.) Theſe at their riſe are ſuſtained by the *Thymus*, and having beſtowed Twigs on the *Larynx*, Tongue, the Muſcles of the *Os hyoides*, and the neighbouring Glands, paſs up on each ſide by the ſides of the Wind- Carotides

pipe to the Jaws, with the internal Jugular Vein, and there are each ſubdivided into the *external* and *internal* Branches.

The *external* is ſmaller, and is diſperſed into all the Muſcles of the Cheeks, Forehead, Temples, Lips; and in general through all the outer parts of the Head and Face.

The *internal*, which is larger, ſends firſt ſome more Twigs to the *Larynx*, Tongue, *&c.* as alſo to the Glands behind the Ears, and the ſpongy parts of the Palate and Noſe. Then it entereth the upper Jaw, and beſtows a ſmall Slip on the Root of each Tooth (as the *external* did on the Roots of the Teeth of the lower Jaw) whereby ſharp Humours flowing in upon them ſometimes cauſe a very painful Tooth-ach. The Remainder of it climbs upon the Skull, being about its *Baſis* divided into two Branches. The *leſs* and hinder whereof having ſent one Slip to the inner Muſcles of the Neck, and another thro' the Hole of the uppermoſt *Vertebra* into the Membrane that inveſts the ſpinal Marrow, aſcending farther enters the Skull at the Hole by which the ſixth Pair of Nerves (commonly ſo called) comes out, and creeping along the *Dura Mater*, ends near its *Sinus*, (which yet ſome ſay it enters.) The larger Branch tending upwards is carried thro' the bony Chanel in the wedge-like Bone, with a winding Duct, to the *Sella equina*; at whoſe *Baſis* after it has ſent out a Twig on each ſide into the *Dura Mater*, it opens itſelf into many ſmall Slips, which being interwoven with thoſe of the cervical Artery (above-mentioned) make the *Rete mirabile*, which is more obſervable in Beaſts than in Men. Yet it is not all ſpent on the ſaid Slips, but perforating the *Dura Mater*, it enters the *Pia Mater* with two notable Branches, which being divided into very ſmall Twigs, are mingled with thoſe of the cer-

vical

cal Artery, with which they pass out of the Skull, and accompany the spinal Marrow even to the Loins. Afterwards it sends a small Branch thro' the second Hole of the wedge-like Bone with the optick Nerve, out of the Skull, to the Eye. And yet still supplying more Twigs to the Substance of the Brain and *Pia Mater*, and being united with some other Twigs of the cervical Artery, it makes the *Plexus choroides*.

The Branches of the Trunk descending.

The *descending* Trunk of the *Aorta*, which is larger than the *ascending*, goes down by the Gullet, to which it cleaveth. And hence is a Man that is hot, so much cooled with a Draught of cold Drink; for the Gullet being cooled thereby, the Blood in the *Aorta*, contiguous to it, must needs be cooled likewise.

1. Intercostalis inferior.

Before it arrive at the Diaphragm, it sends out of its hinder side the *inferior Intercostals*, which run along the Interstices of eight or nine of the lower Ribs, namely those which the *superior Intercostals* did not supply. They likewise send Sprigs by the Holes of the *Vertebræ*, made for the Nerves, to the Marrow of the Back, and to the Muscles which rest upon the *Vertebræ*, and also to those of the *Thorax*. Sometimes above this, and sometimes below it, there arises also out of the hinder Part of the *Aorta*, an Artery called *Bronchialis*, first found out and so named by *Frederick Ruysch*, which accompanies all the *Bronchia* of the Wind-pipe.

2. Phrenica.

When it comes to the Midriff, there spring out of it the *Phrenicæ*, one on each side; these running all thro' the *Diaphragm*, pass up into the *Mediastinum*, and sometimes into the *Pericardium*.

3. Cœliaca.

Then having penetrated the Midriff, it descends in one Trunk to the fifth *Vertebra* of the Loins; in which Passage it first sendeth forth

Cœliaca,

Cœliacæ, which ariſeth ſingle, and is ſo called, becauſe it ſendeth Twigs to the *Stomach*. This ſpringeth from the fore-part of the Trunk, at the firſt *Vertebra* of the Loins, and deſcending under the Hollow of the Liver, upon the Trunk of the *Vena portæ*, it is divided into two Branches, the *Right* and *Left*.

Its Branches.

The *Right*, which is ſmaller, aſcending, produces in its *upper* Part the *Gaſtrica dextra*, that comes to the *Pylorus*, whence *Spigelius* calls it *Pylorica*. And beſides, the *Cyſticæ Gemellæ*, which are very ſmall, and are diſperſed thro' the Gall-bladder. And out of its *lower* ſide there ſpring,

Gaſtrica dextra.

Cyſticæ gemellæ.

Epiplois dextra.

1. *Epiplois dextra*, which runs thro' the right ſide of the inner or hinder Leaf of the Caul, and the *Colon* that it is annexed to.

Inteſtinalis.

2. *Inteſtinalis*, beſtowed on the *Duodenum*, and the beginning of *Jejunum*.

Gaſtro-Epiplois dextra.

3. *Gaſtro-epiplois dextra* on the right ſide (to the Middle) of the Bottom of the Stomach, and alſo on the Caul that is knit to its Bottom.

Hepaticæ.

4. *Hepaticæ*, which are two ſmall ones: Theſe are ſpent on the inveſting Membrane of the Liver (for its *Parenchyma* is nouriſhed by the *Porta*) the *Capſula communis*, the Gall-bladder, and *Porus bilarius*.

The Remainder of this *right* Branch enters the Meſentery with many Twigs.

Splenica.

The left Branch of the *Cœliaca*, which is called *Splenicus* (ſometimes ſpringing immediately from the *Aorta*) is larger than the right, and as it goes towards the ſpleen, it ſendeth forth of its *upper* ſide *Gaſtrica major*, which after it hath beſtowed a Slip on the upper and middle part of the Stomach, is divided into two others; the firſt whereof is called *Coronaria ſtomachica*, which encompaſſes the upper Orifice of the Stomach like a Garland, and ſends many Twigs to the Body of

Gaſtrica major.

Coronaria ſtomachica.

the

the Ventricle itſelf; the other *Gaſtrica ſiniſtra*, which (according to *Diemerbroeck*) is carried towards the right Hand into the upper part of the Stomach, and to the *Pylorus*. Out of its *lower* ſide ſpring, firſt *Epiplois poſtica*, which runs to the hinder Leaf of the *Omentum*, and the *Colon* annexed to it. Secondly, *Epiplois ſiniſtra*, which is beſtowed on the lower and left ſide of the *Omentum*. Gaſtrica ſiniſtra. Epiplois poſtica. Epiplois ſiniſtra.

Juſt as this ſplenick Branch is entring into the Spleen, there ariſe out of its upper Part *Vas breve arterioſum*, which goeth ſtreight to the left part of the bottom of the Stomach, and the *Gaſtro-epiplois ſiniſtra*, which being ſuſtained by the upper or fore-leaf of the *Omentum*, ſends ſome Twigs thereto, and alſo to the left part of the bottom of the Stomach, and to both its fore and hinder ſides. Then it enters into the Spleen, whoſe branchings therein we deſcribed in the former Book, *Chap.* 16. *Of the Spleen*. Vas breve arterioſum. Gaſtro-epiplois ſiniſtra.

All theſe Arteries ſpring from the *Cœliaca*, and accompany the Veins of the *Porta* of the like Denomination.

The next that ariſes out of the Trunk of the *Aorta*, is the *upper Meſenterick*, which ſprings from the fore-part of it, as the Cœliack did. It accompanies the *Vena meſaraica* of the *Porta*, and runs through all the upper Part of the Meſentery, and beſtows many Branches on the Guts, *Jejunum*, *Ileum*, and that part of *Colon* that lieth in the right Hypocondre. 4. Meſenterica ſuperior.

Immediately below this, about the ſecond *Vertebra* of the Loins, there go out of each ſide of the deſcending Trunk of the *Aorta*, an *Emulgent Artery*, each of which being after its Riſe divided into two, and ſometimes three Branches, enters the Kidney of its own ſide. The right ſprings out of it a little lower than the left. Both are 5. Emulgents.

ſubdi-

ſubdivided into innumerable Twigs in the *Parenchyma* of the Kidneys (all of which are inveſted with the Veins in one common *Capſula*, borrowed from the *Pelvis*) and their Capillaries end in the *Glands*, wherein the *Serum* that theſe Arteries bring with the Blood is ſeparated therefrom, and carried from them by the urinary Siphons into the *Pelvis*, of which more in the former Book, *Chap.* 17. *Of the Kidneys.*

6. Spermaticæ. Next to theſe ariſe the *Spermaticæ* (called *Arteriæ præparantes.*) Theſe go out of the fore-part of the Trunk very near together (very ſeldom either of them out of the Emulgents, as the left Spermatick Vein does) and the right paſſes over the Trunk of the *Vena cava*. About two Finger's breadth from their Riſe, they are each joined with the *Vena præparans* of their own ſide, and deſcend with them in *Men* through the Proceſs of the *Peritonæum* to the Stones, being divided into two Branches a little before they arrive at them, one of which runs under the *Epididymis*, and the other to the *Teſtis*. In *Women*, when they come near the *Teſtes*, (or *Ovaria*) they are divided alſo into two Branches, one whereof goes to the *Teſtis*, and the other to the bottom of the Womb.

7. Meſenterica inferior. Next below the Spermatick, ſprings the *lower Meſenterick* out of the Trunk, a little before it is divided into the *Rami iliaci*. This entreth the lower Region of the Meſentery, and diſtributes many Branches to the left part of the *Colon*, and to the ſtreight Gut; and laſtly deſcending to the *Anus*, makes the internal hemorrhoidal Artery.

8. Lumbares. Very near to this, out of the Trunk ſtill, ariſe the *Lumbares*, reckoned four in Number. Theſe go out of the back-ſide of the *Aorta*, and are diſtributed not only to the neighbouring Muſcles of the Loins, and to the *Peritonæum*, but enter in at the Holes

Holes of the *Vertebræ* of the Loins, and run along the Membrane that involves the ſpinal Marrow, and penetrate into the Marrow itſelf.

Beſides theſe, ſome reckon other two, on each ſide one, called *Muſculæ ſuperiores* (which run to the Muſcles of the *Abdomen*) unleſs theſe be two of the four called *Lumbares*.

When the Trunk is deſcended as low as the fifth or laſt *Vertebra* of the Loins, and the Top of *Os ſacrum*, it begins to climb upon the *Vena cava*, under or behind which it paſſed thus far: But as it begins to get upon it, it is divided into two equal Branches, called *Rami iliaci*, and at its very Diviſion there ſprings out of it *Arteria ſacra*, whoſe ſmall Twigs entring in at the Holes of *Os ſacrum*, penetrate into the Marrow contained in it. Rami iliaci.

The Trunk of the deſcending *Aorta* being divided into the *Rami iliaci*, theſe are ſubdivided preſently into the *interior* and *exterior* Branches. *Their Branches.*

From the *interior*, which is leſs, proceed three others.

Firſt, The inferior *Muſcula* (called otherwiſe *Glutæa*) which is beſtowed on the Muſcles named *Glutæi*, that make the Buttocks, and alſo on the lower end of the Iliack Muſcle and the *Pſoas*. 1. Muſcula inferior

Secondly, The *Hypogaſtrick*, which is large, and at the lower End of *Os ſacrum* runs to the Bladder and its Neck, and the Muſcles that cover the *Oſſa pubis*. In *Men*, it goes alſo along the two nervous Bodies of the *Penis* as far as the *Glans*; and in Women it is diſtributed in numerous Branches into the Bottom of the Womb and its Neck, out of which for the greateſt part iſſue the *Menſes* in their Monthly Purgation. It goes alſo to the *Podex*, where it makes the external hemorrhoidal Artery. 2. Hypogaſtrica.

Thirdly, The *Umbilical* Artery, which aſcending by the ſides of the Bladder, and being inſert- 3. Umbilicalis.

ed

ed into the *Peritonæum*, proceeds betwixt the two Membranes thereof to the Navel, out of which it passes in a *Fœtus* in the Womb, and runs into the *Placenta uterina*, of which before, *Book* I. *Chap.* 33. But after the Infant is born, when there is no more Use of it, it closes up, and turns into the Nature of a Ligament, in some measure sustaining the sides of the Bladder, and hindring it from pressing on its Neck.

From the *exterior Branch* of the *Ramus iliacus* two Arteries arise.

4. Epigastrica. First, The *Epigastrick*, which turning upwards on the out-side of the *Peritonæum*, runs betwixt it and the *Musculi recti* of the *Abdomen*, as high as the Navel, where the mammary Artery meets it, and according to Tradition (tho' false) inosculates there with it. Of which before in this Chapter.

5. Pudenda. Secondly, *Pudenda*, which sends forth a notable Artery on each side into the nervous Body of the *Penis* in Men, and into the *Clitoris* in Women. Hence it is carried inwards by the jointing of the *Ossa pubis* to the *Pudenda* and Groins, and their Glands, and is spent on the Skin of those Parts, and of the Yard (in Men.)

When all these Pairs of Arteries have arisen out of the *Rami iliaci*, they run down out of the *Abdomen* to the Thighs, where they begin to be called *Crurales*, where we shall leave them, till we come to speak of the Arteries of the *Limbs*, *Book* IV. *Chap.* 5.

Having now traced all the Arteries springing out of the *Aorta*, (whether out of its *ascending* or *descending* Trunk) in the *Thorax* and *Abdomen*, taking occasion to do so, because the *great Artery*, out of which they all arise, has its Origin in the *Heart*, to which we have considered it as an Appendage; we shall pass on to the Description

of

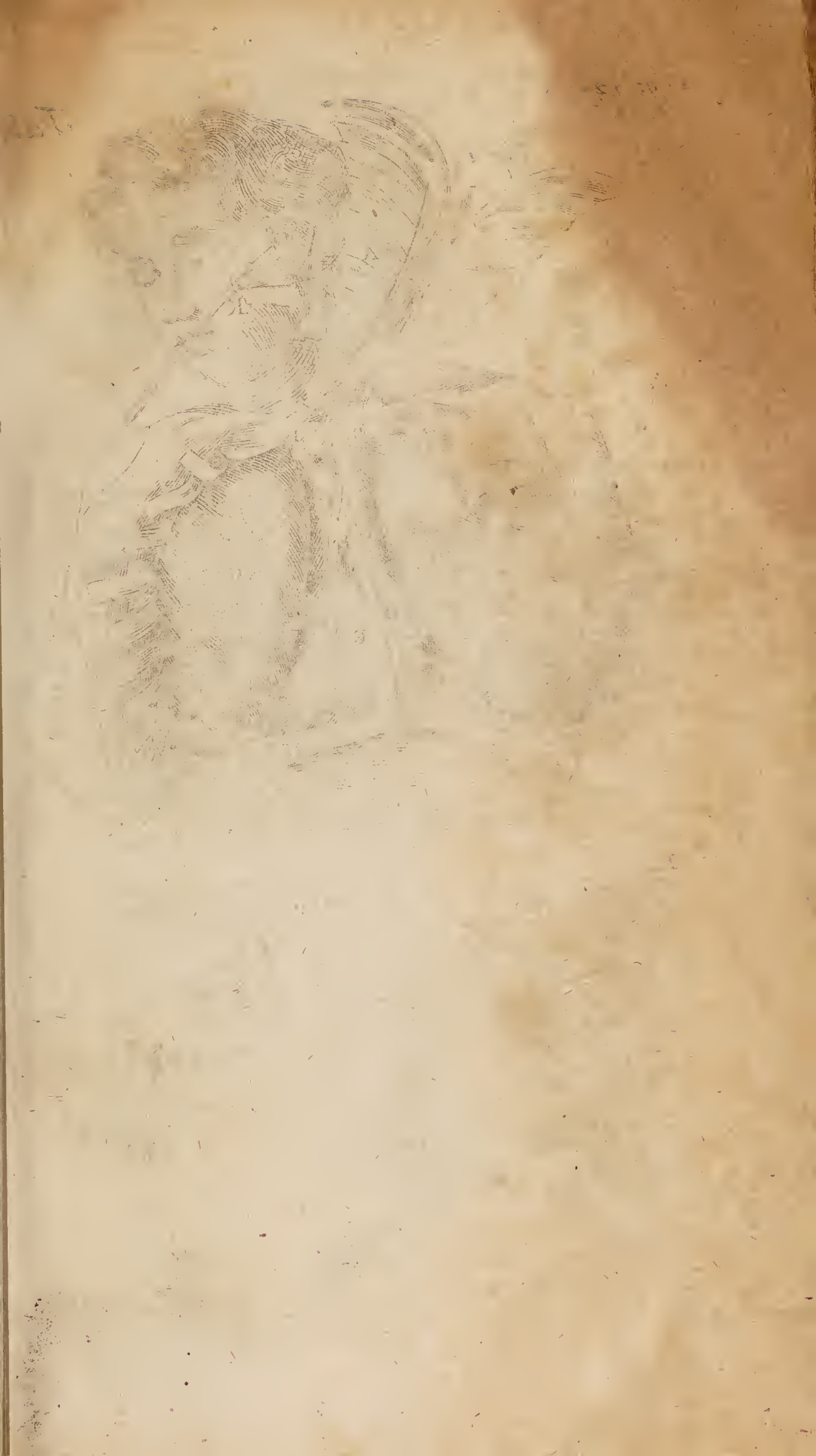


Fig. 1

Fig. 2

Fig. 3

Fig. 4

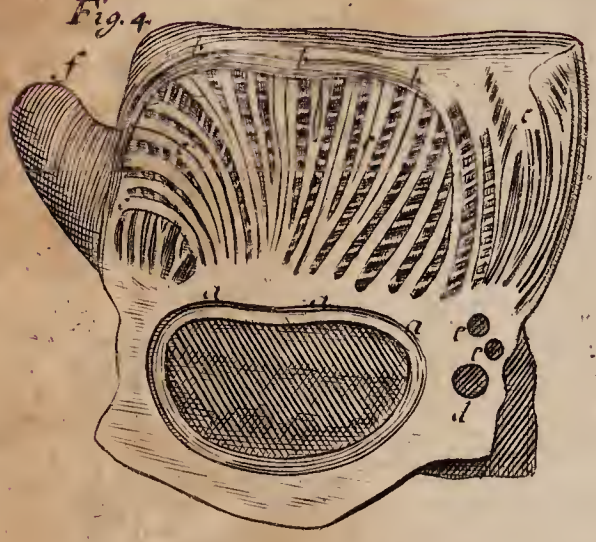


Fig. 5

Fig. 6

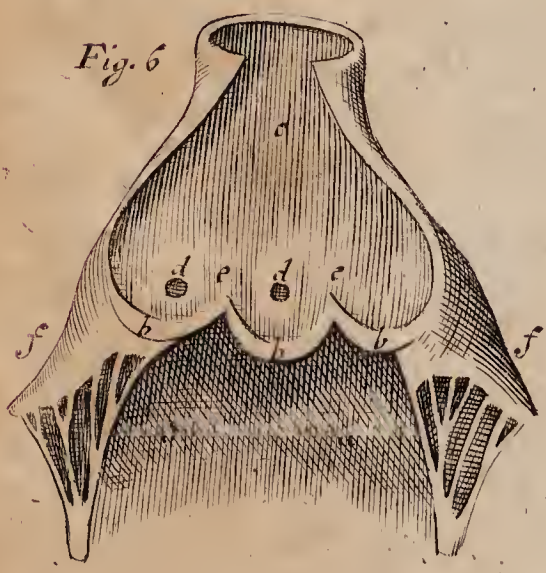


Fig. 7

of the remaining Parts in the *Breaſt*, not yet ſpoken to.

TAB. XII.

Repreſenteth the Fibres of the Heart, with its Auricles, Ventricles, Valves, &c. (*from Dr.* Lower.)

Fig. I. Sheweth the outmoſt or ſtreight Fibres of the Heart.

aa *The Baſis of the Heart.*
b *its Cone.*
ccc *The ſtreight Fibres tending upwards towards the Baſis.*

Fig. II. Sheweth the ſecond Rank of Fibres (which are oblique) lying next under the former; which aſcending obliquely from the left ſide towards the right, terminate in the Baſis of the Heart, imitating a Snail-ſhell, or Screw, by their ſpiral Circuit.

a *The Baſis of the Heart.*
b *The Cone.*
c *Fibres that encompaſs the left Ventricle.*
d *The Fibres encompaſſing the right.*
e *A* Sinus *in the Interſtice of the Ventricles, made for receiving the Veſſels of the Heart.*

Fig. III. Sheweth the third or inmoſt rank of Fibres, which are oblique alſo, but run a contrary Courſe to the former; for they ariſe every where from the right Side of the Heart, whence being carried obliquely towards the left, and embracing each Ventricle of the Heart, they aſcend to the Baſis of the left Side.

a *The Baſis of the Heart.*
b *The Cone.*
c *The right Side of the Heart.*
d *The left.*
e *The Fibres of the right Ventricle.*
f *The Fibres of the left.*

Fig. IV.

Fig. IV. Shews the right Auricle of the Heart inverted and laid open.

aaa *The Basis of the Auricle, where it is united to the Tendon of the Heart.*

bbb *The tendinous Circle, whereby it is distinguished from the* Vena cava.

ccc *The carnous Fibres which are carried to the diverse or opposite Tendons.*

d *The coronary Vein.*

ee *Other lesser Veins appointed for bringing back the Blood which remains from the nutrition of the Heart.*

f *The upper part of the Auricle.*

Fig. V. Shews the inner *Sinus* of the left Ventricle.

aaa *The pulmonary Vein laid open before its Entrance into the Heart.*

c *The* Foramen ovale, *whereby the Blood flows out of the* Vena cava *into the pulmonary Vein, just before the Door of the left Ventricle.*

dd *The two Mitral Membranes or Valves.*

ee *The fleshy Columns protuberating out of each Side of the Ventricle.*

g *The Place under the Mitral Membranes, where the Blood is sent forth into the* Aorta.

h *The Cone of the Heart.*

iii *The carnous Fibres running on every Side through the whole circuit of the inside of the Ventricle.*

Fig. VI. Sheweth the semilunar Valves at the Rise of the *Aorta* out of the left Ventricle, (whereunto those at the Rise of the pulmonary Artery out of the right Ventricle are like.)

aa *Part of the left Ventricle laid open.*

bbb *The three semicircular* Valves *conciding loosly, that they may yield an Exit to the Blood bursting forth.*

c *The*

c *The Trunk of the* Aorta *laid open.*
dd *The two coronary Arteries riſing immediately without the ſemilunar* Valves.
ee *The Root of the* Aorta, *where it is united with the Tendon of the Heart.*
ff *The Mitral Membranes divided and turned back on each Side, that the ſemilunar* Valves *may come into Sight.*

Fig. VII. Shews the ſemilunar Valves cloſed.

aaa *The Trunk of the* Aorta *cut off at the Root.*
bbb *The three ſemilunar* Valves *coming cloſe to one another, and hindring the Recourſe of the Blood out of the* Aorta *into the Ventricle.*
cc *The two coronary Arteries.*

CHAP. XII.

Of the Aſpera Arteria *and Lungs.*

AS in the Firſt Book, being to treat of the *Stomach*, we firſt deſcribed the *Gullet*, which ſerves as a Tunnel to it; ſo the ſame Reaſon induces to begin with the *Wind-Pipe*, called *Trachea* or *Aſpera Arteria*, thereby to uſher in the Deſcription of the *Lungs*, to which it performs the ſame Office as the *Gullet* to the *Stomach*, this receiving in Air, as that does Meat and Drink. *The Wind-pipe.*

The *Aſpera Arteria* then is a long Pipe, conſiſting of Cartilages and Membranes, which beginning at the Throat, or lower part of the Jaws, and lying upon the Gullet, deſcends into the Lungs, through which it ſpreads in many Branchings; and in Reſpiration ſerves to give Paſſage to the Air to and from the Lungs. *Its Figure and Subſtance.*

Parts. 1. Larynx. It is commonly divided into two Parts, the upper, which is called *Larynx*; and the lower, that is named *Bronchus*. Of the former we shall speak in *Chap.* 14. where we shall treat of the Parts contained in the Neck; of the other here.

2. Bronchus. By the *Bronchus* we mean all the *Trachea* besides the *Larynx*, as well before as after it arrive at the Lungs. It is joined immediately to the *Larynx*, to whose loweſt Cartilage all thoſe of the *Bronchus* (ſo far as it reſts upon the Gullet) are aſſimulated. Theſe Cartilages are like ſo many Ribs, Hoops or Rings, ſeated one below another at equal Diſtances, and kept in their Places by both the Membranes of the *Trachea*, which fill up their Interſtices, and tie them one to another like Ligaments. Yet theſe Rings have not their Circle entire, but on the Back ſide of the *Bronchus* next the Gullet, that they might give way to the Meat in ſwallowing, they paſs into a Membrane; ſo that they are in Figure like the Letter C. But this Interſtice in their Circle, which moſt Anatomiſts affirm to be membranous, *Caſp. Bartholin* (after his Father) ſays is rather [‘carnous, for there are very plain and remarkable carnous Fibres that run from one Side or End of the Cartilage a croſs to the other, which in Expiration (eſpecially violent) contracting themſelves draw the ends of the Cartilages towards one another on each Side, and thereby ſtraiten the Pipe of the *Trachea*.] And though the Cartilages, ſo far as they are contiguous to the Gullet (being about twenty in Number) are thus ſemilunar as it were; yet thoſe of the Branches of the *Bronchus* within the Lungs have no Interſtice in their Circumference, being all Cartilaginous, though not all of a circular Figure, but ſome four-ſquare, others triangular, *&c.* as *Diemerbroeck* obſerves. The *inner* Membrane

Its Cartilages and Membranes.

brane is plentifully beſet with miliary Glands, out of which a good Part of that mucous Matter that bedaubs its Inſide iſſues, for the lubricating of it. The *outer* Membrane helps to connect the Cartilages the more firmly one to another, and the whole *Trachea* to the neighbouring Parts, that it may more ſafely and firmly deſcend into the *Thorax*. This is much thinner than the other; for the inner (according to Dr. *Wallis*) has two Rows of muſcular Fibres, the outer ſtreight, the inner oblique; the firſt by their Contraction ſhorten the *Trachea*, the latter ſtraiten it, ſo that he thinks they aſſiſt Expiration, eſpecially when it is violent, as in coughing, hawking, or the like. Yea, he ſays, this inner Membrane has two others growing upon it, as it were, one glandulous, and another vaſcular. Through this latter do the Blood-veſſels and Nerves every where run; and the Glands placed in the former receive and keep all the ſuperfluous Moiſture or *Lympha* depoſited by the Arteries, which the Veins do not imbibe, till they can remand it by the Lympheducts (which ſpring from them;) or if it be over plentiful, ſo that the Lympheducts cannot receive it all, then it iſſues both out of theſe Glands, and out of the Arteries into the Cavity of the Wind-pipe, and cauſes a Catarrh. But the Inſide of this Membrane is naturally moiſt, being beſmear'd with a fattiſh and mucous Humour, to hinder its drying, and to make the Voice ſmoother; ſo that when this Humour is fretted off in Catarrhs, or the Inſide of this Membrane becomes rough from any Cauſe, the Voice becomes hoarſe; and when it is dried by too much Heat, as in Fevers, it becomes ſqueaking.

Veſſels. The *Aſpera Arteria* has *Veins* from the external Jugulars; *Arteries* from the *Carotides*, and from the *Arteria Bronchialis* (firſt found out by *Frederick*

Ruyſch) which ſprings from the Back ſide of the deſcending Trunk of the *Aorta*, a little above the lower Intercoſtals. *Nerves* it receives from the recurring Branches of the *par vagum*, which run moſtly along its inner Membrane, whence it becomes ſo exquiſitely ſenſible.

When it is deſcended as low as the fourth *Vertebra* of the *Thorax*, it is divided into two Trunks, whereof one goes into the right Lobe of the Lungs, the other into the left, and each is preſently again divided into two, and thoſe into others, till at laſt they end in very ſmall Branches, which are diſperſed among the like Branches of the pulmonary Artery and Vein, and end into and are continued with the little Bladders that make up the greateſt part of the Bulk of the *Lungs*.

Beſides the *Glands* in the glandulous Coat abovemention'd, *Verheyen* affirms he can eaſily ſhew an hundred others, placed chiefly indeed at the ſeveral Diviſions of the *Trachea* and *Bronchia*; but alſo lying upon their Sides, eſpecially about their larger Branches. Moſt adhere, he ſays, immediately to thoſe Branches; but ſome are a pretty way from them, ſometimes a larger Branch of the pulmonary Artery coming between. Near the Surface of the Lungs, about the ſmall Twigs of the *Bronchia*, he ſought them in vain; but dare not affirm, whether it was becauſe there were none, or whether becauſe of their Smallneſs he could not diſcern them from the Subſtance of the Lungs. And he doubts whether there be any notable Diviſion of the Branches of the *Bronchus*, but what has ſome ſuch Gland joined to it. They are of a different Size, thoſe at the firſt Diviſions of the *Aſpera Arteria* being as big as a ſmall Nut; and thoſe about the laſt as little as a ſmall Peaſe. As to their Uſe, he doubts not but they ſeparate

that

that unctuous Humour wherewith the Inſide of the Branches of the *Bronchia* is kept ſlippery. See his *Corp. human. anat.* p. 271, *&c.*

Though the *Lungs* (called in Greek πνεύμων, *à* πνέω, to *breathe*) have been held to be of a carnous *Subſtance*, not much unlike the Liver or Spleen; yet *Malpighius* hath diſcover'd them to be of a far other, namely, ſoft, ſpongy, and rare, made up of moſt thin and fine Membranes, continued with the inner Coat of the *Trachea*, which Membranes compoſe an infinite Number of little round and hollow Bladders, ſo placed, that there is an open Paſſage from the *Trachea* out of one into another, and all terminate at the outer Membrane that encloſeth the whole Lungs. *The Lungs. Their Subſtance.*

Theſe *Bladders*, though they are continued to the *Bronchia*, yet they have no Cartilages as thoſe have; but though they are very fine, yet they have muſcular Fibres, whereby they contract themſelves in Expiration, but not ſo cloſe as to expel all the Air included in them; for if the Lungs had wholly ſubſided and fallen flat and cloſe in Expiration, they would have given ſome Stop to the Circulation of the Blood thro' them, out of the pulmonary Artery into the Vein; whereas now that there remains ſtill ſo much Air in theſe *Veſiculæ*, as to keep the Lungs a little puff'd up and rare, the Blood can paſs the more eaſily and ſwiftly through them.

That there are ſuch Bladders annexed to the *Bronchia*, *Diemerbroeck* ſhews by two notable Stories: The one of a *Stone-cutter*'s Man, that died of an *Aſthma*, in whom he found theſe *Veſiculæ* ſo ſtuff'd with the Duſt of the hewn Stone, that when he cut his Lungs open, his Knife ſeem'd as if it went through an heap of Sand: The other of one that being employ'd to pick and cleanſe Feathers, died of a long continued *Aſthma*, and had theſe

Bladders quite filled with the fine Duſt or Down of the Feathers. From whence he concludes, That whereas in a natural State the Air in Inſpiration is received as well into theſe Bladders as the *Bronchia*, ſeeing they could not now admit any Air, being ſtuff'd with the aforeſaid Matters, the Patients were neceſſarily Aſthmatical, and died ſo.

Inveſting Membrane.

We ſaid before, that all theſe *Veſiculæ* were inveſted with a common Membrane in the *Superficies* of the Lungs; and this Dr. *Willis* will have double: The *outer* Tunicle is thin and ſmooth, which ſeems to be a fine Texture of nervous Filaments; the *inner* rough and thicker, conſiſting almoſt wholly of the Extremities of the Veſſels and *Veſiculæ*; and through the little Pits that are all over made in it by them, its inner *Superficies* looks like an Honey-comb. This inveſting Membrane conſiſting thus of two Tunicles, has many large Pores, but ſuch as admit not any thing to paſs from within outwards; for if one fill the Lungs newly taken out of a Sheep, or the like (before they are cold) with a pair of Bellows, never ſo full of Wind, there will none paſs out of the Membrane, not ſo much as to make the Flame of a Candle to wave: But on the other Side they do admit even Liquors to paſs from without inwards; ſo when the Breaſt has been opened to let out Matter in an *Empyema* (which was too thick to be abſorbed by the two narrow Pores) and bitter cleanſing Injections have been ſquirted into the Cavity of the *Thorax*, to clear it from the purulent Matter ſtagnating in it, it has been obſerv'd, that a good Part of ſuch Injections have been hawk'd and cough'd up. And though ſome think, that whenſoever *Pus* is cough'd up, it is certainly bred in the Lungs themſelves; yet I am of Opinion, that in an *Empyema*, when it is thin, theſe Pores may be

be ſo large, as to imbibe it even out of the Cavity of the *Thorax*; otherwiſe I ſee not how any, labouring of an *Empyema*, ſhould ever be cured without tapping: For of the two I think this a far more probable way to diſcharge the Matter by, than that it ſhould be imbib'd by the Mouths of the Veins gaping (as is ſuppos'd) either in the *Superficies* of the *Pleura*, or Diaphragm. But to proceed,

Diviſion. The Lungs are *divided* into the right and left Part, being parted by the *Mediaſtinum*, and each Part is otherwiſe called a *Lobe*. And becauſe they are two, that have no Communication one with the other (ſave in one common Trunk of the *Trachea*, by which the Air comes into and goes out of them) hence in common Speech we ſay *Lungs* in the plural. Each of theſe Parts or Lobes is ſubdivided into two, ſometimes three others, and thoſe into many leſſer Lobules, as may be ſeen in the following Figure taken from Dr. *Willis*.

Connexion. The Lungs hang looſe in the Cavity of the *Thorax*, being ſuſpended by the *Aſpera Arteria* that runs every where through their Subſtance, and is it ſelf ſuſtained by its Connexion to the Parts of the Neck. Preternaturally (tho' pretty often) they cleave by their outer *Superficies* to the *Pleura*, and ſometimes with their lower end to the Diaphragm.

Veſſels. They have all ſorts of *Veſſels*, that are common to them with other Parts; but peculiar to themſelves they have *Bronchia*, or the Branches of the Wind-pipe, for bringing in, and carrying forth of Air. 1. Trachea.

2. *Arteries and Veins.* Their *Arteries* and *Veins* are the *Arteria* and *Vena pulmonaris*, that accompany all the Diviſions of the *Aſpera Arteria* within their ſeveral Lobes. Theſe are ſaid to have many Anaſtomoſes one with another, for the readier Circulation of the

Blood through the Lungs; however, they are admirably interwoven one with another all through the Coats of the *Vesiculæ*. But of these we discoursed so largely before, *Chap.* 10. that we shall say no more of them here. Besides these, that were all the sanguiferous Vessels Anatomists had observed to reach to the Lungs, there has of late been found out an Artery by *Frederick Ruysch* (which he calls *Arteria Bronchialis*) that seems to convey Blood for the Nourishment of the Lungs and *Bronchia*. But of this likewise before (in this *Chapter*.) And *Verheyen* affirms, there is a bronchial Vein that accompanies this Artery, though he has not found out its Rise; but quotes Dr. *Bourdon* asserting it to spring immediately from the ascending Trunk of *Vena cava*.

3. *Lympheducts.* They have abundance of *Lympheducts* that attend upon the Veins and Arteries. Their small Twigs running upon the outer *Superficies* of the Lungs, towards their Root unite into several greater Trunks; which being inserted into the common thoracick Duct, discharge thereinto the *Lympha* imbibed by them in the Lungs. They may be made to appear very plain in the outward Surface, if in dissecting a live Dog, one press upon the Top of the thoracick Duct, so as nothing be poured from thence into the Subclavian Vein; for then the Lympheducts of the Lungs, seeing they cannot unload themselves into the common Duct that is now stopt and full, will swell very much, and be very conspicuous. If these Lympheducts at any time be obstructed or broken, Dr. *Willis* thinks there often proceeds from thence a Dropsy of the Breast or Lungs; yea, Coughs and Phthisical Distempers.

4. *Nerves.* The last sort of Vessels dispersed in the Lungs are the *Nerves*. And these proceed from the recurring Nerves of the *Par vagum*, usually called

Fig. I.

Fig. III

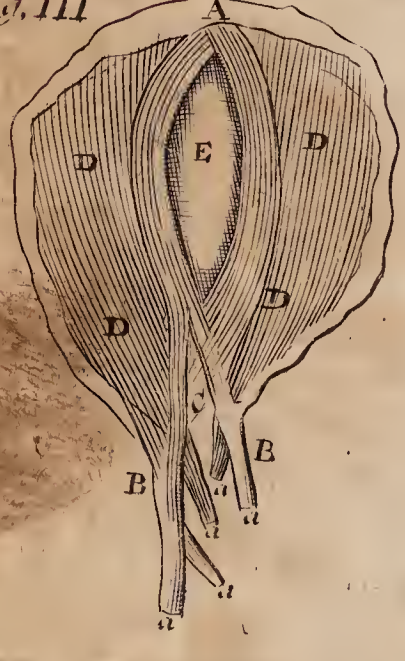
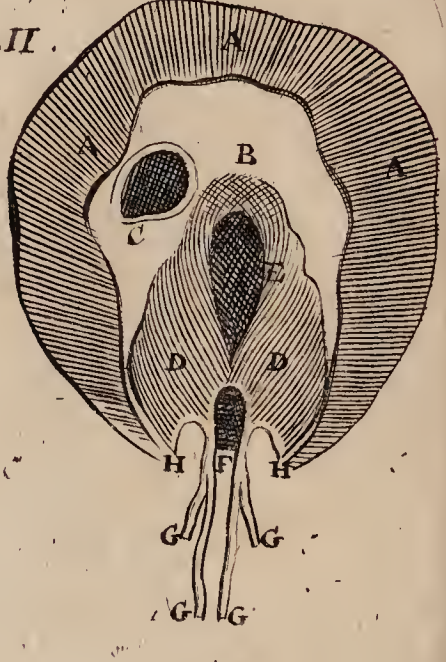


Fig. II.



called the ſixth Pair, but Dr. *Willis*'s eighth, who ſays they are diſtributed all over the Lungs along with the ſanguiferous Veſſels and Ducts of the *Bronchia*, to ſupply animal Spirits to the muſcular Fibres of their Coats.

The *Action* to which they contribute is Reſpiration, of which in the next Chapter.

TAB. XIII.

Repreſenteth the Lungs, Diaphragm, Ductus ſalivalis, *&c.*

Fig. I. Repreſenteth the *Sternum* cut off and lifted up, the *Mediaſtinum*, *Thymus*, Lungs, Diaphragm, *&c.*

AAA *The inner Superficies of the* Sternum, *and of the Cartilages knit to it.*
BB *The mammary Veins and Arteries deſcending under the* Sternum.
C *The glandulous Body, called* Thymus.
DDDD *The ſides of the* Mediaſtinum, *pull'd aſunder from the* Sternum.
EE *The Space between the Membranes of the* Mediaſtinum, *ariſing from the tearing of it from the* Sternum.
GG *The Lungs.*
HH *The Diaphragm.*
I *The* Cartilago enſiformis.
K *The external ſalival Duct.*

Fig. II. Shews the Diaphragm of a Dog (very little differing from that of a Man) from *Caſpar Bartholin.*

AAA *Shew the Courſes of the carnous Fibres in the upper or fore Muſcle, which run ſtreight from the*

the Ribs to the Center, or tendinous part of the Diaphragm.

B *The Center or tendinous Part.*

C *The Hole in the right ſide of the tendinous Part for the Tranſit of the aſcending Trunk of* Vena cava.

DD *The lower or hinder Muſcle of the Diaphragm.*

E *The Hole in the upper Part of the lower Muſcle, through which the Gullet deſcends.*

F *The Hole in the upper Part of the lower Muſcle, through which the* Aorta *deſcends.*

GGGG *Its tendinous Extremities whereby it adheres to the* Vertebræ *of the Loins, formerly called its Proceſſes.*

Fig. III. Shews the lower or hinder Muſcle of a Man's Diaphragm, ſomething differing from that of a Dog, from the ſame Author.

A *Shews the Tendon that intervenes betwixt the upper and lower Muſcle, commonly called the nervous Center of the Diaphragm.*

BB *The lower Tendons (commonly called its Proceſſes) which ariſe by five Heads, as it were* (aaaaa) *from the* Vertebræ *of the Back and Loins.*

C *The Hole by which the* Aorta *(lying along the* Vertebræ *of the Back and Loins) deſcends.*

DDDD *The fleſhy Fibres of the lower Muſcle in their natural and proper Courſe.*

E *The Hole in its carnous Part, by which the Gullet deſcends.*

CHAP.

CHAP. XIII.

Of Respiration.

THE *Action* to which the Lungs are appointed by Nature to minister, is *Respiration*, which is an alternative *Diastole* and *Systole*, or Dilatation and Contraction of the Breast, whereby the Air is received in, and driven forth of the Lungs. *The Action of the Lungs.*

In Dilatation, whereby *Inspiration* is performed, the Lungs are purely passive; for they do not at all dilate themselves by any proper Power or Faculty of their own, being destitute of Instruments to perform such an Action (*viz.* Muscles;) neither do they attract the Air by any magnetick Property: But the Muscles of the *Thorax* being so framed, that tho' Contraction be the only and proper Action of a Muscle; yet the *Thorax* is dilated by certain of them, as it is contracted by others; whilst it is dilated, there is greater Space given for expanding the Lungs; and then the Air, partly by the Pressure of the Atmosphere, and partly by its proper elastick Virtue, issues in at the *Trachea*, and insinuates it self into all its *Bronchia*, and through them into the *Vesiculæ*, and puffs them all up. The Manner whereof is very ingeniously expres'd by Dr. *Mayow*, [' Namely, seeing the Air ' thro' the Weight of the superincumbing Atmo- ' sphere, does not only rush into all empty Places, ' but also strongly presses upon whatsoever things ' are next it; it follows, that the Air which is ' continued thro' the Nostrils and *Trachea*, even ' to the *Bronchia*, or Entrance of the Lungs, doth ' bear upon the Lungs from within, and endea- ' vour an Entrance into them. Whence it comes ' to pass, that whilst the Insides of the *Thorax* *How Respiration is performed.*

(' which

'(which by compreſſing the Lungs from without 'reſiſted the Preſſure of that Air) are drawn out-'wards by the Muſcles of the Breaſt that are ap-'pointed for its Dilatation, and the width of the '*Thorax* is enlarged, that Air which is neareſt 'adjacent to the *Oſtia* of the *Bronchia* (all Obſta-'cles being now removed) ruſhes into the Cavities 'of the Lungs, with all the Preſſure of the At-'moſphere, and puffing them up, occupies and 'fills the widened Space of the *Thorax*. Nor does 'the Preſſure of the Atmoſphere alone, avail 'to Inſpiration; but the Elaſtick Power of the 'Air alſo, whereby it endeavours to extend it ſelf '*in immenſum*, is aſſiſting to the ſame. For the 'Air, eſpecially that which is neareſt the Earth, 'is compreſſed by the Weight of the ſuperincum-'bent; whence it always endeavours to free it 'ſelf from that Preſſure, much like as a Fleece 'of Wool, when the Force that compreſs'd it is 'taken away, by a certain Motion of Reſtitution, 'preſently ſpreads and enlarges it ſelf. Which 'may be confirmed by this known Experiment, '*viz.* If a Bladder, out of which the Air is firſt 'in a great Meaſure preſſed, be tied ſtraitly about 'its Sphincter (or Neck) and put into a Glaſs, and 'then the Air be drawn out of that Glaſs, the 'Bladder will preſently begin to ſwell, and puff 'up to its firſt Dimenſion. The reaſon whereof is, 'That the Air that was in it, tho' little, when 'the external Air (from whoſe Preſſure the ſame 'was driven into a narrow Space) is removed, 'preſently expands it ſelf, and puffs up the Blad-'der, yea ſometimes burſts it with violence. Juſt 'thus is the Inflation of the Lungs cauſed in In-'ſpiration; for as ſoon as the Sides of the *Thorax* '(which by compreſſing the Lungs make them 'concide) are drawn outwards, the Air that is

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'at the entrance of the Lungs, whether thro' 'the Pressure of the Atmosphere, or because of 'its own Elastick Virtue, is presently thrust in-'to the Lungs, and distends them.] But in *Expiration* (or the Contraction of the *Thorax*) the Air is not only driven forth of the Lungs, by the Compression of the *Thorax*; but also by the Contraction of the Muscular Fibres of the *Vesiculæ*, and of the inner Coat of the *Trachea*, and its *Bronchia*.

Muscles ministring to Respiration.

The *Muscles* that assist the Dilatation of the Breast, are those that lift up the Ribs, and draw them backwards; which shall be described, *Book* IV. *Chap.* 15. And besides these, there is another internal Muscle, namely the Midriff, that contributes towards it, as was shewed in *Chap.* 3. of this *Book*, where we treated of it. And as for the straitning, or Concidence of the *Thorax*, that it is not only a Motion of Restitution, or a Cessation of the aforesaid Muscles from their Action, is evident, seeing sometimes Expiration is performed more laboriously and violently than Inspiration, as in coughing, hallooing, or the like: And therefore Nature has provided peculiar and proper Muscles for that purpose, described in the same *Chapter* of the *Fourth Book*; and these are assisted partly by some Muscles of the *Abdomen*, and partly by the muscular Fibres of the *Vesiculæ* and *Bronchia*, as above-said.

What kind of Motion Respiration is.

There hath been great Controversy among Philosophers, whether Respiration be an Animal or Natural Motion. That it is Natural is thought to be proved, both in that it is performed as well when we are asleep, as awake; and also, that though it be continued through a Man's whole Life, yet we are never wearied with it, as we are with animal and voluntary Motions. On the other Side, some prove it to be *animal*; First, because

cauſe it is performed by ſuch Inſtruments as ſerve for animal Motion, namely Muſcles; and Secondly, Becauſe at our Pleaſure we can make it quicker or ſlower, ſtronger or weaker, or alter it how we pleaſe. Others thinking the Arguments on either ſide convincing, take both in, and ſuppoſe it a kind of *mix'd* Action, partly natural, and partly ſpontaneous. But I think there is no neceſſity from the Arguments alledged to grant this Motion to be *natural*, or any more than *animal* or *ſpontaneous*, for as to the *firſt* Argument, That the Motion is as well performed when we ſleep as when we are awake, and therefore it cannot be voluntary: If this were allowed to be of Force, we muſt alſo grant Walking and Talking to be natural Motions, becauſe many perform them both when they are aſleep. And as to the *ſecond*, from our not being wearied by it: In Anſwer to it, we may diſtinguiſh of animal Actions, into ſuch as are done by Inſtinct, and are free, and into ſuch as ſerve the Affections of the Mind; the former proceed always, and without Impediment, even when we think not thereon, but may notwithſtanding be directed and moderated when we *do* think of them, and ſuch is Reſpiration; the latter is not performed continually, as to run, leap, write, *&c.* in the former there is a plentiful and continual Influx of animal Spirits into the Muſcles, of Cuſtom or Courſe; whence there follows no Wearineſs, though they be continual: In the latter, ſeeing by the Determination that is made in the Brain, the Spirits now flow in, and anon ceaſe, ſometimes in greater plenty, and ſometimes in leſs, from this Mutation and Unaccuſtomedneſs does the Wearineſs proceed.

The Uſe of it. Reſpiration is ſo neceſſary to the Continuance of Life, that after once the *Fœtus* comes into the

the open Air, and begins to breathe, it can hardly live two Minutes without it. But upon what Account it becomes so necessary, is not agreed among learned Men, each Party exhibiting such Reasons of it as may best suit with their Hypotheses. Hence some (and those the most) think that Respiration serves for the cooling and ventilating of the Blood that acquires a great Heat in the right Ventricle of the Heart, and also for the carrying out fuliginous Steams therefrom. *Others*, that it serves for the better mixture of the Particles of the Blood, as it passes thro' the Lungs. *Others*, that it condenses the Blood, which was very much rarified in the right Ventricle of the Heart, whereby it comes to take up less room in the Lungs, and passes the readylier thro' each Lobe into the left Ventricle. *Others*, that it principally serves for the Circulation of the Blood thro' the Lungs; for in Expiration, all the *Bronchia*, with the appendant *Vesiculæ*, being in a great measure emptied of the Air, permit a free Entrance of the Blood into the Lungs by the *Vena arteriosa*, out of the right Ventricle of the Heart; but anon the said *Bronchia* and *Vesiculæ* being filled again with Air, do compress the Vessels of the Lungs, whereby the Blood that was received into them in Expiration, is squeez'd out of the Arteries into the Veins, and so its Circulation thro' the Lungs promoted; whereas otherwise it would be apt to stagnate, and occasion a Suffocation. Dr. *Mayow* thinks, that a double Benefit, chiefly, accrues by Respiration; *First*, That the Blood, by the Admixture of the Nitro-aerial Particles of the Air is fermented and freed from Coagulation; and *Secondly*, That the same Nitro-aerial Particles being received into the Blood, are carried to the Brain for the Refection and

Supply

Supply of the Animal Spirits. Laſtly, Dr. *Willis*, Dr. *Charlton*, &c. think, that the Air is drawn in for the greater Subtilization of the Blood, and accending or continuing the vital Flame. Some other Opinions there are concerning the primary Uſe of Reſpiration, which we will not recite, as being leſs probable; and which of theſe produced is the moſt likely, we leave the Reader to judge, being unwilling to enter into the Diſpute about ſo difficult a Speculation in this ſhort Anatomical Treatiſe.

Secondly, Uſes of Reſpiration, are, *Firſt*, To form the Voice; and, *Secondly*, To miniſter to the Senſe of Smelling, by drawing or ſnuffing up the Vapours with ſome Violence thro' the Noſtrils, without which the Organ of Smelling is but little affected. Which Uſe Dr. *Needham* draws from Dr. *Lower*'s Experiment; who having cut a Dog's Wind-pipe aſunder in his Throat, and turn'd it outward (the Wound being in other regards heal'd up again) ſo that the Dog took not his Breath by his Mouth or Noſtrils, but altogether by his Throat; found that thereby he loſt not his Voice only, but his Smelling alſo wholly, ſo that the moſt ſtinking Smells would not excite him.

Tab. XIV.

Repreſenteth one Lobe of the Lungs, with its Lobules, Membranous Interſtices, &c. from Dr. Willis.

Fig. I. Sheweth one whole Lobe of the Lungs in whoſe Superficies the Lympheducts appear creeping this way and that way.

A *The Orifice of the* Trachea *cut off, lying in the middle of the Veſſels.*

B *The Orifice of the ſubjacent Pneumonick Artery.*

C *The Orifice of the Pneumonick Vein lying upon the Artery.*

Fig. 1.

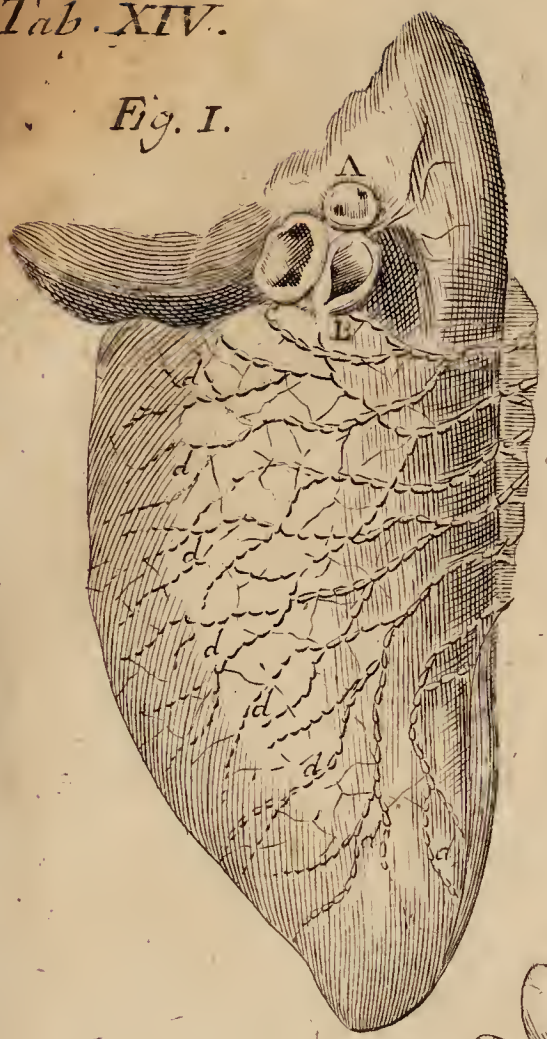


Fig. 4.

Fig. 3.

Fig. 2.

dddd, *&c. The outward Lympheducts diſperſed thro' the Surface of this Lobe.*

Fig. II. Expreſſes one Lobe of the Lungs divided into ſmaller and very little Lobules, according to the Ramifications of the *Aſpera Arteria*, the Branchings and Off-ſprings of which Veſſel being firſt filled by a Liquor injected into them, and then ſevered from one another; as to the Lobules, they were drawn by the Life.

A *The Trunk of the* Aſpera Arteria *cut from the reſt of its Body.*

BBB *Its wider part cut open, that as well the Holes that lead into each Branch, as its ſtreight muſcular Fibres may be ſeen.*

aaa *The aforeſaid Holes leading into the Branches that are extended this way and that way.*

bbb *The ſtreight muſcular Fibres, whereupon other circular ones lie.*

CC *The ſmaller end of this Trunk intire and ſhut, that the annular Cartilages may appear.*

DDDD *The Tracheal Branches, conſtituting the leſſer Lobules, intire, and ſhut in that Place; that the annular Cartilages may likewiſe appear in them.*

EEE *The like Branches cut open, that the Holes and ſtreight muſcular Fibres may be ſeen.*

FFFF *The Stumps from which the* Tracheal *Branches being cut, are removed, that Room may be granted to the reſt expanding themſelves after their Diviſion.*

GGGG *The ſecondary Lobules hanging upon the Stems of the* Bronchia *like Grapes, which may alſo be ſubdivided ſtill into leſſer Lobules, all whoſe inner Ducts paſs out of the* Bronchia *into the Veſiculary Cells.*

HHHH *The ſanguiferous Veſſels creeping through the Superficies of thoſe Lobules.*

Fig. III. Expresses a piece of a pulmonary Lobe, wherein, the membranous Interstices being blown up, all the Lobules appear in their proper Figure, and somewhat represent a Leaf of Polypody.

AA *A piece of the* Aspera Arteria *complicated with the rest of the Vessels, upon which, made up of them all, the Lobules grow like the Leaves of a Tree.*
BBBB *The Lobules themselves.*
cccc *The Blood-vessels creeping through them.*
dddd *The membranous Interstices of the Lobules, thro' which the Blood vessels* eeee *also creep.*

Fig. IV. Represents the Divarication of a Tracheal Branch, distributed within one Lobule, and its Ramification into the Tubes and orbicular Bladders.

AA *The Stem of the* Aspera Arteria.
bbbb *The lesser Twigs proceeding from that Stem.*
cccc *The Transit of these Twigs into the orbicular Bladders, which seem like bunches of Grapes.*
dd *Sanguiferous Vessels distinct from the Pneumonick, which creep upon the* Trachea, *and serve to nourish it.*

CHAP. XIV.

Of the Neck, and the Parts contained in it, viz. *The* Larynx, Pharynx, Tonsillæ, *&c.*

The Neck. HAving now dispatch'd all the Parts of the middle Venter or *Thorax*, we should next proceed to the highest, *viz.* the Head; but betwixt these two is the Neck situated, like an *Isthmus*, which therefore we must take in our way, and describe the Parts contained in it.

It

It is called *Collum*, either *à Colendo*, becauſe it uſed to be adorned with Chains, *&c.* or becauſe it riſeth out of the Trunk of the Body, *inſtar Collis*, like an Hill. *Collum* is a general Name for the whole Neck, but the hinder part of it is particularly called *Cervix*. *Its Name.*

The Parts of it are either *containing*, or *contained*. The *containing* are the ſame which are found in the reſt of the Body, and like them, ſaving that the *Membrana carnoſa* ſeemeth to be more fleſhy. *Parts containing.*

The Parts *contained* are theſe. *Contained.*

1. The *Larynx*, which is the upper part of the Wind-pipe, and the Inſtrument of forming the Voice. 1. Larynx.

It is almoſt round and circular in *Figure*, only jetting out a little before (and ſomething flattiſh behind) to give way to the Gullet in ſwallowing. *Its Figure*

Its bigneſs differs according to Age, Sex, and Temperament; whence proceeds the great diverſity of Voices. Such in whom it is narrow, as in younger People, have ſhrill and ſmall Voices; ſuch as have it wide, and are come to Maturity, have fuller and more hoarſe. The Voice is altered alſo in reſpect of the Length or Shortneſs of the *Larynx*, and as the Air is more ſtrongly or weakly expelled. *Bigneſs.*

It has Arteries from the *Carotides*, *Veins* from the external Jugulars, and *Nerves* from the recurring Branches of the *par vagum*. *Veſſels.*

Beſides the Membranes which are common to it with the reſt of the *Trachea* (deſcribed before *Chap.* 12.) it is made up of five Cartilages, and thirteen Muſcles. *Subſtance.*

The firſt Cartilage is called Θυρεοειδὴς, *ſcutiformis*, or *Buckler-like*; for within it is hollow, but without imboſſed or convex: That Part which ſticketh out, is called *Pomum Adami*, from an idle *Cartilages*

Fable, That part of the Fatal Apple, by God's Judgment, ſtuck in his Throat, and that this Cartilage being thereby diſtended, was made to jet out, and the Protuberance propagated to Poſterity. It is greater in Men than in Women. In its Corners it has four Proceſſes, two longer ones above, whereby it is joined to the lower ſides of the *Os hyoides*, by the help of a Ligament; and two below, by which it adheres to the Cartilage next below it. At the ſides of this Cartilage, and the following, are the Glands placed, called *Thyreoideæ*, which Dr. *Wharton* ſays, are of the ſhape of a Pear or Fig, being ſomewhat hollow on that Side next the *Aſpera Arteria*, and ſomewhat copped on their outer Side. Their Subſtance is more ſolid than that of other Glands, and liker to muſcular Fleſh, tho' it be not fibrous. They contribute to the Roundneſs of the Neck, by filling up the empty Spaces about the *Larynx*; and the Humour ſeparated in them, ſeems to ſerve for the lubricating of the *Larynx*, whereby the Voice may be made more ſmooth and ſweet.

The *ſecond* Cartilage is called κρικοειδὴς, *annularis*, becauſe it is like a Turkiſh *Ring*, and compaſſeth the whole *Larynx*; in the hinder part it is broad and thick.

The *third* and *fourth*, becauſe of the Membrane that inveſts them, ſeem but one, but it being removed, they appear to be two. However they have but one Name, which is ἀρυταινοειδὴς, *guttalis*, becauſe when their two Proceſſes are joined together, they are *inſtar gutturnii*, like to that part of the Neck of a Jug or *Ewer*, at which we pour out the Water; for by their Juncture, they frame a *Rimula*, or little Chink (for the modulating of the Voice) called *Glottis*.

The

The *fifth* is called *Epiglottis*, becauſe it is placed above the *Glottis* or Chink, and covereth it. It is of the Form of a Tongue, and is appointed to hinder the falling down of any thing which to may prove offenſive unto the Wind-pipe, when we eat or drink. It is preſſed down by the Weight of the things which are ſwallowed, for they ſlip over it down into the *Gula*. *Steno* takes Notice of little Holes or Pipes, perforating this Cartilage, which, he ſays, ſpring from certain Caruncles on its upper Side, from whence they evacuate an Humour on the other Side, looking towards the *Larynx*.

The *Muſcles*, by which theſe Cartilages are moved in forming the Voice, are thirteen in Number: But as for their Names and Deſcription, the Reader may pleaſe to conſult *Book* V. *Chap.* 11. *Muſcles.*

The ſecond Part contained in the *Neck*, is the upper part of the Gullet, which is called *Pharynx*, from φέρω, becauſe it conveyeth the Meat and Drink towards the Stomach. It is continued to the *Fauces* (or indeed is the greateſt part thereof) reaching up behind to the *Uvula*, on the Sides to the *Tonſillæ*, and before to the *Epiglottis*. It is membranous; but not purely ſo, for it is thick, and in ſome ſort carnous. It has ſeven Muſcles, to aſſiſt it in ſwallowing, three Pair to open it; and an odd one, which is called its Sphincter, to ſtraiten it; of which afterwards, *Book* V. *Chap.* 12. 2. Pharynx.

The next Parts are the *Tonſillæ*, commonly called *Almonds*; which are two Glands ſeated at the Root of the Tongue, on each ſide of the *Uvula*, and at the Top of the *Larynx*, covered with the common Membrane that inveſts all the Mouth. Dr. *Wharton* ſays, that tho' they ſeem two, yet they are really but one, being continued to 3. Tonſillæ.

one another by a thin and broad Production, which is of the same glandulous Substance with themselves. He says they are of a yellowish Colour, and compares their Substance to concreted Honey, only they are of a more firm Consistency, but they are sandy like it: They have small Vessels from the Jugular *Veins* and *Arteries*, and *Nerves* from the fifth Pair.

Their Duct They have each a large oval common Duct or *Sinus*, that opens into the Mouth, so wide in an Ox, that one may put the Tip of the little Finger into it. Into this many lesser open, and by it discharge into the Mouth, *&c.* the Liquor that is separated in the Gland. *Fallopius* hath observed this Aperture or *Sinus* to look like a small Ulcer, when the Gland has been swelled, and sometimes by unskilful Persons to have been treated as such, when it has only been forced to gape a little too much, through the too plentiful Defluction of Humours upon the Gland.

Use. The *Use* of these Glands was by the Ancients supposed to be only to separate a certain mucous or pituitous Matter from the Blood, for the moistening and lubricating of the *Larynx*, Tongue, *Fauces*, and Gullet: But Dr. *Wharton*, and as many as attribute a fermentative Quality to the *Saliva*, ascribe a more noble Use to them; *viz.* to make a Ferment to further the Concoction of the Stomach; yea, Dr. *Wharton* (but I think mistakingly) thinks, that they are the chief Instrument of Taste.

4. Glandulæ Jugulares. Besides these, there are other *Glands* in the Neck, which from their Situation, Dr. *Wharton* calls *Jugulares*; for they are seated by the sides of the Jugular Vessels. He says he has observed them to be fourteen on each Side, besides another longish one separated from the rest, lurking on each Side at the Root of the *Processus styloides*,

loides, between the Muſcles of the Neck and Jugular Veſſels. The uppermoſt are paleſt of Colour, and the lower the redder. They grow in Knots as it were, and are of an unequal Bigneſs, varying from the ſmallneſs of a Coriander-Seed, to the bigneſs of a Bean. They have no proper excretory Veſſel, and ſo are of the Nature of conglobate Glands, which return the *Lympha* by the Lympheducts into the Blood. Among or near unto theſe Glands are commonly thoſe ſtrumous Swellings that are ſo frequent in the Neck.

As for thoſe other Glands, which are commonly reckoned as Parts contained in the Neck, *viz.* the *Maxillar* and *Parotides*; becauſe their excretory Veſſels diſcharge that Liquor that is ſeparated in them into the Mouth, we ſhall defer the Deſcription of them to the *Twenty ſixth Chapter* of the *Third Book*, which treats *of the inner Parts of the Mouth.* Neither ſhall we here mention the Veins and Arteries that paſs thro' the Neck to the Head, having deſcribed them before in *Chap.* IX. and XI.

And as to other Parts that make up the Neck, *viz.* the ſeven *Vertebræ*, and eight Muſcles, thoſe will come to be treated of in their proper Books: And therefore omitting them here, we ſhall paſs on to the *Head*.

The End of the Second Book.

The Third BOOK.

OF THE HEAD.

CHAP. I.

Of the Head in general, and its common containing Parts.

NOW followeth the third and highest *Venter* of the Body, called *Caput*, the Head. This is the most noble Cavity of the three, containing the Brain, wherein the rational Soul more especially operates, and whereby all the Animal Motions of the whole Body are moderated and determined; as well as performed by means of the Spirits elaborated in it, and sent into all the Parts by the Nerves. *The Head.*

It is *seated* in the highest Place of the Body, because it contains the Organs of the Senses, most of which perform their Office more advantagiously by this sublime Situation. For from hence *Its Seat.*

hence the Eyes can behold things remote, as from a Watch-Tower; here the Ears draw in the Sounds that fly aloft; and the Noſtrils receive the aſcending Odours.

Figure. Its *Figure* is ſpherical; yet ſomewhat flattiſh, and longiſh.

Bigneſs. It is *bigger* in Man than in other Creatures, conſidering the Proportion of their Bodies; as his Brain, that is contained in it, alſo is.

Parts. The *Parts* are of three ſorts; for they are either, 1. diſtinctive; or, 2. expreſſive of the Regions; or, 3. conſtitutive of the whole.

The Parts *diſtinctive* are two: The hairy Scalp, called *Calva*; and that without Hair, called *Facies*.

The Parts which *expreſs* the Regions (of the firſt) are four: 1. *Sinciput*, or the Fore-part, reaching from the Fore-head to the coronal Suture. 2. *Occiput*, the Noddle or hinder Part, beginning at the Suture *Lambdoides*, and reaching to the firſt *Vertebra* of the Neck. 3. *Vertex*, the Crown, which is ſituated on the Top of the Head, between the Bounds of the *Sinciput* and *Occiput*. And, 4. The lateral Parts deſcending from this on each Side between the Ears and Eyes, called *Tempora*, or the Temples.

The Parts *conſtitutive* are either *containing*, or *contained*. The *containing* are either *common* or *proper*. The *common* are thoſe we treated of in *Chap.* 3. of the Firſt Book. The *Cuticula* is thinner and ſofter; but the Skin thicker than in any other Part of the Body, yet porous, that Room may be left for the Hair to grow, and for its Nouriſhment to paſs to it. The *Membrana carnoſa* in ſome aboundeth ſo with muſcular Fibres, and cleaveth ſo cloſe to the Skin, that they can move it at their Pleaſure.

We

We shall not need to say more here of these, or of other the *common* containing Parts, but refer the Reader to the above-cited Place; and now proceed to the *proper*, having first discoursed a little of the *Hair*.

CHAP. II.

Of the Hair.

THE *Hairs* of the *Head* are called in Latin *Capilli, quasi Capitis pili*, and differ not from the Hairs in any other Part of the Body, save in Length. *The Head. Its Name.*

Now an *Hair* may be defined to be *a Body cold and dry, small, thread-like, hard and flexible, budding from the Skin.* *Definition*

The Hairs are seldom round, but generally four-square, as the Stalks of some Plants; sometimes triangular, but always porous, the Pores running lengthways. All these things may be observed by the Help of a good Microscope. They are sometimes curled, and sometimes hang lank. *Figure.*

Hairs are commonly divided into *Congeniti*, such as we bring into the World with us, as those of the Head, Eye-lids, and Eye-brows; and *Postgeniti*, such as begin to grow at certain Seasons in our Life-time, as the Beard, the Hairs growing about the *Pudenda*, on the Breast, in the Armpits, and the like. *Division.*

They are no Parts of the Body, and therefore have no *Animal* Life; yet they have a *Vegetative* Life, and that peculiar to themselves, and not owing to the Life of the Body, seeing they continue to grow after a Man is dead, as has been observed in Embalmed Bodies. *Diemerbroeck* (and *Life.*

before

before him *Malpighius*) ingeniously compare them to Polypody, or some other Plant growing upon an old Tree, which continue to grow after the Tree is dead, as they did before, because they have a proper Life distinct from the Form or *Anima* of the Tree, out of which, and in which they grow.

Generation and Nourishment. The Matter out of which they are *bred* and *nourished*, is commonly reputed to be a moist, fuliginous, crass, earthy and somewhat viscid Excrement of the third Concoction. *Spigelius* thinks, they are nourished by Blood; which Opinion he grounds on an Analogy he supposes there is between Hair, and the Feathers of Fowl; and these latter he says are apparently nourished by Blood, for if one pull one from off a young Fowl, its End is bloody. *Diemerbroeck* dissents not much herefrom, but thinks the Blood to be prepared and concocted in a specifical manner into a crass, earthy and viscid Juice. Whatever the Matter of their *Nourishment* be, it is attracted by the white Roots of the Hairs, and is carried even to their very Ends by the Pores; just as Plants receive Nourishment out of the Earth by their Roots, and communicate it to their outmost Parts. *Malpighius* says, their Head or Root being round and mucous, is set in a kind of oval Case (as in a Flower-pot) to which Case a Nerve is evidently propagated.

Colour. The *Colour* of them differs according to the Climate, or to the natural Constitution of the Party, or to the Diversity of those Humours that are mixed with the Juice whereby they are nourished. In those of cold flegmatick Constitutions they use to be of a light Colour; in cholerick, reddish, *&c.* They are most commonly streight in those which are born in cold Countries, but curled in those who inhabit hot Climates.

And

And as the Reason of the Difference of the Colour of the Hair in several Persons is from different Temperaments, *&c.* so the reason why Men in old Age grow *grey*, when as their Hair before was of another Colour, seemeth to be the Predominance of Phlegm in that Juice that nourisheth them; whence also the Hairs of the Head and Face sooneſt turn white, because the Brain does more abound with pituitous Humours than any other Part of the Body. But it is not so easy to give a Reason of some Mens turning grey in one Night's time, when they have been under great Fears (of which there are many Instances credibly reported;) yet *Diemerbroeck* gives a Reason somewhat probable, *viz.* [' That in ' great Fear and Terror, the Heart by Accident ' is in great Anguish, whence it beats little, and ' very weakly, so that some from this Cause fall ' into a Swoon; by reason of the weak Pulse ' little Blood is impelled into the outer Parts, ' whence by and by they grow cold and stiff; ' Blood failing in the Skin, the Colour also in ' the Juice that nourisheth the Hair, is by and by ' changed from that which before was induc'd ' upon it from the Humours mingled with the ' Blood: Then if by chance whitish pituitous ' Humours stuck before in the Skin, they will ' presently infect the Juice that nourisheth the ' Hair with the Prevalency of their own Co- ' lour, which Juice passing thro' the Hair con- ' tinually, even to their End, and nourishing ' them, their Colour may from hence be chang'd ' in a short time, and become white, seeing their ' Substance is diaphanous, as it were, easily ad- ' mitting of any Colour, which is communica- ' ted to it with the Nourishment.] See his *Anat. Corp. Human.* p. 559, 560. where he answers some Ob-

Why Hair turns white.

Objections that may be made againſt this Opinion.

Their Uſe. The Hairs have three *Uſes*: for they ſerve, 1. for Defence; 2. for Beauty; and 3. ſhew the Temperature of the whole Body and Skin.

CHAP. III.

Of the proper containing Parts.

THE *proper containing* Parts are ſix, to wit, the *Muſcles*, the *Pericranium*, the *Perioſteum*, the *Cranium*, and the two *Meninges*. Look for the *Muſcles* in the *Fifth Book*, and for the *Cranium* in the *Sixth*, Of the other here. And, Firſt,

The Pericranium. The *Pericranium* (which is ſo called from its being extended περὶ τὸ κρανίον, *about the Skull*) is a Membrane ſomewhat thin, denſe and white, of exquiſite Senſe, immediately ſeated under the *Membrana Carnoſa*. It covereth the whole Skull next above the *Perioſteum*, except where the temporal Muſcles lie upon the *Cranium*, for it is ſtretched over them; and ſeeing it is very ſenſible and tender, it cauſeth horrible Pain and Inflammation, when the temporal Muſcle is wounded.

Its Connexion. It is *knit* to the *Dura Mater* by ſome nervous Fibres, which paſs from it to within the Skull by its Sutures, to ſtay firmly the *Dura Mater*, and alſo the Brain, which it inveſts, from violent Concuſſion. For tho' in Infants new-born theſe be ſtrongly united, and in a manner continued, inſomuch that the *Pericranium* is ſaid by ſome to ſpring from the *Dura Mater*; yet in Proceſs of time they part ſo, as to be knit to one another only by theſe nervous Fibres, by which yet Inflammations may be communicated from the *Pericranium* to the Brain.

Next

Next under the *Pericranium* is ſpread the *Perioſteum*, which immediately cleaveth to the Skull, and gives it that Senſe which it hath. It ſelf is a very thin and nervous Membrane, and of very acute Senſe. All the Bones of the whole Body (except the Teeth) are inveſted with ſuch-a-like Membrane, and owe their Senſe to it. Dr. *Havers* thinks [‘ There is little Reaſon to make the ‘ *Pericranium* a diſtinct Membrane from the ‘ *Perioſteum* of the Skull. For although it be di- ‘ vided at the temporal Muſcles; this is no more ‘ than what the ſeveral Series of Fibres do make ‘ the *Perioſteum* capable of in the Leg, or any ‘ other Part: And I have upon the Shin-bone of ‘ an Ox divided it into four or five ſeveral Mem- ‘ branes, if I may ſo call them, when it has ‘ been dried.] To this I anſwer, that though the *Perioſteum* may every where be *diviſible*; yet Nature having *divided* it in no other Place, I think 'tis more reaſonable to adhere to the former Opinion, than to believe ſhe does any thing ſingular here. Perioſteum.

Theſe two Membranes outwardly inveſting the *Cranium*, have *Arteries* from a Branch of the external *Carotides*, and *Veins* from the external Jugulars. *Their Veſſels.*

The *Meninges* follow, called by the *Arabians Matres*; as if all the Membranes of the Body were propagated from them. Theſe are immediately within the Skull, as the other were without; but adhere not cloſe thereto, as thoſe do. They are two in Number: The *Craſſa Meninx* or *Dura Mater*, and the *Tenuis Meninx* or *Pia Mater*. *The* Meninges.

The *Dura Mater* is the outer, that is, is next to the Skull, through whoſe Sutures ſending Fibres to (or receiving them from) the *Pericranium*, it is ſuſpended thereby; for in other Places it is looſe Dura Mater.

looſe from the *Cranium*, ſaving in its *Baſis*, to which it is ſo firmly knit, that it can hardly be pulled from it; or where it is ſuſpended by Veſſels entering into it from the Perforations of the Skull; or laſtly, where it adheres to the *Os cribriforme* at the Top of the Noſe, and ſends Jags through its Holes. It is thicker and harder than the inner, whence it has the Epithet of *Dura*, hard. It conſiſts of a double Membrane, the outer of which is more rough, towards the *Cranium*, having very ſmall and hardly viſible Fibres: the inner on its Superficies next the *Pia Mater* is more ſmooth and ſlippery, being bedewed with a kind of Water, and has very ſtrong and large Fibres. This Inſide is looſe, ſaving that near the *Sinus*'s it is knit to the *Pia Mater* by the Inſertions of the Veins, and in the *Baſis* of the Skull by the Arteries and Nerves.

Its Holes. It has many *Foramina* or Holes for the Tranſit of the Veſſels; and beſides, one very large one in its *Baſis* for the Deſcent of the ſpinal Marrow, and another ſmall one which forms the upper Orifice of the *Infundibulum*.

Veſſels. It has *Arteries* from the larger Branches of the
Arteries. internal *Carotides* (entering into it through the Holes of the wedge-like Bone) and *Veins* from
Veins. the internal Jugulars. The Veins Dr. *Ridley* (in his Anatomy of the *Brain*) ſays, run for ſome Space betwixt its two *Laminæ* (as he calls them) or Membranes, after the manner of the Ureters in the Bladder, in large Trunks, before they enter the *Sinus*'s by and by to be deſcribed. Dr. *Willis* obſerves, That its *outer Superficies* has no where ſo many Twigs of Veins as of Arteries; but that out of its four *Sinus*'s (which are the venous Receptacles of the Blood) more Veins go forth thro' its *inner Superficies*, which being preſently inſerted into the *Pia Mater*, are diſperſed all over it, and every where

where meeting the Arteries ascending from the *Basis* of the Head, and being branched with them, make manifold *Plexus* of Vessels. Dr. *Ridley* says, this Membrane has plenty of *Nerves* from the foremost Branch of the fifth Pair, and is thereby made very sensible. *Nerves.*

At the Crown of the Head it is doubled; and its Duplicature descending inwards, divides the Brain into the right and left Side: Yet its Descent is not quite to the *Basis* of the Brain, but only through the cortical Part; for toward the *Basis* both sides of the Brain are contiguous to one another, making one continued Body, namely, that part of it which is called *Corpus callosum*, of which in the next *Chapter*. This Duplicature, because it is broader backwards, and grows narrower forwards, and so resembles in some manner a Reaper's Sicle, is called *Falx*. Now this *Falx* reaches as far forwards as to the Top of the Nose, where it is knit to the upper Process of the *Os cribriforme*, that stands up betwixt the *Processus mammillares*, and is called *Galli crista*, or Cock's Comb. But its hinder and broader Part towards the *Occiput* being severed, descends towards both the right and left Side, and parts the *Cerebellum* from the *Cerebrum*. *Falx.*

In the said Duplicature are formed four *Sinus*'s or Cavities, three pretty large, and one little one, which (as also the rest which he mentions) Dr. *Ridley* looks upon no other than large Veins. The first, which is the highest and longest, runs along the upper part of the *Falx*, from the Top of the Nose lengthways of the Head towards the *Occiput*, where it is divided into two lateral *Sinus*'s, which descend by the Sides of the Lambdoidal Suture to the *Basis* of the *Occiput*. And at the said Division the fourth short *Sinus* proceeds inwards from it betwixt the Brain and Cerebel *Sinus.*

to the *Glandula pinealis*. This Place, where all the *Sinus*'s are continuous to one another, is called *Torcular*, the Wine-preſs. Some Anatomiſts deſcribe ſeveral other.

Their Uſes. Into theſe Cavities the Mouths both of Arteries and Veins are ſaid to open; by the former whereof Blood is extravaſated into them, and abſorbed again out of them by the latter. Whence if one open the Skull of a live Creature, one may obſerve a beating in the long uppermoſt *Sinus*, from the Blood diſcharged into it by the uppermoſt Arteries. Dr. *Highmore* thinks, that much Blood being ſent to the Brain by the *Carotides*, all of which is not fit to have Animal Spirits elaborated out of it; *that* part of it which is leſs fit and neceſſary for this purpoſe, is diſcharged into theſe *Sinus*'s to be returned by the Veins; even as a notable Branch of the Celiack Artery (when it is come juſt to the Spleen) is implanted into the *Ramus ſplenicus* of *Vena portæ*, by which that Arterial Blood that is unmeet or unneceſſary for the making of that Juice (whatſoever it be) which is excocted in the Spleen, may be remanded back again. And ſome are of Opinion that the Veins alſo convey ſome Blood into theſe *Sinus*'s, which being ſuperfluous to the Nouriſhment of the *Brain* and *Meninges*, is poured in hither by the Veins from their reſpective Parts, and is imbibed again by other Veins, whoſe Mouths gape into them (namely the Branches of the internal Jugulars) to be returned to the Heart.

Pia Mater The ſecond (and inner) Membrane inveſting the Brain is called *Tenuis Meninx*, or *Pia Mater*. This is of moſt exquiſite Senſe, and endowed with very many Arteries and Veins. It immediately cloaths the Brain, and hinders it from running about, and alſo involves all its Windings and Circuits,

cuits, and tying their Summities together, makes all the Superficies of the Brain plain, as it were; which upper Connexion being looſed, the Windings of the Brain being all inveſted apart with this Membrane, may eaſily be ſeparated and laid open. But (according to moſt Anatomiſts) it is only the Cortical part of the Brain, which this Membrane cloaths thus; for the inner Surface of the expanded Brain (which is called *Corpus calloſum*) is not inveſted by it; but inſtead of it (Dr. *Willis* ſays) ['Many *Plexus* of Veſſels commonly 'called *Choroides*, are ſuſpended within its Com- 'plicature, and fluctuate as it were freely. But 'within all the other Receſſes of the Brain, and 'beſides, within the *Plicæ* or *Lamellæ* of the Ce- 'rebel, yea, within the Interſtices of each of 'them, and of the *Medulla oblongata*, does this 'Membrane inſinuate itſelf.] Yet Dr. *Ridley* affirms, that it is extended alſo over the *Corpus calloſum* itſelf, tho' looſely.

Its Veſſels and their Plexus.

This Membrane conſiſts alſo of two Coats (or *Laminæ*) betwixt which the Blood-Veſſels run, and make many admirable *Plexus*. The *Arteries* are four, *viz.* two *Carotides*, and two *Vertebrals*. The *Vertebral* Arteries being united at the Baſis of the Skull, and making a ſingle Trunk, it meets and joins with the *hinder Branches* of the *Carotides*; and from the Place of their Coalition a very remarkable Branch aſcends on either ſide under the *Limbus* of the Brain, which being carried above the *Crura* of the *Medulla oblongata*, is divided into very many ſlender, and as it were capillary Twigs, ſome of which aſcend to the Glands ſeated behind the Cerebel, and the reſt make the Arterial part of the *Plexus Choroides*. The *fore* Branches of the *Carotides* do alſo unite one with the other; and both before and after their joining, ſend forth Twigs all over this Membrane, but chiefly in the

Fore-part of the Brain. Its *Veins* ariſe from the four *Sinus*'s of the *Dura Mater* (as was obſerved above from Dr. *Willis*) and theſe meeting with one another, are diverſly interwoven one with another, and with the Arteries, and return the ſuperfluous Blood by the Jugular Veins to the Heart.

Note, That theſe two Membranes (the *Dura* and *Pia Mater*) not only inveſt the Brain, but the Spinal Marrow alſo, and all the Nerves that ſpring from either: And that the inner Coat of the *Pia Mater* yields a covering to every ſingle *Fibrilla*, that each Nerve is made up of, whence comes the Conſent betwixt Part and Part, and betwixt all and the Brain.

CHAP. IV.

Of the Brain in general.

The Brain. THE *Pia Mater* being taken away, the *Brain* occurs next; by which here we mean in the general, all that ſoft Subſtance which is contained within the whole Skull, and which the Greeks comprehend under the Word ἐγκέφαλος. It is the general Organ of Senſe, in which the Soul, the Governor of the Body, perceives and judgeth of the Senſations of all ſentient Parts; and out of which, as out of a Fountain, it communicateth the Animal Spirits (bred in the Brain) by the Ducts or Rivulets of the Nerves to all the ſentient Parts of the Body, and thereby endows them with the Faculty of performing animal Actions.

The difficulty of diſſecting it. The *Brain* being of ſo looſe a Subſtance, and the Skull wherein it is incloſed, ſo hard, that the Saw or Chizzel are neceſſary to break thro' it, the Brain muſt needs be very much ſhatter'd and concuſſed thereby; and after the Skull is divided, in the very pulling of it off, the vaſcular Connexion

ion of the *Dura Mater*, and it with the *Pia Mater* and *Brain* (and that alſo of the one with the other) being torn in ſunder, the Parts into which the Veſſels are inſerted, are neceſſarily much violated; and laſtly, after the Covers are removed, ſeveral parts of the Brain being of ſuch difficult Acceſs, that others muſt be quite ſpoiled, before one can come to a View of them, and theſe alſo thereby in part violated: Upon all theſe Accounts, a true Anatomy of the Brain, as to its Contiguities, Connexions, Cavities or Ventricles, *&c.* muſt be very difficult; ſo that 'tis no wonder the Obſervations of Anatomiſts are ſo different and ſo oppoſite to one another. But this by the bye. Paſs we on now to diſcourſe of the *Brain* more generally.

If by *Brain* we underſtand the whole *Encephalos* (or all that which is contained within the Skull) it is not of one *Subſtance*, but divers. And is diſtinguiſhed by the particular Names of the *Cerebrum* (in ſpecial) the *Cerebellum*, and the *Medulla oblongata*. Nor is the *Cerebrum* (properly ſo called) itſelf of a like Subſtance, but conſiſting of a Cortical and Medullar Part (called *Corpus Calloſum*) theſe differ in their Nature, Colour and Conſiſtence. Which difference *Malpighius* thus deſcribes. The *Cortex* (being of an Aſh-colour) he ſays, ['is glandulous: The Out-ſide of the Glands 'is covered with the *Pia Mater*, and its Blood-'veſſels, which penetrate deep into their Sub-'ſtance, (each Gland having a Twig of both an 'Artery and a Vein:) Their inner Side ſends 'forth a white nervous Fibre, like a proper Veſ-'ſel, as it were, ſo far as their Brightneſs and 'Whiteneſs permit one to diſcover. Theſe 'Fibres make up all the *Pith* (or *Corpus calloſum*) 'which is of a more cloſe and ſolid Subſtance 'than the *Cortex*. They are flattiſhly round, and

Its Subſtance.

'are not unlike those white Bodies, or *Intestinula*, which the Testicles are made up of; and 'in the Ventricles of the Brains of Fish they 'are so apparent, that if you hold them betwixt 'you and the Light, they represent the small 'Teeth of an Ivory Comb. He saith they are 'inserted by their Ends into (or rather arise out 'of) the *Cortex*, or ash colour'd outer part of 'the Brain; and seem all of them to have their 'Egress out of (or rather Ingress into) the Trunk 'of the spinal Marrow within the Skull.] Whether they be hollow or not, or whether as they are collected into a Bundle they have not Pores and Interstices arising therefrom, which transmit a peculiar Juice into the Nerves continued to them, he leaves undetermined; because they neither admit of Ligature, nor can Sense make any Discovery thereof. Dr. *Ridley* (from *Lewenboeck*) offers at a yet finer Description of these two Parts of the Brain, which the curious Reader may find in his *Anatomy of the Brain*, p. 89, *&c.* As for the other Parts of the *Encephalos*, *viz.* the Cerebel, and *Medulla oblongata*, their *Substance* shall be treated of afterwards, when we come to their Description.

Vessels. The *Brain* receives Blood by *Arteries* derived from the *Carotides* and Cervical, whose Capillaries are dispersed chiefly through its cortical Part. These Arteries are so large and numerous, that a third Part at least of the whole Mass of Blood is conveyed hither by them; which seeing, through the smallness of the Brain, it cannot be consumed in its Nutrition, *Malpighius* thinks it probable that the coagulative (or concrescible) *Serum* is filtred, as it were, in the *Cortex* (or glandulous Part) of the Brain from the Arterial Blood, and that the Fibres of the *Corpus Callosum*, as so many Roots implanted into the said *Cortex*, imbibe

imbibe this *Serum*, and convey it to the *Medulla oblongata*, as the Trunk from whence it is derived into the Nerves as the Branches, and is there the *Succus Nervosus*, if not the Animal Spirit itself. Part nourishes the Brain itself, and what is superfluous to both these Uses, is partly resumed by the *Veins* of the *Meninges* (whose Twigs reach to the several Glands of the *Cortex*) and partly deposited in the *Sinus*'s of the *Dura Mater* by the Arteries themselves, out of which it is resorbed by the internal Branches of the Jugulars, and thereby conveyed back to the Heart. The Arteries inosculate one with another (*i.e.* the right *Carotides* with the left) and so do the Veins also; but not the Arteries with the Veins. It is from the Pulse of the Arteries altogether, that the Beating or (*Systole* and *Diastole* as it were) of the Brain proceedeth.

Bigness. A Man of all other living Creatures, hath the *biggest Brain*; for it weigheth four or five Pound in some, and is as big again as an Oxe's Brain.

Figure. The outer Surface is full of Windings, like those of the Guts, which are severally invested with the *Pia Mater*, as also tied together by it. The whole Brain is much of the same *Shape* with the Head, *viz.* roundish, but with Bunchings out towards the Forehead.

Of its Action we shall speak in the Ninth Chapter.

CHAP. V.

Of the Manner of diſſecting the Brain; of the Brain properly ſo called, the Fornix, Septum, *and the three Ventricles.*

THere are ſeveral Methods of diſſecting the Brain; ſome beginning at the Crown, which was the old way; ſome on the right Side, as *Sylvius*; and ſome behind, as Dr. *Willis*; whoſe Anatomy of the Brain being much more accurate than that of any before him, we will endeavour to give a ſhort, but faithful Abſtract of it.

The manner of diſſecting the Brain.

Having taken out of the Skull the whole *Encephalos*, or all that which is contained under the Name *Brain*, taken in a large Senſe, firſt of all let the hinder *Limbus* or Border of the Brain, properly ſo called, where it is knit to the *Cerebellum* and *Medulla oblongata*, be freed as clear as may be from its Coheſion with the ſubjacent Parts, cutting aſunder the Veſſels and the Membranes on every Hand, for by theſe only is it joined to them. Its hinder Part being thus looſened, lift it up, and turn it forwards, whereby the *Crura* of the *Medulla oblongata* will lie bare, and the *three Ventricles* of the Brain, commonly ſo called, will become *one empty Space*, as being a Vacuity reſulting meerly from the Complication of the Brain. Moreover, one may then ſee, how the two Tips of the *Crura* of the *Medulla oblongata* are knit in two Places to the *Corpus calloſum* or medullar part of the Brain; as alſo obſerve the *Fornix* ſo called, how it is like a *Subtenſa*, or Line drawn under the Arch of a Circle, which beginning before, where the aforeſaid Tips of the

Crura

Crura adhere to the Brain, runs to the Brain's hinder Border, to which it is united by two ſtretched out Arms, as it were, and ſo keeps the whole *Compages* of the Brain in a ſpherical Figure, hindring it from ſpreading into a Plane, and ties it firmly to the *Crura* of the *Medulla oblongata*.

This is Dr. *Willis*'s Manner of Diſſection, wherein the Parts occur to the Diſſector's Inſpection, in this Order.

The Brain properly ſo called.

Firſt, the *Brain* it ſelf, whoſe outer Surface is all full of Windings, like the Convolutions of the Guts: It is exactly divided by the *Falx* (above-deſcrib'd) into two Hemiſpheres, a right and left; and theſe are imperfectly ſubdivided each into two Lobes, a fore and an hinder, by a large Branch of the Carotid Artery running croſs the Middle of them. How deep the *Falx* enters into the Brain, and of what Subſtance the Brain is, has been ſhewn in the former Chapters: We ſhall only farther note here concerning its Subſtance, that its medullar Part (or *Corpus calloſum*) is both thicker and cloſer by much in the fore Parts of each Hemiſphere than any where elſe; and that where it is thickeſt, it adheres on each Side to the Tips of the *Crura* of the *Medulla oblongata* (called *Corpora ſtriata*;) but from theſe Tips, as from its Riſe, being expanded towards the hinder Parts, it grows thinner by Degrees, and towards its outer Border its under Side is knit to the *Caudex* or Trunk of the *Medulla oblongata*, by Membranes and Veſſels.

Fornix.

Which Membranes and Veſſels being cut in ſunder, and the Brain turned up forwards as above-directed, on its inner or under *Superficies* there appears a medullar Proceſs called *Fornix*, which ſpringing forth of the *Corpus calloſum* with a double Root, is united into one broad Proceſs, near the Place where the Tips of the *Crura* of the

the *Medulla oblongata* adhere to the under Side or medullar Part of the Brain, and ſerves as a *Subſtantia* to its Arch (as was noted before.) Under the double Root of the *Fornix*, there lies a medullar Trunk, like a large Nerve, running croſs the Brain, and joining one *Corpus ſtriatum* to the other. And out of the middle Superficies of the *Fornix*, there ſtands up a thin and pellucid *Septum*, or Partition, which is faſten'd to the Roof or Arch of the *Corpus calloſum*, almoſt through its whole Duct.

Septum.

This *Septum*, *Columbus* affirms to be membranous, and *Malpighius* will have it to conſiſt of ſtreight Fibres running lengthways from before, backwards. And thus while the three-ſided *Fornix* doth ſubtend the Arch, that ariſes from the Complication of the Brain, it divides its Cavity as it were into *three Partitions*, and makes them look like ſo many *Ventricles*, by which Name they have been deſcribed by former Anatomiſts.

Three Ventricles.

To theſe three *Ventricles*, thus accidentally formed, the Ancients have attributed a noble Uſe; determining them to be the Work-houſe of the Animal Spirits, where they are both generated, and perform the chief Works of the Animal Function. *Fracaſſatus* (who calls the Brain a Wind-Inſtrument, ſomewhat analogous to the Lungs) thinks, that a purer ſort of Air aſcends through the *Os cribriforme* into the two fore Ventricles (where it is ethereized) and paſſes out of them into the third, and thence into the fourth (to be deſcribed in *Chap.* 7.) by which it is conveyed into the ſpinal Marrow, where being mixed with the nervous Juice, it therewith conſtitutes the Animal Spirit, and likewiſe promotes its Motion. Where, and whereof the Animal Spirits are generated, we ſhall conſider, *Chap.* 9. and ſhall here ſhew a more probable Uſe of theſe

Ven-

Ventricles. They have been commonly distinguished into *two anterior*, and *one posterior*. But the Truth is, there is but one Cavity or *Vacuum*, and instead of that noble Use heretofore ascribed to it, late Anatomists make it only as a Sink or Common-Sewer for excrementitious Matter to be collected in, and to be discharged out again by convenient ways. This excrementitious Matter is generally a serous Humour (or rather *Lympha)* which is separated from the Blood in the adjacent *Plexus Choroides*, by the Help of those many Glands that that *Plexus* is beset withal, and of the *Glandula pinealis*, which the *Plexus* hangs upon, and is woven about like a Button. As to the Exit of this serous Humour, formerly it has been supposed to flow from hence to the *Processus mammillares*, and from them to distil through the *Os cribriforme* into the Nose. But Dr. *Lower* denies any such Office of the *Os cribriforme*, affirming, that the Holes in it are only for the Transit of the Nerves and Membranes going forth from the *Processus*, and that these fill them so close, that nothing can flow thro' them. And says, That the Flux of Rheum through the Nose, and upon the *Uvula*, or into the Mouth, *&c.* in Catarrhs, falls not from the Head, but is separated from the Arteries, in the Glands of the respective Parts, as into the Nose thro' the Glands of its investing Membrane, *&c.* And as to the serous Matter that is poured into these *Sinus*'s in the Brain, he says, it is all absorbed again by the Vessels gaping into them, and returns by the Jugular Veins to the Heart.

CHAP.

CHAP. VI.

Of the Medulla oblongata, *and its* fore *Parts, viz.* Crura, Corpora Striata, Nervorum opticorum Thalami, Nates *and* Teſtes, *with the* Vulva *and* Anus; *as alſo of the* Glandula pinealis, Plexus choroides, *and* Infundibulum.

THE *Brain* continuing turned up forwards, as above-directed, the *Medulla oblongata* lies open to view, whoſe Parts, *&c.* we ſhall deſcribe in this Chapter.

The Riſe of the Medulla oblongata

The *Medulla oblongata* ſeems to ariſe from the *Corpus calloſum* by two Heads, reſembling the Letter Y, and the united Trunk by and by deſcends out of the Skull down the Spine, wherein it is called the *ſpinal Marrow*, of which afterwards. *Fracaſſatus* queſtions whether the Brain, and the Cerebel alſo, be not rather Appendices of, or propagated from the *Medulla ſpinalis* and *oblongata*, than theſe from thoſe; ſeeing in the *Embryo* or firſt Lineaments of a Chicken in the Egg, if you prick the *Carina* (or long Thread that afterwards becomes the Back) with a Pin, it will contract it ſelf, whilſt in the Seat of the Brain there is nothing but a *Lympha*, not yet fixed into a Brain. But this by the bye.

Its Subſtance.

The *Subſtance* of the *Medulla oblongata* is not like that of the *Brain*, conſiſting of an outward or cortical Part of an aſhy Colour, or of an inner medullar and white; but its whole *Compages* is medullar; yet it is not pure and ſhining, but dusky, from its many Fibres that hold a various Courſe: for in ſome Parts they are ſtriated or radious, as it were; in others direct, running lengthways, and in others circular.

It

Its two Heads or Beginnings are called its *Crura*, and the Tips or Extremities of these *Crura* are called *Prominentiæ lentiformes*, or otherwise *Corpora ſtriata*, from the Courſe that their Fibres keep. Their Ends are blunt, and by a pretty large Space of their Surface adhere to the medullar Subſtance of the Brain where it is thickeſt. If one cut them in ſunder lengthways, then may he obſerve their *Striæ*, which have a double Tendency; for ſome deſcend from their Tip towards the *Medulla oblongata*, and others ſeem to aſcend from their lower Part, towards the medullar Part of the Brain, the one meeting the other. So that by the help of theſe Fibres, there ſeems to be a free Paſſage for the animal Spirits from the Brain to the *Medulla oblongata*, or back again, as there is Occaſion. We obſerved above in the former *Chapter*, how there is a medullar Proceſs, that running a-croſs, joins one *Corpus ſtriatum* to the other; and ſhall only note here farther, That juſt behind the lower End of theſe Bodies, the *Proceſſus mammillares*, or ſmelling Nerves, have their Riſe from the *Medulla oblongata*.

Crura an Corpora ſtriata.

When theſe Nerves are ariſen out of it, its *Crura* riſe into uneven Protuberances, out of which ſpring the Optick Nerves, and therefore theſe Protuberances are called *Nervorum opticorum Thalami*: (What Courſe both the Olfactory and Optick Nerves hold towards the Noſe and Eyes, ſhall be ſhewn in *Chap.* 10.)

Thalami nervorum opticorum.

On the Outſide of theſe, Dr. *Ridley* ſays he has always found and often ſhewed a very fair medullary Tract, running all along betwixt the *Corpora ſtriata*, and from the very hindermoſt Extent of the *Corpora ſtriata* forwardly, down to the very Roots of the *Fornix*, to which they ſeem to be continuous.

Be-

Behind these *Thalami*, the two *Crura* of the *medulla oblongata* unite into one Trunk, upon whose upper Side there grow four more notable Protuberances, covering its Surface for about the Space of an Inch, which yet they do not touch in the Middle, having a Cavity under them. There grow two on each Side; the two foremost of which are called *Nates*, and the two hinder *Testes*.

Nates *and* Testes. The *Nates* (or Buttocks) are the larger of the two, and the *Testes* seem only to be an *Epiphysis* or Accretion to these. They are all four like so many round Hillocks, and are joined one to another by certain Processes. Under them, or rather betwixt their Junctures and the Trunk of the *Medulla oblongata* that lies there-under, there is left a narrow but long Cavity or Chink, called

Vulva *and* Anus. by the fanciful Name of *Vulva*, into which there opens another Passage, called *Anus*, and both run by a strait Duct down into the *Infundibulum*. As to the Uses of the *Nates* and *Testes*, the learned Reader may do well to consult Dr. *Willis* largely discoursing thereof, *in Cerebr. Anat.* p. 93, &c. but I shall not enter upon that Dispute, as being too conjectural and doubtful.

Glandula pinealis. Betwixt the *Nates* and the *Thalami Nervorum opticorum*, in a Valley as it were, is seated a Glandule (of the conglobate or lymphatick kind) called in Greek κωνάριον, in Latin *Pinealis*, from its Shape, arising from a broad Basis to a narrower copped Top, somewhat resembling a Pine Apple. It is fasten'd to the subjacent Part, sometimes by many slender Fibres, and sometimes by two notable medullar Roots. Its Substance is harder than that of the Brain, and of a pale Colour. It is included in a Membrane (which is a Portion of the *Pia Mater*) as in a Bag or Case; which Membrane being full of Arteries and Veins, some of these enter into the Gland it self. This Gland *Des Cartes* thinks to be the primary Seat of the Soul,

Soul, and that all animal Operations draw their Origin from it: But that ſeems to be too noble an Uſe for it; and it is more likely, that it is only of the Nature of other Glands, which are ſeated near the Concourſe of ſanguiferous Veſſels, namely, that it may receive into it ſerous Humours depoſited from the Arterial Blood, and retain them, till either the Veins becoming more empty, reſorb them, or Lympheducts (where there are any) convey them away.

That this is the true Uſe of the *Glandula Pinealis*, is the more probable, from that notable *Plexus* of Blood-veſſels that encompaſſes it, and hangs upon it as it were, called *Plexus Choroïdes*, which is conſtituted after this Manner. From each ſide of the *Medulla oblongata*, where the *Limbus* of the Brain is knit to it, there aſcend in a ſtreight Courſe two Arteries ariſing from the hinder Branches of the *Carotides*, where they are joined to the Vertebral, which being by and by divided into very many ſmall Twigs, and being met by as many Twigs of Veins coming from the fourth Ventricle of the *Dura Mater* (which deſcends upon the *Glandula Pinealis*) form this *Plexus*, wherein both ſorts of Veſſels are very much interwoven one with another, and which ſpreads it ſelf on each Hand (as by two expanded Wings) upon the *Crura* of the *Medulla oblongata*, as far as to the *Corpora ſtriata*: yet theſe Veſſels run almoſt only upon the Surface of the *Medulla*, making no deep Inſertions either into it, or into the *Corpus calloſum*, under which they are alſo ſpread. This *Plexus* is beſet with very many ſmall Glands, which are all of them red, and almoſt ſpherical, only a little flattiſh. Plexus choroïdes.

Beſides the Veins and Arteries that conſtitute this *Plexus*, Dr. *Ridley* mentions a third ſort of Veſſels, *viz. Lympheducts*, which he firſt diſcover'd in the

the Brain of a ſtrangled Body, running in different Ramifications amongſt the reticulated Veſſels and Glands of this Part. [‘ Which Obſervation (ſays he) being added to that of the great ‘ Anatomiſt *Anthony Nuck* (who, in that curious ‘ Piece, called *Adenographia*, ſays, he ſaw one ‘ coming from the *Glandula Pinealis*, and that his ‘ Friend, another Anatomiſt, ſent him Word, he ‘ ſaw another not far from the aforeſaid Place) ‘ may be of ſufficient Authority to evince the ‘ real Exiſtence of theſe Veſſels hitherto ſo ‘ much enquired after in the Brain, as well as in ‘ other Parts of the Body.

Its Uſe. According to Dr. *Willis*, it has a double Uſe: *Firſt*, he ſays, that the more watery Part of the Blood deſign'd for the Brain, is ſent into the Veſſels of this *Plexus*, that the Remainder may be more ſincere and defecate for the making of animal Spirits; which watery Part, if it be ſo plentiful, that it cannot be all received into the Veins, to be returned to the Heart, it is then received into the ſmaller Glands wherewith the *Plexus* is beſet, but eſpecially by the *Glandula Pinealis* juſt now deſcribed, by which it is either retained; or if it abound, may diſtil from them into the ſubjacent Cavity, as into a Sink. (But there is no need of its either being retained in the Glands, or elſe of its diſtilling into the ſubjacent Cavity, ſeeing the Lympheducts juſt now mentioned are proper reductory Veſſels for it.) A *ſecond* Office is, to preſerve within the Plicature of the Brain (or in the *Corpus calloſum*) an Heat, which is raiſed from the Blood (as from a Fire) that eſtuates in the Complications of the Veſſels of the *Plexus*, and which cauſes the Animal Spirits to circulate in the *Corpus calloſum*.

Infundibulum. Thus far as to the Parts which appear on the *upper Side* of the *Medulla oblongata*, betwixt the

Corpora

Corpora ſtriata and Cerebel. But within this Space in the *Baſis* of the ſame *Medulla* there are other things obſervable, eſpecially the Situation and Structure of the *Infundibulum*. Now this *Infundibulum* is a tube-like Receptacle, outwardly covered with a thin Membrane ariſing from the *Pia Mater*, and within fenced with a medullar Subſtance, which deſcends behind the Coalition of the two Optick Nerves, betwixt the *Crura* of the *Medulla oblongata*: Its upper Orifice is between the *Crura*, and from thence a ſhort Tube or Pipe deſcends upon the *Glandula pituitaria* (to be deſcribed in the next Chapter) upon which, ſerous Humours (or *Lympha*) flow down from the upper Cavities of the Brain this way; whence it has its Name of *Infundibulum* or Tunnel. Which Humours Dr. *Ridley* thinks to be condenſed Vapours ariſing from the Arteries of the *Plexus choroïdes*.

And thus we have done with the *fore* Part of the *Medulla oblongata*, which only lies bare by the turning up of the Brain properly ſo called: In the next Chapter we ſhall examine its *hinder* Part, which comes to our View by raiſing up the *Cerebel*; but of the Cerebel it ſelf firſt.

CHAP. VII.

Of the Cerebellum, *and the fourth Ventricle*; *as alſo of the* hinder *Part of the* Medulla oblongata, *of the* Rete mirabile *and* Glandula pituitaria.

BEfore we can take a View of the *hinder* Part of the *Medulla oblongata*, it is neceſſary to remove the *Cerebellum* that is placed upon it (as the Brain is upon the *fore* Part) which therefore we ſhall firſt of all deſcribe.

The Cerebellum, its Figure and Substance.

The *Cerebellum* is seated in the hinder Part of the Head, being of somewhat a globous *Figure*, as well as the Brain it self, and uneven in its Surface (like it) by Reason of certain Convolutions, both the Ridges and Furrows whereof the *Pia Mater* is spread over, tying their Summities together, covering their deep Furrows, and reaching *Plexus* of Vessels to them all. But its Convolutions are not so various and uncertain as those of the Brain, but are disposed in a certain Order like so many Semi-circles; the *Lamellæ* or Plates lying upon and environing it in a parallel Course. All these *Lamellæ* have a cortical Part and a Medullar, which seem to be of like Substance with the *Cortex* and *Corpus callosum* of the Brain, described before, *Chap.* 4.

Its Processus vermiformes.

Both Regions of the *Cerebellum*, viz. the *fore* and *hinder*, terminate in a *worm-like Process*, towards which the *Lamellæ* or Circles are shortest, lengthning by Degrees towards the middle or top.

Vessels and Glands.

The *Cerebellum* has a great many *Plexus* of Vessels beset with Glands, like the *Plexus choroïdes* of the Brain, which come into Sight by separating the *Pia Mater* from its hinder Part; for there the *Plexus* creep upon each Side by the worm-like Process, consisting on each Side, of a Branch from the vertebral Artery, and of venous Ducts sent out of each lateral *Sinus* of the *Dura Mater*. To these *Plexus* and Glands Dr. *Willis* ascribes the same Use as to those of the Brain, *viz.* that the Glands serve to separate the superfluous Phlegm from the arterial Blood, and to retain it; and that both the Arteries and Veins not only running on the Surface of the Cerebel, but sending Twigs into its inner Substance, the most subtile and spirituous Part of the Blood being conveyed through long Windings

ings and ſerpentine Ducts of Veſſels, and ſo ſublimed into Spirit, is received and retained within, whilſt the more impure and feculent Part is ſent back by the Twigs of Veins that are alſo deeply inſerted into the Cerebel.

It reſts upon the Trunk of the *Medulla oblongata*, or rather ſeems to ſtand upon each Side of it by two *Feet* or *Stalks*, betwixt which Feet on the Sides, the *Cerebellum* above, and the *Medulla oblongata* underneath, there is formed a Cavity which is commonly called the *fourth Ventricle*, of which by and by. *Pedunculi*

In each of theſe Feet that ſuſtain the Cerebel, there are *three* diſtinct medullar *Proceſſes*; the firſt of which proceeding from the *Nates*, aſcends obliquely; the ſecond deſcending ſtreight from the Cerebel, and paſſing a croſs the former, encompaſſes the *Medulla oblongata*; and the third deſcending from the hinder Region of the Cerebel, is inſerted into the *Medulla oblongata*, encreaſing the Thickneſs of its Trunk. *Their Proceſſes.*

The ſecond of theſe Proceſſes, *viz.* that which deſcends ſtreight, is it which makes the *Annular Protuberance* (otherwiſe called *Pons Varolii*) upon the *Medulla oblongata*, which it forms in this manner. Deſcending ſtreight upon the *Medulla*, aſſoon as it touches its Sides, it ſeems not to be preſently implanted into them, but growing into a greater Bulk, encompaſſes the Surface of the ſaid *Medulla* with divers circular Fibres. So that the Fibres of the Proceſs of one Side meeting thoſe of the Proceſs of the other Side underneath, or at the *Baſis* of the *Medulla*, make this circular Protuberance. Which that it may be ſeen, as alſo the three Proceſſes of each Foot of the *Cerebellum*, *&c.* 'tis neceſſary to cut the Cerebel through the middle, from one worm-like Proceſs to the other, for then they will all appear plainly. *The annular Protuberance.*

The Office of the Cerebel.

The *Office* of the Cerebel has generally been reputed to be the same with that of the Brain, *viz.* to elaborate the animal Spirits, which Anatomists have not used to distinguish into different Kinds, till of late Dr. *Willis* has taught, that some Spirits assist *natural* Motion, and others *spontaneous*. Accordingly he makes two Laboratories of these Spirits, appointing the Brain for the Confection of such Spirits as flow into those Nerves that perform *spontaneous* Motions, *viz.* such which we are conscious of, and can moderate or determine, as the moving of the Hand, *&c.* and the Cerebel for the making of such as flow into those Nerves by which *involuntary* or natural Motions are performed, *viz.* such as are done in a constant manner without our Knowledge or Will, as the Pulse of the Heart, *&c.* To which Opinion of his some have made these Objections: *First*, That Fowl have no Cerebel, and yet their Heart, *&c.* moves. *Secondly*, the Motion of the Heart, called natural, depending (in a great Measure) on the Influx of the Animal Spirits conveyed by the *par vagum* which arise out of the *Medulla oblongata*, one cannot easily conceive how the Animal Spirits should flow into these Nerves from the Cerebel, and not as well those generated in the Brain; or if they entred them alone, why, *Thirdly*, not only the natural Motion of the Heart should be performed by the said Pair of Nerves, but voluntary Motions also, as those of the *Larynx*, *&c.* He that would be satisfied of the Grounds of Dr. *Willis*'s Opinion, may consult his *Cerebr. Anat. cap.* 15, 16, 17.

The fourth Ventricle.

We said a little above, that betwixt the two Feet of the Cerebel standing on each Side, and the Cerebel it self above, and the Trunk of the *Medulla oblongata* below, the *fourth Ventricle* was formed, which we need not farther describe, only

only ſpeak a Word of its *Uſe*; which ſome have thought to be, for the *perfecting* of the Animal Spirits (as they were *prepared* by the three other) and therefore they have called this *the noble Ventricle*. But as was ſaid above of the other three, that they ſeemed not to be deſigned purpoſely by Nature, but reſulted only accidentally from the Conformation of the circumjacent Parts, and ſerved only as Sinks to receive ſerous Humours ſeparated in the Glands: So we believe that this reſults in like manner, and is of the ſame vile Uſe.

The hinder Part of Medulla oblongata.

Having now removed the Cerebel from off the Trunk of the *Medulla oblongata*, we come to have a View of the *hinder* Part of the *Medulla*. Now, omitting to ſpeak of the *vertebral Arteries* that run up by its Sides (as having mentioned them often before) as alſo of the Pairs of *Nerves* that ariſe out of it (which we ſhall deſcribe afterwards) I ſhall only in this Place take notice of the *two* medullar *pyramidal Bodies* adhering to its Sides. Theſe proceed from the *annular Protuberance* formed about the *Medulla* by the ſecond Proceſſes of the Feet of the Cerebel, near the *Baſis* of the *Medulla*, and being diſtinct from the reſt of the medullar Trunk, they tend ſtreight towards the ſpinal Marrow, and in their Progreſs by little and little becoming narrower, after about the Space of an Inch, they end into ſharp Points pyramidalwiſe, whence they have their Name. Dr. *Willis* thinks them to be Ducts or Chanels of the Animal Spirits from the annular Protuberance, or, which is all one, from the Cerebel, to the Nerves that ſpring out of the *Medulla oblongata*, there whereabout theſe pyramidal Bodies end.

Corpora pyramidalia.

We have now done with all the Parts of the *Encephalos*, whether relating to the Brain, *Medulla oblongata*, or Cerebel, from whence we might

proceed to the *Action* of the Brain; but we will first describe the *Glandula pituitaria* seated in the Cavity of the wedge-like Bone, with the notable *Plexus* of Vessels spread about it in some Creatures, called *Rete mirabile*; and in the next Chapter treat shortly of the *spinal Marrow*, as being an *Appendix* or Continuation of the *Medulla oblongata*.

Glandula pituitaria.

This *Glandula pituitaria* has a proper Seat of its own, made for it in the middle of the wedge-like Bone, in a Cavity commonly called *Sella equina*. It is not so big in Men, as in many other Creatures, being hardly bigger than a large Pease. Its Substance is far differing from that of other Glands: ['In Consistence indeed (as Dr. *Ridley* 'says) 'tis the same with most of the conglobate 'kind, if not somewhat harder; but then being 'prest or squeezed, it emits much more Water 'than any of them. In its Circumference 'tis 'almost four-square, above somewhat hollow, 'and below convex. It is covered with a very 'thin Membrane from the *Pia Mater*, proceeding 'from the *Infundibulum*, and by means of this 'Membrane it is knit very closely to the *Sella*.

Its Use.

It has been heretofore a current Opinion, that on this Gland is poured, by the *Infundibulum*, that serous Humour that is collected in the Ventricles of the Brain above; and that from this Gland it distils through the Holes of the wedge-like Bone upon the Palate, so to be spit out by the Mouth. But Dr. *Lower* denies this, appealing to the Structure of the Parts, and his often Experiments upon Calves Heads: ['In which, he says, the 'wedge-like Bone lying under the *Glandula pituitaria*, is sometimes perforated in divers Places, at 'least by one large Duct, which being divided 'into two, does on each side open into the jugular 'Veins: So that if Milk or Ink be injected thro' 'those

'thoſe Ducts by a Syringe, it preſently paſſeth 'through on each ſide into the ſaid Veins; and 'nothing of Tincture will appear about the Pa- 'late, Noſtrils, Mouth, *Fauces* or *Larynx*. So 'that in a Calf the Humour that proceeds from 'the Brain, returns all again into the Veins. 'And the ſame thing, he ſays, he has lately try'd 'in a Man's Skull, wherein though the wedge- 'like Bone be never perforated, yet Nature has 'framed other Ducts, whereby all the *Serum* may 'be again derived out of the Ventricles of the 'Brain into the Blood: For there are two Veſ- 'ſels ſeated on each ſide the *Sella Turcica* (to be 'deſcribed, *Book* VI. *Chap.* 6.) which with gaping 'Mouths as it were receive all the Water diſtil- 'led out of the *Glandula pituitaria*, and depoſit 'it on each ſide into the jugular Veins without 'the Skull; whoſe Ducts will eaſily appear, if 'Water or Milk be ſquirted forcibly out of a 'Syringe into either Jugular Vein near the Skull, 'for the Liquor will by and by break out near 'the *Glandula pituitaria*: which makes it evident, 'that whatever *Serum* is ſeparated into the Ven- 'tricles of the Brain, and iſſues out of them thro' 'the *Infundibulum*, diſtils not upon the Palate, 'but is poured again into the Blood, and mixed 'with it.] So that according to this Opinion, the Rheum that iſſues ſo plentifully ſometimes into the Mouth and *Fauces*, *&c.* falls not from the Brain; but, as was noted above, is ſeparated from the Arteries immediately, by the Glands of the reſpective Parts.

In thoſe Creatures that have the *Glandula pituitaria* large (as in Calves for Inſtance) the two Carotid Arteries meeting about the *Sella* of the wedge-like Bone, preſently divide themſelves into ſmall Twigs, which being interwoven with like (tho' not ſo numerous) Twigs from the internal Rete mirabile.

Jugular Veins, and alſo with nervous Fibres from the larger Trunk of the fifth Pair of Nerves, make on each ſide a notable *Plexus*, called *Rete mirabile*. There enter into this *Rete* ſome Twigs alſo from the cervical Arteries; and there paſs out of it ſeveral Twigs into the *Glandula pituitaria*. So that in theſe Creatures that Gland ſeems to be of the ſame Uſe to the *Rete mirabile*, as the *Glandula pinealis* is to the *Plexus choroides, viz.* to ſeparate a ſerous Matter from the arterial Blood. But in Man (according to moſt Anatomiſts) this *Rete* is wholly wanting; ſo that there paſſing only ſometimes a Twig or two, and ſometimes none, from the Trunk it ſelf of the Carotid Artery into the *Glandula pituitaria*, that Gland is of leſs Uſe in him than in other Creatures that have the *Rete*. Yet Dr. *Ridley* affirms, that he never found this *Rete* wanting, or with any Difficulty diſcoverable in Men, ſpringing from and lying on the inſide of each carotid Artery. But confeſſes that it is far ſmaller in them than in Brutes; for which Difference he thus accounts. 'Brutes, by reaſon of 'their prone Poſition, would, but for this *Rete*, be 'in Danger of having their Brains deluged, as it 'were, with an over-great Quantity of the influ-'ent Blood, and of a Rupture of the Veſſels, by 'its violent Ingreſs; and this Danger ſo much the 'more threatned, by how much the ſame Cauſe 'which brings it into the Brain with that Force, 'is equally as great and effectual to hinder its 'proportionable return: For the Relief of which 'Inconveniency Nature hath contrived a means of 'its more eaſy and ſafe Deſcent into the Brain, 'by turning that one large Stream of Blood (which 'through its being pent in one Chanel, becomes 'ſo rapid) into many more (by which means the 'carotid Trunk above the *Dura Mater* in thoſe 'Creatures is very ſmall to what it is beneath;

where-

'whereas that Artery in Men, *&c.* hath the ſame 'Bigneſs on both ſides that Membrane) and they 'not only reticulated and contorted, for the 'more ſlow and laborious (which Contrivance 'the Ancients thought was only for a more exact 'Preparation of the Blood for animal Spirits) De-'ſcent of the Blood, but alſo many of them by 'their inſertion into the *Glandula pituitaria*, atten-'ded with ſmall Veins iſſuing thence, to take off 'ſome part of the Burthen too.--And that to the 'aforeſaid Poſition of ſeveral Creatures, ought 'chiefly to be aſcribed the Variety of Magnitude 'of this *Rete* in ſeveral of them, its Size in *Dogs* 'ſeems highly to evince; in whom, by reaſon 'of their horizontal Poſition, being neither ſo 'prone as ſeveral Brutes who feed on Graſs, 'nor ſo erect as Man, this *Rete* is found ſmaller 'than in the firſt, and larger than in the laſt.

CHAP. VIII.

Of the Spinalis Medulla.

IT has been our Method, whenſoever we have come to the Riſe or Origin of any part that is extended thro' ſeveral Regions of the Body, to give a general Deſcription of it thro' its whole Extent, as if it all belonged to that Region where its Riſe is. Thus, for Inſtance, we have given a general deſcription of all the Arteries of both Head and *Abdomen*, as well as of the *Thorax* in our Anatomy of the middle Venter, becauſe they have all of them their Riſe from the *Aorta*, that ſprings out of the left Ventricle of the Heart, ſeated in that Venter. In like manner having deſcribed the *Medulla oblongata* within the Skull, we ſhall proſecute it in its deſcent down the *Vertebræ* of the

the Neck, Back, Loins and *Os ſacrum*, wherein it is called the *ſpinal Marrow*: But this very briefly.

Medulla ſpinalis.

We ſhewed above, how its Head (the *Medulla oblongata*) was joined by the *Corpora ſtriata* to the *Corpus calloſum* of the Brain, as alſo by thoſe many Protuberances that are upon it, both to the Brain and Cerebel, from and thro' which the Animal Spirits are derived into it. Its Trunk within the Brain (after its *Crura* are united) is generally about an Hand's breadth long: but its Length in the Spine is very different, according to the various Statures of Men.

Its Subſtance.

Its *Subſtance* is fibrous (which appears by the help of a Microſcope) as if it were compoſed of innumerable ſlender long Filaments, which whether they are hollow or no, cannot be diſcovered through their Fineneſs.

Veſſels.

If one cut through its Subſtance, there will innumerable little Specks or ſprinklings of Blood appear, but the Veſſels are ſo ſmall that they cannot be diſcovered, but there are plainly diſcoverable very many Twigs of *Arteries* and *Veins* running through the Membranes that inveſt it, (being principally Branches of the *Cervical*) from which Arteries the Blood is infus'd into the Pores of the *Medulla*, as it is imbib'd again from thence by the Veins.

Figure.

It is round and long, and decreaſeth not in its Thickneſs by the Nerves that go out of it. But on the contrary (as Dr. *Willis* obſerves) 'Where 'the moſt and the largeſt Nerves ſpring from it, 'it is there thickeſt, as particularly at the riſe of 'the Brachial and Crural Nerves. Of which he gives this Reaſon, ['Becauſe within the medul-'lar Tracts the Animal Spirits do not run down 'and paſs by ſwiftly, but for the moſt part iſſu-'ing leiſurely from their Fountains; when they 'have filled all Spaces, they keep their Abode in 'them;

'them; and where more Spirits are wont upon 'Occasion to be spent on any Work, there are 'provided larger Receptacles or Store-houses for 'them.] Only towards its end in the *Os sacrum*, it grows smaller and smaller.

It hath three *Membranes*. The first is that which immediately cloaths it. This springeth from the *Pia Mater*, and passeth thro' its middle (dividing it into two Parts) alone without the outer. The Twigs of Arteries and Veins run mostly thro' this. The second covereth the first, and springeth from the *Dura Mater*. There is no Distance between them, as there is in the Brain, but one toucheth another close, being knit together by Fibres. The third, proceeding from the Ligament which tieth together the fore-Parts of the *Vertebræ*, covereth both these. *Membranes.*

It is divided all along from the very first meeting of its *Crura* within the Skull, to the end of *Os sacrum*, by a Membranous Partition parting it into two; but this Division is not apparent in the Spine, because of the *Dura Mater* that covers it, but it may be discovered if that be taken off, and the *Medulla* severed in the middle. The Partition is made of the *Pia Mater*, and by means of *it*, it is, that the Use or Motion of *one Side* only is sometimes taken away in the Palsie. *Its Division.*

As for the Nerves that spring out of it, those shall be described after we have done with those of the Brain.

CHAP. IX.

Of the Action of the Brain, and the (supposed) Succus nutritius *of the Nerves.*

IT is generally agreed that the proper *Action* of the Brain (taken in a large Sense, is the elabo-

elaborating of Animal Spirits; and that they are ſent from it by the Nerves into the ſeveral Parts of the Body, for performing both natural and animal Actions. But what, and of what nature theſe Animal Spirits are, and in what particular Part of the Brain they are generated, is not agreed upon by learned Men.

The Animal Spirits where, and of what made.

Anat. of the Brain, P. 108.

P. 155.

Steno thinks it not improbable, that the Animal Spirits are of the ſame Nature with the Matter of Light. Dr. *Ridley* calls them *fluidum Animale*, of which he thinks there is no reaſon to form any other Idea than what we ordinarily have of the pureſt Liquors. And he looks upon this Animal fluid only as a Body conſiſting of very minute and flexible Particles, contained in ſuch a ſpace as allows them a Capacity of being agitated on all ſides by virtue of the ſubtile Matter, or ethereal *Globuli* they ſwim in, *&c.* Dr. *Willis* ſuppoſes they are ſpirituo-ſaline, and that in the Muſcles they do efferveſce with a *Latex* of a contrary nature, ſupplied by the Blood, whence the Muſcle grows turgid, and conſequently contracts. Some are of Opinion that they differ in no other regard from the Vital, but only as they are conveyed by proper Veſſels, and miniſter to other purpoſes, and are of a cooler Temperament; but that there is no ſpecifical Difference betwixt them. Others on the other ſide, think they differ *in Specie*, and agree in nothing, but only that the Vital Spirits and Blood are the Matter out of which the Animal Spirits are formed. Another ſort deny the Arterial Blood to be the Matter of theſe Spirits, and affirm, that the Nerves of the Stomach, *&c.* abſorb a part of the Chyle, of which they are made, and beſides, a Nutritious Juice, of which by and by. And ſome there are, that ſuppoſe Air alſo to be an Ingredient, which either aſcends into the Brain thro'

thro' the *Os cribriforme* (and fills the Ventricles, according to *Fracaſſatus*) or inſinuates itſelf into the Blood, as that circulates through the Lungs. We cannot ſtand upon the Examination and Refutation of ſeveral of theſe Opinions here; but upon a due Conſideration of the Arguments urged for each, we think that the Animal Spirits are ſpecifically diſtinct from the Vital, but that the Vital, with the Arterial Blood, their Vehicle, are the true and only Matter, out of which they are elaborated.

Where elaborated.

And there is no leſs Difference in what part of the Brain the Animal Spirits are made. Some deputing to that Office the *Sinus* of the *Falx*, others the four Ventricles of the Brain, eſpecially the fourth, a third ſort the *Plexus choroides* and *Rete mirabile*; *Des Cartes* thinks, that they are ſeparated out of the Arteries of *Plexus choroides* in the *Glandula pinealis* into the Ventricles; and others, laſtly, aſſign the Subſtance of the Brain and Cerebel (eſpecially their cortical or glandulous Part) for the Place of their Confection. As to the *Sinus* of the *Falx*, the Uſe of that was ſhewn above, *Chap.* 3. And as to the Ventricles, ſeeing they are often almoſt *quite full* of wateriſh Humour, but always have *ſome*, they ſeem very unfit for the making or ſtoring up ſuch ſubtile and volatile Spirits as the Animal are. As for the *Plexus choroides* and *Rete mirabile*, there is no Veſſel that goes out of either, which contains any thing, but under the Form of Blood; ſo that ſeeing there are no *Vaſa deferentia* (or call them what you will) to convey the Spirits from theſe *Plexus* to the Origin of the Nerves, we cannot reaſonably aſcribe to them ſuch an Action. We muſt therefore ſubſcribe to the laſt Opinion, that aſcribes this Work to the very Subſtance of the Brain and Cerebel, and is perform'd in this manner.

ner. The Heart is like the *Primum mobile* of the Body, to which the Motion of all the Humours that have once paſs'd it, is owing. This by its *Syſtole* impels the Blood, as into all other Parts, ſo into the Brain by the ſeveral Branches of the *Carotides*, whoſe innumerable Twigs run chiefly thro' the outer *Cortex*, or greyiſh part of the Brain and Cerebel, and partly into the medullar or white Subſtance. Theſe Twigs of Arteries ſpring partly from the *Plexus choroides*, and *Rete mirabile* (in thoſe Creatures that have it) and partly from the *Carotides* themſelves immediately. The ſuperfluous *Serum* is ſeparated from the Blood contained in the Arteries before they enter into the Brain and Cerebel, by the Glands above deſcribed; and that Blood which is not elaborated into Animal Spirits in theſe Parts, is returned again to the Heart by the Veins. But thoſe Particles that are fit and proper to be converted into them, are extravaſated into the very *Parenchyma* of the Brain and Cerebel (*viz.* their Cortical Part) or at leaſt are diſtributed thro' it by inviſible Capillaries; in which being perfected into Spirits, theſe by help of the Fibres or Filaments, which the inner medullar Subſtance of the Brain and Cerebel chiefly conſiſts of, are conveyed to the *Medulla oblongata*, by the *Corpora ſtriata*, and other Proceſſes, whereby the *Medulla* adheres to the Brain and Cerebel; out of which *Medulla* they enter the Nerves, whoſe inner Subſtance is Fibrous, like the *Medulla* from whence they ſpring. And the Reaſon of this ſucceſſive Motion from one to another, is the Pulſe of the Heart, whereby that which comes behind, always drives forward what is before. Whence the true Cauſe of an Apoplexy (wherein Motion and Senſe are almoſt quite aboliſh'd) is very probably from the Obſtruction or Compreſ-

ſion,

sion, *&c.* of the Arteries in the Brain and Cerebel; whereby both little Blood and vital Spirit can be conveyed thither to make Animal Spirit of, and also when it is made, it is not impelled thence into the *Medulla oblongata*, nor out of it into the Nerves, to enable them to perform their Functions.

The Succus Nutritius of the Nerves.

There is no less Controversy about the *Nutritious Juice* of the Nerves; some contending for it to that Height, as to affirm, that all the Parts of the Body are *only* nourished by *it*, and not at all by the Blood, which by its rapid Motion, they say, is liker to wear and carry away something from the Parts thro' which it passes, than to adhere to them for their Restauration. Others are more moderate, and suppose that Nourishment is dispensed only to the spermatick Parts by the Nerves, which the Nerves receive not from the Blood, but imbibing the most thin part of the Chyle out of the Stomach and Guts, they carry it up to the Brain, from whence it is conveyed again by the same or other Nerves to the Parts to be nourished by it. *Diemerbroeck* is of Opinion, that the Juice of the Nerves (which is as a Vehicle to the Spirits) being somewhat acid, does contribute or yield Assistance to the Nourishment of the spermatick Parts, not as it is the Matter of, but as it separates from the Blood, such Particles as are fit for their Nourishment. Whence it is, he says, that such parts of the Body as are most exercised, and by Consequence into which most Animal Spirits flow, grow the strongest, having more of such Particles of the Blood as are fit for their Instauration, separated in them. So they that are used to walk, will endure it better, than others that are not so used, tho' otherwise much stronger, and hence the right Arm is usually stronger than the left, in those that are right-handed

handed (as we ſay.) But he thinks that the Nerves have no Juice in them which they did not firſt receive from the Blood. Dr. *Willis* is much of his Opinion, ſaving as to this laſt Particular; for he ſays, it is without doubt that the nervous Fibres and Filaments which cloath the Senſory of the Taſte, and the Bowels that ſerve Concoction, do immediately take ſome Taſte of the Aliments for the ſupply of the Brain, eſpecially at ſuch times as the Spirits are much waſted in too long faſting, or over-much Exerciſe. But then that Juice that may be ſuppoſed to be made thereof in the Brain, and to be diſpenſed by the Nerves into all the Parts of the Body, he believes not to be the Matter of the Nouriſhment of any Part, whether ſpermatick or ſanguineous; but that it is as the *Form* only, and the Blood the *Matter*, whoſe ſeveral Particles being analyſed or ſevered by the ſaid Juice, are directed and adapted by its *directive Faculty* or *plaſtick Power*, as it were, to ſuch Parts reſpectively as they are ſuitable for. And from hence he draws a Reaſon why paralytick Parts do waſte ſo much tho' the Blood flow plentifully enough into them, *viz.* becauſe the Nerves being obſtructed, and no animal Spirits (with their Vehicle) paſſing by them, the Particles of the Blood are not ſeparated for the Supply of ſuch Parts. As for the nervous Juice it muſt needs be very little in Quantity, ſeeing if one make a Ligature upon the Nerve, it will not ſwell betwixt the Head and Ligature; nor if one cut the Nerve in ſunder will any thing diſtill out of it. So that it ſeems very abſurd to think, that it ſhould be ſufficient for the Nouriſhment of *all* the Parts of the Body, according to the firſt Opinion. Nor does it ſeem reaſonable to imagine, that the Chyle ſhould deſcend from the Stomach, *&c.* to the Brain by the Nerves, whiles this nervous Juice that is con-

contended for, with the animal Spirits, is descending by the same; for one cannot conceive, how such contrary Motions of Liquors in the same Vessel can be at the same time. Tho' from the sudden Refection that Persons ready to faint, receive from spirituous Liquors, *&c.* it be probable that certain *Effluvia* or subtil and spirituous Vapours do enter the nervous Filaments of the Mouth and Stomach, and recruit the animal Spirits immediately, without fetching that Compass that I believe all the Chyle does. And as the Nerves imbibe no Chyle from the Stomach, *&c.* so receive they no more from the Arteries, than some of its most spirituous and volatile Particles elaborated in the Brain into animal Spirits, which have indeed some little Moisture accompanying them, as a Vehicle, but which is neither of a suitable Nature, nor of proportionable Quantity for the Nourishment even of the spermatick Parts only. For seeing the Nerves have no conspicuous Cavity, but only imperceptible Pores, by which any Liquor can drill along them; such Liquor must needs be most thin and watry, and therefore unfit to be assimilated to any Part. And lastly, as to the Opinion that it separates the Particles of the Blood, and so distributes those that are respectively proper for, unto each Part, as the sulphureous to the Fat, *&c.* or is to the Blood as the Form is to the Matter. It is an ingenious *Hypothesis* I confess, but whether true, I dare not affirm. I shall only add what Dr. *Havers* says on this Subject, *viz.* [' I do not suppose that the ' *Succus Nutritius* of the Body is from the Nerves; ' yet they have, as other Parts, a supply of it for ' their own Nourishment, which I take to be all ' the *Succus Nutritius* they have.]

CHAP. X.

Of the Nerves ariſing from within the Skull; and firſt, of the firſt and ſecond Pairs.

WE have now done with all the Parts of the *Encephalos*, wherein the animal Spirits are either elaborated or ſtored up, and have alſo deſcribed the Nature of the Spirits themſelves: It remains that we ſhew by what and how many Inſtruments they are diſpenſed to the Parts, for the Performance of whoſe Functions they are neceſſary. Theſe Inſtruments are the *Nerves*, all of which ſpring either out of the *Medulla oblongata*, within the Skull; or out of the *Medulla ſpinalis*, in the Spine. They all of them ariſe by *Pairs*, ſo that they are not reckon'd to be ſo many *Nerves*, but ſo many *Pairs* of Nerves. As for the *Pairs* within the Skull, they were formerly reckoned to be but *ſeven*, ſum'd up in theſe Verſes:

Optica prima; oculos movet altera; tertia guſtat:
Quarta & quinta audit; vaga ſexta; at ſeptima linguæ eſt.

But ſtricter Examination has found them to be more; Dr. *Willis* particularly has encreaſed them to the number of *Ten*, holding the *Proceſſus mammillares* to be the *Olfactory* Nerves, and the *Par vagum* and *Intercoſtal* to be two diſtinct Pairs; and laſtly, deſcribing a tenth Pair, which deſcending out of the Skull with the *Medulla*, emerges betwixt the firſt and ſecond *Vertebræ* of the Neck. We ſhall adhere to this Account, and deſcribe the *Olfactory* and *Optick* in this Chapter, and the reſt afterwards in order.

O

Of all the *Pairs* of Nerves that rise within the Skull, the *Olfactory* or smelling Pair arise the foremost, and are therefore reckon'd for the first. They spring from the *Crura* of the *Medulla oblongata*, betwixt the *Corpora striata*, and the little Hillocks or Eminences, out of which the optick Nerves rise (called by *Galen* their *Thalami.*) Tho' *Diemerbroeck* (that following the Ancients) denies them to be Nerves, affirms that they spring not from the said *Medulla*, but from the globous Marrow of the Brain (properly so called) and its four Ventricles.

Nervi olfactorii, *the first Pair.* *Their Rise.*

From their Rise they run forwards under the *Basis* of the Brain (encreasing in Bulk as they go) as far as the *Os cribriforme*, at the Top of the Nose, growing there into round Processes, like Paps, being therefore called *Processus papillares*, or *mammillares.* *Progress.*

They are manifestly hollow in their whole Progress, and their Substance is very marrowy and soft. *Cavity and Substance.*

Having arrived at the *Sinus* of the Sieve-like Bone, they there acquire Coats of the *Dura Mater*; with which being clad, Dr. *Willis* says they are divided into many Fibres and Filaments, which pass out of the Skull thro' the Holes in the said Bone, into the Caverns of the Nostrils, running thro' the Membrane that invests those Caverns. *Insertion.*

Dr. *Willis* ascribes a double *Use* to them, making them both the true Organs of Smelling, and also Emunctories to the Brain, thinking that when too much *Serum* is collected in its Ventricles, these deriving it thence, send it forth by their Filaments thro' the *Os cribriforme*, into the Nostrils. *Diemerbroeck* believes they have only this latter Use; only that the *Serum* or *Lympha* distils from them as well upon the *Fauces*, and their Glands, as in- *Use.*

to the Noſtrils. Dr. *Lower* grants only the *former*; and ſays, that [‘It is incredible that the ‘Humour that is contained in the Cavity of theſe ‘Proceſſes ſhould iſſue out by the Nerves (or ‘*Nervous Filaments*) into the Noſtrils, for if it did, ‘the ſenſe of Smelling muſt needs be much pre-‘judic’d thereby. And beſides, if this Water ‘could diſtil by and out of the Nerves, much ‘more might the Spirits, that are thinner and ‘more ſubtil, fly away. And as to the Humour ‘contained in the Cavity of the Proceſſes, he ‘ſuppoſes it to be of very great Uſe; namely, ‘that when *Effluvia*, or moſt ſubtil Particles, ex-‘haling from an external Object, are deliver’d ‘to the *Olfactory Nerves*, that their Species may ‘reach the Brain the better, it was neceſſary ‘that theſe Nerves or *Proceſſes* ſhould be made ‘hollow from their very Riſe, and be filled with ‘a limpid Humour: Not that I believe, *ſays he*, ‘that the Species themſelves are conveyed thro’ ‘their Cavities into the Ventricles of the Brain, ‘or that the Animal Spirits are lodged in thoſe ‘Ventricles, as the Ancients thought; but that ‘they are therefore hollow and moiſten’d with-‘in with Water, that their marrowy Bodies may ‘ſerve the better both for retaining and convey-‘ing Smells into the Brain: For as things ſmel-‘led are better perceiv’d from moiſt Bodies, and ‘in a moiſt Air, than in a dry Seaſon from the ‘parched Ground (as Huntſmen know too well) ‘ſo it is likely, that in the ſame manner as they ‘are beſt perceived outwardly, they are alſo ‘beſt conveyed inwardly, *&c.*] And indeed, if we will allow them to be *Olfactory Nerves* (as I think there is great Reaſon) it is very incongruous that they ſhould ſerve for an Emunctory to the Brain, to diſcharge its ſuperfluous *Serum*. And therefo re we think it fit to acquieſce in this

Learned

Learned Phyſician's Opinion; and to believe that the *Lympha* or *Serum*, gathered in the Ventricles of the Brain, is emptied by thoſe ways we before obſerved out of the ſame Author, and not at all by the nervous Filaments that paſs from theſe Proceſſes, through the *Os cribriforme*, into the Noſtrils.

The *ſecond Pair* are the *Optici*, or *Viſorii Nervi*, which beſtow upon the Eyes the Faculty of Seeing. They ſpring from the upper Sides of thoſe unequal Protuberances of the *Crura* of the *Medulla oblongata*, which are called *Nervorum opticorum thalami*, from whence being carried forward, and ſomewhat downwards, after having fetch'd a Compaſs, they meet one another about the *Infundibulum*, upon the *Sella* of *Os ſphenoides*; where they are united by the cloſeſt Conjunction, but not Confuſion, of their Fibres, which run Parallel lengthways in theſe Nerves, as they do in all other. Nervi optici, *the ſecond Pair. Their Riſe.*

They are obſcurely hollow, until they be united; but after, their Hollowneſs cannot be diſcerned. This Hollowneſs may be ſhewed in a large Beaſt newly killed, and in a clear Light. *Cavity.*

Thus do *Riolanus*, *Gliſſon*, &c. teach: But *Veſalius*, *Aquapend*, &c. deny that they have any manner of *Cavity*. *Malpighius* ſays ['They have 'not one Cavity only, but ſundry; but that theſe 'Cavities reſult only from the neceſſity of their 'Structure, all their inner or medullar part, con-'ſiſting of round *Inteſtinula*, or Fibres, running 'lengthways, which cannot be ſo cloſely fitted 'to one another, but that there will reſult long 'Interſtices, which yet perhaps are of no uſe, nor 'of the Nature of Ducts, but only accidental. 'But whether the *Inteſtinula* or Filaments them-'ſelves have not little Channels in them (like to 'Blood-veſſels) he thinks may be doubted of: De Cerebr. *p.* 22.

'But seeing Sense has not yet discovered any 'such, 'tis probable that there are to be admitted 'only little Pores and Interstices in the medullar 'Substance, by means whereof the nourishing 'and vivifying Juice may be propagated.

Insertion. After their Union, they are separated again, and each of them running farther forwards, passes through an Hole of *Os cuneiforme*, and is inserted obliquely into the Center of the Eye of its own side.

Vessels. Dr. *Willis* says, they receive not only nervous Fibres from the third Pair of Nerves, but also Twigs of Arteries from the Fore-branches of the *Carotides*, which run upon them as far as the *Basis* of the Eye. Whence, he thinks, a Reason may be assign'd, why, when a Man grows sleepy after plentiful Eating or Drinking, he presently feels a notable Heaviness or Oppression, as it were, about his Eyes. For when the Blood becoming very turgid, fills the Vessels that run thro' the Brain, more than usual, and by distending them, stops the Pores of the Brain; these Nerves also in their whole course are compressed by the Blood that is become turgid in their Blood-vessels likewise.

Dr. *Ridley* says, that he has seen the Blood-vessels to run not only upon or with them, but also in injected Bodies exactly quite thro' the medullary Substance of them, into the reticular Coat of the Eye, wherein they end in an infinite number of the most capillary Ramifications, which by an Injection of that Artery, made with Mercury, becomes very delightfully conspicuous to the Eye.

Substance and Parts. They are very soft, so long as they are within the Skull, but having pass'd the *Os sphenoides*, they become somewhat more firm and hard. The Reason of which Alteration seems to be, that within the Skull they are only clad with the *Pia Mater*,

Mater, but as they go out, they assume a second Coat from the *Dura Mater*.

From the whole Substance of these Nerves, *viz.* from their two Membranes, and the inner medullar, and fibrous Substance, are the three (proper) Tunicles of the Eyes framed; for the *Cornea* or *Sclerotica* doth proceed from the *Dura Mater*, the *Choroides* or *Uvea* from the *Pia Mater*, and the *Retina* from the marrowy Substance. *They make the proper Tunicles of the Eyes.*

CHAP. XI.

Of the third and fourth Pairs.

THE *third Pair* are termed *Motorii Oculorum*, because they move the Muscles of the Eyes. They have their beginning at the innermost Part or *Basis* of the Trunk of the *Medulla oblongata* behind the *Infundibulum*. *The third Pair. Their Beginning.*

This Pair is united at its Rise; whence is commonly drawn a Reason why one Eye being moved towards any Object, the other is directed also to the same. But tho' this Conjunction may be a Reason why the Spirits should flow equally to the Muscles of each Eye; yet it satisfies not why they should flow at the same time, into different Muscles. As for Example; Why, when one would look to the right Side, the Spirits are presently determin'd into the *external Muscle* of the right Eye, and into the *internal* of the left; and not into the external, or internal of both. And therefore a truer Reason of both Eyes being moved together to one Object, is the Intention of the Mind, which aiming only to have a View of one Object at one time, directs the Spirits to those Muscles only that serve to turn the Eye towards that Object, *&c.* *Why both the Eyes are directed to the same Object.*

Their Substance and Branches. They are ſmaller and harder than the former, and preſently parting one from the other, they paſs along by the optick Pair, and penetrating the ſecond Hole of *Os cuneiforme*, are carried towards the Globe of the Eye, where each is divided into four Branches. The firſt whereof mounting above the Optick, is beſtowed upon the attollent Muſcle and the Eye-lid. The ſecond is inſerted into the adducent Muſcle, by ſundry ſmall Twigs. The third by many Fibres is inſerted into the depriment Muſcle. The fourth paſſing farther in a ſingle Trunk, is implanted into the middle of that Muſcle that draws about the Eye obliquely downwards to the inner Corner. At that place where this Nerve divides itſelf into four Branches, it forms a little round *Plexus*, out of which many ſlender Twigs ariſe that creep through the Trunk of the Optick Nerve, ſerving perhaps to widen or ſtraiten it as there is occaſion.

The fourth Pair. Their Beginning, March and Inſertion. The *fourth Pair* proceed from the Top of the *Medulla oblongata* (contrary to all others, which ariſe either from its *Baſis*, or Sides) behind the round Protuberances called *Nates* and *Teſtes*: Whence bending forwards by the Sides of the *Medulla oblongata*, they preſently hide themſelves under the *Dura Mater*; under which proceeding a while, they paſs out of the Skull, each in a ſingle Trunk at the ſame Hole with the others deſigned for the Eyes (communicating with no other Nerves in their whole Progreſs) and are beſtowed wholly (as Dr. *Willis* affirms) on that Muſcle of the Eye called *Trochlearis*, which ſerves to rowl the Eye about. Which Motion of the Eye being generally attendant upon or expreſſive of ſome *Paſſion* of the Mind, as Love, *&c.* theſe Nerves are thence called *Oculorum pathetici.*

CHAP.

CHAP. XII.

Of the fifth, sixth, and seventh Pairs.

THE *fifth Pair* spring from the sides of the *Medulla oblongata*, where it is encompassed with the annular Process or Protuberance of the Cerebel (or as Dr. *Willis* will have it, from that Process it self.) Each Trunk is very large and broad, consisting of very many Fibres, some soft, and some hard: So that it seems to be not one single Nerve, but a Collection or Bundle of many small ones, some of which are design'd for one part, some for another; some serving for Motion, and others for Sense. And the Reason why they are *all* united together in their Rise, the said Author thinks to be, that there may be a Sympathy and Consent of Actions in the several Parts to which they are distributed. Whence it is that Seeing or Smelling what is pleasing to the Appetite makes ones Mouth water, *&c.* because this Pair of Nerves sends Twigs both to the Eyes, Nostrils, Palate, Tongue, *&c.* *The fifth Pair.* *Their Rise.*

Each Trunk is divided into *two* notable Branches, sometimes before, but oftener after it has penetrated the *Dura Mater*. The *first* whereof tending streight downwards, and passing out of the Skull by its proper Hole, in its Descent towards the lower Jaw (for whose Parts 'tis chiefly design'd) is divided into many lesser Branches, which provide for the temporal Muscle, as also for the Muscles of the Face and Cheeks. From these also there go Twigs to the Lips, Gums, Roots of the Teeth, *Fauces*, Tonsils, Palate and Tongue. The *second* Branch of this fifth Pair, being the larger, goes a little streight forward by the Sides of the *Sella Turcica*, and over against the *Division and Progress.*

the *Glandula pituitaria*, ſends little Twigs to the Trunk of the *Carotides*, or to the *Rete mirabile*, in ſuch Creatures as have it; then inoſculates with the Nerve of the ſixth Pair, and afterwards ſends back a Slip or two, which being united with another Slip returned from the Nerve of the ſixth Pair, conſtitute the Root or firſt Trunk of the *Intercoſtal Pair*, which we ſhall reckon for the ninth, and ſpeak of it by and by. After this it is divided into *two* notable Branches: The *leſs* and *upper* whereof tends towards the Globe of the Eye, and being again divided, ſends forth two other, the firſt of which is parted into two more, that go one to the Noſe, and the other to that Muſcle of the Eye which is proper to Brutes; and the ſecond into four or five Slips, that are moſtly ſpent on the Eye-lids, but partly on the *Uvea Tunica*, and the Glands of the Eye. The *greater Branch* (of its ſecond Diviſion) being carried towards the Orbit of the Eye, is divided into two new Branches. The *lower* whereof bending downwards, is beſtowed on the Palate, and upper Region of the *Fauces*; and the *upper* being carried beyond the Orbit of the Eye, paſſes through an Hole of the upper Jaw, with the Vein and Artery which it twiſts about, and ſends many Slips to the Muſcles of the Cheeks, Lips, Noſe, and Roots of the upper Teeth. From its twiſting about the ſanguiferous Veſſels deſigned for the Cheeks, and other Parts of the Face may a Reaſon be drawn why one bluſhes when he's aſham'd: For the Animal Spirits being diſturbed by the Imagination of ſome uncomely thing, as if they took Care to hide the Face, enter this Nerve diſorderly; ſo that its Twigs, embracing theſe ſanguiferous Veſſels, by compreſſing and pulling of them, cauſe the Blood to flow too impetuouſly into the Cheeks and Face by the

Ar-

Arteries, and detain it there ſome time, by conſtringing the Veins.

The ſixth Pair. Their Riſe and Inſertion.

The *ſixth* Pair riſe juſt by (but below) the fifth, and each preſently ſinking under the *Dura Mater*, goes out of the Skull by the ſame Hole with the Nerves of the third and fourth Pairs, and is carried by a ſingle Trunk towards the Orbit of the Eye; but ſo, as by the Side of the *Sella Turcica*, it inoſculates with the ſecond or greater Branch of the fifth Pair (as was noted in the former Paragraph;) whence ſending back ſometimes one, ſometimes two Twigs, theſe being united with the recurring Twigs of the fifth Pair (above-mentioned) make the Beginning of the *Intercoſtal Nerve*. Afterwards going forwards, near the Orbit of the Eye, it is divided into two Branches; of which *one* is inſerted into the abducent Muſcle of the Eye, placed in its outer Corner; and the *other*, being cleft into many Fibres, is beſtowed on the ſeventh Muſcle, proper to Brutes, whereby they defend the Eye from external Injuries accidentally occurring, when they are ſaid *nictitare* (which I think we have no Word to expreſs in Engliſh.)

The ſeventh Pair. Their Riſe and Inſertion.

The *ſeventh* Pair, by the Ancients commonly reckon'd for the fifth, miniſter to the Senſe of Hearing. Each Nerve has two Proceſſes, one ſoft, and the other harder, which might ſeem to be two diſtinct Nerves, but they are uſually accounted for one. They ſpring a little behind the former, out of the Sides of the *Medulla oblongata*. Dr. *Willis* ſays, the *ſofter* Proceſs ariſes from the lower Side of the annular Protuberance, from whence it aſcends; and the harder from its upper Part, from whence deſcending, it meets the other. The *ſoft* Part or Proceſs (that is properly the auditory Nerve) is carried through an Hole of *Os petroſum*, into the Cavern of the Ear, which

it

it cloaths with a moſt thin Membrane. By this are Sounds conveyed to the common Senſory. The *harder* Proceſs ſerves rather for Motion than Senſe; which paſſing out alſo thro' the *Os petroſum*, by its proper Hole, preſently admits a Twig from the *Par vagum* or eighth Pair, after which it is immediately divided into *two* Branches; *one* whereof tending downwards, is beſtowed on the Muſcles of the Tongue and *Os hyoides*; and the *other* winding about the auditory Paſſage, and bending upwards, is divided into three Twigs; of which the *firſt* correſponding to the Nerve of the firſt Diviſion, beſtows certain Slips on the Muſcles of the Lips, Mouth, Face and Noſe, and ſo actuates ſome outward Organs of the Voice, as the former ſome of the inner; the *ſecond* is diſtributed to the Muſcles of the Eye-lids and Forehead, and the *third* to the Muſcles of the Ears. Whence upon ſome unuſual and aſtoniſhing Sound, by a certain natural Inſtinct, the Ears prick up, and the Eyes open. As alſo the Voice does officiouſly anſwer as an Eccho to thoſe Sounds that are perceived by the Ears, from the Community of the Nerves diſtributed to the Organs of the Voice and Hearing.

CHAP. XIII.

Of the eighth, ninth and tenth Pairs.

The eighth Pair. THE next *Pair* in order is the *eighth*, which has uſed to be reckon'd for the ſixth, and is otherwiſe called *par vagum*, or the *wandering Pair*, from their being diſtributed to ſundry Parts.

Their Riſe. They ſpring below the auditory Nerves, out of the Sides of the *Medulla oblongata*, the Root of each Nerve conſiſting of twelve Fibres at leaſt

(in

(in Man) to which a notable Fibre, or rather *Nerve* (much greater than any of these twelve) coming from the spinal Marrow, as far as from about the sixth or seventh *Vertebra* of the Neck, is joined, and both are invested with the same Coat from the *Dura Mater*, as if they grew into one Nerve; but if their common Coat be removed, this accessory Nerve, and many of the other Fibres remain still distinct; and after they are gone out of the Skull together, are dispensed to several Parts; the accessory Nerve to the Muscles of the Neck and Shoulder-blade, and one notable Fibre of the eighth Pair to the harder Process of the auditory or seventh Pair, as also two others to the Muscles of the Gullet and Neck. But the other Fibres of this *par vagum* continue united; and instead of those Companions they have parted with, each Nerve entertains a new one, namely, a Branch from the *Intercostal* or *ninth* Pair, whereby is made a notable *Plexus* (which in a Nerve is like the Joint of a Cane, or the Knot upon the Trunk of a Tree where a Bough goes out, whence they are called *ganglioformes*) and out of the same *Plexus* there springs a considerable Branch, which being carried towards the *Larynx* is divided into three Twigs, of which one goes to the Sphincter of the Gullet, a second to the upper Muscles of the *Larynx*, and the third going under the *Cartilago Scutiformis*, meets the Top of the recurring Nerve, and is united to it. Below the aforesaid *Plexus* of this *par vagum*, each *Progress.* Trunk goes streight down by the sides of the ascending *Carotides*, on which they bestow some Slips. And at the Bottom of the Neck each receives a second Branch from the Intercostal (*viz.* from its first *Plexus*) and near thereto the left Nerve of this Pair sends out another Twig into the recurrent Nerve, but so does not the right.

From

From hence both Trunks descend without any notable Ramification, till they become over against the first or second Rib; where out of a second *Plexus* (or Knot) many Twigs and Fibres go towards the Heart, and its Appendage, from whence this *Plexus* is called *Cardiacus*. There is one notable Difference (which we cannot but note) of the two *recurring Nerves* that spring out of the Trunks of this eighth Pair, *viz.* That that on the right side arises out of it higher, and winds about the Axillar Artery; whereas that on the left springs much lower therefrom, and twisting about the descending Trunk of the *Aorta*, returns back from thence. Dr. *Willis* says, that the *recurring Nerve* is really a distinct Nerve from the *par vagum*, from the very Original, and was only included in the same Case or Cover, for the more convenient and safe Passage. The Branches of the *par vagum* do frequently unite with others of the Intercostal Pair, about the *Præcordia*. And when their two Trunks are descended as low as over against the Heart, many Twigs go out of them into the Lungs, *&c.* Whence both Trunks descending by the Sides of the Gullet, are divided into two Branches, *outer* and *inner*: The outer unite with the outer, and the inner with the inner, and both descend to the Stomach, in which they terminate, but are spent chiefly upon its upper Orifice. As for their more particular Distribution, we have spoken thereof while we treated of the Parts themselves on which they are bestowed.

End.

The ninth Pair.

We are next to describe the *ninth Pair* (which before Dr. *Willis* was not distinguished from that going before.) It is called the *Intercostal*, because as its Trunks march down by the Roots of the Ribs, betwixt every Rib they receive a Branch from the spinal Pairs. They have no proper

Their Rise.

Root

Root of their own, but each Trunk is compounded of two or three recurring Branches of the fifth and sixth Pairs (near their Origin) as was noted when we treated of those Pairs. Being thus formed, they pass out of the Skull by their proper Holes, and presently each has a *Plexus* near those of the *par vagum*, into which, two nervous Processes, from the tenth Pair of the Brain are inserted, and out of which there goes a Twig into the Sphincter of the Gullet, and into the *Plexus* (aforesaid) of the *par vagum*. Whence descending by the *Vertebræ* of the Neck, by that time they arrive at its Middle, each has another greater *Plexus*, *into which* a large Nerve from a neighbouring vertebral Pair is inserted; and *from which* proceed many Twigs, that uniting with others of the *par vagum*, are distributed all about the *Præcordia*, as also one single one a little lower. This *Plexus cervicalis* out of which so many Branches spring, is proper to Man, being not found in Brutes. From the Neck they descend by the *Claviculæ* into the *Thorax*, where having arrived at the second Rib, each receives three or four Branches from the vertebral Nerves next above, whereby is made another notable *Plexus* (commonly called the *Intercostal.*) From whence as they pass down by the Roots of the Ribs, in every one of their Interstices, and even as low as *Os sacrum*, from every jointing of the *Vertebræ* each receives a vertebral Branch. Assoon as they are descended out of the Cavity of the Breast, and are come over against the Stomach, each sends forth a notable Branch, which tending towards the Mesentery, make its chief *Plexus*, which are in number *seven*, *five large* ones, which are *upper*, and *two less*, that are *lower*. For each Branch is presently divided into two other, and every one forms one *Plexus*, which make four; *Progress.*

and

and the fifth is in the Middle of theſe, being the largeſt, and like the Sun amongſt the Planets (as Dr. *Willis* compares it.) And theſe are the *five upper*. The *two lower* are framed of Branches that ſpring from the Trunks deſcended as far as the lower parts of the Loins, and are diſtinguiſhed by the Names of *Plexus infimus* and *minimus*. As to the Parts that all the Twigs which ſpring from theſe ſeven *Plexus* are diſtributed to, it may be learned from the Deſcription of the Parts themſelves in the *Firſt Book*, in which we conſtantly mentioned from whence each Part had its Nerves. Laſtly, when this Intercoſtal Pair is come to the *Os ſacrum*, its two Trunks bend toward each other, and ſeem to be knit together by two or three Proceſſes; and at length each of them *ends* in ſmall Fibres, that are diſtributed into the Sphincter of the *Anus*.

End.

The tenth Pair. Their Riſe and Progreſs.

We are now come to the *tenth* and laſt Pair of Nerves that riſe from the *medulla* within the Skull. This Pair ſpring from the Sides of the *medulla*, behind all the reſt, and deſcending with it out of the Skull into the *Vertebræ* of the Neck, they come out betwixt the firſt and ſecond *Vertebræ* thereof. Preſently after their Egreſs each ſends forth a Branch into the *Plexus* of the Intercoſtal Nerve of its own Side: But their main Trunks being carried downwards, and each receiving a Twig from the ninth Pair, they are beſtowed on the Muſcle *Sternothyreoideus*, and ſome other Muſcles of the Neck. So that though this Pair riſe within the Skull, yet it ſeems to be more of the Nature of the Vertebral Nerves, as beſtowing ſome Branches on the Intercoſtal, and being all the reſt of it ſpent upon the Muſcles of the Neck.

And thus we have done with all the Nerves that proceed from the *Medulla* within the Brain

in

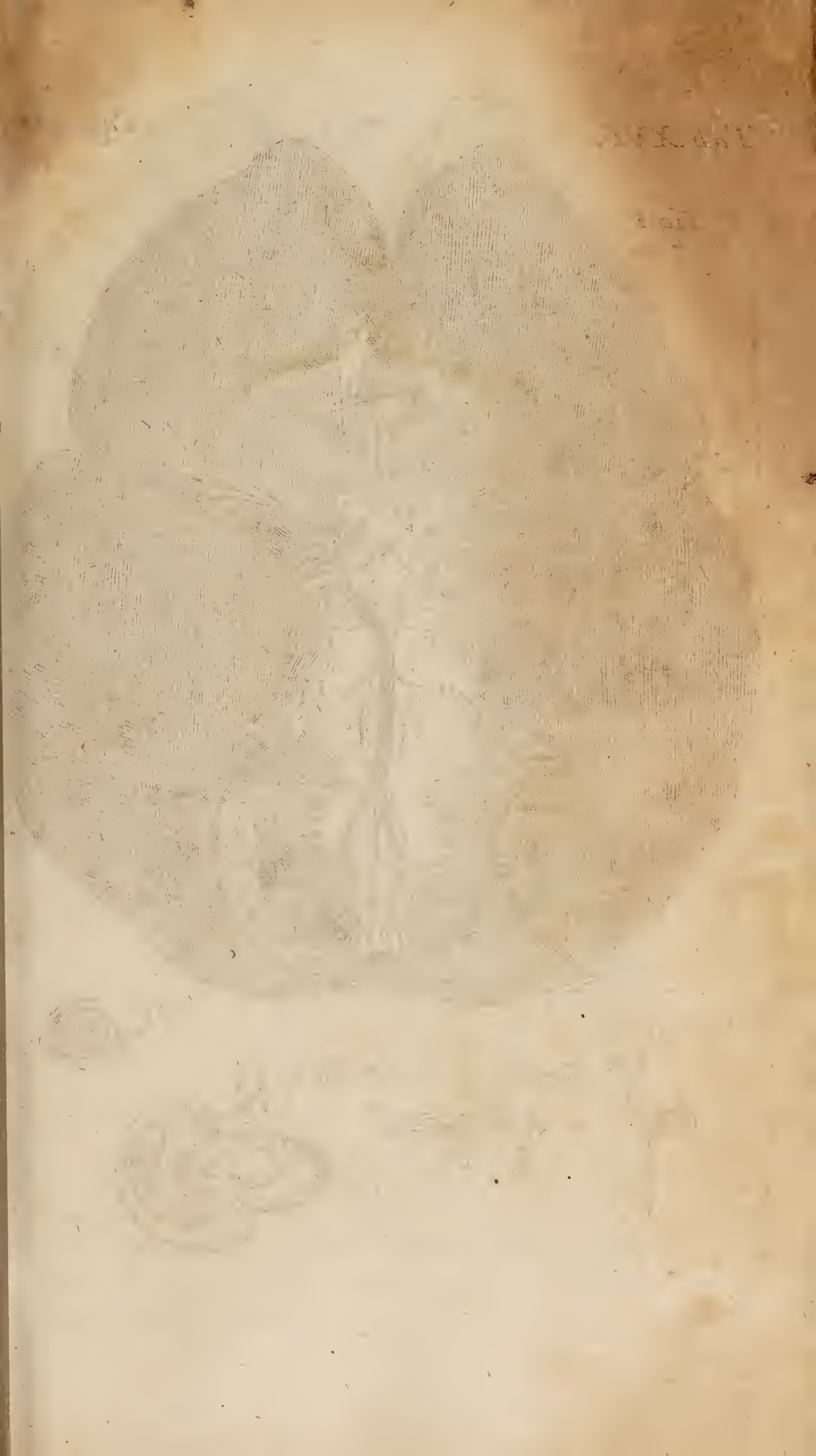


Fig. 1.

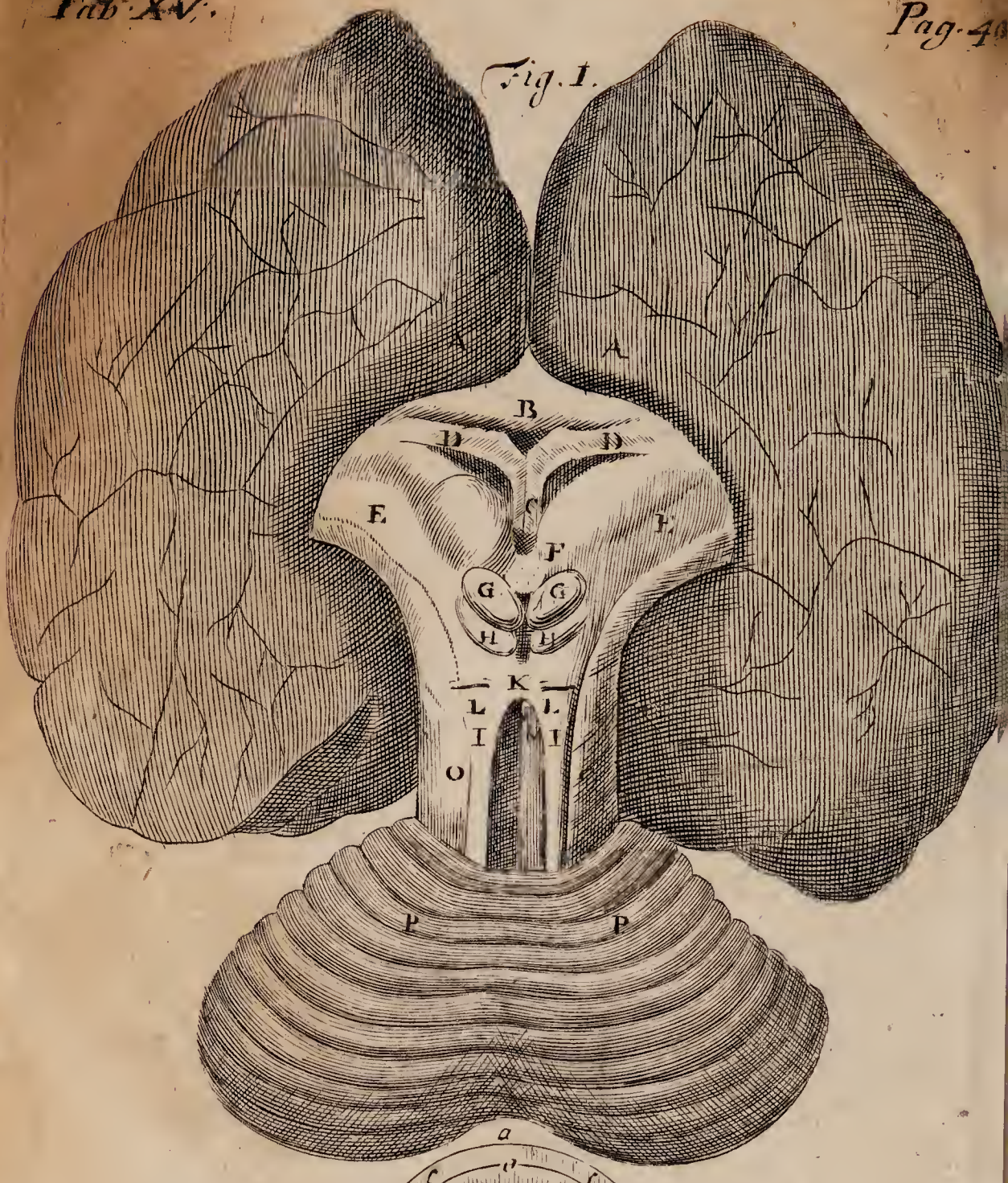
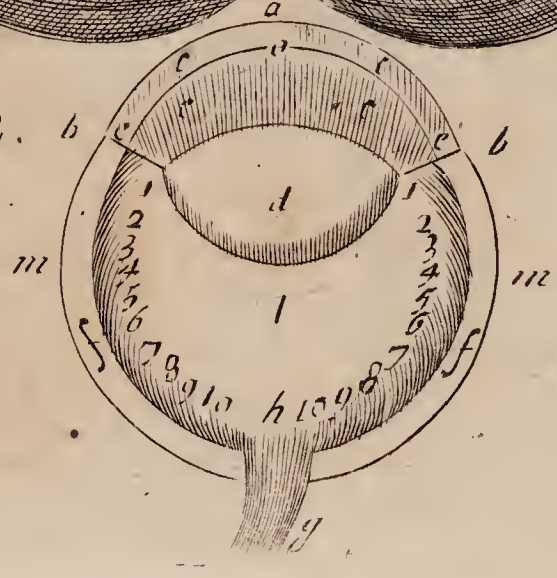


Fig. 2.



in describing of which we have followed Dr. *Willis* for the most Part, that most accurate Tracer of them.

TAB. XV.

Fig. I. Representeth the outer or upper Superficies of the Brain taken out of the Skull; where the *Limbus* of the Brain being loosed from its Coherence with other Parts by Membranes, is lifted up and bent forwards, that the *Crura* of the *Medulla oblongata*, the *Fornix*, *Nates* and *Testes* with the *Glandula Pinealis*, and other Processes may be clearly and distinctly seen (from Dr. *Willis.*)

AA *The* Limbus *of the Brain, which in its natural Situation was contiguous to the* Cerebellum.

B *The Border or Margent of the* Corpus callosum *spread over both Hemispheres of the Brain, which in its natural Situation lay upon the* Glandula pinealis.

C *The* Fornix.

DD *Its Arms embracing the* Crura *of the* Medulla oblongata.

EE *The* Crura *of the* Medulla oblongata (*out of which the optick Nerves proceed*) *whose Ends* (*being placed farther out of sight*) *are called* Corpora striata.

F *The* Glandula pinealis, *betwixt which and the Root of the* Fornix, *is the Chink that leads to the* Infundibulum.

GG *The orbicular Protuberances called* Nates.

HH *The lesser Protuberances called* Testes, *which are Processes of the former.*

II *The Medullary Processes, which ascend obliquely from the* Testes *to the* Cerebellum, *and make a part of each of its* Meditullia.

K *The joining of those Processes by another transverse Process.*

L *The Rise of the pathetick Nerves (or fourth Pair) out of the joining of the aforesaid Processes.*

MM *A Portion of the* Medulla oblongata *lying under the aforesaid Processes and Protuberances.*

N *The* Foramen *of the Ventricle or Cavity that lies under the orbicular Protuberances.*

OO *A Portion of the annular Protuberance let down from the* Cerebellum, *and embracing the* Medulla oblongata.

PP *The outer and upper Superficies of the* Cerebellum.

Figure II.

Representeth the Eye cleft in two (from behind forwards) that the divers Situations of the Humours may appear (from Dr. *Briggs.*)

bab *The* Tunica cornea, *or fore or more convex Arch of the Eye.*

ee *The* Tunica uvea (*whose* Foramen o *is called the* Pupilla) *swimming in the watery Humour* cccc.

d *The Crystalline Humour* in situ.

ff *The* Tunica choroides, *which in this Figure (as being too much separated from the* Sclerotica mm) *cannot be duly represented.*

g *A Portion of the Optick Nerve.*

h *Some of its small Fibres cut off near the* Exit *of the Nerve.*

I *The Center of the* Humor Vitreus, *and of the* Retina.

1, 2, 3, 4, 5, &c. *The* Capillamenta *of the Optick Nerve, whose Ends on each Side being cut off, did adhere to the* Ligamentum ciliare, *namely by the Region of the Crystalline Humour.*

TAB.

Fig. I.

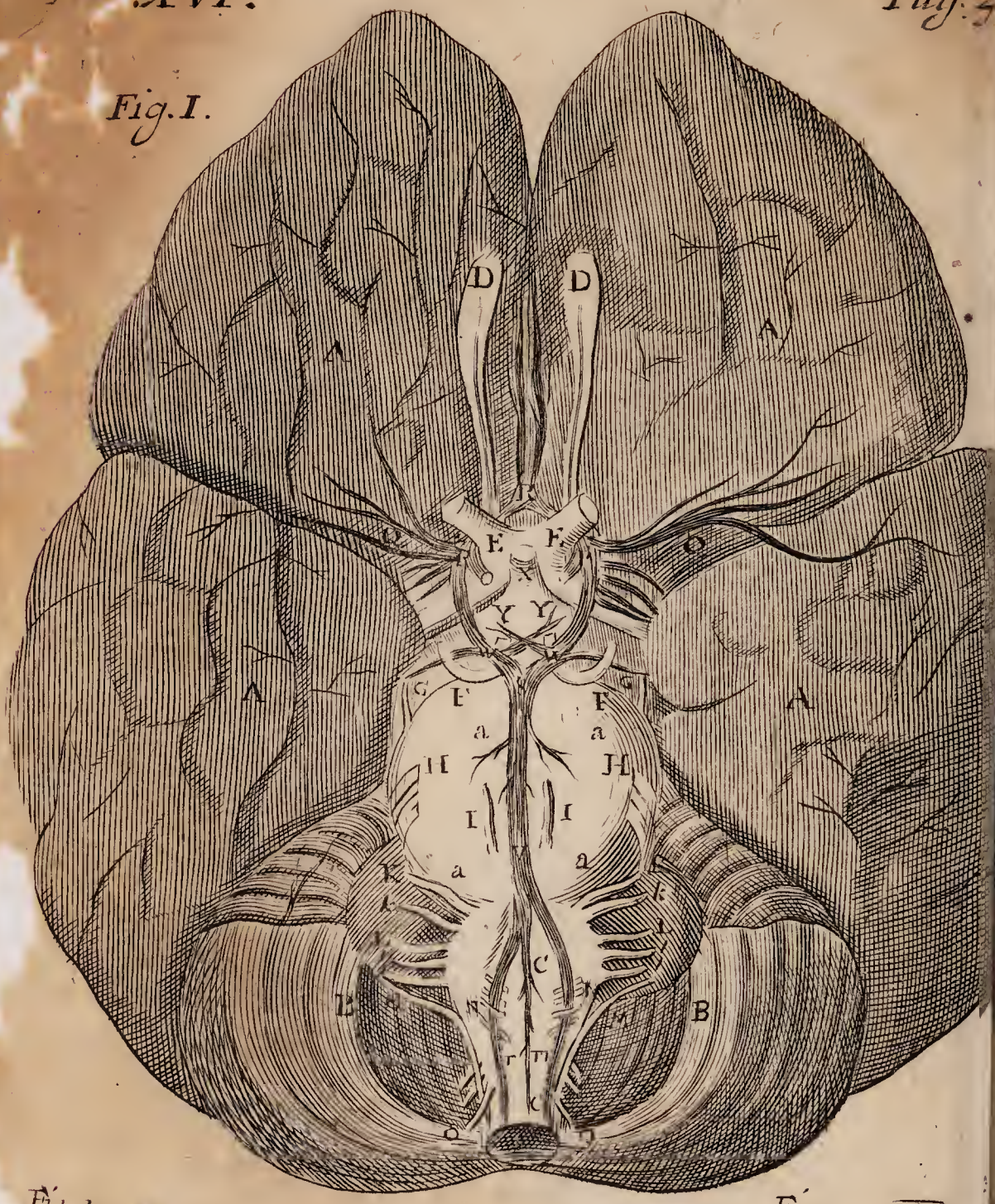


Fig. 2.

Fig. 3.

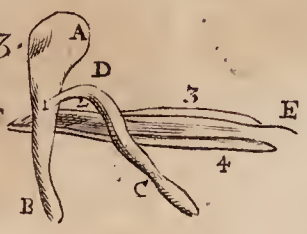


Fig. 4.

Fig. 5.

TAB. XVI.

Fig. I. Repreſenteth the Baſis of an Human Brain taken out of the Skull, with the Roots of the Veſſels cut off ſhort (from Dr. *Willis.*)

AAAA *The fore and hinder Lobes of the Brain.*
BB *The* Cerebellum.
CC *The* Medulla oblongata.
DD *The Olfactory Nerves, or firſt Pair.*
EE *The Optick Nerves, or ſecond Pair.*
FF *The Motory Nerves of the Eyes, or third Pair.*
GG *The Pathetick Nerves of the Eyes, or fourth Pair.*
HH *The fifth Pair.*
II *The ſixth Pair.*
KK kk *The Auditory Nerves, and their two Proceſſes on each Side, the ſeventh Pair.*
LL lll, &c. *The* Par vagum, *or eighth Pair, conſiſting of ſeveral Fibres.*
MM *The ſpinal Nerve, coming from afar to the Origin of the* Par vagum.
NN *The ninth or Intercoſtal Pair, conſiſting alſo of many Fibres (that tending downwards, unite into one Trunk) which emerges a little above the Proceſs of the* Occiput.
OO *The tenth Pair tending downwards.*
PP *The Trunk of the Carotid Artery cut off, where it is divided into the fore and hinder Branch.*
QQ *Its Branch paſſing betwixt the two Lobes of the Brain.*
R *The fore Branches of the* Carotides, *being united, part again, and proceed to the Fiſſure of the Brain.*
S *The hinder Branches of the* Carotides *united, and meeting the Vertebral Trunk.*
TTT *The Vertebral Arteries, and their three aſcending Branches.*
U *The Branches of the Vertebral Arteries uniting into the ſame Trunk.*

WW *The Place where the Vertebral and Carotid Arteries are united, and a Branch on either Side aſcends to the* Plexus choroides.

X *The* Infundibulum.

YY *Two Glands placed behind the* Infundibulum.

aaaa *The annular Protuberance, which proceeding from the* Cerebellum, *embraces the Trunk of the* Medulla oblongata.

Fig. II. Exhibits a Side-View of the Anvil and Stirrup (two Bones in the firſt Cavity of the Ear) *in ſitu*, from Monſ. *du Verney*.

A *The thick Part of the Anvil.*

B *The ſhort Branch which in this Situation we behold fore-right.*

C *The long Branch.*

D *The Head of the Stirrup which is joined with the long Branch, the fourth little Bone coming between.*

E *The Muſcle that is inſerted into the Head of the Stirrup.*

Fig. III. Repreſents the Hammer (a third Bone in the ſame Cavity) on its Fore-ſide with its Muſcle *in ſitu*, from the ſame Author.

A *The Head of the Hammer.*

B *The Handle.*

C *The external Muſcle of the Hammer.*

D *Its Inſertion.*

E *The internal Muſcle.*

F *The Place where it is fitted for its Inſertion into the Handle of the Hammer underneath the external Muſcle.*

1. *The great Proceſs of the Hammer in a direct View.*

2. *The ſlender Proceſs into which the external Muſcle is inſerted.*

3, 4. *The nervous Covering of the internal Muſcle opened in the middle, that the Muſcle may be ſeen.*

Fig.

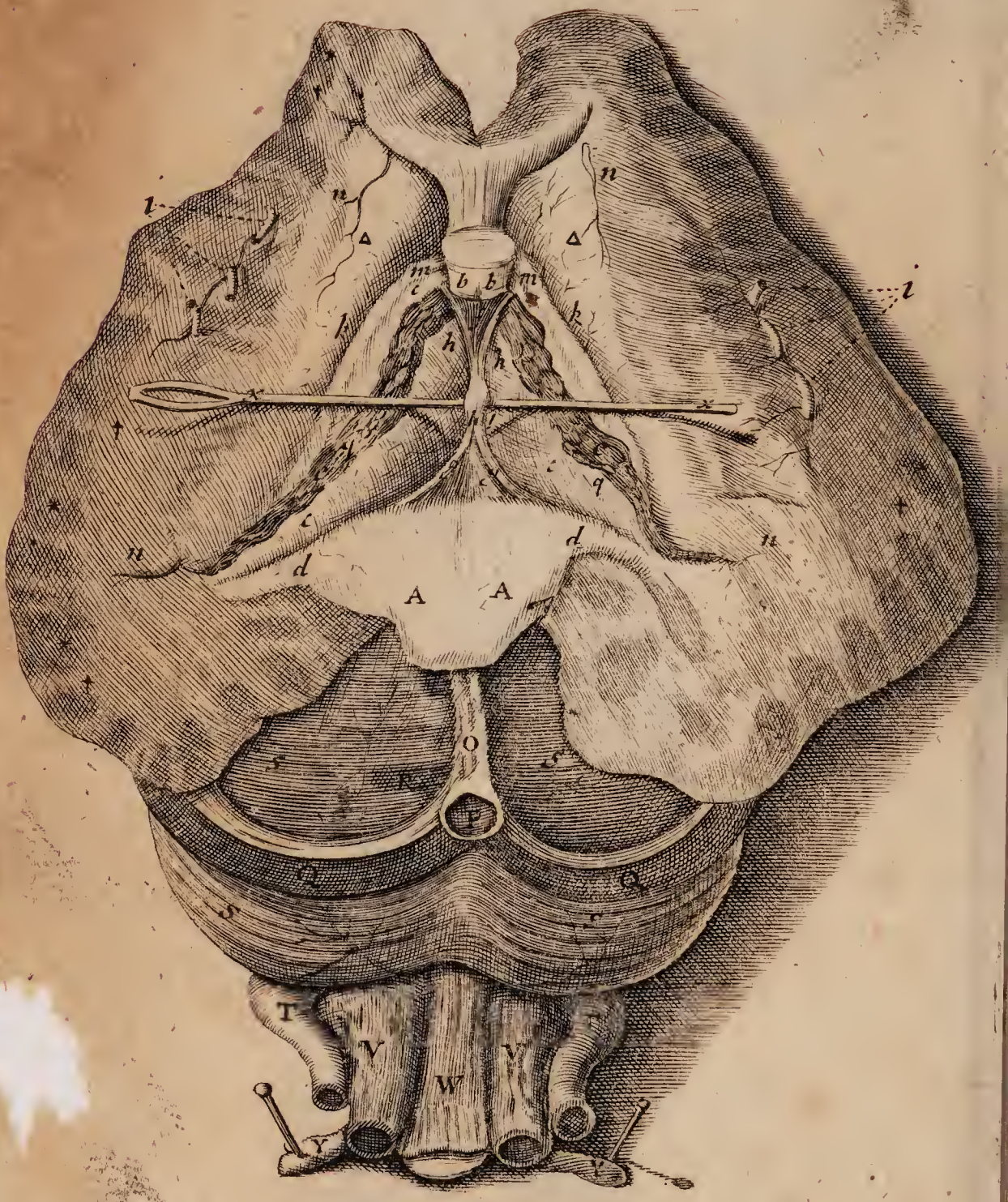

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Fig. IV. Shews a Portion of the *Veſtibulum*, or Entrance of the Labyrinth (a ſecond Cavity of the Ear) with its three ſemicircular Canals, from the ſame Author.

A *The lower part of the* Veſtibulum.
B *The upper Canal.*
C *The lower.*
D *The Middle.*
1. *The Entrance of the upper ſemicircular Canal.*
2. *The firſt Entrance of the middle Canal.*
3. *The Entrance of the lower Canal.*
4. *The other Entrance of the middle Canal.*
5. *The common Entrance to the upper and lower Canals.*
6. *The firſt Hole that gives a Paſſage to one of the Branches of the ſoft part of the auditory Nerve.*
7. *The ſecond Hole that gives a paſſage to another Branch of the ſame Nerve.*

Fig. V. Shews the *Cochlea*, which the aforeſaid Author makes a part of the Labyrinth, but other Anatomiſts call a third Cavity.

Tab. XVII.

Repreſenteth the Brain in a middle Section, the Blood-Veſſels being firſt Injected with Wax, (from Dr. *Ridley*.)

AA *The* Fornix *cut off at its Roots and turned back.*
bb *Its Roots at the beginning of the* Thalami Nervorum opticorum.
cc, &c. *The* Thalami Nervorum opticorum.
dd *That part of the* crura Fornicis, *which growing ſomewhat thicker as it turns off towards the Lateral Ventricles, runs over the* Crura Medullæ oblongatæ, *which being very prominent in Sheep, and Calves, help to thruſt it up into ſuch a Protuberance, as the Ancients called* Bombyces *or* Hippocampi.

ee *That part of the* Plexus choroeides *which is made of the first Branch of the cervical Artery, sometimes seeming as though it came from the communicant Branch in the lateral Ventricles.*

f *The place where those two* Plexus's *on each side meet under the* Fornix.

gg *That other part of the* Plexus *which is made of the second Branch of the cervical Artery, joined with the first by a communicant Branch, not to be seen here, lying under the* crura Fornicis, *which is expanded all over the* Isthmus, *becoming glandulous near to, and especially under the* Glandula pinealis, *covered here with the* Fornix.

h h *Two large Veins coming from the top of the upper part of the* Plexus, *down to the other Branch of the* Plexus, *all the length of the third Ventricle, and then terminates in the fourth* Sinus.

i i *The Trunks of several Arteries, appearing as they were cut off, in dividing the medullary* † *and cineritious* * *part of the Brain*

k k *A venous Branch on each side entring the* Plexus choroeides, *from whence there are many Slips branched upon the* Corpora striata.

ΔΔ *The* Corpora striata *whole.*

l *The* Rima *of the third Ventricle.*

m m *A long medullary Tract between the* Thalami Nervorum opticorum *and* corpora striata.

n n, *&c. The* Centrum ovale *of* Vieussenius.

O *The first* Sinus *of the* Dura Mater.

P *The* Torcular, *where the* Sinus's *meet.*

Q Q *The lateral* Sinus's.

R *A large Vein entering the lateral* Sinus *on one side.*

S S, *&c. The* Cerebellum *covered with the second Process of the* dura mater *on its uppermost part.*

T T *The vertebral Arteries.*

V V *The vertebral* Sinus's.

W *The* Medulla spinalis *with its Integuments*

X X *The Style supporting the large Veins of the* Plexus choroeides *in the third Ventricle.*

q q *The Lympheducts of the* Plexus choroeides.
Y Y *Two of the cervical Nerves ſpringing from the* Medulla oblongata.
†† *The medullary part of the Brain.*
** *The cineritious part of the Brain.*

CHAP. XIV.

Of the Nerves of the Spinalis Medulla: *And firſt, Of the Nerves of the Neck.*

WE obſerved above, that when the *Medulla oblongata* is deſcended out of the Skull into the Spine, it loſes its Name of *Oblongata*, and acquires that of *Spinalis* (which Name it borrows from the *Spine*, thro' which it paſſes) but is of the ſame fibrous or filamentous Subſtance as it was within the Brain. And now we come to deſcribe the Nerves that ſpring out of it, which aſſiſt the Motion of all thoſe Parts, which thoſe ten Pair already deſcribed, that ariſe within the Skull, reach not to.

Nerves ſpringing from the Spinalis Medulla.

In its whole Progreſs from the Skull to the *Coccyx*, there ſpring out of it *thirty* Pairs of Nerves; *ſeven* of which are of the Neck, *twelve* of the *Thorax*, *five* of the Loins, and *ſix* of the *Os ſacrum*.

The *firſt* and *ſecond* Pairs of the *Neck* come not out of the ſides of the *Vertebræ*, as all the reſt do; but becauſe of the peculiar Articulation of the two uppermoſt *Vertebræ*, ſpring out before and behind.

Seven of the Neck.

The firſt Pair.

The *fore* Nerve of the *firſt* Pair cometh out between the Bone of the *Occiput* and the firſt *Vertebra* of the Neck, and is beſtowed upon the Muſcles of the Neck, which lie under or behind the *OEſphagus*, and on the Skin of the Face. The *hinder* Nerve cometh out of the Hole which is common to the *Os Occipitis*, and the firſt *Vertebra*

of the Neck. This hath two Twigs: The ſmaller is beſtowed upon thoſe Muſcles, which lie upon the *Occiput*, and upon the Skin of the Head, as high as the Crown; the bigger is inſerted into the Muſcle, which lifteth up the Shoulder blade.

The ſecond. The *fore* Nerve of the *ſecond* Pair (which is ſmaller) cometh out between the firſt and ſecond *Vertebræ*, and is beſtowed upon the Skin of the Face. The hinder cometh out of the ſides of the hinder Proceſs of the ſecond *Vertebra*, but preſently is parted into two Twigs. The thicker of which is beſtowed upon the whole Skin of the Head, even to the Crown; the ſmaller upon the greater ſtreight, and the lower oblique Muſcles, which ſtretch out the Head. Dr. *Willis* ſays, that the firſt and greateſt Root of the *Nerve of the Diaphragm* ariſeth from the ſecond Pair of the Neck; of which Nerve we ſhall ſpeak more by and by.

The five remaining Pairs of the Neck, as alſo all the Pairs of the Back and Loins, and the firſt of *Os ſacrum*, come out of the lateral Holes betwixt the *Vertebræ*, and immediately after their *Exit* are divided into the *fore* and hinder Branches, and are diſtributed as followeth.

The third. The *third* Pair come out of the *lateral* Holes, between the ſecond and third *Vertebræ*, and each being immediately divided into two Branches, the *foremore* thereof have each four Twigs: The firſt is inſerted into the *long* Muſcle, or the firſt of the Benders forward of the Neck: The ſecond deſcending is beſtowed upon the Muſcles, which lie under the *OEſophagus*, being firſt united to a Twig of the fourth Pair: The third aſcending, goeth to the Skin of the back part of the Head, having firſt joined with the thicker Twig of the hinder Nerve of the ſecond Pair: The fourth is beſtowed upon the tranſverſe Muſcles of the Neck, and the Muſcle which lifteth up the Shoulder-

Shoulder-blade, the hinder Branches are beſtowed upon the ſecond Pair of Muſcles which heave up, or widen the Breaſt.

The *fourth* Pair come out of the Holes common to the third and fourth *Vertebræ*, the *foremore* Branches whereof are each divided into three Twigs: The firſt of which uniting with a Twig of the third Pair, is beſtowed on the firſt of thoſe Muſcles which bend the Neck forward, called *Longus* (as aboveſaid: The ſecond upon the tranſverſe Muſcle of the Neck, and the *Cucullaris* of the Shoulder-blade: The third being ſlenderer than the other two, is joined with the Twig of the fifth Pair, and both with one of the ſixth; and laſtly, all three (according to Dr. *Willis*) with that of the ſecond Pair above-mentioned; and the Trunk made up of all theſe, deſcendeth by the Sides of the Gullet down the Neck and *Thorax*, without any Branchings, till it come to the Diaphragm, where it is divided again into three or four Twigs, on each ſide, and is inſerted into its fleſhy or muſcular Part, being known by the Name of *Nervus Diaphragmatis*, or *Phrenicus* (of which we have diſcourſed more largely, in *Book* II. *Chap.* 3. *Of the Midriff.*) The *hinder* Branches go back to the Spine, under the Muſcles of that Part, upon which they beſtow Twigs, and going down between the Muſcles of each ſide of the Neck, each is carried to the *Muſculus quadratus* of its own Side, that draweth the Cheek down. *The fourth.* *Nervus phrenicus.*

The *fifth* Pair iſſue out between the fourth and fifth *Vertebræ*, the *foremore* Branches whereof have each four Twigs: The firſt goeth to thoſe Muſcles that bend the Neck forward: The ſecond is that which joineth with the Twigs of the ſecond, fourth, and ſixth Pairs, and makes up the *Nervus phrenicus*: The third goeth to the Muſcle *Deltoides*: The fourth goeth to the ſame *Deltoides*, *The fifth.*

and

and to *Coracohyoideus*, or the third Muſcle of the *Os hyoides*. The hinder Branches bend back to the Spine, and are beſtowed upon the Muſcles there, as the like Branches of the fourth Pair were.

The ſixth. The *ſixth* Pair come out between the fifth and ſixth *Vertebræ*. Their *foremore* Branches ſend forth firſt one Twig to make the Trunk of the *Nervus phrenicus*; then proceeding farther, they are united with the like Branches of the three following Pairs, namely, the laſt of the Neck, and two firſt of the *Thorax*, making on each ſide one *Plexus* with them, out of which thoſe Nerves proceed that are carried to the Arms. The *hinder* Branches go to the Muſcles behind, which ſtretch out the Neck and Head, or bend them backward.

The ſeventh. The *ſeventh* Pair come out of the Holes common to the ſixth and ſeventh *Vertebræ*. The *foremore* and larger Branches are joined with the like of the ſixth of the Neck, and two firſt of the *Thorax*, as aforeſaid furniſhing Nerves to the Arms. The *hinder* and ſmaller are beſtowed upon the Muſcles of the neck, and quadrate Muſcles which pull down the Cheeks.

Nervus ad par vagum acceſſorius. About where theſe ſixth or ſeventh Pairs of Nerves riſe, there ſprings on each ſide another Nerve deſcribed by Dr. *Willis*, and by him called *Nervus ſpinalis ad par vagum acceſſorius*. They riſe ſmall out of the ſides of the Spinal Marrow, and aſcend up by the Sides of it, growing thicker as they go (but without being inſerted any where into the Marrow) till having enter'd the Skull, they are joined to the Fibres of the *par vagum* or eighth Pair. Their Progreſs from thence we obſerved in *Chap.* 13. when we deſcribed the eighth Pair.

CHAP.

CHAP. XV.

Of the Nerves of the Vertebræ *of the* Thorax.

FRom the Marrow of the *Vertebræ* of the *Thorax* ſpring twelve Pair. In all of which the foremore Branches are bigger, and the hinder, which are beſtowed upon the Muſcles ſeated on the Back, ſmaller. *Twelve of the* Thorax.

The *firſt* Pair ſpring out of the lateral Holes which are common to the ſeventh *Vertebra* of the Neck, and the firſt of the *Thorax*, and therefore 'tis indifferent whether they be eſteemed to belong to the Neck or *Thorax*, ſome reckoning them to be the eighth Pair of the Neck, and others (as we do here) the firſt of the *Thorax*. Each Nerve is preſently divided (as all the reſt are) into two Branches; the *foremore* of which are united to the like Branches of the ſixth and ſeventh of the Neck, as was noted in the foregoing Chapter, and ſo are all ſpent on the Arms, except one little Twig, that ſpringing out of the Beginning of each, marcheth forward towards the *Sternum*, and beſtoweth Twigs on the *Muſculus ſubclavius*, and thoſe Muſcles which ariſe from the Top of the *Sternum*; and another that goes to that Muſcle, which fills up the Hollowneſs of the Shoulder-blade. The *hinder* Branches creeping under the Muſcle which cleave to the *Vertebræ*, are beſtowed upon the Muſcles of the Neck, Head and Shoulder-blades. *The firſt Pair.*

The *ſecond* iſſue out of the Holes between the firſt and ſecond *Vertebræ* of the *Thorax*, the *fore* Branches whereof are united with the like of the firſt of the *Thorax*, and together with them are joined to the *fore* Branches of the ſixth and *The ſecond.*

ſeventh

ſeventh of the Neck, and theſe all together make one *Plexus* on each ſide (called Axillar) that ſendeth forth all the Nerves to the Arms that they have (as ſhall be farther explain'd, *Book* IV. *Chap.* 3.) But before the *fore* Branches of this Pair unite with the others, each ſends a Twig alſo to the Intercoſtal Nerve (or ninth Pair) deſcending down the *Thorax* (as alſo does every one of the remaining ten Pair) and from that Twig before it join with the Intercoſtal, there proceed ſmall Slips to the Muſcles that lie upon the *Thorax*. The *hinder* Branches have the ſame Diſtribution with the hinder of the foregoing Pair.

The reſt of the Pairs. The reſt of the ten Pair come out of the lateral Holes betwixt the *Vertebræ*, and are all immediately divided on each ſide into two Branches, whereof the *former* being larger, always ſend each of them one Twig to the Intercoſtal Nerve, and the Remainder of them is beſtowed on the Intercoſtal Muſcles internal and external, and on thoſe that lie on the *Thorax*; as alſo on the obliquely deſcending Muſcles of the *Abdomen*, &c. The *hinder* bend backward to the Spine, and are ſpent upon the Muſcles and Skin of the Back.

CHAP. XVI.

Of the Nerves of the Vertebræ *of the Loins.*

Five of the Loins. OUT of the Marrow contained within the *Vertebræ* of the Loins, ariſe five Pair of Nerves. The *fore* Branches being greater, go to the Muſcles of the Belly: The *hinder* to thoſe which reſt upon the *Vertebræ*. The *foremore* (as *Spigelius* affirms) are joined together, the firſt with

with the ſecond, the ſecond with the third, the third with the fourth, and the fourth with the fifth, as the two laſt with the Neck, and two firſt of the *Thorax* were.

The *firſt* Pair come out of the lateral Holes between the laſt *Vertebra* of the *Thorax*, and the firſt of the Loins. The *fore* Branches are beſtowed upon the fleſhy Part of the Midriff, eſpecially its hinder Proceſſes that are knit to the *Vertebræ* of the Loins, and on the Muſcles *Pſoæ*. Whence when there is a large Stone in either Kidney (the lower Ends of the Kidneys reſting upon the Heads of theſe Muſcles) this Nerve is compreſſed thereby, and from thence is a Numbneſs extended to the Thigh of that ſide, becauſe theſe Muſcles terminate in the Thighs. Theſe *fore* Branches do each of them alſo ſend a Twig along with the *Arteria præparans* to the Stone, according to *Spigelius*. From whence it is, partly, that too immoderate Venery cauſeth a Weakneſs in the Loins. The hinder are beſtowed upon the *Muſculus longiſſimus* of the Back, *Sacrolumbus*, &c. *The firſt Pair.*

The *ſecond* come out between the firſt and ſecond *Vertebræ* of the Loins, under the Muſcles *Pſoæ* (which are the firſt Pair of thoſe that bend the Thighs.) The *foremore* Branches are beſtowed upon the ſecond Pair of thoſe Muſcles that bend the Thighs, which fill up the Cavities of *Oſſa Ilea*, and on the *Muſculi faſciales*, and the Skin of the Thighs. The *hinder* are beſtowed upon the *Muſculi glutæi*, and the Membranous Pair of Muſcles which extend the Leg. Each of thoſe Twigs which from this Pair join with the Intercoſtal, goeth to the *Teſtis* of its own ſide (according to *Veſalius*, &c.) *The ſecond.*

The *third* paſs out of the Holes between the ſecond and third *Vertebræ*, under the *Pſoæ* alſo. The *foremore* Branches each of them ſend one *The third.*

Twig

Twig to the Knee and the Skin thereof, and another which doth accompany the *Saphœna* down the Leg. The *hinder* turn back, and are beſtowed upon the Muſcles, which reſt upon the Loins.

The fourth. The *fourth* iſſue out between the third and fourth *Vertebræ*, being the largeſt of the Nerves of the Loins, and marching under the *Pſoæ* and *Oſſa pubis*, accompany the crural Veins and Arteries.

The fifth. The *fifth* come out between the fourth and fifth *Vertebræ*. The *fore* Branches paſs through the Holes that are between the Bones of the *Coxendix*, *Pubes* and *Ileum* (one on each ſide) and are beſtowed upon the *Obturatores Muſculi* of the Thigh, the Muſcles of the *Penis*, and on the Neck of the Bladder, and of the Womb. The *hinder* are beſtowed upon the Muſcles and Skin, which lie upon the *Vertebræ*.

CHAP. XVII.

Of the Nerves which ariſe from the Marrow of Os ſacrum.

Six of Os ſacrum. FRom the Marrow of *Os ſacrum* ſix Pair of Nerves ſpring.

The firſt Pair. The *firſt* iſſue out between the laſt *Vertebra* of the Loins, and the firſt of *Os ſacrum*, in the ſame manner as thoſe that ſpring out of the *Vertebræ* of the Loins, and like them are each divided into two Branches. The *fore* Branches are a great part of them mixed with thoſe other of the Loins that go towards the Thighs, yet each ſends forth a Twig that is diſpenſed to the Muſcles of the Belly, and to the ſecond Bender of the Thigh.

The

The *hinder* are bestowed on the Skin of the Buttocks, and the greatest *Glutæi*.

Of the other five Pair.

The other *five* Pair spring after a different Manner from the foregoing. For before they come out of the *Os sacrum*, they are every of them double on each side; and so from each on either side there arise two Nerves, one of which is carried into the fore or inner, and the other into the hinder or outer side. The *three uppermost foremore* Nerves go towards the Thighs, as the greatest part of the first Pair did: The *two lower* to the Muscles of the *Anus* and Bladder; in Men to the *Penis*, in Women to the Neck and *Vagina* of the Womb, and so to the outward Privity. All the *five hinder* Nerves are distributed to the Muscles of *Ossa Ilea* and *sacrum*, towards the back Part, which are *Longissimi*, *Sacrolumbi*, *Sacri*, and the *Glutæi*.

How the *Brachial* and *Crural* Nerves are formed out of the Nerves of the Spine, shall be more particularly, but briefly, shewn in the next Book.

And thus we have done with all the *thirty Pair* of *Nerves* that arise out of the *Spinal Marrow*, having shewn which way they pass, and to what Parts they are distributed: Which should be diligently noted, that we may the better know to what place to apply Remedies when from any outward Cause, as from a Fall, Bruise or the like, any Part has lost either Sense or Motion, or both. For the Medicine is to be applied always to the Beginning or Rise of that Nerve that passes to that Part, and not to the Place in which the Symptom appears. And the same thing is to be observed in Palsies, when the Use of some particular Limb is taken away from an inward Cause.

The Blood-Vessels of the Spinal Marrow.

Having finished our Discourse of the Vessels that *spring from* the Spinal Marrow, we will add a

a Word to what was ſaid above, *Ch.* 8. of the *Blood Veſſels* that are *diſperſed through* it, from Dr. *Willis*. Theſe are of three ſorts, *Arteries*, *Sinus* and *Veins*. It is ſupplied with *Arteries* after one manner, *above* the Heart; and after another, *below* it. For *above* it, ſeeing the Trunk of the *Aorta* is preſently cleft into many Branches, which depart from the Spine, therefore from its Axillar Branches there ſprings a *Vertebral Artery* on each ſide, which aſcending ſtreight to the *Occiput*, ſends a Twig in at every jointing of the *Vertebræ*: But below the Heart, inaſmuch as the *Aorta* in its whole Deſcent lies upon the Spine, there are received into the Spine two Arteries from its back ſide, betwixt every jointing of the *Vertebræ*. But both above and below, the Arterial Branches that are carried toward the Spine being preſently divided each into two, one Twig is beſtowed on the neighbouring Muſcles, and the other enters in at the jointing of the *Vertebræ*, within whoſe Cavity it is ſubdivided into three other Twigs, two of which are beſtowed on the *Medulla* (with its two Membranes) and the third on the Membrane that lines the inſide of the *Vertebræ* before. How theſe Branches of Arteries inoſculate with one another, may better be conceived by the ſaid *Author*'s Draught of them in his *Tab.* 13. than by a verbal Deſcription. I therefore remit the Reader thither. The *Sinus*, he ſays, are continued from the lateral *Sinus* of the Brain, and all along the Spinal Marrow they lie under the Arteries, having one Veſſel to receive the Blood from the Arteries, and another to deliver it to the Veins, ſerving for the ſame Uſes as thoſe of the Brain did, which were ſhewn above in *Ch.* 3. of this Book. Its *Veins*, like the Arteries, are communicated to it different ways, *above* and *below* the Heart. *Above*, a Branch ariſing from the Trunk

Trunk of *Vena cava* below the ſubclavian, accompanies the Vertebral Artery up to the *Occiput*, ſending a Twig in at every jointing of the *Vertebræ*; but *below* the Heart, becauſe the Trunk of *Vena cava* does not, like the *Aorta*, lie immediately upon the Spine, and ſo cannot immit Twigs into it directly, therefore it ſends out of its ſelf *Vena ſine pari*, out of whoſe Trunk two Branches ſpringing, and each of thoſe being divided into two, one of them is beſtowed on the neighbouring Muſcles, and the other enters the Spine. Yet below the Kidneys, when there is leave given to the *Vena cava* to be carried near the Spine, the *Vena ſine pari* ends, and the *Vaſa Lumbaria* proceed immediately from the Trunk of the *Vena cava* as well as from the Trunk of the great Artery. The Branchings of the *Sinus* and *Veins* within the Spine and their *Anaſtomoſes* are curiouſly delineated in the aforeſaid *Tab.* 13. which deſerves to be conſulted by the Reader.

CHAP. XVIII.

Of the Face and its Parts.

IN the former *Chapters* we have diſcourſed of that Part of the Head that is decked with Hair, called *Calva*, of the Brain, *&c.* contained within it, of the *Medulla oblongata* ariſing out of it, and prolonged into the *Medulla ſpinalis*, with the Nerves that ſpring out of the ſame, both within the Skull, and in the Spine, all which we have conſidered as Appendages to the Brain, ſeeing both the Marrow out of which they ariſe, ſprings out of it, and alſo all the Nerves have their Animal Spirits from it. Next we come to

ſpeak of the ſmooth or unhairy Part, called *Facies*, the Face.

Now though all the Parts of the Body ſufficiently ſhew the Wiſdom of the Creator; yet both the Beauty of the Face, and its admirable Conſent with the Mind, doth epitomize, as it were, the Comelineſs and Dignity of all the other Parts, and exhibits their Affections as in a Glaſs. For from it are not only taken Signs of Health, Diſeaſes, and imminent Death; but alſo moſt clear Tokens of the very Diſpoſition, Manners and Affections of the Mind. For as Shame and Frightedneſs betray themſelves in the *Cheeks*; ſo do Anger, Joy, Sadneſs, Hatred, and eſpecially Love in the *Eyes*. So from the *Forehead* are known ones Gravity and Humility: From the *Eye-brows* (or *Supercilia*) Pride; from the *Noſe*, Sagacity or Blockiſhneſs, *&c.* from the *Motion* of the Face, Wiſdom or Fooliſhneſs, Honeſty or Wickedneſs, Civility or Incivility, Good-Will or Hatred; from its *Colour*, the Temperament of the whole Body. Beſides, the Sex, the Age, the Stock, and one Man from another may be diſtinguiſhed by the Face.

The Parts of the Face. The *Parts* of the Face are either *containing* or *contained*.

The *containing* are *proper* or *common*.

The *common* are ſufficiently deſcribed in *Book* I. *Chap.* 3. as not differing from the common Integuments in other Parts of the Body. Only here the *Membrana carnoſa*, from the Eyes to the Chin, is ſo thin, that ſome have affirmed there is none; but in the Brows it is thicker, and cleaves very cloſe to the Skin.

The *proper* are the *Muſcles*, *Bones* and *Cartilages*, which ſhall each be deſcribed in their proper Places.

The

The Parts *contained*, are the Eyes, Ears, Mouth and Noſe, and many beſides, which ſhall be treated of in the following *Chapters* of this *Book*.

The Face is divided into its *upper* and *lower* Part. The *upper* is from the Hair of the Skull to the Eye-brows, and is called *Frons*, the Fore-head, which while the Body is intire, belongs to the Face, but in a Skeleton to the Skull. This is not to be treated of here, as conſiſting of no proper Parts but *Muſcles* and a *Bone*, which are to be deſcribed in their proper Books. The *lower* is extended from the Eye-brows to the Chin, and includes all the Parts betwixt them; and to the Deſcription of theſe we now proceed.

CHAP. XIX.

Of the Eyes in general, and their outward or containing Parts.

THE Eyes (in Latin *Oculi*, from *occludo*, to ſhut, or *occulto*, to hide, becauſe they lie hid under the Eye-lids) are the Organs of Sight, conſiſting of many ſimilar Parts; and are as the two Luminaries of the Microcoſm, to afford us Light; or like two Watch-men placed in the upper Part of the Body, as in a Watch-tower, to give Notice of any approaching Danger.

They are in *Number* two, partly to make the Sight ſtronger; and partly, that one being hurt, the other might perform the Function of ſeeing in ſome meaſure, though more imperfectly. *Their Number.*

The Eye alone, diveſted of its Muſcles, is of a round or ſpherical *Shape*, both that it might move the better in its Orbit, and alſo that it might more conveniently receive the viſible Rays. *Figure.*

The *Colour* of the Eyes in *Men* is ſometimes grey, ſometimes browniſh, ſometimes black; *Colour.*

which Variety is moſt conſpicuous about the *Pupilla* in the *Iris*, and proceeds from the Colour of the *Uvea*. *Brutes* of the ſame Species have not that Diverſity of Colours.

Bigneſs. Some have much larger Eyes than others; but thoſe which are largeſt, and ſtand much out, have not ſo acute and piercing a Sight as thoſe that are leſs, and ſtand farther in.

Conſent. There is a great *Conſent* betwixt them, ſo that one being moved towards any Object, the other is moved towards the ſame. The Reaſon whereof we enquired before, *Chap.* 11.

Light. Some think they have a kind of congenit or inbred *Light*, without which they could not ſee; even as the Ears have a congenit Air within their Cavities, without which they could not hear.

Situation. They are each *placed* in a large Cavity, called *Orbita* (or a Socket) on each Side the Noſe, which is hollowed out of the Bones of the Skull. And theſe Orbits are inveſted on their inſide with the *Pericranium*, to which the Fat and Origins of the Muſcles cleave firmly. Theſe may be reckoned the firſt *containing* Parts of the Eye; as may alſo, in the ſecond Place,

The Eyelids. The *Palpebræ* or *Eye lids*, which ſerve as Curtains to the Eyes, by which Duſt and troubleſome Smoaks and Vapours, too much light, and the Injuries of the Air are kept out; and the outward Tunicle of the Eye called *Adnata*, but eſpecially that called *Cornea*, which covereth the *Iris* and *Pupilla*, is moiſten'd, wip'd and clean'd. They conſiſt outwardly of a very thin Skin which has no Fat under it; inwardly they are lined with the *Pericranium*, that is here moſt thin and ſmooth. Betwixt theſe Parts comes the *Membrana carnoſa*, which is alſo very thin. Each Eye has two. In Man the lower is leſs, and is but very obſcurely moved in Compariſon with the upper: But in

Birds

Birds the lower is the larger, and in moſt ſeems only to be moved, the upper remaining unmoveable. *Steno* mentions ſeveral *puncta lachrymalia* in their inner Membrane, which run on each Side into one Duct (called by him *Colliciæ*) whereby the ſuperfluous Moiſture of the Eye-lids is conveyed into the Noſtrils. At their Edges they have little ſoft Cartilages (called *Cilia* in Latin) to ſtrengthen them, and that they may meet the more exactly. Upon theſe Cartilages there grow Hairs, which having attained to a certain Length, will naturally grow no longer, ſo that they never need to be cut. Thoſe on the upper Eye-lid turn ſomething upwards, and thoſe on the lower downwards. Above the upper Eye-lid grow alſo a Set of Hairs, betwixt it and the Fore-head, out of the *Supercilia*, or Eye-brows; theſe lie pretty flat, bending from within outwards, and hinder Sweat from the Brow, Duſt, or other things from falling into the Eyes.

Cilia.

Supercilia.

The Eye-lids have two Corners, called *Canthi*. The *outer* of theſe is leſs, and in its upper part it has a Gland placed (uſually called *Innominata*, or nameleſs, but might be named *Lachrymalis*, as affording the moſt of that *Lympha* that makes the Tears.) This Gland is conglomerate, being made up of many leſſer, and has ſmall Twigs of Arteries that creep to it, and depoſit *Serum* or *Lympha* in it, to ſupply Matter for *Tears* upon occaſion. But the ordinary Uſe of this *Lympha*, is to moiſten the inſide of the Eye lids, and the Superficies of the Eyes, that they may move more glibly. *Steno* has obſerv'd, that in a Calf the fore-part of this Gland is elegantly divided into Lobes (being indented on its Edge) and that betwixt the Intervals of theſe, there paſs out excretory Veſſels from the Gland, which running forward within the inner Coat of the Eye-lid, make little Holes in

Canthi, *their Glands.*

Whence Tears proceed.

it at a little distance from the *Cilia*, thro' which they discharge their Humour. And he doubts not but there are such Vessels in Men, in whom he calls them *vasa Lachrymalia*. *Diemerbroeck* having reckoned eight Opinions concerning the Cause, Origin and Matter of Tears, rejects them all, and this we have mentioned with the rest; and thinks, that their Matter is the more serous and thin Particles of the pituitous Humour collected in the Brain, and flowing to the Eyes upon its Contraction, through the *Foramen lachrymale* seated at the inner Corner of the Eye. Which the Reader may see defended in his *Anat. lib.* 3. *cap.* 15. There is another spongy and soft Gland in the inner *Canthus* or Corner, seated upon the *Foramen lachrymale*, which helps the former in its Office, but is not above a third Part so big. Dr. *Briggs* says, there are two or three lymphatick Vessels that receive *Lympha* from it, and end in the inside of the Eye-lid, and that eight arise out of the former Gland, and end in the *Tunica adnata*, where they continually deposit something of *Lympha*, to keep the Eye moist. *Nerves* come to them from the *fifth* Pair, which communicating with the *Intercostal*, are much irritated in the Passions of sudden Joy, or of Sadness, and so twitch and compress these Glands, that the *Lympha* is squeezed or milked as it were out of them, as Dr. *Willis* ingeniously supposes. *Steno* thinks, that in weeping, the Flux of Tears is principally owing to the Contraction of the capillary Veins, by which means the Blood and *Serum* cannot be so quickly carried back from these Glands, as they are brought to them by the Arteries, and therefore the *Serum* ouzes out (as Blood has also been observed to do sometimes.) Which Opinion differs not much from Dr. *Willis*, if we will suppose the Contraction of the Veins to be owing to the Nerves, as it is reasonable we should. As

As for the *Muscles* of the Eye, they shall be described in the Fifth Book.

CHAP. XX.

Of the Tunicles of the Eyes.

HAving done with the outward or *containing Parts* of the Eye, we come now to the *Eye* it self, and first of its *Tunicles*.

The Tunicles of the Eye, one common.

The outmost *Tunicle* of the Eye is *common*, and is called *Adnata*. It springs from the *Pericranium*, and is spread over all the White of the Eye, above the *Sclerotica*, reaching as far as the *Iris*. By this the Eye is kept firmly within its Orbit, from whence it is also called *Conjunctiva*. It is of very exquisite Sense, and has many capillary Veins and Arteries creeping through it, which are most conspicuous in an Ophthalmy, or Inflammation of the Eyes. Under this Tunicle are the Tendons of the Muscles extended and expanded to the Circumference of the *Iris*, which encrease its Whiteness; and some take them for a second Tunicle, calling it *Innominata*.

Three proper.

1. Sclerotica.

The *proper* Tunicles of the Eyes are three, according to the threefold Substance of the Optick Nerve. For this Nerve (as all the other) consists of two Tunicles springing from the *Dura* and *Pia Mater*, and an inner marrowy Substance. From the *Dura Mater* springeth the outmost Coat of the Nerve, and from this the Tunicle that is spread next under the *Adnata*, called *Sclerotica*, from its Hardness; but in its fore-part, where it covereth the *Iris* and *Pupilla*, it is named *Cornea*, from its Transparency; though sometimes this latter Name includes the whole Tunicle, as well behind and on the sides, as before.

2. Choroïdes.

That which lieth next under the *Cornea*, is much thinner than it, and is called *Choroïdes*, from its resembling the Membrane *Chorion*, wherein the *Fœtus* is included in the Womb. Its fore-part is otherwise called *Uvea*, because it is somewhat of the Colour of a Grape. This springs from the *Pia Mater*, and is spread from the Bottom or Center of the Eye behind, all over the Eye to the *Pupilla*; to whose Circumference when it is come, it becomes double, making with one Part the *Iris*, with the other the *Ligamentum ciliare*. On the Inside it is of a duskish Colour (in Man) but blacker on the Outside. But where it makes the *Iris*, it is of divers Colours, resembling the Rainbow, from whence it borrows its Name: Yet in some it is more blue, in others black, in others grey. This Tunicle is perforated before as wide as the *Pupilla* (or Sight of the Eye) to permit the Rays of visible Species to pass into the crystalline Humour. Next unto which crystalline Humour lies the *Ligamentum ciliare*, the second Part of the duplicated *Uvea*. This consists of slender Filaments of Fibres (like the Hairs of the Eye-lids) running like so many black Lines from the Circumference of the *Uvea* to the Sides of the crystalline Humour, which they encompass, and widen or constringe as there is Occasion, by contracting or opening the *Foramen* of the *Uvea*.

3. Retiformis. *This is the principal Organ of Sight.*

The third Tunicle is made of the medullar Substance of the Optick Nerve, and is called *Retina* or *Retiformis* (Net-like:) This seemeth to be the principal Organ of Sight. For, as Dr. *Briggs* well argues, neither the crystalline Humour, through which the Rays pass much refracted; nor the Tunicle *Choroïdes*, are at all fit for this Use. For this latter Part (as rising from the *Pia Mater*) cannot communicate the Impressions of the Rays to the medullar Part of the Brain, which it does not

not at all touch. Whereas the medullar Fibres of the *Retina* have Communication therewith, as ſpringing therefrom, and therefore can well perform that Office. The Fibres of this Tunicle are extended from the Bottom or inner Center of the Eye, where the Optick Nerve enters it, as far as the *Ligamentum ciliare*, (to which it affords Animal Spirits for the continuance of its Motion.) If one take this *Tunica Retina*, and put it into warm Water ſhaking it a little, to waſh off the mucous Subſtance that cleaves to it, and then hold it up to the Light, theſe Filaments will appear very numerous, like the Threads of the fineſt Lawn.

CHAP. XXI.

Of the Humours and Veſſels of the Eye.

NExt to the Tunicles of the Eyes are the *Humours* contained in them to be conſidered. And theſe are in Number three, *viz. Aqueus*, *Cryſtallinus*, and *Vitreus*. The ſecond weighs as much again as the firſt, and yet not ſo much as the third by a ſixth Part. The Cryſtalline is the moſt denſe of Conſiſtence by much; and the glaſſy more denſe than the watry. *The Humours of the Eye, three.*

The *Aqueous* Humour is outermoſt, being pellucid, and of no Colour (as neither are the other two.) It fills up that ſpace that is betwixt the *Cornea* and the Cryſtalline Humour before. If any thickiſh Particles ſwim in it, then Gnats, Flies, Spiders Webs, and the like, will ſeem to be flying before the Eyes. But if thoſe Particles grow ſtill thicker, and cloſe together, ſo as to make a Film, and this be ſpread before the Hole of the *Pupilla*, then is the Sight quite taken away; which Diſeaſe 1. Aqueous.

is

is called a *Cataract*. This Humour is very clear and thin, and therefore eaſily diſſipable; but by which way its Expence ſhould be ſupplied, is difficult to determine. Some think it is fed by the Arteries, out of which this Water iſſues, thro' I know not what Glands: Others derive it from the Nerves, and a third ſort from the Lympheducts. But Dr. *Ant. Nuck* refutes all theſe Opinions: The firſt from the Non-appearance of any Glands; the ſecond from the no (or at the moſt a very ſmall Quantity of) Liquor that at any time can be obſerved in the Nerves: Whereas if the *Tunica Cornea* be prick'd, and all, or the greateſt part of this aqueous Humour be let out, he has found, by repeated Experiments, that it will be recruited again in ſix Hours ſpace. The third Opinion he refutes from the general Office of Lympheducts, which is, to bring back from the Circumference to the Center, and not contrarily, becauſe the Valves wherewith they every where abound, cannot admit of that Motion. Wherefore exploding all theſe Opinions, he eſtabliſhes a new one of his own, upon the ſcore of the new Veſſels that he has obſerved to terminate in the *Tunica cornea* (which he calls *ductus oculorum aquoſi* (which we ſhall deſcribe from him by and by) affirming that theſe Ducts are the Conduits by which this Humour is fed, and that they ſupply it ordinarily with ſeveral Drops daily, becauſe of the continual Tranſpiration of it by Pores, looking from within outwards. As to the Particles of this Humour, from ſeveral Experiments he has made, he thinks it is demonſtrable; 1. That it contains in it a very limpid and pellucid Water. 2. Viſcid and tenacious Particles. 3. A ſalt and an acid. 4. Earthly Particles. 5. That it wants not alſo its volatile Spirit.

The

The *Crystalline* Humour (so called from its being as clearly transparent as Chrystal) is placed betwixt the aqueous and the vitreous, but not exactly in the Middle or Center of the Eye, but rather towards its fore-part. It is inclosed in the Bosom as it were of the vitreous Humour, and is flattish on the fore-side, but rounder behind. It is more bright and thick than either of the other two. It has been the common Opinion, that it is inclosed in its proper Membrane, which is called either *Chrystallina*, from its Transparency; or *Aranea*, from its most fine Contexture. But Dr. *Briggs*, a very accurate Anatomizer of the Eye, denies any such Tunicle, affirming that it is meerly adventitious when the Humour is exposed for some while to the Air, or is gently boil'd. As to the Collection or Reception of the Rays of things visible, this Humour is the primary Instrument of Sight; though as was said before, the *Tunica Retina* is the principal as to Perception, because through it the Rays are communicated to the common Sensory. 2. Crystalinus.

The third and last Humour of the Eye is the *Vitreous*, so called, because it is like to molten Glass. This is thicker than the Aqueous, but thinner than the Crystalline; and much exceeds them both in Quantity, for it fills up all the inner or hinder Hemisphere of the Globe of the Eye, and a pretty deal (towards the lateral Superficies) of the former. It is round behind, but hollowed in the middle forwards to receive the Crystalline into its Bosom. This Humour is also said to be separated from the other two by a proper Tunicle called *Vitrea*, which the aforesaid ingenious Author likewise denies. 3. Vitreus.

See the Situation of these Humours represented in *Fig.* II. of *Tab.* 15.

The

The Veſſels of the Eye. The Eyes have *Arteries* from the *Carotides*, which beſtow Twigs on their Muſcles, and on their Tunicles. And theſe are accompanied with *Veins* ſpringing from the Branches of the Jugulars. As for their *Nerves*, they either aſſiſt the Senſe of Seeing, and are called the Optick Nerves, which we have reckoned for the ſecond Pair, and deſcribed before, *Chap.* 10. or ſerve for the moving of them, being inſerted into their Muſcles; and to this purpoſe ſerve the third and fourth Pair, and ſome Twigs of the Fifth. As to their *Lympheducts*, we have ſpoken of them above, *Ch.* 19. when we diſcourſed of the Glands placed at each *Canthus* or Corner of the Eye-lids. Beſides theſe Veſſels, Dr. *Ant. Nuck*, whom we cited but juſt now, has diſcovered a fifth ſort of Veſſel, called by him *ductus oculorum aquoſi*, which he believes do recruit the continual Conſumption of the watry Humour of the Eye. He ſays they are of an uncertain number, and may be plainly diſcerned to run along the *Tunica ſclerotica*, and to penetrate at length the *Cornea*, where their Oriſices have ſuch a Valve as the Ureters have in the Urinary Bladder, or the *Porus bilarius* in the *Veſica fellea*. In the *Tunica ſclerotica* and *Cornea*, they are of a dusky Colour, but not before they arrive thereat. They admit of a Probe of a pretty Bigneſs and are of a ſtronger Make than Lympheducts. He has taken great Pains to trace them to their Origin, but has not yet been able to follow them further than to the Optick Nerve. So that he knows not whether their Riſe may be from ſome Gland not yet diſcovered, or whether the *Glandula pituitaria* may not ſend forth ſome Shoots that conſtitute theſe Ducts.

The Action of the Eyes. The *Action* of the Eyes is *Viſion*. Which is very well defined by *Diemerbroeck*; *viz.* That it is *a Senſe whereby, from the various Motion of viſible Rays, collected in the cryſtalline and vitreous Humours,*

and

and darting upon the Tunica retina, *the Colours of visible Objects are perceived, with their Site, Distance, Greatness, Figure and Number*;] the *Medium* of which Perception is the Light. But we shall not enter upon a Discourse of Vision here, as being more proper for a Philosopher than an Anatomist.

CHAP. XXII.

Of the Auricula.

The Ears.

AS the *Eyes* are placed in the upper part of the Body like Watch-men, to descry approaching Danger, so are the *Ears* there seated also, that they might give information of what the Eyes cannot discover either in the Night, for want of a Light, or through the interposition of some thick and opake Body, which the Sight cannot penetrate. And as the Eyes contemplate the wonderful Works of God, whereby the Mind may conceive of his Infinity; so the Ears are the Inlets or Receivers of Verbal Instruction in all Wisdom and Science. For they are the Organs of Hearing, and are in Number two, that the one failing, yet we might hear with the other. They are placed in the Head, because Sounds ascend.

Their Parts Auricula.

The *Parts* of the Ear are either *outward* or *inward*. The *outward* is called *Auricula*, which is only an adjuvant Instrument of Hearing, being spread like a Van to gather and receive the Sounds. Its upper Part is called *Ala* or *Pinna* the Wing; and its lower or soft Lobe, usually *Infima Auricula*. It has several Protuberances or Eminences, and Cavities. Its outmost *Protuberance* that makes its Circumference, from its winding is called *Helix*; and that which is opposite to it, *Anthelix*: But that next the Temple, because in some it is hairy, is called *Hircus* or *Tragus*; and that which is opposite to it, to which the soft

The Names of its Parts.

Lobe

Lobe of the Ear is annexed, *Antitragus*, which likewiſe in ſome is hairy. Its *Cavities* are three. The inmoſt, becauſe of the yellow Ear-Wax (as we call it) that is gathered in it, is named *Alvearium*; as alſo *Meatus Auditorius*; (of which more in the next Chapter.) The next to this outwards which is bigger, from its Tortuoſity or winding, is called *Concha*. The third is that betwixt the *Helix* and *Anthelix*, which has had no Name impoſed on it.

Its conſtituent Parts

The *conſtituent Parts* of the *Auricula* are either *common* or *proper*. The *common* are *Cuticula*, *Cutis*, and *Fat* in the Lobe. The *proper* are the *Muſcles*, *Veins*, *Arteries*, *Nerves*, the *Cartilage*, and a *nervous Membrane* or Tegument, which immediately embraces the whole Cartilage, which ſome reckon to the *common* Parts. As concerning the *Muſcles*, they are ſet down in their proper Treatiſe. The *Veins* come from the external Jugulars; the *Arteries* from the *Carotides*; the *Nerves* from the ſecond Pair of the Neck, being joined with the harder Proceſs of the ſeventh Pair. As for the *Cartilage*, it is a Subſtance that is fitteſt for this Place. For if the Auricle had been bony, it might by many Accidents have been broken off; or if it had been fleſhy or only membranous, it would not have ſtood ſo ſpreading, but have flapt down. Whereas a Cartilage is not in Danger of breaking, and yet it is ſtiff enough to keep this outer part of the Ear expanded. It is tied to *Os petroſum* by a ſtrong Ligament which riſeth from the *Pericranium*.

Uſes.

The *Uſes* of the *outward* Ear or *Auricle* are theſe: Firſt, it ſerveth for Beauty. Secondly, it helps the receiving of the Sounds. For firſt, it gathereth them, being diſperſed in the Air. Secondly, it doth moderate their *Impetus*, ſo that they come gently to the *Tympanum*. Such as have

have it cut off upon any occasion, are very much prejudic'd in their Hearing, which becomes confused with a certain Murmur or Swooning, like the Fall of Waters.

Both behind and below each Ear, there are several Glands outwardly under the Skin, that are called *Parotides*. But there are two more notable than the rest, near one another; of which one is lesser, and is *conglobate*; but the other bigger, consisting as it were of many lesser, and is *conglomerate*. From the *conglobate*, according to *Steno*, there arise Lympheducts, returning the *Lympha* that is separated in them into the Jugular Veins; and in the *conglomerate*, the *Saliva* is separated, which is conveyed into the Mouth by proper Ducts: But of these more by and by, in Chapter 26. Parotides.

CHAP. XXIII.

Of the inward Part of the Ear.

THE inward Part of the Ear is that which we properly call *Auris*, and begins at the *Meatus auditorius*, or that inmost Cavity of the Auricle, in which the Ear-wax is collected. This Cavity ascends something with a winding Duct, that the vehement *Impetus* of Sounds may be a little infring'd before they vibrate upon the *Tympanum*. Monsr. *du Verney* (that has lately writ a particular Treatise of the Ear) says, that this *Meatus* or Tube that reaches from the *Concha* to the *Tympanum*, consists partly of a Cartilage, and partly of a Bone. The Skin that covers it, he says, is furnished with an infinite number of Glandules, of a yellowish Colour, each of which has its Tube opening into this *Meatus*, by which they send that yellow glewy Substance, which is ordinarily Meatus Auditorius. *The Ear-wax.*

narily found in it (called *Cerumen*, or Ear-wax) and hinders Insects from creeping into the Ear, entangling them like Bird-lime.

The Tympanum. Before its inner End is spread the *Tympanum* or Drum (or more properly *tympani membrana*, the Membrane of the Drum) which is a nervous, dry, almost round and pellucid Membrane, of most exquisite Sense, dividing the *outward* from the *inner* Ear. Some will have it to spring from the *Pericranium*; others from the *Pia Mater*; a third sort from the *Dura Mater*; a fourth from the softer Process of the Auditory Nerve expanded. And lastly, some think that it has a proper Substance, springing from no other Membrane, but made in the first Formation of the Parts. It is very dry, that it might give the better Sound: It is Strong, that it should the better endure external Harms: It is inchased in a Channel or Rift, made in the Circumference of the outer End of the Bone that joins to the Cartilage, which forms the largest part of the *Meatus*, and it has a Cord that runs cross it behind, which some take for a Ligament to strengthen it; but *du Verney* says it is a Branch of the seventh Pair of Nerves, which supplies Twigs to the Muscles that move the *Tympanum*: (for it hath two *Muscles* to move it, which shall be described in the Fifth Book, *Chap.* 8.)

The first Cavity. When it is taken away, there appears a *Cavity* on the Inside of it, which by some is also called *Tympanum*, but by *du Verney* the *Barrel*. He says, it is a quarter of an Inch long, and half an Inch wide. It is encompassed round with Bone, and clad within with a Membrane that is interwoven with a great number of Vessels.

Its four little Bones In this Cavity are contained *four* little *Bones* that are movable, and conduce much to Hearing. They have no Marrow in them, nor are covered with any Membrane or *Periosteum*; yet

at

at their Extremities where they are joined, they are bound with a ſmall Ligament one to another. And they have this alſo peculiar to themſelves, that they are as big in Infants as in grown Perſons, as are alſo the Bones of the *Labyrinth* and *Cochlea*, according to *Veſlingius* and *du Verney*.

The *firſt* is called *Malleolus*, the little Hammer. It hath a round Head, which is inarticulated into the Cavity of the Anvil by a looſe Ligament. This Head is continued into a ſmall Neck or Handle, which reaching beyond the Middle of the *Tympanum*, adhereth to it. About the Middle it hath two Proceſſes: The one of which, being ſhorter but thicker, has the Tendon of the internal Muſcle inſerted into it; and the other being longer but ſmaller, the Tendon of the External, whereby this Bone immediately, but mediately the *Tympanum* is moved, as ſhall be farther explained in the aforeſaid *Chapter* of the Fifth Book. And ſee *Tab.* 16. before going, wherein all theſe four Bones with the Muſcles are repreſented. 1. Malleolus.

The *ſecond* is called *Incus*, the Anvil, having one Head, and two Feet, being ſomewhat like one of the grinding or double Teeth that has two Roots, only one of its Feet is conſiderably longer than the other. The Head is pretty maſſy, having in the Top of it a little ſmooth Cavity, which receiveth the Knob or Head of the Hammer. The ſmalleſt (but longeſt) Foot is tied to the Top or Head of the Stirrop by a looſe but firm Ligament; but the thickeſt, broadeſt and ſhorteſt reſteth upon the *Os ſquamoſum*. 2. Incus.

The *third* is *Stapes*, or the Stirrop. This is not ſo compact and ſolid as the two former, but more porous. In Figure it is almoſt Triangular, in the Middle hollow, to give way to the paſſing of the Air to the *Labyrinth*. In the upper Part of it is a very ſmall and round Knob, upon which the 3. Stapes.

longeſt Foot of the Anvil reſteth. Its Shape is much adapted to the *Feneſtra ovalis* (which opens into the Labyrinth) about which it is tied round ſomewhat looſely, ſo that it may be driven to within its *Sinus*, but cannot without Violence be pulled outwards.

4. Os orbiculare. The *fourth* Bone was found out by *Franc. Sylvius*, and from its round Shape is called *Orbiculare*. It is tied by a ſlender Ligament to the Side of the *Stapes*, where the *Stapes* is joined to the *Incus*. *Du Verney* ſays, that this Bone comes betwixt the long Foot of the Anvil and the Knob or Head of the Stirrop: And that on that Side next the Head of the Stirrop it is convex, being received into a little Cavity of the ſaid Head; and on that Side next the Foot of the Anvil, it is a little hollow, receiving the ſaid Foot into it ſelf.

Two Chanels. From the lower Side of this *firſt inner* Cavity, wherein theſe Bones are contained, there is a round *Meatus* or Chanel to the Palate of the Mouth near the Root of the *Uvula*; and another from its upper Side that runs to the Cavity of the Noſtril, as has formerly been taught; but the aforeſaid Author deſcribing it to be much wider, but a great deal ſhorter than the other, ſays, That it penetrates to within the Sinuoſities of the mammillary Proceſs of the Temple-bone. Thoſe who thought it to run to the Noſtrils, ſuppoſed it to convey thither pituitous Matter collected within this firſt Cavity; but *du Verney* thinks its Uſe to be, to permit the internal Air, to retire into the Sinuoſities of the aforeſaid Proceſs when the *Tympanum* is driven inwards by the external Air, and that the internal Air returns from thence again upon the Relaxation of the *Tympanum*. And as to the former Channel, he calls it an *Aqueduct*, and ſays, that its firſt and ſhorter

Part

Part is bony, but the second and longer partly cartilaginous, and partly membranous; which Part passing near the Root of the Nose, is lined with a glandulous Skin, that is a Continuation of that which cloaths the inside of the Nostrils. So that he believes, that part of the Air which is drawn in at the Nose penetrates this Channel (and so may ascend to the Ear) and on the contrary thinks, that aqueous Humours descend by it into the Mouth by its Aperture in the Palate; for he denies that there is any Valve in it which might stop any thing from passing either way. Other Authors (not denying this latter Use, but not supposing that it had any Communication with the Nostrils; instead of the former Use derived from thence) have thought, that Air and also Sounds might pass through it in at the Mouth to the Ear, by observing that those who are thick of Hearing do usually hold their Mouths open when they listen attentively, which they do probably, because they are partly assisted thereby in their hearing.

Two Holes. In the Middle also of this Cavity, opposite to the *Tympanum*, in the *Os petrosum*, there are two Holes, the greater and higher of which is shut by the Basis of the *Stapes* (when no Sounds affect the Ear) and is of an oval Figure, whence it is called *Fenestra ovalis*, and opens inwards or backwards pretty wide into the Labyrinth. The other is less and lower, and is of a round Shape, whence it is called *Rotunda*. The Orifice of this is open, but within the middle of its Channel it has a Rift wherein is inchased a thin, dry and transparent Membrane like that of the *Tympanum*. Behind which it is divided into two Pipes, divided by the *Os squamosum*, one of which tends to the *Cochlea*, the other to the Labyrinth.

Fenestra ovalis.

Rotunda.

The second Cavity or Labyrinth

This *Labyrinth* is the *second inner* Cavity, being far leſs than the former, and was firſt ſo called by *Fallopius*, from the hollowed bony Semicircles (cloathed with a thin Membrane) returning circularly into the ſame Cavity. The *Feneſtræ ovalis* and *Rotunda* open into it out of the firſt Cavity: And beſides theſe Holes it has five others, one of which opens into the End of the larger *Gyrus* or winding of the *Cochlea*: The other four are ſo ſmall, that they hardly admit an Hair, through which the moſt ſlender Fibres of the auditory Nerve proceed to the inner Membrane, that encompaſſes this Cavity.

The third Cavity called Cochlea.

The *third* and laſt *inner* Cavity, is called *Cochlea*, becauſe in its ſpiral winding it reſembles a Snail's Shell. It is leſs than the Labyrinth, and has two, ſometimes three or four ſpiral Windings, which are cloathed inwardly with a moſt thin Membrane, into which, as into the Labyrinth, the ſlender Fibres of the auditory Nerve enter, thro' three or four very ſmall Holes.

Du Verney makes but two *inner Cavities viz.* the *Barrel* (which we deſcribed above) and the *Labyrinth*. But then he divides the Labyrinth into three Parts: The foremoſt of which he calls the *Veſtibulum* or Entrance; the ſecond comprehends the three ſemicircular Conduits or Channels, which (he ſays) are on that ſide of the Veſtible which is towards the hinder Part of the Head; and the third is the *Cochlea*, which is on the other ſide. But this new Diſtinction is of leſs moment, and therefore I paſs it over. As for the Shape of the *Labyrinth* and *Cochlea*, it is ſhewn before in *Tab.* 16. But they are repreſented much larger than according to Nature, as are alſo the Bones in the firſt Cavity, that their Parts might appear more plainly.

Theſe

The congenit Air.

These three inner Cavities are all formed within the *Processus petrosus* of the Temple-bone, and in them is contained a most pure and subtil *Air*, which some think to be included in them in the very first Formation of the Parts, and therefore call it *Aer Insitus* and *Congenitus*. Some suppose it to be Animal Spirit, effused into them by the auditory Nerve.

The Vessels of the Ear.

This inner Part of the Ear has *Veins*, *Arteries*, and *Nerves*, from the same Origins as the outer: only the *harder* Process of the auditory Nerve goes to the *outer*, and the *softer* to this *inner*, which coming by the hinder *Meatus* of the *Os petrosum*, is inserted into and dispersed through the Circles of the *Cochlea* and *Labyrinth*.

Hearing what, and how performed.

All the Parts of the *Auricula* and *Auris* concur to the perfecting the *Hearing*, which is a *Sense whereby Sound is perceived from the various trembling Motion of the external Air, beating upon the* Tympanum, *and thereby moving the internal Air with the Fibres of the auditory Nerve, and communicated to the common Sensory*. Now *Sound* that is the Object of it, is nothing else but a Quality arising from the Air or Water beat upon and broken by the sudden and vehement Concussion of solid Bodies. And the Diversity or Greatness of such Sound is distinguished by the four Bones that stand on the Inside the *Tympanum*: For as from the greater or less, gentle or harsh Impulses of the external sonorous Air (fluctuating like Waves caused by a Stone thrown into the Water) the Membrane of the *Tympanum* is accordingly driven or shook against the *Malleus*, the *Malleus* against the *Incus*, and the *Incus* against the *Stapes*; so, as the same *Stapes* and *Os orbiculare* open the *Fenestra ovalis* more or less, is there a freer or straiter Passage granted to the internal

Air out of the first inner Cavity into the Labyrinth and *Cochlea*, in whose tortuous and unequal Windings it is variously infringed and modulated, from whence the *Species* of Sound that is made thereby (according to the Diversity of the external Impellent) is sometimes more acute, sometimes more dull, sometimes more harsh, sometimes more gentle, sometimes bigger, sometimes less; the *Idea* of which *Species* is carried to the common Sensory (and so represented to the Mind) by the auditory Nerve that expands it self through the Membrane that invests the said Labyrinth and *Cochlea*.

CHAP. XXIV.

Of the Nose.

The Nose. THE Organs of *Seeing* and *Hearing* being described in the foregoing Chapters, we come now to the Instrument of the third Sense, *viz. Smelling*, which is the *Nose*.

Its external Parts, viz. The Parts of the *Nose* may be distinguished into the more *external*, and the more *internal*. The more *external* Parts are these, the Cuticle and Skin, Muscles, Veins, Arteries, Nerves, Lymphe-ducts, a proper Duct, Bones and Cartilages.

Skin. First, the *Skin* cleaveth so fast to the Muscles and Cartilages, that it cannot be severed without renting.

Muscles. Secondly, as for the *Muscles*, they are set down in the Description of the Muscles, *Book* V.

Veins, Arteries and Nerves. Thirdly, the *Veins* come from the external Jugulars; and the *Arteries* from the *Carotides*. Fourthly, the *Nerves* spring from the fifth Pair. Fifthly, *Steno* has observed in Sheep and Dogs a *Lymphatick* Vessel in each Nostril; and 'tis probable

bable there are the same in Men. Sixthly, Both *Steno* and Dr. *Needham* describe a *Meatus* or Duct, having two *Foramina* in the *Canthus* of the Eye, but opens but by one into the Nose; and Dr. *Needham* has observed another Passage going out of the middle of this, toward the Palate. By which Ducts any one may perceive, that in weeping, a great Quantity of Water doth flow from the Eyes. Seventhly, the *Bones* are described in *Book* VI. *Chap.* 6. Eighthly, the *Cartilages* are in Number five; the two *upper* are broader, and adhere to the lower side of the Bones of the Nose, where they are broader and rough, and being joined to one another, pass from thence to the Tip of the Nose, making up one half of the *Alæ*; the two *under* make up the other half, being joined to the upper by a membranous Ligament; the fifth divideth the Nostrils. These Cartilages are moved by the Muscles.

Bones.

Cartilages.

The *inner* Parts of the Nose are these: First, the Membrane which covereth its Inside, which some think proceedeth from the *Dura Mater*, passing through the Holes of the *Os cribriforme*, with the nervous Fibres. This Membrane on its backside hath abundance of little *Papillæ*, or Glands; in which the *Serum* or Rheum is separated that runs out by the Nose (tho' *Diemerbroeck* thinks them to be the true Organ of Smelling.) Secondly, the *Hairs*, called in Latin *Vibrissi*, which hinder the entrance of Insects and of Dust in a great Measure, as one draws his Breath in at his Nose. Thirdly, the red fleshy spongious Substance, with which the Holes of the *Os spongiosum* in the upper Side of the Nostril are filled up; from which the *Polypus* springeth.

Its inner Parts.

A glandulous Membrane.

Hair.

Spongy Flesh.

The *length* of a comely Nose is the third part of the length of the Face.

Length.

The Denomination of its Parts. The upper Part of the Nose which is bony, is called *Dorsum Nasi*, or the Ridge. The lower lateral Parts, *Alæ* or *Pinnæ*. The Tip of the Nose, *Globulus*, and *Orbiculus*. The middle cartilaginous Partition, *Septum*; and the fleshy Part, that at the Bottom of the *Septum* reaches from the Tip of the Nose to the Root of the upper Lip, *Columna*. The two Holes that are caused by the Partition, are called *Nares* the Nostrils. And these about their Middle are each divided into two, one of which goes up the *Os cribriforme*, to convey Scents thither: The other descends down upon the Palate to the *Fauces*, by which Rheum falls down either of its own accord, if it be very thin; or by snuffing the Air up strongly in at one's Nose, if it be thick, which we may hawk and spit out at Pleasure.

Its Uses. The *Nose* is an *external adjuvant* Organ of Smelling, as the *Auricula* is of Hearing. For when Smells exhale out of odoriferous Bodies into the Air, by taking our Breath in at the Nose, the Scents accompanying the Air ascend up the Nostrils to the Top of their Cavity, *viz.* to the *Os cribriforme*, through whose Holes the olfactory Nerves (otherwise called *Processus mammillares*) issue out by their Fibres, and are dispersed thro' the Membrane that cloaths the inside of the Nostrils, especially its upper Part; which Nerves, Fibres and Membrane are the *inward* immediate and *adequate* Organ of Smelling. Other inferiour *Uses* the Nose has also; as first, sometimes to take in our Breath by, that we may not keep our Mouth always open for that Purpose. Secondly, to help the Speech, which is very much impaired by the Loss of it. Thirdly, it serves for the Separation and Discharge of the mucous Humours in the Blood.

CHAP.

CHAP. XXV.

Of the external Parts of the Mouth.

THE next Part to be deſcribed, is the *Mouth*, whoſe Parts are either *External* or *Internal*. The *External* are the *Cheeks* and *Lips*. *The outer Parts of the Mouth.*

As to the *Cheeks*, their Subſtance being Muſcular, this is no proper Place for their Deſcription (but *Book* V.) only we ſhall note from *Steno*, that betwixt their Muſcles and the inner inveſting Membrane of the Mouth, there is ſpread on each ſide towards the lower Gums a large conglomerate *Gland*, from whence many ſmall Ducts open into the Cavity of the Mouth, pouring *Saliva* thereinto. And as to their *Parts*, we ſhall obſerve this farther, that their upper part next under the Eyes, that jets out a little, and is commonly higheſt of Colour, is called *Malum* or *Pomum Faciei*, in Engliſh commonly the Ball of the Cheek; and their lower part that is ſtretched out in blowing of a Trumpet, or the like, is called *Bucca*. *The Cheeks.* *Their Glands.*

The *Lips* are framed of a carnous ſoft fungous Subſtance, and of the Muſcles, covered with a thin Skin, under which, on the inſide, eſpecially of the lower Lip, there lie numerous Glands, whoſe excretory Veſſels penetrate the Skin, pouring forth their *Saliva* into the Mouth. They are in Number two, the upper and the lower. (Of their *Muſcles* ſee *Book* V.) The upper Lip has a little Dimple in its Middle, which is called *Philtrum*; and its Sides are named μύσαχες, whence the Hair that grows thereon is called *Muſtaches*. *The Lips.*

The

The Uses of the Lips. The *Uses* of the *Lips* are these: First, they help to retain the Meat in the Mouth, while it is chewing. Secondly they serve for beautifying of the Face, if they be well fashioned. Thirdly, for the containing the Spittle in the Mouth, that it should not drivel out constantly, but be spit out when we please. Fourthly, to keep the Gums and Teeth from external Injuries. Fifthly, for framing of the Speech.

CHAP. XXVI.

Of the inner Parts of the Mouth.

The inner Parts of the Mouth. THE *inner* Parts of the Mouth are these: The *Gums*, the *Teeth*, the *Palate* or *Roof* of the *Mouth*, the *Almonds*, the *Uvula*, the *Tongue*, the *Glands*, and *Salival Ducts*.

1. *Gums.* The *Gums* (*Gingivæ*) are two, made up of a hard fleshy Substance, destitute of Motion, set like a Rampire about the Teeth, for the keeping of them in their Sockets.

2. *Teeth.* As for the *Teeth*, look for them in *Book* VI. *Chap.* 8.

3. *Palate.* The *Roof of the Mouth* is its upper Part, something concave, like a Vault, formed in the *Os sphenoides*, and serves partly for perfecting of the Voice, by repercussing the Air, and partly assists the Sense of Tasting. It consists of Bones (of which, *Book* VI. *Chap* 6) of a peculiar glandulous Flesh, and a thick Tunicle, full of little Holes for the *Saliva* that is separated in the Glands to destil through into the Mouth. *Steno* calls this glandulous Flesh the *palatine Gland*, and says, it is conglomerate, and continued to the *Tonsils*; and that there spring out of it innume-

rable

rable ſlender Ducts, which perforating the Membrane, make it like a Sieve. The ſame Author mentions alſo two Holes that it has in its Forepart, juſt within the Teeth, which come from the Noſtrils.

Of the *Tonſillæ* or Almonds we have ſpoken before in *Book* II. *Chap. ult.* 4. *Almonds.*

The *Uvula* is a red, ſpongy and longiſh Caruncle, that being ſomewhat broad at its Baſis, hangs down from the middle of the Palate (where the Noſtrils open into the Mouth) with a ſmall but bluntiſh End. It is covered with a very lax and ſoft Skin, and is often ſwelled with Defluxions of Rheum, hanging down flaggy, which is called the falling down of the *Uvula*, and by ignorant People, the falling of the Roof of the Mouth. It is otherwiſe called *Columella*, and *Gurgulio*. 5. Uvula.

The *Tongue* (*Lingua, à lingendo*, from *licking*) is the Inſtrument of Taſte and Speech. It is long and broad, thicker at the Foot than towards the Tip.

It is cloathed with two *Membranes*. The outer covers only the upper Part of the Tongue, and is very porous, being pretty ſmooth in Men, but in ſome Brutes it is rough, by reaſon of abundance of copped Bodies which ariſe out of the upper Surface of the Tongue, and are cloathed with this Membrane. Which Bodies are of a cartilaginous Subſtance, and ſtand like the Teeth of Wooll-cards, bending towards the Root of the Tongue. This Membrane has a Line that runs lengthways of it in its middle, dividing the Tongue into two Parts. The *inner* covers the whole Tongue, the lower ſide as well as the Upper. This is thin and ſoft, and has many *Papillæ* protuberating out of it, which in the upper *Its Membranes.*

upper part of the Tongue intrude themſelves into the Pores of the outer. *Malpighius* makes the outer Membrane to be that which cloaths the ſides, and under ſide of the Tongue, as well as its upper ſide: And this which we call the ſecond, he names a nervous and papillar Body, running through the upper Surface of the Tongue like a Membrane.

Subſtance. As to the *Subſtance* of the Tongue, there is great Diverſity of Opinions. Some think it to be a Gland; others, that it has a peculiar Subſtance; *Spigelius*, that it is truly a Muſcle; and ſo does Dr. *Wharton* call it *verus Muſculus*, tho' towards its Root (he ſaith) it hath ſomething of a glandulous Subſtance. *Malpighius* (*Exercit. Epiſtol. de Lingua*, p. 9.) ſays, it is rather muſcucular than glandulous, and deſcribes the Subſtance thus: [‘ Immediately under the aforeſaid ‘ Membranes there lie ſtreight fleſhy muſcular ‘ Fibres, whereby the Tongue is drawn in- ‘ wards, and ſhortned, but the Center of the ‘ Tongue conſiſts of a manifold kind of Fibres, ‘ long, tranſverſe and oblique, which riding ‘ one upon another, are interwoven like a Mat. ‘ This inner Part is ſofter and more luſcious to ‘ the Taſte than the outer; not that it is of a- ‘ nother Subſtance, but becauſe it is looſened ‘ and larded as it were by a certain luſcious Fat ‘ that (eſpecially toward the Baſis) fills up the ‘ Interſtices of the Fibres; and there are more- ‘ over on the ſides of the Fibres in this Place a ‘ ſort of miliary Glands which give it the more ‘ pleaſant Reliſh.] But though this be its Subſtance, yet it cannot properly be called a Muſcle, both becauſe no Muſcle ſerves to move itſelf, but ſome other Part; and alſo becauſe one Muſcle is not moved by another, as the Tongue is by ſeveral Pair, to be deſcribed *Book* V.

It is connected to the *Os hyoides*, *Larynx*, and *Fauces*, and by a membranous Ligament to the Parts under it. The Extremity of which Ligament is called *Frænum*, which being too ſhort, or extended to the tip of the Tongue, hindreth ſucking in Children, when they are ſaid to be Tongue-tied. *Veſſels.*

Its *Veins* proceed from the external Jugulars, and are very apparent under the Tongue, where they are called *Ranulares*. The *Arteries* come from the *Carotides*. Nerves it hath from the fifth and eighth Pairs, *Connexion*

The *Actions* and Uſes of the Tongue are theſe: Firſt, It is the Inſtrument of Taſting; eſpecially the *Papillæ* in its inner Membrane, which have nervous Filaments (running amongſt the fleſhy Fibres) inſerted into them. Secondly, it formeth or modulateth the Speech. Thirdly, it helpeth the chewing of Meat, by toſſing of it to and fro, and turns it down into the Gullet. *Actions and Uſes.*

7. *Glands.* Beſides the *Glands* already mentioned, there are ſeveral others, ſome of which are placed in the Mouth; and others, tho' not ſeated therein, yet diſcharge into it, by proper Ducts, that Liquor that is ſeparated in them, and therefore are properly enough to be treated of here.

Parotides. The firſt are the *Parotides*, which are of two ſorts, *Conglobate* and *Conglomerate*, and are both ſeated in the hollow under the Ear. The *Conglobate* are ſituated on the upper and fore ſide of the Conglomerate. The *Conglomerate* are of an irregular Shape, ſuch as the Inequalities and Eminences of the circumjacent Parts grant to them. They were both of them formerly reputed Emunctories of the Brain, and ſuppoſed to ſerve likewiſe for the Suſtentation of the Veſſels that aſcend this way. But *Steno*, and from him others have

have found out more noble and genuine Uſes for them. The *Conglobate* ſeparate the *Lympha* from the Arterial Blood, and conduct it by Lympheducts into the Jugular Veins. The *Conglomerate* have not only inſerted into them Veins and Arteries from the external Jugulars, and *Carotides*, and Nerves from the harder Branch of the ſeventh Pair; but alſo there ſprings out of each a peculiar Veſſel, commonly call'd a *Salival Duct*, from the Liquor it conveys. This Veſſel ariſes out of it by many ſmall Roots, that preſently unite into one Trunk, which running on the outſide of the upper Jaw-bone by a ſtreight Courſe in (Man) as far as to the Center of the *Muſculus buccinator*, there opens into the Cavity of the Mouth, into which it diſcharges the *Saliva* which it had imbibed out of the *Parotis* of its own Side. This is called *Ductus ſalivalis Stenonianus*, from its Inventor *Steno*; or otherwiſe *Superior*, to diſtinguiſh it from the maxillar, which is the lower. As to the Origin and Uſe of the *Saliva*, we ſhall ſpeak thereof by and by.

Their Salival Ducts.

Nuckianæ.

The ſecond Glands I call *Nuckianæ*, being lately firſt deſcribed, with the *Salival* Ducts proceeding from them, by Dr. *Ant. Nuck* a Dutchman. They are ſeated in the Orbit of the Skull wherein the Eye is placed, betwixt the abducent Muſcle of the Eye, and the upper part of *Os jugale*. Their Shape is various, in ſome oblong, in others flattiſhly round, in others oval, and in others ſomewhat triangular. Each weighs commonly half a Dram, or ſomewhat more. They have *Arteries* from the *Carotides*, *Veins* from the *Jugulars*, *Nerves* from the *motory Pair* of the Eyes; and he thinks, there is no doubt but they have *Lymphaticks*. Each has a *Salival Duct* ſpringing out of it by many Roots, which deſcend ſtreight down-

Their Salival Ducts

downwards on the outside of the Jaw-bone, till it come to the upper Part of the Gum in the upper Jaw, near to the second double Tooth, reckoning from behind forwards, where it empties itself very near the *Stenonian* one. He calls them *Ductus salivales superiores alteri*, to distinguish them from the foregoing.

Maxillares.

The next Glands are the *Maxillar*, which are either *External* or *Internal*. The *External* are of less Moment, being very small. They are seated outwardly about the middle of the lower Jaw, where the other Branch of the Carotid Artery, and the external Jugular Vein, with a remarkable Branch of the fifth Pair of Nerves, ascend into the Muscles of the Face. It is probable these have no other Use but to separate *Lympha*, and to convey it into the Neighbouring Jugular Veins. The *Internal* are seated immediately within the lower Jaw. Their hinder Side, which is next to the *Parotides* and Jugular Glands, is much thicker and rounder, as also redder: But as they reach forwards they wax thinner by Degrees, and are extended betwixt the Jaw and the Muscles of the Tongue, as far forward as to the Chin, as Dr. *Wharton* affirms. They are Conglomerate, and have each a proper Vessel (first found out by the said Author) arising out of them, as the conglomerate *Parotides* had; which Vessels are called the *inner* or *lower salival Ducts*, as those springing from the *Parotides*, the *outer* or *upper*; these running on the inside of the lower Jaw, as those did on the outside of the upper. These Vessels spring by many small Roots out of the thicker and hinder part of the Glands, and run streight forwards towards the Chin, but in their Passage each Trunk does here and there receive new Twigs springing out of the Gland.

Their salival Ducts

When

When they are come to the middle of the Chin, they end there juſt within the Gums, and have each a certain *Papilla* affixed to their Orifice, whereby they can eaſily diſcharge themſelves, and yet nothing return out of the Mouth into them.

Sublinguales. The laſt Glands to be treated of are the *Sublinguales*; to the firſt Diſcovery whereof, and of their proper ſalival Ducts, ſeveral pretend. They lie underneath the Tongue on each ſide, and each of them ſends forth a proper excretory Veſſel, or ſalival Duct, which running parallel with thoſe of the internal Maxillar Glands, open in the ſame *Papillæ*, but have a peculiar Orifice of their own, ſtraiter than that of the other.

The Uſe of the Glands and Saliva Now the *Uſe* of all theſe Glands is to ſeparate the *Saliva*, and to convey it into the Mouth by the ſalival Ducts. As to the Origin of the *Saliva*, it is moſt probably derived from the Arterial Blood. For as the Arteries pour nutritious Blood into all other Parts, ſo they do into the Glands alſo; part of which they convey into their own Nouriſhment, part is returned by the Veins in the Circulation, and part (*viz.* of what is ſerous) they ſeparate, and beſtowing a ſubacid Quality thereupon, make *Saliva* (or Spittle) of it.

To the Compoſition whereof (if not for the Separation of it) ſome think a nervous Juice is contributed, the rather becauſe larger and more numerous Twigs of Nerves are communicated to the Glands than to moſt other Parts, which yet have a more exquiſite Senſe than theſe. But in Refutation of this Opinion, the above-mentioned Dr. *Nuck* alledges this Experiment: 'That if the Nerve that runs to any Gland be 'either hard tied or cut in ſunder, yet the Se-

'cretion

'cretion of the *Saliva* will not thereupon ceaſe, 'but will only proceed more ſlowly; which ſlowneſs may be attributed, not to the want of any conſtitutive Principle of the *Saliva*, ſo much as to the want of that Motion in the Gland (that to be ſure depends as well upon the Pulſation of the Artery) which is neceſſary for the quicker diſpatch of the *Saliva*, through or out of the Gland. I ſhall not need to diſcourſe of the manner of the Secretion of the *Saliva* in the Glands, ſeeing it proceeds like the Secretion of other Parts (*v. g.* of the Kidneys) *viz.* from the Conformity of the Particles of the Liquor to the Pores in the Gland, or the Mouths of the excretory Veſſel. After its Separation, its Motion into and along the Salival Ducts is much farthered by the muſcular Motion of each Part reſpectively. Now the *Saliva* is not to be reputed a meer Excrement, for it is believed by all modern Anatomiſts, that it ſerves for the farthering of the Fermentation of Meats in the Stomach, if it be not the main Ferment of it, as was ſhewed in *Book* I. *Chap.* 7. That it has a fermentative Quality, *Diemerbroeck* proves by this Experiment; that if a piece of white Bread be chewed and moiſten'd with much Spittle, and then be mixed with Wheat-paſte kneaded with warm Water, it will make it ferment. Dr. *Nuck* thinks it is an univerſal Ferment for Meats and Drinks, partaking of divers Qualities (or Particles) but of none in any exceſſive Degree. That it is acid he demonſtrates in this familiar Obſerva-'tion: 'That if when Milk is a boiling, one 'take a Spoonful to taſte of, and then preſently, 'whilſt it is moiſt with the *Saliva*, put it into 'the Milk again (ſtill a boiling) the Milk will 'break, as if ſome acid Liquor were mix'd

'with it.] That it is endued with a volatile Salt, he thinks is evident, from its curing the Itch, Tetters, *&c.* That oleous Particles are mixed with the acid, he ſuppoſes muſt be concluded from its killing Quickſilver. And whereas it uſually becomes frothy in the Mouth, upon its being agitated by the Motion of the Muſcles of the Tongue, and thoſe which move the lower Jaw, that he thinks proceeds from its being endued with a lixivial Salt, and ſpirituous oleous and acid Particles, while the volatile Spirit vaniſhes.

The End of the Third Book.

The

The Fourth BOOK.

Containing a

DESCRIPTION

OF THE

Veins, Arteries and *Nerves*

OF THE

LIMBS:

With an APPENDIX of the *GLANDS* thereof.

CHAP. I.

Of the Veins of the Arm.

IN the three former Books we have finiſhed the Deſcription of the three Cavities or Ventricles of the Body; out of which thoſe *Veſſels* ariſing that are propagated to the *Limbs*, it ſeems convenient to ſubjoyn thereunto a ſhort

Treatiſe of the Courſe that thoſe Veſſels keep in theſe Parts.

In *Book* II. *Chap.* 9. treating of the Aſcending Trunk of the *Vena cava*, we ſhewed, that when it arrived at the Top of the *Thorax*, it was divided into two Branches called *Rami ſubclavii*; which running obliquely under the *Claviculæ*, as ſoon as they were paſt them and come to the Arm-pit, were called *Axillares*. Now each of theſe parteth itſelf into two Veins, the *Cephalica* and *Baſilica*. But before their Diviſion they ſend forth two ſmall Veins, *viz. Scapularis interna* and *externa*; whereof the firſt paſſeth to the Muſcles that lie in the Cavity or Inſide of the *Scapula*, the latter to thoſe on the outſide.

Cephalica. The *Cephalica* paſſeth through the upper or outward part of the Arm, to the bending of the Elbow, where it is divided into two Branches; of the which one, joining with the *Baſilica*, makes the *Mediana*, which is very frequently opened when one is let Blood in the Arm: The other, marching along the *Radius*, reacheth to the Hand, thro' which it is ſpread; but chiefly in that part which is between the Ring-finger and the little Finger, where it is called *Salvatella*.

Baſilica. The *Baſilica* paſſeth thro' the inner and lower part of the Arm, accompanied with the Artery and Nerves.

About its beginning there ſpring out of it the *Thoracica ſuperior* and *inferior* (tho' ſometimes theſe ariſe from the Axillar before its Diviſion) of which the former runs to the Inſide of the Pectoral Muſcle, *&c.* the latter to the *Muſculus latiſſimus* of the Back, and all over the ſide of the *Thorax*, where 'tis ſaid to inoſculate with the Twigs of *Vena ſine pari*.

Its Branches. The *Baſilica* about the bending of the Elbow is divided into two; one of which is called *Subcutanea*,

nea, running just *under the Skin*; and the other *Profunda*, because it lies hid deep in the Flesh.

The *Subcutanea*, or shalloweſt Branch, near its Origin turns up to the outer Part of the *Ulna*, and is carried along it to the Hand. Subcutanea.

The *Profunda* descends between the *Ulna* and *Radius* (but towards the Wrist is carried by the outer part of the *Ulna*) to the Hand also. Profunda.

The *Mediana* is also double, *profunda* and *subcutanea*; both which run by many Twigs thro' the Muscles of the Cubit to the Hand and Fingers. The Mediana.

Note, That since the Circulation of the Blood has been generally believed, it is held indifferent which of these three Veins (the *Cephalica*, *Basilica*, or *Mediana*) are open'd in Blood-letting; for they all receive their Blood from one common Artery, *viz.* the Axillar, which returns by them all indifferently towards the Heart: Only it is best to open that which is fairest.

CHAP. II.

Of the Arteries of the Arm.

AS soon as the *Subclavian* Branches of the ascending Trunk of the *Aorta* are past out of the *Thorax*, they are called *Axillar* (like the Veins) as we shewed in *Book* II. *Chap.* 11.

This Artery before it arrive at the Arm, sendeth out of its *upper* part *Humeraria*, which is bestowed on the Muscles of the Shoulder, and out of its *lower*, *Thoracica superior*, *inferior* and *scapularis*, which run to the same Parts with the Veins of the like Denomination in the foregoing Chapter. Then having communicated small Twigs to the Glands in the Arm-pit, it accom-

panieth the *Basilica* along the Arm (for there is no Cephalick Artery.) When it is come to the bending of the Elbow, it is parted into two Branches, which pass almost wholly to the inner side of the Hand; for the Back-side hath no Artery, but from a small Twig that runs betwixt it and the Bone of the Thumb.

The *one* of these resting upon the *Radius*, is that which beats about the Wrist, and is commonly felt by Physicians.

The other marcheth by the *Ulna*, and with the former is spread through the Hand.

CHAP. III.

Of the Nerves of the Arm.

THE *Nerves* that spring from betwixt the two lowest *Vertebræ* of the Neck, and the first two of the Back (some say, three of the Neck, and three of the Back) do every one send a Branch towards the Arm; all which, for their greater Strength, uniting with one another, and again separating, are carried under the *Claviculæ* to the Arm-pit, where they unite together again, and are called *Axillar*; but they pass out from thence again separate one from another. The first of them goes to the Muscle *Deltoides*, to the second Muscle of *Os hyoides*, and to the Skin of the Arm. All the other five are bestowed wholly on the Muscles and Skin of the Arm and Hand.

CHAP.

CHAP. IV.

Of the Veins of the Thigh, Leg and Foot.

THE Iliacal Branches of the *Vena cava*, after they are descended as far as the Thigh, (where we left them, *Book* I. *Ch.* 13.) are called *Crurales*, which being past the Groins, are each divided into six more notable Veins, *viz. Saphœna*, *Ischias major* and *minor*, *Muscula*, *Poplitea* and *Suralis*. The first called *Saphœna*, descends down on the inside of the Thigh and Leg, betwixt the Skin and *Membrana carnosa*, and appears pretty large on the inside of the Ankle, where it is frequently opened in Diseases of the Womb, and *may* with great Safety, having neither Artery nor Nerve accompanying of it. The *Ischias major* is that which runs down on the outside of the Ankle (where it is wont to be opened in the *Sciatica*, or other Distempers of the Hips;) but the *minor* goes no farther than the Muscles of the Hip. The other three are spent on the Muscles, Skin, *&c.* of the Thigh, Leg, and Foot.

CHAP. V.

Of the Arteries of the Thigh, Leg and Foot.

IN *Book* II. *Ch.* 11. describing the descending Branches of the *Aorta*, we traced them to the Thighs, where the *Rami Iliaci* begin to be called *Crurales*, as was said of the Veins. The Crural Artery is less than the Vein, and before it arrive at the Ham sendeth forth three Branches, *viz. Muscula cruralis exterior*, *interior*, and *Poplitea*. The first enters the fore Muscles the second the inner Muscles of the Thigh; and the third runs

down the hinder Muſcles as low as the Ham, whence it has its Name. When the Trunk of the Crural Artery is paſt the Ham, it ſends out three more called *Tibiæa exterior, poſterior elatior,* and *poſterior humilior,* which are beſtowed on the Muſcles, Skin, *&c.* of the Leg and Foot; and what remains of it deſcends to the Foot, upon which it is ſpent.

CHAP. VI.

Of the Nerves of the Thigh, Leg and Foot.

THE three lower Pair of Nerves of the *Vertebræ* of the Loins, and the four uppermoſt of *Os Sacrum*, conſtitute the Crural Nerves. For all theſe very near their Riſe joining together, and proceeding united for a while, make four Nerves. The *firſt* and *third* enter the Muſcles that lie upon the Thigh-bone, whether for *its* Motion, or of the Leg. The *ſecond* accompanies the Crural Vein and Artery down by the Groins, and the inſide of the Thigh, on whoſe foremore Muſcles it is moſt of it ſpent, but ſends one notable Branch down the Leg, as far as to the great Toe. The *fourth* is the thickeſt, hardeſt, and ſtrongeſt of all the Nerves in the Body. This diſtributeth Twigs to the Skin of the Buttocks and Thigh, to the Muſcles of the Thigh and Leg, and being deſcended to the Ham, is divided into the outer and inner Branches, which beſtow Twigs on all the Muſcles and Skin of the Leg and Foot, to which there comes no other Nerve, but the aforeſaid Branch of the *ſecond.*

AN

AN APPENDIX TO BOOK IV.

Of the Glands of the Limbs.

HAving finiſhed the Deſcription of the Veſſels of the Limbs, this ſeems the fitteſt Place to mention the *Glands* of the ſame, ſeeing theſe miniſter to thoſe, either as ſupporting them in their Paſſage, according to the Ancients; or as ſeparating *Lympha* from the Arteries, according to ſome Moderns (or Superfluities from the Nerves, according to others) and returning the ſame by Lympheducts into the Veins.

Glands of the Groin and Arm-pit.

The moſt conſiderable of theſe *Glands* are thoſe in the *Groin* and *Arm-pit*. The former are called *Bubones* (not only when ſwelled, but alſo in their natural State) and are commonly about eight. The latter are called *Axillares*, from their Situation. Theſe are ſmaller than the other, and fewer in Number, ſeldom exceeding three.

Their Uſe.

The Groins and Arm-pits, the Ancients called Emunctories; the one of the Belly, the other of the Breaſt. And, beſides the ſupporting of the Diviſions of the Veſſels, all the *Uſe* aſſigned to theſe Glands, was to imbibe a Moiſture from the Blood,

Blood, for the Nouriſhment of the Hair that grows in theſe Parts. But ſeeing in the Groins, where the moſt and largeſt Glands are, there grows little or no Hair (moſt of that growing upon the Region of the *Os Pubis*, where are no Glands at all) this ſeems not to be the proper Uſe of them; and indeed it is too trifling and vile. The true Uſe, as of all other conglobate Glands (of which ſort theſe are) is to ſeparate the *Lympha* from the Arterial Blood, and to tranſmit it by the Lympheducts into the Veins, in which it is conveyed back together with the venal Blood to the Heart.

The Pope's Eye. In the middle of the Thigh, on the Inſide (about the middle of the Length of the *Muſculus ſartorius*) is a pretty conſiderable Gland, which we commonly call in Sheep *the Nut or Pope's Eye*. This is of the ſame Kind and Uſe with the former. As for the *Mucilaginous Glands* of the *Joints*, lately found out, and accurately deſcribed by the ingenious and ſedulous Dr. *Havers*, they ſhall be particularly taken Notice of in the VI*th* Book, *of the Bones*, when the reſpective Joints, to which they belong, are deſcribed.

The End of the Fourth Book.

The

The Fifth BOOK.

CONTAINING

A Treatise of all the

MUSCLES

Of the BODY.

CHAP. I.

Of a Muscle in general, and of its Parts.

A Muscle. Its Name.

A *Muscle* in Greek is called μῦς, a *Mouse* (of which *Musculus* in Latin is but a diminutive) either because it resembles a fley'd Mouse; or else from μύω, to *contract*, which is its Action. And under this Denomination is understood all that which is properly called Flesh; which is not one continued Substance through the whole Body, but consists of divers Parts or Parcels, that have no continuation

tion of Subſtance, but lie only contiguous to one another in ſuch convenient and decent Order and Situation, as may conduce to the Comelineſs of the Body, and the Performance of each one's particular Office.

Definition. Now a Muſcle is rightly defined to be a *diſſimular* or *organical Part* (framed of its proper Membrane, fibrous Fleſh, a Tendon, Vein, Artery, and Nerve) *appointed by Nature to be the compleat Inſtrument of free local Motion.*

By which Definition, ſeeing it appears to be a diſſimilar Part, conſiſting of many ſimilar, we ſhall in the firſt Place examin what theſe are: They are either *common* or *proper*. The *common* are three: The Vein, the Artery, and the Nerve. The *proper* as many, *viz.* The fibrous Fleſh, the Membrane, and the Tendon.

Conſtitutive Parts, viz. common and proper. The common are Arteries, Veins and Nerves.

The *Arteries* convey to the Muſcles (as to all the other Parts of the Body) vital Heat and Nouriſhment; and according to Dr. *Willis*, a *Latex*, that in Motion efferveſces with the Animal Spirits; the *Veins* carry back from them what Blood is not aſſimilated to them; and the *Nerves* bring Animal Spirit, whereby their Action is perform'd. And theſe Nerves ſpring either from the *Medulla oblongata* within the Brain; or from the *Spinalis*, ſo called, after it is deſcended out of the Skull into the Spine. Dr. *Willis* is of Opinion, that the Nerve which enters every particular Muſcle, is ſingle and peculiar from its very Original, though it be included in a common Coat with many others: Otherwiſe he cannot conceive how the Animal Spirits, which are directed by the Soul along the Trunk of any Nerve, for ſuch or ſuch a particular Motion, ſhould hit the way into one Branch rather than another. As ſoon as it hath entred into the Subſtance of the Muſcle, it is divided into innumerable Twigs, which in

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a little Space from its Inſertion become ſo very ſlender and fine, that they eſcape the Sight. Some make Lymphatick Veſſels common Parts of a Muſcle, but according to *Steno*'s Obſervation, though they run along their Surface, they do not enter into them.

Now theſe are called the *common* Parts of Muſcles, becauſe they are common to *them* with *other* Parts of the Body that are endowed with the ſame Kind of Veſſels. But as to each particular Muſcle, they have every one their peculiar and proper Veſſels, numerically diſtinct. That is, though thoſe Twigs of Veſſels that are inſerted into one Muſcle, be propagated from the ſame Trunks from which other Twigs paſs to other Muſcles; yet thoſe Twigs, whether of Arteries, Veins or Nerves, that are beſtowed on one Muſcle, are wholly ſpent thereon, and paſs not out through its inveſting Membrane again to any other. *Why called common.*

The *proper* Parts are ſo called, becauſe they are proper and peculiar to a Muſcle, and not common to any other Part. *The proper why ſo called.*

The firſt of theſe is *fibrous Fleſh*, or *fleſhy Fibres*, which ſome diſtinguiſh into two Parts, *Fibres* and *Fleſh*: and Fibres again into *fleſhy*, and *membranous*. *Theſe are,* 1. *Fibres.* (1.) *Fleſhy.*

A *Fibre* is thus defined by Dr. *Gliſſon*, in *Cap.* 4. de Ventric. *A Body in Figure like a Thread, ſlender, tenacious, tenſile, and irritable, made of ſpermatical Matter, for the ſake of ſome Motion and Strength.* Which he thus explains; "*In Figure like a Thread*] 'i. e. oblong and round; *Slender*] like a Spider's 'Web: *Tenacious*] whoſe Parts firmly cohere, and 'are not eaſily broken: *Tenſile*] *viz.* that may be 'extended as to Longitude, its Latitude being 'leſſen'd, and in like manner that may be thicken'd 'as to Latitude, its Longitude being ſhorten'd:

'*Irri-*

'*Irritable*] i. e. which by Irritation may be excited to contract it ſelf and the Irritation ceaſing, to be remitted of its own accord. *Made of ſpermatick Matter*] namely, if it be a bare Fibre; but if it be ſtuft with a *Parenchyma*, perhaps it is not always made of only ſpermatick Matter; (for the ſtuft Fibres may be divided into ſanguineous and ſpermatick; of the former Kind are thoſe of the Muſcles; of the latter, thoſe of the Stomach and Guts:) *for the ſake of ſome Motion and Strength*] for in that it is tenacious, it adds Strength to the Part, and that which is apt to be extended and contracted, is deſtin'd for ſome Motion.]

Their Courſe. Theſe *fleſhy Fibres* are commonly *ſtreight*, but not *always*, for ſometimes they run *round*, as in the Sphincters.

(2.) Membranous. Beſides theſe fleſhy Fibres, ſome later Anatomiſts deſcribe another ſort, which they call *membranous*, running from Tendon to Tendon, overthwart the other, cloathing them, and knitting them to one another; and make them to communicate to the fleſhy ones their motory Inſtinct, and alſo to convey to the Tendons the Spirits which flow into the Belly of the Muſcle by the Nerves, as likewiſe the ſame Spirits from the Tendons back again to the Belly of the Muſcle, as there is occaſion.

Fleſh what, and of what made The Fibres being ſtuft in their Interſtices with a ſanguineous *Parenchyma*, are that which we properly call *Fleſh*. For (ſaith Dr. *Croone*) all the Fleſh of a Muſcle (which makes the greateſt Part of it, and of which the Bulk of the whole Body chiefly conſiſts) ſeems to be nothing elſe but that Portion of the Blood that flows through the Intervals of the Fibres, which thickning by their Coldneſs, is ſtaid amongſt them. *Steno* denies any *Parenchyma*; and ſays, that every Fibre is tendinous

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at both Ends, and carnous in the Middle: and that the ſame Fibres, which being ſtraitly knit to one another, make the Tendon; being more looſly joined, make that we call Fleſh. With him conſent moſt of the more modern Anatomiſts, who will have all the fleſhy Fibres vaſcular or tubular, and to be filled with a Fluid. But tho' we ſhould grant they are, yet I think it is neceſſary, beſides them, to allow of a *Parenchyma*; otherwiſe the Muſcles of ſlaughter'd Animals would more conſiderably abate of their Bulk, for a good Part of this Fluid muſt needs be derived out of the Fibres, and be evacuated together with the Blood. For nothing can come into the Fibres, but out of the Blood; and upon Depletion of the Blood-Veſſels, what ſhould hinder the ſame from returning out of the Fibres into thoſe Veſſels again? And a *Parenchyma* is farther demonſtrated, in that in ſome Muſcles in fat People the (lean) Fleſh is interlarded with Fat, which Fat yet is not a neceſſary Part of a Muſcle, ſeeing it is not in all Muſcles, even in fat Perſons; and in very lean, in none.

Every Muſcle hath a proper *Membrane* that inveſts it, and diſtinguiſhes it from others. Whereto its Origin is owing, is difficult to determine. 'Tis moſt probable, that 'tis made out of the Fibres expanding themſelves at their Ends; to conceive which we muſt underſtand, that the Fibres run not lengthways of the Muſcle, ſo as to reach from one End of it to the other; but from one ſide of it to another, yet not directly, but a little ſloping. Notwithſtanding (ſo long as they continue fleſhy) they are ſtreight in Figure, if you conſider them a-part, and run parallel one by the ſide of another. But ſuppoſing this to be the Origin of this Membrane (which I propoſe as doubtful) we muſt not conceive that the Fibres

2. *A Membrane.*

are

are wholly ſpent thereupon, ſo as to terminate there; for under this Membrane they run (being diveſted of their *Parenchyma*) lengthways of the Muſcle, and conſtitute its Tendon.

3. A Tendon. Its Definition.

The laſt *proper* Part of a Muſcle is the *Tendon*, which *Spigelius* defines thus: *It is a ſimilar and ſimple Part, of a peculiar Kind, diffuſed through the whole Body of the Muſcle lengthways, which in ſome Part thereof is united* (and there it is white with a kind of Brightneſs, denſe, hard and ſmooth) *and in ſome divided and ſtuffed with Fleſh* (where it is not eaſily diſcernible:) *and ſeeing it is very much adapted for Contraction, when it is contracted at our Pleaſure, it moves together with it ſelf that Part into which it is inſerted. Steno* affirms the Riſe of a Muſcle to be tendinous, as well as its Inſertion; and defines a Tendon to be a Body continued from the Beginning of Muſcles to their End.

Which Muſcles have Tendons.

All Muſcles which are appointed for the moving of Bones, have Tendons which are inſerted into thoſe Bones they are to move: But commonly thoſe which move other Parts, as the Tongue, Lips, *&c.* as alſo the Sphincter of the Bladder, and *Anus*, have none, or however ſuch as are not eaſily diſcoverable; for indeed ſome affirm (as Dr. *Croone*) that every Muſcle has its Tendon.

Of what they are framed.

There are ſundry Opinions as to the *Subſtance* of a Tendon. *Spigelius* (as appears by the foregoing Definition) thinks it to be a *ſimple* Part, that is, *truly* ſimilar, and not appearing ſo to the Eye only. He ſays, it is neither a Nerve nor a Ligament, nor is it a Subſtance mix'd of both; but it is a Part of its own proper kind, ſofter than a Ligament, and harder than a Nerve. *Veſalius* on the other Hand affirms (with *Galen*) that it is a diſſimilar Body, compoſed of a Concourſe of Fibres, Ligaments, and very ſlender Nerves,

Nerves, growing by Degrees into one Body. *Diemerbroeck* doubts not but that the Nerve which enters into any Muscle, is extended as far as its Tendon (though it cannot be traced by the Eye thither) because of the very acute Sense of the Tendon; and yet the Tendon, he says, is not a meer Nerve, but 'tis likely that the Fibres and Membrane with a Ligament are intermixed with it.] I think 'tis most probable that it is only a Production or Prolongation of the Fibres freed from their *Parenchyma*, and cloathed with the investing Membrane of the Muscle, which it self seems also to be derived from the Fibres, as was noted above. But whatever its Substance be determin'd to be, it has always been held to be the principal Part of the Muscle, and the chief Instrument of its Action; though according to *Steno*, it is not it self that contracts, but the fleshy Fibres by its means. Dr. *Willis* thinks that the Animal Spirits which reside in the Muscle, do in cessation from Motion retire into the Tendons, and in Motion are darted from thence into the *parenchymatous* or fleshy Part, where they are joined with more, flowing in by the Nerves.

Their Figure.

The Tendons are sometimes round, as in the *Musculus biceps*; sometimes broad, as in the oblique and transverse Muscles of the Belly.

The Parts distinguished from the Position.

These are the *Parts constitutive* of a Muscle. It hath besides these, Parts derived from the *Position* (or rather from its Action) and those are three: The Head, the Tail, and the Belly. The *Head* or Beginning is that Part of the Muscle that arises from the Part *unto* which the Contraction is made: The *Tail* or *End* is that Part of it which is inserted into the Part which is moved: The *Belly* is all that (fleshy) Part that lies betwixt the Head and Tail. *Steno* thinks the *Head* and *Tail* of a Muscle are better expres'd by the *two Extreams*;

ſeeing if that be the Head to which the Contraction is made, then neither Extream, but the Middle or *Belly* is the Head, becauſe both the Extreams in Contraction move towards *it*: Or if any will contend that one End is moved towards the other, the ſame End is not always the quieſcent one in all the Motions of every Muſcle; and therefore the ſame End in ſeveral Motions being ſometimes the Head, and otherwhiles the Tail, this Diſtinction breeds but a Confuſion.

The Uſe of a Muſcle. The *Uſe* (or rather *Action*) of a Muſcle, was intimated in the laſt Part of the Definition, in that it was ſaid to be the Inſtrument of *free* local Motion; which Word we rather make Uſe of than of *voluntary*, becauſe Beaſts have Muſcles and Motion, unto whom *Will*, properly ſo called, is denied, becauſe it ſuppoſeth Reaſon. But hereof more in the next Chapter.

CHAP. II.

Of the Differences and Actions of the Muſcles.

The Differences of Muſcles. THE *Differences* of the Muſcles are taken from ſundry things: *Firſt*, from their *Subſtance*; ſo ſome are fleſhy, as moſt of the Tongue and *Larynx*; ſome are membranous, as the *Conſtrictores*, or internal *Adducents* of the Noſe; and ſome are partly fleſhy, and partly nervous, as the temporal.

Secondly, from their *Quantity*: Whence ſome are *long*, as the ſtreight Muſcles of the *Abdomen*, the longeſt of the Back, *&c.* Others *ſhort*, as the pyramidal at the Bottom of the *Abdomen*: ſome *broad*, others *narrow*; ſome *thick*, others *thin*, and ſlender, *&c.*

Thirdly,

Thirdly, from their *Situation*; from hence ſome are called *external*, ſome *internal*; ſome *oblique*, ſome *ſtreight*, ſome *tranſverſe*.

Fourthly, From their *Figure*: as *Deltoides*, becauſe it reſembleth the Greek Letter Δ *Delta*; ſome *round*, others *ſquare*, *&c.*

Fifthly, From their *Beginning*: ſo ſome proceed from *Bones*, one or more; ſome from *Cartilages* or Griſtles, as thoſe of the *Larynx*; and ſome from the Membrane that inveſts the Tendon of ſome other Muſcle, as the *Lumbricales* of the Hands and Feet.

Sixthly, From their *Inſertion*: Some being inſerted into *Bones*, as moſt are; ſome into *Cartilages*, as the Muſcles of the Eye-lids, *&c.* others into a *Membrane*, as thoſe of the Eye, *&c.*

Seventhly, From their *Compoſition* or *Variety of Parts*; ſo ſome are called *bicipites* and *tricipites*, having two or three Heads; others *biventres*, having two Bellies.

Eighthly From their *Action*; from whence four Differences of Muſcles are taken: For *firſt*, ſome are hence called *fraterni*, or *congeneres*, brotherly, becauſe they aſſiſt one another in their Action; ſome *Antagoniſtæ*, Adverſaries, becauſe they have an oppoſite Motion. *Secondly*, Some only move themſelves, as the Sphincters; ſome other Parts, as the reſt. *Thirdly*, Some have one only Action, as the greateſt Part of the Muſcles; ſome have divers Actions, as the *maſſeter* and *trapezius*. The *fourth* Difference is taken from the Variety of the Action; ſo ſome are called *flexores*, others *extenſores*; ſome *elevatores*, others *depreſſores*; ſome *adductores*, others *abductores*. Others *ſuſpenſores*, *rotatores*, &c.

Thus much of the *Differences* of Muſcles one from another: In the next Place proceed we to their *Action*, in which they all agree.

Their Action.

Now the proper *Action* of a Muſcle is the *Contraction* of it ſelf, whereby it brings the Part from which it ariſes, and that into which it is inſerted, nearer to one another. But whether this Contraction be from the Repletion, or from the Inanition of its Fibres, or by both theſe, or which way elſe, we ſhall not ſpend time to Philoſophize, nor is it agreed on among learned Men.

The efficient Cauſe, and mediate Inſtrument thereof.

The *efficient Cauſe* of this Action is the Soul, or the Loco motive Animal Faculty, which being invited, or offended by ſome Object, moves the whole Body, or ſome Member of it, in Purſuance or Avoidance thereof; of which Motion the Muſcle is the *immediate* Inſtrument, but the Nerves conveying the Animal Spirits to the Muſcle, are the *mediate*.

The Differences of their Motion.

I ſaid even now that the *proper* Action of a Muſcle is Contraction, but that is not the only Motion it is capable of, for Anatomiſts commonly aſcribe to it four different Motions: The *firſt* is that already mentioned, *viz.* Contraction: The *ſecond* is the Perſeverance of the Contraction: The *third*, the Relaxation of the Contraction; and the *fourth*, the Perſeverance of the Relaxation. The Perſeverance is called *Motus tonicus*, whenas the Member is ſtill kept in the ſame Poſture.

Theſe four Motions are common to every particular Muſcle: But there are others which agree, ſome to one, ſome to another, in reſpect of their Situation, or the Courſe of their Fibres: So a ſtreight Muſcle hath a ſtreight Motion; a tranſverſe, a tranſverſe Motion; an oblique, an oblique; and a Sphincter, an Orbicular.

The Reaſon and Manner of Motion.

As for the *Reaſon* and *Manner* of Motion, whereof different Authors have invented various *Hypotheſes*; as it would be too *large* a Task to examine theſe, ſo I think it too *difficult* to explain thoſe:

And

And therefore waving all ſuch ſpeculative and conjectural Diſcourſes, and frankly declaring with *Steno*, that to me *non liquent*; I proceed to the Deſcription of the Muſcles themſelves, wherein I may appeal to the Hand and Eye of any skilful Diſſector.

CHAP. III.

Of the Muſcles of the Eye-lids and Fore-head.

The Muſcles of the Eye-lids, viz. Recti.

THE upper Eye-lids are moved very manifeſtly, the lower more obſcurely; wherefore the upper have each a Muſcle that the lower want, which is called *Rectus* or *Aperiens*, ſerving to pull it up. It is placed in the upper Region of the Orbit of the Eye, and ſpringeth from the ſame Origin with the *Elevator* of the Eye (above it) namely, at the Hole through which the optick Nerve paſſes into the Orbit, and holds the ſame Courſe with it, being of the ſame Figure and Subſtance, *viz.* fleſhy, till at laſt parting from it, with a pretty broad but thin Tendon, it is inſerted into the Cartilage of the upper Eye-lid, which it ſerves to lift up, and ſo to open the Eye.

Theſe, I ſay, are proper to the *upper* Eye-lids; but the following belong to the *lower* as well as upper.

And Semi-circulares.

They are called *Claudentes*, or Shutters of the Eye lids, as alſo *ſemicirculares*; (others call them *Circulares*, taking them for one.) They are placed between the *membrana carnoſa* and the inner Membrane of the Eye-lids that is extended from the *Pericranium*. That which draweth down, or ſhutteth the *upper*, is the larger, and ariſeth from the inner corner of the Eye, and that part of the

Supercilium that is next the Noſe, with a ſharp Beginning; from whence it paſſeth tranſverſly toward the outward Corner, growing preſently fleſhy and broader, ſo that it filleth up all the Space betwixt the Eye-brow and the loweſt Edge of the Eye-lid on which the Hairs grow (which is called *Cilium* or *Tarſus*) and at length is inſerted into the outer Corner. That which moveth the *lower* (though but obſcurely) in order to ſhut it, is leſs, being membranous and thin, ariſing from the ſide of the Noſe with a ſharp Beginning, as the other; whence being carried tranſverſly, it comes to the Middle of the Eye-lid, where becoming ſomething fleſhy, it continues its Courſe to the outer Corner, which it turns about, and aſcending to the upper Eye-lid, is inſerted into it with a broad End. Theſe two Muſcles being contracted, ſhut the Eye, the greater drawing down the upper Eye-lid, and the leſs pulling up the lower. But the lower has no Muſcle to pull it down again, ſeeing its own Gravity, and the Relaxation of its Fibres is ſufficient for that purpoſe: whereas the upper, as was obſerved before, has a peculiar Muſcle to pull it up.

The Frontales. Yea, beſides the *Recti* aforeſaid, there ſometimes concur, when we would open our Eyes very wide, the *Muſculi frontales*, or Muſcles of the Forehead, which ſpring from the Skull near the coronal Suture, and having their outer Edge knit to the temporal Muſcles, are contiguous to one another with their other Side upon the Middle of the Fore-head, upon which they deſcend with ſtreight Fibres to the Eye-brows, where they terminate. By the help of theſe we draw up and wrinkle the Fore-head, and by Conſequence pull up the upper Eye-lid a little. The Skin grows very cloſe to theſe Muſcles.

Some

Some deſcribe another Pair of Muſcles of the Fore-head, called *Corrugantes*, whoſe Fibres deſcending a-ſlant from the lower Part of the *Frons* betwixt the Eye-brows, towards the Top of the Noſe (where they meet one another) help to knit the Brows (as we call it) when we frown. But theſe ſeem to be only a part of the frontal Muſcles, having their Fibres running in this Place a little obliquely. *Corrugantes.*

CHAP. IV.

Of the Muſcles of the Eyes.

THE Muſcles of each *Eye* are in Number ſix; four *ſtreight*, and two *oblique*. The *ſtreight* move the Eyes upwards and downwards, to the right hand and to the left: the *Oblique* move them obliquely. The *ſtreight* are more thick and fleſhy than the *oblique*. *Each Eye hath ſix Muſcles.*

As to their Beginning (*viz.* of the *ſtreight*) they have all the ſame Origin; as to their Progreſs, the ſame Structure; and as to their End, the ſame Inſertion. Their *Origin* is contiguous and acute, being at the Hole through which the optick Nerve enters the Orbit of the Eye, from whoſe Membrane they ſpring. Their *middle*, or Belly, is fleſhy, and almoſt round. Their End is a moſt thin and membranous Tendon, whereby they are inſerted into the *tunica cornea*, where it is pellucid, near the *Iris*, and ſo do encompaſs the whole Eye before as far as it is white. *Four ſtreight.* *Their Riſe and Inſertion.*

The *firſt* of the *ſtreight* is called *Attollens*, or *Elevator*, becauſe it moveth the Eye upwards; and it is ſomewhat larger than the ſecond, that moveth the ſame downwards, becauſe it requireth greater Force to pull any thing upwards than downwards.

wards. This firſt is otherwiſe called *ſuperbus*, becauſe that Motion of the Eye is owing to it, when we are ſaid to look high. For which reaſon the *ſecond* has the Name of *humilis*, becauſe by it we look down; whence alſo it is otherwiſe named *deprimens*. The *third* is called *adducens*, becauſe it moveth the Eye inwards towards the Noſe; as alſo *bibitorius*, becauſe we are wont to uſe it to look into the Glaſs or Cup when we drink. The *fourth* is called *abducens*, from its drawing the Eye outwards, from the inner Corner to the outer; and alſo *indignatorius*, becauſe that Motion or Caſt of the Eye (as we call it) is proper to Men in the Paſſion of Anger.

The firſt is placed in the upper Region of the Orbit, the ſecond in the lower (oppoſite to the upper) the third in the inner Corner of the Eye; the fourth in the outer.

Two oblique. Their Riſe and Inſertion.

The *oblique* Muſcles are called *circumagentes*, Winders or Rollers about, and *amatorii*, or amorous; and are in Number two. The *firſt* is *obliquus major*, or *ſuperior*, the upper and larger. This beginneth at the Hole by which the Optick Nerve enters into the Orbit of the Eye, as the four foregoing Pair did, and paſſing to the upper part of the inner Corner of the Eye, endeth in a ſmall and round Tendon, which paſſeth thro' a tranſverſe Cartilage there placed (called by *Fallopius*, *Trochlea*) as a Cord thro' a Pully, and is inſerted into the upper ſide of the *Cornea*, betwixt the *attollens* and *abducens*. This ſeems to be a very conſiderable Muſcle, ſeeing the fourth Pair of Nerves (called *Nervi pathetici*) are wholly ſpent upon it, according to Dr. *Willis*. The *ſecond* is *obliquus minor*, or *inferior*, the lower and ſmaller. This ſpringeth from the lower and almoſt outer part of the Orbit (namely, at the Juncture of the firſt Bone of the upper Jaw with the fourth) with a carnous

Be-

Beginning. It is ſlender, but not quite round, and paſſeth obliquely to the outer Corner of the Eye, which having turned about, it ends in a ſhort roundiſh and nervous Tendon, which meeteth with the Tendon of the other oblique Muſcle, and is inſerted obliquely near the *Iris*, betwixt the Tendons of the *attollens* and *abducens*, with the other, ſo that both ſeem to have but one Tendon. This rolleth the Eye towards the Noſe, as the other draweth it from it.

How theſe Muſcles are to be ſhewed.

Before you ſhew the Muſcles of the Eye, cut off the Fat with your Sciſſars, then ſhew firſt the *obliquus major*, then the *obliquus minor*, and laſt of all the four ſtreight Muſcles. Nevertheleſs let the *obliquus major* remain laſt, when all the reſt are taken away, that you may ſhew how the Tendon of it paſſeth through the *Trochlea* or Pully the more plainly.

Trochlea.

Which *Trochlea* is thus deſcribed by *Spigelius*: *It is a little round Cartilage hollowed like a Pipe, or piece of Straw that is ſuſpended by a Ligament in the inner Corner of the Eye*, through which the Tendon of the greater oblique Muſcle paſſing, procures unto that Muſcle the Name of *Trochlearis*.

CHAP. V.

Of the Muſcles of the Noſe.

The Noſe hath four Pair.

THE *Noſe* is not all of it moveable, but only its lower griſtly Parts, which are called *Alæ* or *Pinnæ*. And theſe are either drawn together to ſhut the Noſtrils, which is performed by the *adducent Muſcles*; or drawn aſunder to open the Noſtrils, which is done by the *Abducent*. And there are two Pair to ſerve each Office.

Before I enter upon the Deſcription whereof,

I deſire it may be noted (once for all) that tho' all the Muſcles of the Body be double (except the Sphincters) ſo that they are commonly reckoned by *Pairs*; yet in their Deſcription we ſhall ſpeak of them in the ſingular Number, as if there were but one of a ſort. Which Method (after this Advertiſement) can occaſion no Miſtake or Inconvenience, ſeeing all the Particulars that agree to one, agree to its Fellow likewiſe.

Two abducent. The *firſt* of the *abducent* or opening Muſcles is ſmall, rather Carnous than Membranous, ariſing from the upper Jaw-bone, near the firſt proper Muſcle of the Lips, and is inſerted partly into the lower part of the *Ala* of the Noſe, and partly into the upper Part of the upper Lip, by the Dimple in its middle, which is called *Philtrum*. The *ſecond* covering the ſide of the Noſe, begins at its Top near the *Foramen Lachrymale*, with an acute and fleſhy Origin, and deſcending obliquely by the Bone of the Noſe, it ends in a broad Baſis, and ſtill remaining fleſhy, is implanted into the *Ala*. It is near of a three-ſquare or triangular Shape, like the Greek Letter Δ *Delta*, whence it is called by ſome *Deltoides*. Theſe two by drawing the *Ala* upward widen and open the Noſtril.

Two adducent. The *Adducent* or cloſing Muſcles are very ſmall ones, ſo that they can hardly be diſcovered or diſtinguiſh'd exactly, but in them that have large Noſes. The *firſt* of theſe is *external* and fleſhy, riſing about the Root of the *Ala*, which it aſcends, creeping tranſverſly over it to the Ridge or Tip of the Noſe, into which it is inſerted. The *ſecond* is *internal*, and is hid in the Cavity of the Noſtril, under the inner Coat that covers it; it is membranous, and ariſes from the Extremity of the Bone of the Noſe, where the Cartilage is joined to it, and is inſerted into the *Ala*. The former being con-

contracted depreſſes the *Ala*; the latter draws it inwards, and ſo cloſes or conſtringes the Noſtril. And to the ſame End or Purpoſe there is another that ſerves (which is common) namely the *orbicularis* of the upper Lip, which by drawing the Lip downwards, doth at the ſame time conſtringe the Noſtrils.

Bartholin writes, that beſides theſe Muſcles, he has ſometimes found a ſmall carnous Muſcle reaching ſtreight down from the frontal Muſcle (with a broad Baſis, but preſently growing narrower) and ending about the Cartilage of the Noſe. Such as have this Muſcle can draw their Noſe (eſpecially its Skin) a little upwards: Which Motion we uſe, when (as *Horace* ſpeaks) *ſuſpendimus aliquem naſo*, we jeer or ſcoff at one.

CHAP. VI.

Of the Muſcles of the Lips and Cheeks.

THE Muſcles of the *Lips* are either *common* to the *Cheeks* and *Lips*, or *proper* only to the *Lips*.

Muſcles common to the Cheeks and Lips.

The *common* are two on each ſide. The *firſt* is called *Detrahens quadratus*: This is a thin but broad Muſcle reſembling a Membrane interlaced with fleſhy Fibres. It hath its beginning from the hinder ſide of the Neck, the Shoulder-blade, the *Clavicula* and the Breaſt-bone, and mounting up by oblique Fibres to the Face, is implanted into the Chin, Lips, and Root of the Noſe; which Parts it draws obliquely downwards. Sometimes it proceeds alſo to the Root of the Ear, and is reckoned for one of its Muſcles. It is called *Quadratus*, or four-ſquare, from its Shape. When a Convulſion happens in this Muſcle, it cauſes the *Spaſmus cinicus*, which we can imitate voluntarily by drawing down one ſide of the Mouth.

1. Detrahens quadratus.

The

2. Contrahen. The *ſecond* is called *Contrahens*, or *Buccinator* the Trumpeter. This lieth under the former, in the upper Part of it. It makes up all that Part of the Cheek which is diſtended in blowing hard. It ſprings from the Gums of the upper Jaw, and ends in thoſe of the lower. Moſt Anatomiſts deſcribe it to be of a round Figure. It is thin and membranous, interlaced with divers Fibres, and is knit ſo cloſe unto the Membrane which covereth the inſide of the Mouth, that it can hardly be ſevered from it. This Muſcle is not only of uſe to move the Cheeks with the Lips, but when it is contracted it turneth in the Meat upon the Teeth again that had got to betwixt them and the Cheek, in chewing of it.

Muſcles proper to the Lips. The Muſcles *proper* to the Lips are *five* Pair, and one odd one. The *Firſt* is *Par Attollens*. If both of theſe act together, they draw all the upper Lip directly upwards and outwards; but if only one, then it is but one ſide of the Lip drawn up obliquely. Each ſpringeth from the firſt Bone of the upper Jaw, where the Ball of the Cheek is. At its Riſe it is broad and fleſhy: From thence marching obliquely to the forepart, it is inſerted into the ſide of the upper Lip near to the Noſe.

1. Attollens.

2. Abducens. The *ſecond* is called *Abducens*, and aſſiſteth the Motion of the former, or rather draweth the upper Lip more to one ſide. It ariſeth out of the Cavity that is under the Ball of the Cheek, with a fleſhy but ſlender and round Beginning, and being covered with much Fat, it is implanted into the *Frænum* where the Lips meet, at the Corner of the Mouth.

3. Jugale. The *third* Pair is called by *Riolanus*, *Zugomaticum* or *Jugale*, becauſe it ariſes outwardly from the Jugal Proceſs. It is fleſhy and round, and deſcending obliquely through the Cheek, is ter-

minated

minated near the Corner of the Mouth, and ſerves to draw both Lips upwards ſide-ways; for it is common to them both.

The *fourth* Pair is the *Deprimens*, which pulleth down the lower Lip. It ſpringeth broad and fleſhy from the lower and fore-ſide of the Chin, from whence aſcending obliquely, it is inſerted into the middle of the under Lip, continuing broad from its Origin to its End. 4. Deprimens.

The *fifth* Pair may be called *obliquè detrahens*, for it draws the lower Lip obliquely downwards and outwards. It ſprings from the lower ſide of the lower Jaw with a fleſhy and broad Beginning (being ſometimes extended to the middle of the Chin) from hence it goes upwards, and growing narrower by Degrees, it is inſerted obliquely into the lower Lip near its Corner. Some make but one of this and the immediately fore-going; as alſo one other of the ſecond and third, but they are indeed diſtinct. 5. Oblique detrahens.

And theſe are all of them Pairs, one on each Side; but this which follows is ſingle, namely the *Orbicularis* or *Conſtringens*, and is common to both Lips. It is otherwiſe called *Oſculatorius*, becauſe it contracteth the Lips, in Kiſſing. This is that which makes the proper Figure and ſoft Subſtance of both the Lips, encompaſſing the whole Mouth like a Sphincter, which by its orbicular Fibres it conſtringes, or purſes up when one is ſaid to Simper. It is cloſely knit to the Skin of the Lips, thro' which it looks red when we are well, and pale when we are ſick. Some ſuppoſe this to be no Muſcle, but a ſpongy ſort of Fleſh, endued with no true muſcular Fibres, *viz.* ſuch as are capable of true muſcular Contraction. But I think there is Reaſon enough to acknowledge it for a true Sphincter Muſcle, ſeeing the purſing up of the Mouth can be performed by none of the other Muſcles that belong to the Lips. 6. Conſtringens.

CHAP.

CHAP. VII.

Of the Muſcles of the lower Jaw.

THE *lower Jaw* (for the *upper* is immovable, and therefore has no Muſcles) is moved upwards, downwards, towards the right and left Sides, and backwards. For the Performance of theſe Motions *five* Pair of Muſcles are appointed, of which there is only one Pair that draweth the Jaw downwards, all the others in ſome meaſure upwards, but chiefly the firſt Pair or Temporal. The Reaſon why there is ſo ſlender a Proviſion for pulling the Jaw down is, becauſe upon the Relaxation only of thoſe Muſcles that draw it up, its own Gravity is ſufficient to make it fall down; but yet that that Motion may be performed the more quickly and nimbly in chewing or ſpeaking, Nature has appointed one Pair of Muſcles to promote it.

The lower Jaw hath five Pair of Muſcles.

1. Temporale.

The *firſt* Pair of the *Shutters* or Drawers up, is called *Temporale*, and is the ſtrongeſt and largeſt. It ſpringeth from the Bones of the *Frons*, *Sinciput* and Temples, and from *Os ſphenoides*, with a fleſhy, large and ſemicircular Beginning, and on its outter ſide is covered with the *Pericranium*, its inner lying next the *Perioſteum*. Its Fibres, the farther they are from its middle, the more obliquely are they carried towards its Tendon, for the farther it deſcends, the narrower (but thicker and more carnous) it grows; and at length paſſing under the *Os jugale*, it embraceth and is inſerted into the thin and broad Proceſs of the lower Jaw (called κορώνη) with a ſhort, but very ſtrong Tendon. *Spigelius* ſays, this Tendon is extended thro' the whole Muſcle, in the midſt of its fleſhy Subſtance.

Whence

Whence it is, that if this Muſcle be wounded, and inflamed, moſt bitter Pains and dangerous Symptoms enſue, partly becauſe the Tendon paſſeth ſo; partly becauſe it is covered with the *Pericranium*. This Muſcle forcibly pulleth up the lower Jaw, and ſo ſhutteth the Mouth. *Why the Wounds of the temporal Muſcle are dangerous.*

The *ſecond* is called *Maſſeter*, becauſe it ſerveth for chewing, by moving the Jaw to the right and left Sides: From its Situation it may be called *laterale*. This hath two Beginnings; one of which is nervous, large and ſtrong, ſpringing from the Suture, where the firſt Bone of the Jaw is joined to the fourth; the other fleſhy, proceeding from the *Os jugale*, from whence marching towards the Chin, it is implanted into the whole Breadth of the lower Jaw ſtrongly. The Fibres of this Muſcle, by reaſon of its two Beginnings, croſs one another; ſo that it does not only move the Jaw laterally, but backwards and forwards alſo; upon which account ſome eſteem it a double Muſcle. 2. Maſſeter *or* laterale.

The *third* Pair is called *Pterygoideum* (or *Aliforme*) *externum*, or *Maxillam abducens*. This hath alſo a double Beginning, partly nervous, and partly fleſhy; ſpringing partly from the upper external ſides of the Wing like Proceſs of the *Os ſphenoides*, partly from the rough and ſharp Line of the ſame Bone. Whence marching down with ſtreight Fibres, it becometh greater and thicker, and at length is inſerted by a ſtrong Tendon into the inſide of the *Condyloides* Proceſs of the lower Jaw, under the Tendon of the temporal Muſcle. This moveth the Jaw forward, whereby the Teeth of the lower Jaw are made to ſtand farther out than thoſe of the upper. 3. Aliforme externum, *or* maxillam abducens.

The *fourth* Pair is termed *Maxillam adducens*, or *Pterygoideum internum*. This draweth the Jaw towards its Head, or backward. This, in the Beginning 4. Aliforme internum, *or* maxillam adducens.

ginning being nervous, doth ſpring from the inner Cavity of the wing-like Proceſs of the *Os ſphenoides*; then becoming fleſhy, large and thick, and marching down by a ſtreight Paſſage, it is inſerted into the inner and hinder Part of the lower Jaw, by a nervous, broad and ſtrong Tendon. Beſides its more proper Action of drawing the Jaw backwards, it alſo helps the temporal Muſcle to draw it up, and ſo to the ſecond and third pair, in ſome meaſure, wherefore we rank all theſe four amongſt the *Shutters*.

5. Deprimens, *or* biventre.

The *fifth* and laſt Pair *opens* the Mouth by pulling down the Jaw, whence it is called *deprimens*, and otherwiſe *digaſtricum* or *biventre*, becauſe it hath two Bellies. Anatomiſts commonly reckon this for the ſecond Pair of the Movers of the lower Jaw; but ſeeing it has a diſtinct Office from the other four, we have placed it laſt. It has its Beginning from the *Styloides* Proceſs of the Temple-Bone, where it is nervous and broad; and afterwards becoming fleſhy, ſmall and round, it paſſeth downwards; and in its Middle, where it cometh to the Flexure of the lower Jaw-bone, it loſeth its fleſhy Subſtance, and degenerates into a nervous and round Tendon; but by and by it becomes carnous again, and going along the inner Side of the lower Jaw, is inſerted into its Fore-part under the Chin. It loſeth its fleſhy Subſtance, and becomes tendinous in its middle, that it may give way to the Jugular Vein aſcending in that Place. This Muſcle, as hath been ſaid, draws down the Jaw; in which Action ſome think it is partly aſſiſted by the *Par quadratum*, deſcribed in the foregoing Chapter.

CHAP.

CHAP. VIII.

Of the Muſcles of the Ear.

THE *Ear* conſiſts of an *outer* and *inner* Part, and each has its proper Muſcles.

The *outer* Part is moved but very obſcurely, becauſe in Men the Muſcles are exceeding ſmall; ſo that *Galen* calls them only Lineaments, or Reſemblances of Muſcles. There are commonly reckoned *four* of them, which by their Situation ſeem fit to move this *outer* Part of the Ear (called *Auricula* by *Spigelius*, to diſtinguiſh it from the *inner* Part called *Auris*) four manner of ways. *The Auricula hath four Muſcles.*

The *firſt* is called *Attollens*. This ariſes at the outer Edge of the frontal Muſcle (where it is contiguous to the temporal) with a thin and membranous Beginning; and in its Deſcent lies upon the temporal Muſcle, by degrees becoming narrower, and is inſerted into the upper Part of the Ear, which it moveth upwards and forwards. 1.

The *ſecond* is called *detrahens*. This ariſeth broad and carnous from the mammillary Proceſs, and growing narrower, is inſerted into the Root of the Cartilage of the Ear, ſometimes by two, ſometimes by three Tendons. It draweth the Ear upwards and backwards. 2.

The *third* is called *adducens ad anteriora*, whereby the Ear is drawn forward and downward. This is but a Particle of the *Muſculus quadratus*, that pulleth down the Cheeks, deſcribed before, which aſcending with its Fibres, is implanted into the Root of the Ear. 3.

The *fourth* is *abducens ad poſteriora*, which draws the Ear backward. This hath its Beginning in the Back-part of the Head, from the Tunicles of the Muſcles of the *Occiput*, above the *Proceſſus mammillares*, where it is narrow, but waxing 4.

broader, it is carried downward tranſverſly and is inſerted into the Ear behind. All theſe Muſcles in Horſes, Oxen, and the like, are very large to what they are in Men (yea, they have more than theſe) whereby they can move their Ears more ſtrongly and apparently, to ſhake off Flies or any thing that offends them.

Monſ. *du Verney* only reckons two Muſcles of the Auricle, the firſt of which, he ſays, is made up of certain carnous Fibres ariſing from that Part of the *Pericranium* that covers the temporal Muſcle, from whence deſcending in a ſtreight line, it inſerts itſelf into the upper and back-part of the *Concha*. The ſecond he ſays, likewiſe conſiſts of five or ſix carnous Fibres, that take their Riſe from the upper and foremoſt Part of the Proceſs *Maſtoides*, and deſcending obliquely for about an Inch, terminate at the middle of the *Concha*.

The Auris *three.*

In the *inner* Part of the Ear (called *Auris*) there are three. The firſt is called *Externus*. It is ſmall, 1. ſpringing pretty broad from the upper part of the *Meatus auditorius*, then becoming narrower, it grows into a very fine and ſmall Tendon, which being carried contiguous to the *Tympanum*, is inſerted into the longer Proceſs of the *Malleus*. The Handle of which *Malleus*, adhering to the *Tympanum*, when the *Malleus* is moved by this Muſcle, the *Tympanum* is ſo alſo, both of them being drawn a little outward and upward.

2. The *ſecond* is called *Internus*. This is very ſmall, and is placed within the *Os Petroſum*. It hath its Beginning in the *Baſis* of the Wedge-like Bone, there where it is joined with the *Proceſſus petroſus*, and at about its Middle, it is divided into two ſmall Tendons, whereof the one is inſerted into the ſhorter Proceſs of the *Malleus*, and the other into the Neck or Handle of it. This draws the Head of the *Malleus* obliquely forward, and pulls

it

it inward from the *Incus*, and together with the *Malleus*, it draws the *Tympanum* alſo inwards, to which the Handle of the *Malleus* is affix'd.

Theſe two *du Verney* reckons for Muſcles of the *Malleus*, and he deſcribes a *third*, belonging to the *Stapes*, which (I think) no former Anatomiſt hath obſerved. He ſays it is hid within a Quill-like Cavity, formed in the *Os petroſum*, almoſt at the Bottom of the Barrel, from whence it takes its riſe. Its Belly is thick and carnous, and in a little ſpace it ends in a very looſe Tendon, which inſerts itſelf into the Head of the *Stapes*. The Cavity which contains the Belly of the Muſcle is about the ſixth part of an Inch long, and is much wider than the Hole by which the Tendon of the Muſcle paſſes. 31

CHAP. IX.

Of the Muſcles of the Tongue.

THE *Tongue* being the chief Inſtrument of Speech, and a part which ſerves to roll the Meat in the Mouth this way and that way, has all manner of Motions, being moved forward and backward, upward and downward, to the right Hand and to the left; it is alſo ſtretched out broad, or contracted. Its Muſcles are either *proper* to itſelf, or *common* to it with the *Os hyoides* (to be deſcribed in the next Chapter.)

The Tongue has five Pair.

It has *five* pair of *proper* Muſcles. The *firſt* is *Genioglоſſum*, ſo called from its Riſe and Inſertion, (γένειον the *Chin*, and γλῶσσα the *Tongue*) as moſt of the reſt are. This pulleth the Tongue forward without the Teeth and Lips. It ſpringeth from that rough Part of the lower Jaw-bone which is in the middle of the Chin, in the inner and lower ſide of it; and is inſerted into the lower ſide, and towards the Root of the Tongue. 1

2. The *ſecond* is called *Ypſilogloſſum* (on the ſame account.) It ariſeth from the middle and upper Part of the *Os hyoides*, or *Ypſiloides*, and ends in the middle of the Tongue, which it draws ſtreight backwards or inwards.

3. The *third* is called *Mylogloſſum*. This ſpringeth from the inner Part of the lower Jaw, where the fartheſt *grinding Teeth* are (whence it has its Name) and is inſerted into the Ligament by which the Tongue is tied to the *Fauces*. Authors differ about the Uſe of this Pair; ſome thinking that it draws the Tongue downward; others, that if both of them act together, they draw the Tip of the Tongue ſtreight upward and backward to the Palate, and upper Teeth; if but one, that it draws it obliquely upward towards its own Side.

4. The *fourth* is called *Ceratogloſſum*, becauſe it ariſeth from the *Horn* of the *Os hyoides*. It is inſerted into the Side of the Tongue. If both of theſe be contracted at once, they draw the Tongue ſtreight downward and inward; but if only one, then is the Tongue drawn obliquely to that Side.

5. The *fifth* Pair is called *Styloglossum*, becauſe it ariſeth from the *Styloides Proceſſus* of the Temple-Bone; from which ſpringing fleſhy and ſmall, but afterwards becoming broader and thicker, it is inſerted into the ſide of the Tongue, at about the middle of its Length. If both theſe act together, they pull the Tongue upward and inward; but if one only, then to the right Hand, or to the left.

CHAP.

CHAP. X.

Of the Muscles of the Bone of the Tongue, called Os Hyoides.

THIS Bone is moved upwards, downwards, forward, backward, and towards the Sides, as the Tongue is; for seeing it is fixed to the Root of the Tongue, they must needs accompany one the other in their Motions; so that the Muscles that are inserted into this Bone, moving the Tongue also, they are esteemed *common* to both.

To perform these Motions, it hath *four* Pair of Muscles. The *first* is called *Sternohyoideum*. This springing from the upper, but inner Part of the *Sternum*, with a broad and carnous Beginning, and ascending under the Skin of the Neck by the Wind-pipe, still keeping the same Largeness and Substance, is inserted in the Root or *Basis* of the *Hyoides*, which it moveth (and the Tongue with it) downward and backward. Os hyoides *hath four Pair.* 1.

The *second* is opposite to this, and is called *Geniohyoideum*. This springing from the inner Part of the Chin (by the *Geniogloſſum*) fleshy and broad, is inserted into the upper Part of the *Basis* of the Bone, where a Cavity is made to receive its Tendon, and draweth it streight upwards, and a little forwards. 2.

The *third* is called *Coracohyoideum*. It ariseth from the upper Side of the *Scapula*, near the *Coracoides Processus*, having a carnous Beginning, and lurking under the *Levator* of the Shoulder-blade, called *Musculus Patientiæ*, it ascends under the *Parmastoides*, that bends the Head, where it loseth its fleshy Substance, and degenerates into a nervous and round Tendon. But as soon as it is past this, it becomes carnous again; and so continues till it is inserted into the Horns of the *Os hyoides*. Con- 3.

ſidering its Slenderneſs, it is the longeſt Muſcle of the Body, and has two Bellies, like the *Par deprimens*, that pull down the lower Jaw. The Reaſon of its becoming tendinous in the middle, *Spigelius* thinks to be, that it may make way for the *Par maſtoides*, as being more worthy than it ſelf; but Dr. *Croone* is of Opinion, that the Reaſon is, that it may give way to the *Carotides* aſcending under it. Its Office is to pull the Bone obliquely downwards.

4. The *fourth* is *Styloceratohyoideum*. This riſeth from the Root of the *Proceſſus ſtyloides*, and endeth in the Root of the Horn of the *Os hyoides*, which it draweth obliquely upward.

CHAP. XI.

Of the Muſcles of the Larynx.

The Larynx hath two Pair of common Muſcles.

THE *Larynx* conſiſts of four Cartilages (beſides the *Epiglottis*) of which we have treated in *Book* II. *Chap.* 14. Of theſe only three are moveable, *viz.* the *Thyreoides*, or Buckler-like, which is one; and the *Arytænoides*, or Ewer-like, which are two. By theſe latter is the *Rimula* of the *Glottis* formed, for the widening and ſtraitning, or opening and ſhutting whereof, the Muſcles of the *Larynx* ſerve. Theſe are divided into *common* and *proper*. The common ſpring from other Parts, but are inſerted into one of the Cartilages; the proper both ariſe from, and are inſerted into them. The *common* are *two* Pair, *viz.* *Hyothyreoideum* and *Sternothyreoideum*.

1. The *Hyothyreoideum* ſpringeth from the whole *Baſis* almoſt of the Bone of the Tongue, having a broad and carnous Beginning; from whence deſcending with ſtreight Fibres, and covering all the Out-ſide of the Cartilage *Thyreoides*, it is in-

inserted into its under Side. When this is contracted, it draws the buckler-like (or *Thyreoides*) Cartilage upwards and inwards, and thereby straiteneth the Chink of the *Larynx*.

The *Sternothyreoideum* ariseth from the upper and inner Part of the *Sternum* with a carnous and broad Beginning, from whence ascending with streight Fibres up by the Sides of the Wind-pipe (continuing the same Largeness and Substance) it is at last inserted into the lower Side of the buckler-like Cartilage, by drawing down which it opens or widens the Chink. *Diemerbroeck* assigns clear contrary Actions to these Muscles, *viz.* that the former widens, and this latter straitens the *Rimula* of the *Larynx*. 2.

The *proper* are *five* Pair (or only nine Muscles, as some reckon, esteeming the fifth Pair to be a single Muscle.) The *first* Pair is called *Cricothyreoideum anticum*. This springeth from the fore-part of the *Cricoides* or ring-like Cartilage (*viz.* that which is immoveable) and is inserted into the lateral Parts of the *Thyreoides*, which it moves forwards, and so widens the *Rimula*, for the forming of a big Voice. *Bartholin*, from the Insertion of the Nerve, says, it arises from the *Thyreoides*, and is inserted into the *Cricoides*. Also if this Pair be very broad, he says, it may be divided into two Pair (which *Riolanus* has done) and then the second may be called *Cricothyreoideum laterale*. *Five Pair of proper.* 1.

The *second* Pair which is called *Cricoarytænoideum posticum*, springeth carnous from the hinder and lower Part of the *Cricoides*, and ascending with streight Fibres, is inserted with a nervous End into the lower Side of the *Arytænoides*, serving to pull its two Cartilages side-ways, and thereby to open and widen the *Larynx*. 2.

The *third* is *Cricoarytænoideum laterale*, which springeth from the Side of the *Cricoides*, where it 3.

is broadeſt, with a ſlender Beginning; but growing preſently larger, it is implanted into the Side of the *Arytænoides*, in that part that the foregoing did not cover. This openeth the *Larynx*, by drawing the Cartilages obliquely aſide, and ſo aſſiſteth the Action of the former.

4. The *fourth* Pair is called *Thyreoarytænoideum*. This is internal, carnous and broad, ariſing from the fore interiour Part of the *Thyreoides*, and is inſerted into the ſide of the *Arytænoides*, whoſe Cartilages it draws the one towards the other, and ſo ſtraitens the *Larynx*.

5. The *fifth* and laſt is reckoned by ſome for a Pair, and by others but for one Muſcle. It is called *Arytænoides*, becauſe it has its Riſe from an Inſertion into the Cartilage ſo called. Its Riſe is at the hinder Line of the Cartilage, from whence being extended with tranſverſe Fibres, it is inſerted into the ſide of the ſame, and by conſtringing of it, ſtraitens the *Larynx*.

Theſe are the Muſcles that perform the Motions of the *Larynx*; but as to the Uſe of each Particular, Authors diſagree very much. Dr. *Croone* gives this general Rule to underſtand their Uſes, That thoſe which lie on the fore-ſide of the *Larynx*, ſerve to open or widen the *Rimula*; and thoſe which lie on the hinder-ſide, to ſtraiten or ſhut it. To whoſe Opinion great Deference is owing.

As for the *Epiglottis*, which is reckoned for the fifth Cartilage of the *Larynx*, though in ſome Brutes it have Muſcles, yet Anatomiſts generally agree, that in Man it has none, nor is moved with a voluntary Motion, but is only depreſſed by the Weight of what is ſwallowed, and by the drawing of the Tongue backward or inward; which Motion being over, the *Epiglottis* ſtands up again in its natural and proper Poſture, and ſo opens the *Larynx*.

CHAP.

CHAP. XII.

Of the Muſcles of the Uvula, *Palate and Throat.*

THE *Uvula* is ſaid by *Veſlingius*, *Riolanus*, *&c.* to have two Pair of Muſcles to hold it up; of which one is called *Pterygoſtaphilinum externum*, which ſpringeth from the upper Jaw, a little below the furthermoſt Grinder, and is inſerted into the Side of the *Uvula*: The other *Pterygoſtaphilinum internum*, proceeding from the lower Part of the internal Wing of the *Pterygoides Proceſſus*, and inſerted into the *Uvula* in like manner. But theſe Muſcles are very hard to diſcover: And indeed there ſeems no Occaſion for them, ſeeing the *Uvula* has no apparent Motion, and its own Frame ſeems ſufficient to ſuſpend it.

The Uvula ſaid to have two Pair of Muſcles.

From the aforeſaid wing-like Proceſs (of the *Os cuneiforme*) does there another Pair of Muſcles ariſe, firſt found out by Dr. *Croone*, and by him called *Pterygopalatinum*. Its Inſertion is into the Roof of the Mouth by the Side of the Palatine Gland (deſcribed in *Book* III. *Chap. ult.* from *Steno*.) Its Uſe is very obſcure; but perhaps in ſtrong hawking it may ſerve to compreſs the ſaid Gland a little, and to ſqueeze out of it ſome of that Humour that is ſeparated in it.

The Palate hath one Pair.

The *Throat*, or the Beginning of the *Oeſophagus*, called *Pharynx*, hath ſeven Muſcles; to wit, *three* Pair and a *Sphincter*.

The Throat hath three Pair, and a Sphincter.

Of the Pairs, the *firſt* is *Sphenopharyngæum*. This ſpringeth from the ſharp Point of the *Os ſphenoides*, with a ſmall and nervous Beginning, and paſſing downward, ends in a fine Tendon, which is inſerted obliquely into the lateral Part

1.

of

of the Palate and *Pharynx*, which it widens in ſwallowing.

The *ſecond* Pair is called *Cephalopharyngæum*, and ſpringeth from that Part where the Head is joined to the firſt *Vertebra* of the Neck; from whence marching down, it is ſpread about the *Pharynx* with a large *Plexus* of Fibres, and ſeemeth to make its Membrane. This ſtraitens the Throat in ſwallowing.

3. The *third* is *Stylopharyngæum*. This ſpringing from the *Styloides* Proceſs of the Temple-bone, is inſerted into the Sides of the *Pharynx*, to dilate it.

4. That Muſcle which hath no Fellow, is called *Oeſophagiæus*. This ariſes from one Side of the *Thyreoides* Cartilage, and circularly encompaſſing the *Pharynx* with tranſverſe Fibres, is inſerted into the other Side of the *Thyreoides*; and ſerves to contract the Mouth of the Gullet, as the *Sphincters* of the *Anus* and Bladder do thoſe Parts.

CHAP. XIII.

Of the Muſcles of the Head.

The Muſcles of the Head are common or proper. The proper are eight Pair.

THE Muſcles of the *Head* are either *common* or *proper*. The *common* are thoſe which move the Head together with the Neck, which are to be deſcribed in the next Chapter.

The *proper* are thoſe which only move the Head, the Neck remaining unmoved, and theſe are in Number ſixteen, or eight Pair, and move it either forward or backward, to one ſide or the other, or about.

1. The *firſt* Pair, called *Maſtoideum*, bend the Head forward, if both act together; but on one ſide obliquely, if but one. Theſe have each a double

double Beginning; one nervous, from the Top of the *Sternum*; the other carnous, from the upper ſide of the *Clavicula*; which Origins joining, it becomes wholly carnous; and aſcending obliquely by the Neck, at laſt is inſerted with a carnous End into the mammillary (or *maſtoides*) Proceſs of the Temple-bone. This is the only Pair that is placed in the Fore-part, and bows the Head forward; all the reſt are ſeated behind, of which the five next bend it backwards, if both act, (which is called extending of the Head) or a little ſide-ways, if but one; and the two laſt ſerve to turn it about.

The *ſecond* Pair is called *Splenium*, or *Triangulare*. It riſes with a nervous Beginning from the Spines of the five uppermoſt *Vertebræ* of the *Thorax*, and of the five lowermoſt of the Neck; from whence aſcending, and becoming thick and carnous, it is implanted into the *Occiput* with a broad and fleſhy End. 2.

The *third* is called *Complexum* or *Trigeminum*, becauſe it has ſo plainly a threefold Beginning, that it ſeems to be a Compound of three Muſcles. *One* Beginning is from the tranſverſe Proceſſes of the fourth and fifth *Vertebræ* of the *Thorax*; a *ſecond*, from thoſe of the firſt and ſecond of the ſame; and a *third*, from the Spine of the ſeventh *Vertebra* of the Neck: All which in their Aſcent being united into one, are inſerted into the *Occiput*, ſometimes by one, and ſometimes by a triple Tendon. 3.

The *fourth* Pair is called *parvum & craſſum*, becauſe it is but a *little* one, yet pretty *thick*. This lieth under the third Pair. It ariſes nervous from the tranſverſe Proceſſes of the ſix uppermoſt *Vertebræ* of the Neck, and is inſerted into the hinder Root of the mammillary Proceſs. 4.

The

5. The *fifth* Pair is *Rectum majus.* Theſe ſpringing from the Tip of the Spine of the ſecond *Vertebra* of the Neck, are inſerted into the *Occiput.*

6. The *ſixth, Rectum minus.* Theſe lie under the former, and proceeding from the Back-part of the firſt *Vertebra*, end into the *Occiput.*

Theſe five laſt ſerve all to bow the Head backward, or extend it; the two following turn it about, as was obſerved before.

7. The *ſeventh* is *Obliquum ſuperius.* This Pair lies under the two *Recta*, anſwering to them in Subſtance and Form. It ſprings from the tranſverſe Proceſs of the firſt *Vertebra* of the Neck, and is implanted into the *Occiput*, by the outer ſide of the *Recta.* Some ſay its Riſe is here, and its Inſertion into the *Vertebra.*

8. The *eighth, Obliquum inferius.* This riſes from the Spine of the ſecond *Vertebra* of the Neck, and is inſerted into the tranſverſe Proceſs of the firſt *Vertebra* of the ſame. So that having both its Riſe and Inſertion in the Neck, it might juſtly be reckoned for a Muſcle thereof, and ſo ſhould have been deſcribed in the next Chapter: But we have ranked it among thoſe of the Head, partly from the Authority of moſt Anatomiſts, who generally have done ſo; and partly becauſe the firſt *Vertebra* into which it is inſerted, always follows the Motion of the Head, as ſhall be ſhewn in the next Book, *Chap.* 10. Of the Uſe of theſe two laſt Pairs we have ſpoken already.

CHAP.

CHAP. XIV.

Of the Muſcles of the Neck.

THE *Head* is not only moved by the *proper* Muſcles aboveſaid primarily, but ſecondarily alſo by theſe of the *Neck*, which are therefore called *common*, and are eight in Number, on each ſide four. The firſt and ſecond Pair bend the Neck, and together with it the Head directly backward, or obliquely; the third and fourth directly forward, or to one ſide, as both or one act. *The Muſcles common to the Head and Neck are four Pair.*

The firſt is called *Spinatum.* This proceeding from the Roots of the *Spinæ* of the ſeven upper *Vertebræ* of the *Thorax*, and of the five loweſt of the Neck, is inſerted ſtrongly into the whole lower ſide of the Spine of the ſecond *Vertebra* of the Neck. 1.

The *ſecond*, *Tranſverſale.* This riſing from the tranſverſe Proceſſes of the ſix upper *Vertebræ* of the *Thorax*, is inſerted into the outſide of all the tranſverſe Proceſſes of the *Vertebræ* of the Neck. 2.

The *third*, *Longum.* This being placed behind the *Oeſophagus*, doth ſpring from the Bodies of the fifth and ſixth *Vertebræ* of the *Thorax*, and as it aſcends, is knit to the ſides of the Bodies of all the *Vertebræ*, till it come to the firſt or higheſt of the Neck, where each touching other, they are both inſerted into its Proceſs, which anſwers to the Body of the other *Vertebræ.* 3.

The *fourth*, *Triangulare*, or *Scalenum.* It proceeds carnous from the firſt Rib, and is inſerted into the inſide of all the tranſverſe Proceſſes of the Neck, except ſometime the firſt and ſecond. It is perforated, to make way for the Veins and Arteries, which paſs to the Arms. The Uſes of all theſe Pairs were ſhewn at the Beginning of the Chapter. 4.

CHAP.

CHAP. XV.

Of the Muſcles of the Thorax.

HAving done with the Muſcles that belong to the Head, the higheſt *Venter*, we come now to thoſe of the Middle or *Thorax*, which aſſiſt Reſpiration. Of theſe ſome dilate the Breaſt in Inſpiration, ſome contract it in Expiration.

The Dilaters. Of the *Dilaters*, the *firſt* is called *par ſubclavium*. This ariſeth fleſhy from the inſide of the *Clavicula* near the Shoulder-point, and paſſing obliquely (or almoſt tranſverſly) is inſerted into the firſt Rib, near to the *Sternum*.

1.

2. The *ſecond* is *Serratum majus anticum*. This ariſes from the inſide of the *Baſis* of the Shoulder-blade, and the two uppermoſt true Ribs, and is inſerted into the five loweſt true Ribs, and two uppermoſt baſtard Ribs, before they end into Cartilages. It is called *Serratum* or Saw-like, becauſe its unequal *Extremities* being intermixed with the like unequal *Beginnings* of the obliquely deſcending Muſcle of the *Abdomen*, imitate the Teeth of a *Saw*.

3. The *Third* is *Serratum poſticum ſuperius*. This lying under the *Rhomboides* (or fourth Muſcle of the *Scapula*) ſpringeth membranous from the Spines of the three loweſt *Vertebræ* of the Neck, and of the firſt *Vertebra* of the Back, and is inſerted into the three or four uppermoſt Ribs.

4. The *fourth* is *Serratum poſticum inferius*. This ariſeth from the Spines of the three loweſt *Vertebræ* of the Back, and of the firſt of the Loins, and is inſerted into three or four of the loweſt (ſhort) Ribs.

5. *Fifthly*, *The eleven external Intercoſtals*, which perform the Office but of one Muſcle. Theſe ſpring

ſpring from the lower Part of the upper Rib, and are inſerted into the upper Part of the lower Rib obliquely.

There is another Muſcle beſides theſe that aſſiſts the widening of the Breaſt, namely the *Diaphragm*. But of it we ſpoke at large in *Book* II. *Chap.* 3. where the Reader may find its Deſcription and Uſe.

Theſe that follow *contract* the Breaſt. *Firſt*, the *par triangulare*. This ariſing from the middle Line of the *Sternum*, is inſerted into the bony Ends of the third, fourth, fifth and ſixth true Ribs, where they are joined to the Cartilages. *Steno* ſays, its Riſe is from the *Sternum*, and Inſertion into the Ribs. *The Contracters.* 1.

The *ſecond* is *Sacrolumbum*. This ariſeth from the Edge of *Os ileum*, the upper Part of *Os ſacrum*, and the Spines of the *Vertebræ* of the Loins; and aſcending up to the Ribs, is implanted into each of them in their lower Side, about three Fingers breadth from the Spine, by a particular Tendon. *Diemerbroeck* deſcribes another Pair oppoſite to this (which he calls *Cervicale deſcendens*) ſpringing from the third, fourth, fifth, ſixth and ſeventh *Vertebræ* of the Neck, and is inſerted into the upper Side of each Rib, as the *Sacrolumbum* is into the lower; and ſays, that this Pair, by pulling the Ribs upwards in Inſpiration, widens the Breaſt, as the other, by drawing them down in Expiration, ſtraitens it. 2.

Thirdly, *The eleven internal Intercoſtals*, which are as one Muſcle. Theſe paſs obliquely from the lower to the upper Rib. Their Fibres run a contrary Courſe to thoſe of the external, croſſing of them like the Strokes of the Letter X. 3.

I place the *Internal* Intercoſtals among the Contracters of the Breaſt, as alſo the *External* among the Dilaters, becauſe moſt Anatomiſts have *The Uſe of the intercoſtal Muſcles.*

have done ſo; tho' ſome there are that think the Internal dilate it, and the External contract it. Yea, Dr. *Mayow* is of Opinion, that they both of them dilate it. For going upon this Suppoſition, That the *Thorax* is widened by drawing the Ribs upward, he thinks them both equally adapted for that Action. For ſeeing in all muſcular Motion the Part that is leſs firm, is moved towards that which is more firm, and that each lower Rib ſucceſſively is jointed looſer than that immediately above it, it muſt needs be, that the Internal upon their Contraction draw the Ribs upwards as well as the External, and that not obliquely, but directly. For by their croſſing one another, they hinder the *Obliquity* of one another's Motion (for which each ſeverally is fitted) and ſo perform the ſame Motion, as if their Fibres deſcended *ſtreight* from the upper Rib to the lower; which courſe of Fibres was not convenient here, becauſe of the ſmall Space betwixt one Rib and another, which would not permit them to have that Length which the Nature of Muſcles requires.] Thus that ingenious Perſon diſcourſes, I think, very probably.

Theſe Muſcles of Reſpiration are much aſſiſted in their Action; ſecondarily, by the Muſcles of the *Abdomen*, *Scapulæ* and Arms, which ſhall be deſcribed in their proper Chapters.

CHAP.

CHAP. XVI.

Of the Muſcles of the Back and Loins.

THE *Back*, but eſpecially the *Loins*, being moved diverſly; *viz.* backward and forward, and to the ſides, into every *Vertebra* there are Tendons of Muſcles inſerted, as if there were a great many Muſcles in all. But there are but four (proper) Pair to aſſiſt the Motion of both. *The Back and Loins have four Pair.*

The *firſt* Pair are two triangular Muſcles, which being joined together, make a kind of a Quadrature, and are therefore called *Par quadratum*. Theſe ariſe broad and thick from the hinder upper Cavity of *Os Ileum*, and the inner ſide of *Os ſacrum*, and are inſerted into the tranſverſe Proceſſes of the *Vertebræ* of the Loins, even up to the loweſt Rib. If both theſe act together, they bow the *Vertebræ* of the Loins ſtreight forward; if one alone, obliquely forward. 1.

The *ſecond* and principal Pair are the *Muſculi longiſſimi*. This ſprings from all the Spines of *Os ſacrum*, and of the *Vertebræ* of the Loins, and alſo from the inſide of *Os ileum*, where it is joined to the *ſacrum*; from whence it aſcends all up the Spine, and terminates in the *proceſſus mammillaris* of the Temple-bone, in its way lying upon the tranſverſe Proceſſes of the Lumbar *Vertebræ*, and beſtowing Tendons on the tranſverſe Proceſſes of all the *Vertebræ* of the Back (whence ſome have divided this Muſcle into as many as there are *Vertebræ*.) It is almoſt confounded with the two following, from its Riſe till the loweſt *Vertebra* of the *Thorax*, where it begins to be ſeparated from them, and leaves them. But ſo far as 2.

they accompany it, it is ſo very difficult to ſeparate and diſtinguiſh them, that ſome account all three but one.

3. The *third* Pair are the Muſcles called *Sacri.* This ariſes behind from the *Os ſacrum*, with an acute and fleſhy Beginning, and ends in the Spine of the loweſt *Vertebra* of the *Thorax*, and for the moſt part alſo is inſerted, by the way, into the Spines and oblique Proceſſes of the *Vertebræ* of the Loins. This helpeth the Action of the former.

4. The *fourth* and laſt Pair are the *Semiſpinati.* This ſprings by a nervous Beginning from all the Spines of *Os ſacrum* and the Loins, and ends in the tranſverſe Proceſſes of the *Vertebræ* of the Loins, and of the lowermoſt of the *Thorax*. *Spigelius* ſays, it ariſes from the Spine of the loweſt *Vertebra* of the Back, and ends in the Spine of the firſt; by the way beſtowing Tendons on all the *Spines*, as the *Longiſſimi* did on the *tranſverſe* Proceſſes. Others deſcribe it otherwiſe. The Truth is, it is ſo almoſt impoſſible to ſeparate and raiſe theſe Muſcles of the Back and Loins, that 'tis no wonder Authors differ ſo much in their Number and Deſcription.

But how many ſoever they be, or whereſoever be their Riſe and Inſertion, the Uſe of them all is, to erect the Trunk of the Body, by bending the Back and Loins backward, except the firſt Pair, which bow it forward; in which Action they are much aſſiſted by the *Recti* of the *Abdomen*, which we ſhall deſcribe in the next Chapter.

CHAP.

CHAP. XVII.

Of the Muſcles of the Abdomen.

IN the firſt *Book*, *Chap.* 3. where we diſcourſed of the *common containing* Parts of the *Abdomen*, or loweſt Venter, we only barely mentioned its Muſcles, deferring the Deſcription of them till this Place, where it ſeems more proper.

The Abdomen *hath five Pairs.* 1.

The *Abdomen* then hath ten Muſcles, five on each Side. The *firſt* Pair is *Obliquè deſcendens*. It ſpringeth from the lower Side of the ſixth, ſeventh, eighth, ninth, tenth, and eleventh Ribs (before they paſs into Cartilages) by ſo many diſtinct acute Beginnings: And each preſently ſpreading it ſelf, in a ſhort Space they grow into one Muſcle. Theſe ſeveral Beginnings appear ſomewhat like the Teeth of a Saw, and are intermixed with the Saw-like Tendons of the *Serratus major anticus* of the *Thorax*, as when one thruſts the Fingers of one Hand betwixt thoſe of the other. Beſides theſe Origins, it is ſaid alſo to ſpring from the tranſverſe Proceſſes of the Lumbar *Vertebræ*: But Dr. *Croone* thinks that to be a Miſtake, becauſe thoſe Proceſſes are ſo covered with other Muſcles, eſpecially with the *Latiſſimus dorſi*, that this can by no means ſpring therefrom. Wherefore he aſſigns to it in this Place another Origin, namely from the inveſting Membrane of the ſaid *Latiſſimus*, as he does alſo to the following Pair, who have been alſo ſaid to riſe from the ſaid Proceſſes. Laſtly, it ſprings from the upper Edge of *Os ileum*; from all which Places its Fibres deſcend obliquely forward, and it endeth by a broad Tendon in the middle of the Belly in the *Linea alba*; which Tendon

cleaves ſo faſt to that of the obliquely aſcending (lying next under this) that they cannot be ſeparated without tearing. The *Linea alba* in which theſe Tendons end, is a white Part or Line running from the *Mucronata cartilago* at the Pit of the Stomach, down the middle of the Belly by the Navel to the *Oſſa pubis*, and is made of the Concourſe of the Tendons of the Muſcles of the *Abdomen*; namely of this Pair already mentioned, and of the *Obliquè aſcendens*, the tranſverſe and pyramidal.

Linea alba.

2. The *ſecond* is the *Obliquè aſcendens*. This lies next under the former, and its Fibres aſcending obliquely croſs thoſe of the other like an X. It ſprings from the tranſverſe Proceſſes of the *Vertebræ* of the Loins (as hath hitherto been taught, but Dr. *Croone* ſays, from the inveſting Membrane of the *Latiſſimus dorſi*) and the Spines of *Os ſacrum* with a membranous Beginning, and from the Edge of *Os ileum* with a fleſhy. Aſcending carnous from hence it is joined to the Cartilages of the eighth, ninth, tenth and eleventh Ribs, and ends in the *Linea alba* with a broad and nervous Tendon.

Note, That the Tendons of both theſe oblique Muſcles (as alſo thoſe of the tranſverſe) are perforated in the Bottom of the *Abdomen*, for the Deſcent of the Spermatick Veſſels into the *Scrotum*.

3. The *third* Pair is the *Rectum* or ſtreight. This ariſes fleſhy from the lower Part of the *Sternum*, from the Side of the *Cartilago mucronata*, and from the cartilaginous Ending of four Ribs; and ſo marching ſtreight down along the Belly, it is inſerted by a ſtrong Tendon into the *Os pubis*. It hath ſometimes three, ſometimes four tranſverſe Inſcriptions or Interſections, that appear tendinous: Whence ſome divide each Muſcle into

to four or five Muſcles, accordingly as they have three or four Interſections. And indeed if *Galen*'s Rule be true, that whereſoever the Nerve is inſerted into the Muſcle, *there* is its Head: We muſt confeſs that they are diſtinct Muſcles. For Nerves are inſerted into both their upper and lower Parts, and into each of thoſe that lie betwixt the Interſections. And by ſuppoſing them thus diſtinct, we may conceive how they may better perform their primary Action, which is ſtrongly to compreſs the Belly for the Expulſion of the *Fæces* or *Fœtus*. Under theſe Muſcles do the *Arteriæ* and *Venæ mammariæ* deſcend to about the Navel, as the *Arteriæ* and *Venæ epigaſtricæ* aſcend under them to near the ſame Place; and theſe were held to inoſculate one with another (the deſcending with the aſcending) till of late that ſuch Inoſculation is diſcovered to be meerly imaginary.

The *fourth* Pair is the *Pyramidal*. Theſe Muſcles 4.
are ſeated upon the lower Part of the *Recti*, ſpringing carnous from the *Oſſa pubis*, into which the *Recti* are inſerted. They are broader at their *Baſis*, and in their Aſcent grow narrower and narrower till they end in an acute Tendon, which is inſerted into the *Linea alba*, and reaches ſometimes as high as the Navel, tho' their carnous Part be but about an hands breadth long. They are ſaid to aſſiſt the *Recti* in their Action, and are for that Reaſon called otherwiſe *Succenturiati*. But they ſeem to ſome more particularly to ſerve to compreſs the Bladder in making Water; tho' conſidering the Shortneſs of their carnous Part, and their external Situation, 'tis difficult to conceive how they can much aſſiſt that Action, which moſt probably is chiefly performed by the proper muſcular Fibres of the Bladder it ſelf, but perhaps may be ſomewhat promoted by all the

Muſcles of the *Abdomen* as well as this, while they conſtringe the Belly, and ſo preſs the Guts againſt the Bladder; which Preſſure is remotely owing alſo to the Muſcles of the *Thorax*, eſpecially the Diaphragm. Sometimes one, and ſometimes both of theſe pyramidal Muſcles are wanting, and then the ending of the *Recti* is broader and more carnous.

5. The *fifth* Pair is the *Tranſverſe*. Theſe cleave cloſe to the *Peritonæum* on their Inſide; and they are called *Tranſverſe*, becauſe their Fibres run croſs or athwart the Belly. They ſpring from a Ligament that grows from the tranſverſe Proceſſes of the *Vertebræ* of the Loins, from *Os ileum*, and the Inſide of the cartilaginous Ends of the baſtard Ribs, and end in a broad and membranous Tendon in the *Linea alba*.

Their Uſe. The *Uſe* of all theſe Muſcles hath been held to be *firſt*, when they act not, to defend the *Viſcera* contained under them from external Injuries, and to encreaſe their Heat: And *ſecondly*, when they are in Action, firſt to farther the Excretion of the Excrements; *ſecondly*, to help the Excluſion of the Infant in Labour; *thirdly*, to aſſiſt the Breaſt in ſtrong Expiration and Expectoration; and *fourthly*, to help to bend the Trunk of the Body forward in ſtooping, which is chiefly done by the *Recti*. But *Diemerbroeck* thinks that the ſtreight, pyramidal and tranſverſe are all that ſerve for the Compreſſion of the Belly, and that the oblique do elevate or dilate it. And he endeavours to prove this to be their Action; *firſt*, becauſe there will be no Muſcles to elevate the Parts of the *Abdomen*, if theſe do it not; whereas it is both evident to every one's own Obſervation in himſelf, that the *Abdomen* is alternately elevated and depreſt, and alſo ſuch an alternate Elevation and Depreſſion ſeems neceſſary for the furthering the

Motion

Motion of the Aliments and Humours thro' the Parts contained in the lower Belly. *Secondly*, he appeals to their oblique Situation, which is inconvenient for Pressing. *Thirdly*, he thinks their Rise, and the Length of their Tendons evince, that their Use is not to compress: For he says, when their fleshy part grows tumid, they draw the Tendons with the *Linea alba* outwards, and elevate them; and that this Intumescence ordinarily concurs with that of the Muscles that dilate the Breast. *Casp. Bartholin* believes the transverse chiefly conspire with the Diaphragm to Respiration. For demonstrating that the Diaphragm is a digastrick or double-bellied Muscle, the nervous Center being the Tendon intervening between the two Bellies; he has observed farther (in Oxen) that the Fore-part of the Diaphragm extends a particular Tendon to the end of each of the *Costæ nothæ*, whereto the upper part of these transverse Muscles firmly also adheres; and so he supposes that there is a Continuation of the one into the other, the two Bellies of the Diaphragm, and the transverse Muscles making on each side a trigastrick one. And upon this Supposition he is of Opinion, ['That 'seeing in Inspiration, wherein the Breast is to 'be dilated, the Ribs ought to be drawn upward, 'at which time also the Flesh of the said tri-'gastrick Muscle is relaxed, and the Diaphragm, 'being from bowed become more plane and re-'laxed, and thrust toward the *Abdomen*, permits 'the Ribs to be a little lift up and elonged for 'the Dilatation of the Breast; which when at 'length it is contracted by the fleshy Fibres of 'this trigastrick Muscle, the Ribs return to their 'former Angles with the *Vertebræ*, and the con-'tracted Fibres of the Diaphragm, from plane 'becoming bowed, do ascend up farther into

'the Cavity of the Breaſt, which, by depreſſing 'the *Sternum* alſo, they ſtraiten, and ſo cauſe the 'Air to be expelled out of the Lungs.] So that he makes the chief Uſe of the tranſverſe Muſcles to be, to aſſiſt Expiration.

CHAP. XVIII.

Of the Muſcles of the Genitals, both in Men and Women.

The Penis *hath two Pair.*

IN the firſt Book, *Chap.* 23. *Of the Yard*, we deſcribed its Muſcles and their Action, whither the Reader may pleaſe to turn, for here we ſhall but juſt name them. They are *two Pair*. The *firſt* are the *Erectores*, or *Directores*, which ariſe from the inner Knob of the *Coxendix*, and are inſerted into the nervous Bodies of the *Penis*, near their Beginning. The *ſecond* are the *Acceleratores*, which ariſe from the *Sphincter* of the *Anus*; and paſſing on the under ſide of the *Penis* (by the ſides of the *Urethra*) end about its middle.

The Clitoris *hath alſo two Pair.*

The *Clitoris* in Women (ſomething reſembling the *Penis* in Men) hath alſo *two* Pair of Muſcles, which having deſcribed, *Book* I. *Chap.* 29. we ſhall not inſiſt on here, but remit the Reader thither.

As to the *Cremaſter* Muſcles, by which the *Teſtes* are ſuſpended in Men, ſee them deſcribed, *Book* I. *Chap.* 31. As for Womens *Teſtes*, they have no Cremaſters.

CHAP.

CHAP. XIX.

Of the Muſcles of the Bladder and Anus.

THE *Bladder*, as was ſhewn in the Firſt Book, *Chap.* 19. conſiſts of three Membranes, whereof the middle is muſcular, being endued with carnous Fibres; yea, by *Spigelius* it is reckoned for a *Muſcle*, and called *Detruſor Urinæ*. But in the above-mentioned Place we have deſcribed it under the Notion of a *Membrane*; and what is there ſaid of it may ſuffice, unleſs we would enter upon a Controverſy of Names.

The Bladder hath but one Muſcle.

Excluding that Membrane therefore from the Number of Muſcles, the Bladder will have but *one*; namely, its *Sphincter*, which encompaſſes its Neck (and environs the Proſtates alſo.) In Men it is about two Inches broad, and is generally eſteemed to be nothing elſe but the middle Membrane, here grown more carnous than in the reſt of the Bladder. Its Fibres are orbicular, and by the Contraction of them is the Neck of the Bladder conſtringed or purſed up, ſo that the Urine cannot paſs out, unleſs they be voluntarily relaxed, or rather unleſs when they are overpower'd by the Contraction and Compreſſion of the muſcular Membrane, *&c.* for then they are forced to give way to the Urine. In Women it is not ſo broad, becauſe the Neck of their Bladder is ſhorter, but it reaches to the Hole by which the Urine paſſeth into the *Vagina Uteri*, and ſeemeth to form it.

The Anus *three.*

The *Anus* hath three Muſcles. The *firſt* is the *Sphincter Ani.* This is fleſhy, and encompaſſes the End of the ſtreight Gut, being two Inches broad. Its Fibres are orbicular. It doth not ſpring from any adjacent Bone, but only adheres

to

to the *Coccyx*. It serves to purse up the Fundament, and so hinders the involuntary Evacuation of the *Fæces*. The *second* and *third*, are called *Levatores*. These spring from the inside of the Ligaments of the *Coxendix*, and *Os sacrum*, being broad and membranous, from whence passing by the sides of the streight Gut, they stick to it, and are inserted into the upper Part of the *Sphincter*. These draw up the Fundament again, after it is made to strut out in straining at Stool; yea, they prevent its falling out, which sometimes happens upon their Violation.

CHAP. XX.

Of the Muscles of the Scapula, *or Shoulder-blade.*

THUS we have done with the Muscles of all the three *Venters*; now we come to those of the *Limbs*. And first of the *Scapula* or *Shoulder-blade*.

Each Scapula hath four Muscles.

It is moved forward, backward, upward and downward; and for the performance of these Motions hath four *proper Muscles*. The *first* is called

1. *Trapezius*, as also *Cucullaris*, because it with its Fellow, covering the Back, resembles a Monk's Cowl. It ariseth fleshy from the lower part of the *Occiput* towards the Ear; but from the posterior Processes or Spines of the five lowest *Vertebræ* of the Neck, and of the eight uppermost of the *Thorax*, it springeth membranous. Being thus broad at its Rise, it grows narrower in its Progress, and is inserted into the whole Spine of the *Scapula*, into the Shoulder-point, and broader part of the *Clavicula*. Now through its large Beginning, and indifferent narrow Tendon or End, it comes to

pass,

paſs, that its Fibres hold a various Courſe; ſome of them being ſtreight, others *obliquely deſcending*, and others *obliquely aſcending*. Whence it is alſo, that it performs divers Offices; for it draws the *Scapula* directly backwards by its ſtreight Fibres, (which ſpring from about the firſt and ſecond *Vertebræ* of the *Thorax*;) obliquely downwards, by the obliquely aſcending (which ariſe *below* the ſtreight:) and obliquely upwards, by the obliquely deſcending (which ariſe *above* the ſtreight.)

The *ſecond* is *Levator*, or *patientiæ Muſculus*, ſo called from its helping to ſhrug up the Shoulders, when we would intimate that there is no Remedy but *Patience*. This hath its beginning from the tranſverſe Proceſſes of the firſt, ſecond, third and fourth *Vertebræ* of the Neck; which Beginnings being united about the middle of the Length of the Muſcle, it is at length inſerted by a broad and carnous Tendon into the upper Corner of the Shoulder-blade, which it draws upward, and (as Authors ſay) ſomewhat forward. 2.

The *third* is *ſerratus minor anticus*. This lies under the Pectoral Muſcle, and ſprings from the four uppermoſt Ribs (except the firſt) before they become cartilaginous, by four fleſhy Portions, repreſenting the Teeth of a Saw, and is inſerted by a broad Tendon near to the Anchor-like Proceſs of the *Scapula*, which it draws forward toward the Breaſt. 3.

The *fourth* from its Figure is called *Rhomboides*. This is placed immediately under the *Cucullaris*: It ſpringeth fleſhy from the hinder Proceſſes or Spines of the three loweſt *Vertebræ* of the Neck, and ſo many uppermoſt of the *Thorax*, and is inſerted by as broad a fleſhy ending, as the beginning was, into the *Baſis* of the Shoulder-blade, which it draws backward. 4.

Beſides

Beſides theſe four *proper* Muſcles, it hath others that are *common* to it with other Parts; which in ſome meaſure aſſiſt its Motions, as the *Serratus major*, deſcribed above, *Chap.* 15. and the *Deltoides*, which we ſhall deſcribe in the next Chapter.

CHAP. XXI.

Of the Muſcles of the Arm.

THE *Arm*, in common Acceptation, is meant of all the Diſtance betwixt the Shoulder-point or Neck of the Shoulder-blade, and the Wriſt; but we take it more ſtrictly here, for that Part only that reaches from the Shoulder to the Elbow (which itſelf is otherwiſe called *humerus*) and conſiſts of one Bone, which we ſhall call the *Shoulder-bone*. It hath five Motions, for it is moved backward, forward, upward, downward, and circularly.

Each Arm hath nine Muſcles.

Erectors.

It is moved upward by two Erectors, *Deltoides* and *Supraſpinatus*. 1. *Firſt*, *Deltoides* (ſo called, becauſe in Shape it reſembles the Greek Letter *Delta* Δ) ſpringeth nervous and broad from the middle of the *Clavicula*, the top of the Shoulder, and the whole Spine of the *Scapula*, as from ſo many diſtinct Beginnings. But preſently becoming carnous and thick, it grows narrower and narrower in its Progreſs, till it end in a ſtrong Tendon (carnous without, and nervous within) which is inſerted tranſverſly into the middle of the Shoulder-bone, and moves it either upwards and forwards, towards the Face, or elſe backwards, as theſe or thoſe of its Fibres are contracted. And beſides its moving of the *Humerus*, it helps alſo to draw up the *Scapula*.

1.

The

The *ſecond* is *Supraſpinatus*, or *Superſcapularis ſuperior*. This ariſes from the *Baſis* of the *Scapula*, and fills up the upper *Interſcapulium*, *viz.* all that Cavity that is betwixt the Spine and upper Edge; and paſſing over the jointing of the *Scapula* with the Shoulder-bone, by a broad and ſtrong Tendon, is inſerted obliquely into the Neck of the latter. Some think this doth not only lift the Arm upward, but help to turn it about alſo. 2.

It is pulled down by *Latiſſimus*, and *Rotundus major*. *Latiſſimus* is ſo called from its Largeneſs; for with its Fellow it covereth almoſt the whole Back. It is called alſo *Ani Scalptor*, or *Terſor*; becauſe thoſe Offices are performed by the help of this Muſcle. It ſprings by a broad membranous Beginning from the hinder Proceſſes or Spines of all the *Vertebræ* of the Back-bone, that are betwixt the ſixth of the *Thorax*, and the middle of *Os ſacrum*, as alſo from the upper Edge of *Os ileum*: Then paſſing upwards when it is come to that part of the Back where the Ribs begin to bend, it becometh fleſhy, and is carried over the lower Corner of the *Scapula* (from which alſo it often receives many carnous Fibres) where becoming narrower, it is inſerted into the Shoulder-bone, by a ſhort broad Tendon, between the *Muſculus pectoralis* and this that follows, *viz.* *Depreſſors* 1.

Rotundus major, or more properly, *Teres major*. (For *Rotundus* means a thing ſpherical, but *Teres* long and round like a Thread, as this is.) It ſpringeth carnous from the whole lower Edge of the *Scapula*, and is inſerted by a ſhort and ſtrong Tendon into the Shoulder-bone, a little below its Neck, and moves it contrary to the *Deltoides*, *viz.* downward and ſomewhat backward. 2.

It

Movers forwards.

It is drawn forward by *Pectoralis* and *Coracoideus*. *Pectoralis* hath a very large, and for the greateſt Part membranous Beginning, ariſing from divers Parts, yet is one and continuous. In its *upper* Part it riſes from the middle of the *Clavicula*: In its *middle*, from the whole Length of the *Sternum* and the Cartilages of the Ribs annexed to it; in its *loweſt*, from the Cartilages of the ſixth, ſeventh and eighth Ribs. It preſently becomes carnous and thick, but narrower, and running towards the Shoulder it is inſerted into the Shoulder-bone, a little below its Head, between the *Deltoides* and the *Biceps* of the Cubit. The Fibres of this Muſcle are of three ſorts, *viz.* obliquely deſcending, ſtreight (or tranſverſe) and obliquely aſcending; and accordingly it draws the *Os humeri* either directly forward towards the Breaſt by its middle ſtreight Fibres, or elſe obliquely forwards, *viz.* forward and upward, or forward and downward, as the obliquely deſcending, or obliquely aſcending Fibres are contracted.

1.

2. *Coracoideus* or *Coracobrachiæus* ſpringeth from the *Coracoides* Proceſs of the *Scapula*, and endeth about the middle of the Shoulder-bone, aſſiſting the obliquely deſcending Fibres of the *Pectoralis*, in moving that Bone obliquely forward and upward.

Pullers backwards.

It is moved backward by *three*: *Infraſpinatus*, *Subſcapularis*, or *Immerſus*, and *Rotundus minor*.

1. *Infraſpinatus* or *Supraſcapularis inferior* ſpringeth from the lower *Baſis* of the *Scapula*, and filleth up the lower *Interſcapulium*, *viz.* all that Space that is betwixt its Spine and lower Edge, as the *Supraſpinatus* did that between the Spine and upper Edge. It is inſerted by a broad and ſhort Tendon into one of the Ligaments, that ſtrengthen the joining of the Shoulder-bone with the *Scapula*.

Sub-

Subſcapularis or *Immerſus* poſſeſſeth the whole inner Cavity of the *Scapula*. It ſpringeth from the inner Part of its *Baſis*, fleſhy, and ſo continuing, paſſeth forward (but becoming ſtill narrower) to the Neck of the *Scapula*, and at the laſt by a broad Tendon is inſerted into one of the Ligaments that ſtrengthen the aforeſaid Shoulder-joint. 2.

Rotundus minor ariſeth from the loweſt Corner of the *Scapula*, by a fleſhy Beginning, and is implanted into the Neck of the Shoulder-bone. Some make but one Muſcle of this and the *Rotundus major*. 3.

As to the circular Motion of the Arm, that is not performed by any particular Muſcle, but ſeveral of theſe contribute towards it, namely, the *Supraſpinatus*, *Infraſpinatus*, and *Subſcapularis*, and in ſome Meaſure the others alſo.

CHAP. XXII.

Of the Muſcles of the Ulna.

THE lower Part of the Arm from the Elbow to the Wriſt is called the Cubit, and conſiſteth of two Bones, called *Ulna* and *Radius*. The *Ulna* ſerveth for Flexion and Extenſion; but the *Radius* helpeth to turn the Cubit inward or outward, ſo as to make the Back or Palm of the Hand look upward or downward.

Two Benders of the Ulna.

The *Ulna* is bended by *two*, to wit, *Biceps*, and *Brachiæus internus*. *Biceps* is ſo called, becauſe it hath *two Heads*, both of which ſpring from the Shoulder-blade. The one is outward, tendinous and round, ſpringing from the upper brim of the 1.

Ace-

Acetabulum, or Cavity of the *Scapula*, into which the Head of the Shoulder-bone is received: The other is broader, and is framed partly of a Tendon, and partly of Fleſh: It ſprings from the Anchor-like Proceſs of the Shoulder-blade, from whence deſcending by the Inſide of the Head of the Shoulder-bone, it meeteth with the former, and both together become a ſtrong fleſhy Muſcle: Which lying on the Inſide of the Arm, afterwards ends in a thick, round, and ſtrong Tendon, which is inſerted into the Inſide of the Head of the *Ulna* (or of the *Radius*, as *Bartholin* will have it) This Tendon is ſometimes pricked in letting Blood in the Arm, and then it cauſeth great Pain.

2. *Brachiæus internus* lieth under the *Biceps*, being ſhorter than it, and altogether fleſhy. It riſeth where the *Deltoides* endeth, *viz.* from the middle of the Shoulder-bone, unto which it cleaveth firmly, and is inſerted between the Heads of the *Ulna* and *Radius*, in their foreſide.

Four Extenders. The *Ulna* is extended by *four* Muſcles, *Longus*, *Brevis*, *Brachiæus externus*, and *Cubitalis*. *Longus*

1. hath two Beginnings; the one is, partly fleſhy, and partly nervous, at the lower Edge of the *Scapula*, near its Neck (where it hath a peculiar Hollowneſs to receive it:) This deſcends by the Inſide of the Shoulder-bone, and when it is come as far as the Inſertion of the *Ani ſcalptor* (deſcribed in the foregoing Chapter) there ariſes another carnous Beginning towards the outer Side, that (according to *Spigelius*) joins with it and makes up one Muſcle, which is inſerted into the inner ſide of the hinder Proceſs of the *Ulna*, called *Olecranum*.

2. *Brevis* ariſeth from the hinder Part of the Neck of the Shoulder-bone, and endeth in the outer

outer ſide of the *Olecranum*; namely, in that Part of the Elbow that we lean upon.

Brachiæus externus (ſo called by *Riolanus*, to diſtinguiſh it from the *internus*) is placed towards the outſide of the Shoulder-bone, and is confounded with the other two, and endeth where they do. This ſeemeth to be *Spigelius*'s ſecond Beginning of the *Longus*, which he ſays grows into one Muſcle with it. 3.

Cubitalis or *Anconæus* ariſeth from the lower End and hinder ſide of the Shoulder-bone, and paſſing over the Elbow joint, it endeth by a nervous Tendon in the ſide of the *Ulna*, a very little below the *Olecranum* or *Ancon*, whence it is called *Anconæus*. Some make one Muſcle of this and the *Brevis*. 4.

Note, That the Fibres of both theſe Benders and Extenders of the *Ulna*, keep all a ſtreight Courſe, and ſo only move the Cubit ſtreightwiſe.

CHAP. XXIII.

Of the Muſcles of the Radius.

THE *Radius*, the other Bone of the Cubit, is moved *accidentally* (or in *common*) by the Muſcles of the *Ulna*, to which Bone it is faſten'd; but it has beſides, *proper* Motions of its own, and for the Performance of theſe, two ſorts of Muſcles; of which ſome are called *Pronatores*, *viz.* thoſe that turn it inwards, and the Palm of the Hand upwards; and others *Supinatores*, which turn it outwards, and the Palm of the Hand downwards. *The* Radius *hath four Muſcles.*

The *Pronatores* are *two* in Number. The *firſt* is, *Pronator ſuperior, rotundus*, or *teres*. This ſpringeth from the Root of the inner Knob of the Shoul- *Two* Pronatores. 1.

der-bone, at the Elbow, and from the inner ſide of the *Ulna*, where it is joined to the Shoulder-bone; and running obliquely on the Inſide of the *Radius*, endeth about its Middle in a membranous Tendon.

2. The *ſecond* is *Pronator inferior quadratus*, which is altogether fleſhy. It ſpringeth from the lower and inner Part of the *Ulna*, two Inches broad; then marching tranſverſly above the Ligament, which joineth the *Radius* to the *Ulna*, it endeth in the Inſide of the *Radius*. The Ending is as broad as the Beginning; wherefore it is called *quadratus*, or four-ſquare.

Two Supinatores. The *Supinatores* are in like manner *two*. The

1. *firſt* is *Supinator longus*, ſo called, becauſe of all the Muſcles which lie along the *Ulna*, it hath the longeſt Belly. This ſpringeth fleſhy from the Edge of the outer Knob of the Shoulder-bone; and marching obliquely under the *Radius*, is implanted by a membranous Tendon, into the upper ſide of the lower end of the *Radius*, bending ſomewhat to the inner ſide.

2. The *ſecond* is *Supinator brevis*. This ſpringeth from the Out-ſide of the Ligament, which ſtrengthens the Jointing of the *Ulna* with the Shoulder-bone, and from the hinder Proceſs of the *Ulna*, as *Spigelius* deſcribes it; but as others, from the outer Proceſs of the Shoulder-bone; from whence it paſſeth on obliquely, being without membranous, and within fleſhy, and is inſerted into the middle of the *Radius*.

Note, That tho' for Order's Sake we have deſcribed the Muſcles of the *Radius* next to thoſe of the *Ulna*; yet when one would ſhew them in Diſſection, the Muſcles of the Fingers, Thumb and Wriſt are firſt to be raiſed, and then theſe of the *Radius*, after thoſe are taken away.

CHAP. XXIV.

Of the Muſcles of the Wriſt.

THE *Carpus*, or *Wriſt*, has three Motions: It is either bended, extended, or moved ſide-ways. For its Flexion and Extenſion it has proper Muſcles; but as for its Motion ſide-ways, that is not performed by any proper Muſcles, but by a Bender and Extender of that ſide to which it is moved, if they act together. The Benders lie on the Inſide of the Cubit, and the Extenders on the Outſide. *The Wriſt hath four Muſcles.*

The *Benders* of the Wriſt are *two*; of which the *firſt* is *Cubitæus internus*: This ariſeth by both a fleſhy and nervous Beginning, from the inner Tubercle or Knob of the Shoulder-bone; then paſſing fleſhy the Length of the *Ulna* or *Cubitus* (to which it immediately adheres) it ends by a Tendon, partly nervous, and partly fleſhy, in the fifth Bone (ſome ſay the fourth of the firſt Rank) of the Wriſt. *Two Benders.* 1.

The *ſecond* is *Radiæus internus*: This ariſing from the ſame Tubercle, paſſes along the *Radius* (adhering to it;) and before it comes to its lower end, turns into a round Tendon, which proceeding forward, grows to the tranſverſe Ligament of the Wriſt: But ſtill paſſing farther, and waxing broader, it is at laſt inſerted into that Bone of the Back of the Hand, which is ſet before, or ſuſtains the Fore-finger. 2.

The *Extenders* are alſo *two*:

The *firſt* is *Radiæus externus*, or *bicornis*: This ariſeth by a double Origin from the bony Tip of the Shoulder bone, and from the outer Knob of the ſame; then becoming more fleſhy, it paſſeth along the *Radius* to its Middle, where it turneth into a ſtrong Tendon, which preſently is divided *Two Extenders.* 1.

into two almoſt round Tendons. Both theſe paſs a little aſunder by the *Radius* under the Ligament of the Wriſt, and are one of them inſerted into that Bone of the Back of the Hand which ſtayeth the fore-Finger, and the other into the Bone which ſtayeth the middle-Finger.

2. The *ſecond* is *Cubitæus externus:* This hath its Beginning from the Root of the external Knob of the Shoulder-bone: It paſſeth along the *Cubitus* or *Ulna*, and when it is come to the Wriſt, it endeth in a ſtrong round Tendon, which is inſerted into the upper Part of that Bone which ſtayeth the little Finger, not far from the Wriſt.

CHAP. XXV.

Of the Muſcles of the Palm of the Hand.

The Palm hath two Muſcles.

THE *Palm* of the Hand is ſaid to have *two* Muſcles. The *firſt* is *Palmaris*, which ariſeth from the inner Knob of the Shoulder-bone,

1. round and nervous, but preſently becoming fleſhy, it continues its Courſe along the *Ulna*, under all the other Muſcles; but about the Middle of the ſaid Bone, it turns into a round Tendon, which paſſing over the tranſverſe or annular Ligament of the Wriſt, is afterwards dilated into a broad nervous Membrane, which cleaveth firmly to the Skin of the Palm of the Hand (cauſing it to be of moſt exquiſite Senſe) and endeth in the Inſide of the firſt Joint of the Fingers. This Muſcle ſpreading its Tendon thus in the Palm, beſides that it adds much to its Senſibleneſs, helps to contract and wrinkle the Skin thereof, for the taking the faſter hold in graſping of a thing.

The

The *ſecond* is *Caro quædam quadrata*, or a four-ſquare fleſhy Subſtance: This ſpringeth from the *Membrana carnoſa*, that covereth that Region where the eighth Bone of the Wriſt is placed. From thence it is carried under the dilated Tendon of the *Muſculus Palmaris*, to the middle of the Palm of the Hand, and there ends. *Spigelius* ſays, it is inſerted into the Out-ſide of the Tendon of that Muſcle, which moveth the little Finger outwards. It looks as if it conſiſted of two or three Muſcles, and ſerveth (as ſome think) for the hollowing of the Palm of the Hand, by drawing the Out-ſide of it towards the Ball of the Thumb; but, according to *Spigelius*'s Opinion, it ſerves rather to withdraw it, and ſo to ſpread the Palm open. 2.

CHAP. XXVI.

Of the Muſcles of the Four Fingers.

THE *Fingers* are bended, extended, and moved laterally. By *the Fingers*, we mean only the four, excluding the Thumb, whoſe Motion differs very much from that of the other; and therefore we ſhall deſcribe its Muſcles in the next Chapter, as being altogether diſtinct from theſe.

Three Benders of the Fingers.

The Fingers are bended by *three* Muſcles, or rather by ſix. The *firſt* is called *Sublimis*, or *Perforatus*. This ſpringeth ſomewhat nervous, from the inner Knob of the Shoulder-bone, and deſcends fleſhy betwixt the *Ulna* and *Radius*, till near the Wriſt, where it is cleft into four fleſhy Portions, which preſently paſs into ſo many round Tendons, all whereof are involved together in one common, thin, and mucous Membrane, that they may march the more ſafely. Thus they are carried under the tranſverſe Ligament of the 1.

Wriſt, and along the Palm to the ſecond Joint of the Fingers (growing there broader and thinner) into which they are inſerted, one into each. *Spigelius* notes, That as they paſs along the firſt Joint, they run under a tranſverſe Ligament (that ſprings from one ſide of the Bone, and is inſerted into the other) as under an Arch; which Ligament hinders them, upon their Contraction, from ſtarting up out of their Places. Near their end each has a Fiſſure or Perforation, to give way to the Tendons of the *Profundus* paſſing through.

2. The *ſecond* is named *Profundus* or *Perforans*. This ariſeth from the upper Parts of the *Ulna* and *Radius*, a little below the Joint of the Elbow, and being cleft at the Wriſt into four Tendons, theſe run (inveſted in a common Membrane) under the annular Ligament of the Wriſt, and alſo the tranſverſe ones of the firſt Joint of the Fingers, and laſtly through the Clefts of the Tendons of the *Sublimis*, and are implanted into the third Joint of the Fingers.

3. The *third* ſort of Muſcles are called *Lumbricales*, one to each Finger. Theſe are very ſmall, and ariſing from the Tendons of the *Muſculus profundus*, end each in a round Tendon in the firſt Joint of the Fingers, being confounded with the Tendons of thoſe Muſcles that move the Fingers laterally; yea ſometimes they proceed farther along with them by the Sides of the Fingers, to the third Joint, and aſſiſt their lateral Motion. The firſt of theſe Muſcles bends the ſecond Joint of the Fingers, the ſecond the third, and the *Lumbricales* the firſt.

Three Extenders. The Fingers are extended by *three* Muſcles, whereof one is *common* to all the four Fingers, and two *proper* to two particular.

The

The *common* is *Extenſor magnus.* This ariſing from the outer Knob of the Shoulder-bone, a little above the Wriſt is divided into four Tendons, which paſſing the Wriſt, like the foregoing, are inſerted into the ſecond and third Joints of the Fingers. Some make two of this, ſuppoſing that Tendon that is inſerted into the little Finger, to be the Tendon of a Muſcle that is diſtinct from that from which the Tendons are propagated to the other three Fingers; but grant, it has the ſame Origin, and keeps the ſame Courſe. *One common.*

The two *proper* are one of them called *Indicator,* becauſe it belongeth to the Fore-finger. It ariſeth from the middle of the *Ulna* on its outſide, and by a double Tendon it endeth in the ſecond Joint of the Fore-finger: But one of the Tendons becometh one with the Tendon of the *Extenſor magnus.* *Two proper* 1.

The other is named *Auricularis,* becauſe it belongeth to the little Finger. It ariſeth from the upper Part of the *Radius,* and marching between the *Ulna* and the *Radius,* it is inſerted by a double Tendon into the Backſide of the little Finger, of which Tendons one coaleſces with that of the common Extender. 2.

The Fingers are moved laterally two manner of ways: For either they are brought to the Thumb, or they are carried from it. Theſe Motions are performed by *eight* Muſcles, called *Interoſſei,* becauſe they are placed between the Bones of the *Metacarpium.* That is, ſix of them are placed in the three Interſtices of the four Bones of the *Metacarpium,* one on the outſide of that Bone which ſuſtains the Fore-finger, and another on the outſide of that which ſuſtains the little Finger. They are fleſhy and round, and ſpring from the Bones of the *Metacarpium,* to which they alſo adhere, as they paſs along them. When they *Movers laterally, Eight.*

are come to the Roots of the Fingers, they paſs into Tendons, which cleave to the Sides of the Fingers, and end in the laſt Joint of the Fingers near the Root of the Nails. When the Tendons of the *Lumbricales* join with theſe, they may be reckon'd amongſt the Movers of the Fingers laterally, and then there will be twelve in all, the *Lumbricales* being four, and theſe *Interoſſei* eight: But uſually the *Lumbricales* ſerve only to bend the firſt Joint of the Fingers, as was ſhewed above.

Abducing Muſcles, two.

Beſides theſe Muſcles, the Fore-finger and the little Finger are ſaid to have each one *proper* Muſcle. That of the Fore-finger may either be called

1. *Abducens*, in reſpect of the middle Finger from which it draws it; or *Adducens*, in reſpect of the Thumb towards which it draws it. It ſprings from the Inſide of the firſt Joint of the Thumb, and ends in the Bones of the Fore-finger, which it pulls towards the Thumb.

2. That of the little Finger is called *Abductor* (by ſome, *Hypothenar*) and ſprings from the third and fourth Bone (of the ſecond Rank) of the Wriſt; whence proceeding along the Palm of the Hand, it is implanted by a ſmall nervous Tendon into the outſide of the firſt Joint of the little Finger, which it draws outwards from the reſt.

CHAP. XXVII.

Of the Muſcles of the Thumb.

Two Extenders of the Thumb.

THE *Thumb* is extended by *two* Muſcles. The *firſt* is called *Longior*. This ariſeth fleſhy

1. from the outſide of the *Ulna*, near the membranous Ligament which tieth together the *Ulna* and *Radius*. From thence it is carried obliquely upon the *Radius*, and before it come to its *Appendix*,

pendix, turneth into a round Tendon; which paſſing under the annular Ligament of the Wriſt, marcheth along that ſide of the Thumb, which is next to the Fore-finger, and is inſerted into its third Bone.

The *ſecond* is named *Brevior*. This ariſeth from the ſame Origin with the other, and paſſeth obliquely above the *Radius*. By one Tendon it is implanted into the Root of the firſt Joint of the Thumb (which anſwers to the Bones of the *Metacarpium* that ſuſtain the Fingers;) the *other* becoming membranous, cleaveth faſt to its ſecond and third Bone.

Two Benders.

It is bended alſo by *two* Muſcles; one of which ſpringing from the upper Part of the *Radius*, is implanted into the firſt and ſecond Joint of the Thumb; the other being leſs, proceeds from that Bone of the *Carpus* which ſuſtains the Thumb, lying under the other, and reacheth to the middle of the Thumb. Theſe two are all the Benders acknowledged by *Bartholin*, *Diemerbroeck*, &c. but *Spigelius*, *de hum. corp. fabric.* l. 4. c. 19. deſcribes two which bend the firſt Joint, four the ſecond, and one the third. Thoſe two which bend the firſt Joint, together with the *Abducens* of the ſame, he ſays, make the *Monticulus pollicis*, or Ball of the Thumb, or as Chiromancers call it, *Monticulus lunæ*.

1.
2.

Monticulus lunæ.

Movers laterally, two

It is moved laterally by *two* Muſcles. The *firſt* is called *Thenar* (by *Riolanus*) or *Abducens*. This ſpringeth from the inner Part of that Bone of the Wriſt, which ſtayeth the Thumb, by a nervous Beginning: Then becoming fleſhy, it is inſerted into the firſt Joint of the Thumb by a membranous Tendon, and draweth it from the Fore-finger. Some make three of it.

1.

The *ſecond* is *Antithenar*, or *Adducens*, which lieth in the Space between the Thumb and Fore-finger.

2.

finger. This doth ariſe from the outſide of that Bone of the *Metacarpium* which ſuſtaineth the Fore-finger; and being fleſhy, is inſerted into the whole inner Side of the firſt Joint of the Thumb, and ſendeth a membranous Tendon to the ſecond. This draweth the Thumb to the Fore-finger. Some deſcribe a ſecond *Adducens* ariſing from the inner ſide of the Bone of the Wriſt, that ſuſtaineth the Thumb, and ending in its ſecond Joint.

Authors differ very much as to the Number, Riſe, and Inſertion of theſe Muſcles of the Thumb, which is occaſion'd partly by their Smallneſs, and partly from their croſſing and being entangled one with another, ſo that 'tis very difficult to trace and raiſe them.

CHAP. XXVIII.

Of the Muſcles of the Thigh.

THE *Thigh* hath four manner of Motions: It is either bended (and that forwards, or backwards) or drawn inward or outward, or moved round.

Two Benders forward of the Thigh. 1. It is bended forward by *two* Muſcles. The *firſt* is called *Pſoas*, or *Lumbaris*: This lieth in the inner part of the *Abdomen*, upon the *Vertebræ* of the Loins, *&c.* It ariſeth fleſhy from the ſide of the Bodies, and from the tranſverſe Proceſſes of the two lowermoſt *Vertebræ* of the *Thorax*, and two or three uppermoſt of the Loins, from whence deſcending by the inſide of *Os ileum*, when it is come to the *Os pubis*, it turns into a round and ſtrong Tendon, which is inſerted into the leſſer *Rotator* of the Thigh-bone.

The

The *ſecond* is *iliacus internus*: This ſpringeth with a ſlender and fleſhy Beginning from the inner Cavity of *Os ileum*, and being joined to the *Pſoas* by its Tendon, it endeth before between the greater and leſſer *Rotator*. 2.

It is bended backward, or extended by the three *Glutæi*, which make up the Buttocks, and ſerve to go backward withal, or elſe to raiſe the Body up ſtreight after ſitting. *Three Benders backwards.* The *firſt*, which is the greateſt, and lieth outmoſt, is called *Glutæus major*. It ſpringeth very carnous from the *Coccyx*, from the Spine of *Os ſacrum*, and from all the Circumference of the *Coſta*, or Edge of *Os ilium*, and is inſerted by a ſtrong Tendon four Inches below the great *Rotator*. 1.

The *ſecond* lies in the Middle, whence it is called *Glutæus medius*. It ſpringeth from the fore-part of the *Coſta*, and back of *Os ileum*, a little lower than the former, and is inſerted into the outer and upper part of the great *Rotator*. 2.

The *third* lies undermoſt, and is called *Glutæus minor*. It ſpringeth a little lower than the former (from the outer or backſide of *Os ileum*) lying wholly under it, and is implanted into the upper and inner Part of the great *Rotator*, by a broad and ſtrong Tendon. 3.

It is drawn to the inſide by the *Muſculus triceps*. This is the thickeſt of all the Muſcles of the Body, and might more juſtly be called *Quadriceps*, ſeeing it has four Beginnings; but they that impoſed the Name of *Triceps*, made a particular Muſcle of the firſt of its four Heads, and called it *Pectineus*, or *Lividus*. The *firſt* Head doth proceed nervous from the upper part of the *Os pubis*, and is inſerted into the rough line of the Thigh-bone. The *ſecond* ſpringing from the lower ſide of the ſaid Bone, being leſſer, is inſerted a little higher up into the ſaid Line. The *third* ariſing *One drawer to the Inſide.*

from

from the whole lower part of the *Coxendix*, is inſerted a little under the leſſer *Rotator*. The *fourth* ſpringing from the *Apex*, or Tip of the *Coxendix*, is implanted into the inner and lower Tubercle of the Thigh by a round Tendon, which is joined with the ſlender Tendon of the firſt Part of this Muſcle.

Four Turners towards the outſide.

It is turned towards the outſide by *four* ſmall Muſcles called *Quadrigemini*. They are placed behind upon the Articulation of the Thigh, one by another.

1. The *firſt* is called from its Situation *Iliacus externus*, and from its Figure *Pyriformis*; it is longer than the reſt, and ariſeth from the outſide of the three loweſt *Vertebræ* of *Os ſacrum*.
2. The *ſecond* ariſeth from the Knob of *Os iſchium*.
3. The *third* ariſeth from the ſame Part. Theſe three are inſerted into that Dent that is in the Top of the great *Rotator*; or as *Bartholin* ſays, into that Space that is betwixt the two *Rotators*.
4. The *fourth* is called *Quadrigeminus quadratus*, and is more fleſhy and broad than the reſt: It lieth two Inches diſtant from the third, ariſing from the Inſide of the Knob of the *Iſchium*, and is implanted into the outſide of the great *Rotator*.

Two Turners about obliquely.

It is turned about obliquely by *two* Muſcles, called *Obturatores*. The *firſt* is *Obturator internus*, this

1. turneth it outward. It ariſeth from the inner Circumference of the Hole that is between the *Iſchium* and *Os pubis*, from whence paſſing tranſverſly outwards over the *Coxendix*, it is inſerted into the aforeſaid Dent or Cavity of the great *Rotator*.

2. The *ſecond* is *Obturator externus*: This ariſeth from the outer Circumference of the ſaid Hole, and turning about the Neck of the Thigh-bone, as about a Pulley, it endeth in the ſaid Cavity of the great *Rotator*, and turneth the Thigh inward.

Note,

Note, That tho' for Order's ſake we have deſcrib'd the Muſcles of the Thigh before thoſe of the Leg; yet the Diſſector cannot ſo eaſily nor conveniently raiſe and ſhew them, till thoſe of the Leg are firſt raiſed and removed.

CHAP. XXIX.

Of the Muſcles of the Leg.

THE *Leg* is made up of two Bones, as well as the Cubit, *viz. Tibia* and *Fibula*; but Anatomiſts have not diſtinguiſh'd their Muſcles like thoſe of the *Ulna* and *Radius*, but call them all, *the Muſcles of the* Tibia, *or Leg*. *Five Benders of the Leg.*

Now the *Leg* is either bended, extended, or moved obliquely.

There are *five* that bend it. The *firſt* is *Longiſſimus*. This ariſeth from the inner Knob of *Os ilium*, and deſcends outermoſt juſt under the Skin on the inſide of the Thigh, running obliquely over the other Muſcles, and a little above the Knee ending in a Tendon, which is inſerted under the Knee, into the fore and inner ſide of the *Tibia*. It is otherwiſe called *Faſcialis*, becauſe it embraces the Muſcles that lie upon the Thigh like a *Swadling-band*; and alſo *Sartorius*, becauſe it helpeth one to ſit croſs-leg'd. 1.

The *ſecond* is called *Gracilis*, and ſpringeth with a nervous and broad beginning, at the jointing of the *Os pubis*; from whence it runs down the ſide of the Thigh, and is implanted by a round Tendon into the inner ſide of the *Tibia*, near the Inſertion of the firſt, but a little lower. 2.

The *third* is named *ſeminervoſus*, becauſe it is *half nervous* and half fleſhy; for it ariſes nervous 3.

from

from the Knob of the *Iſchium*, and ſo continues till its middle where it becomes fleſhy, deſcending on the backſide of the Thigh; and when it is come near the Ham, it turns into a round Tendon, which is inſerted into the inner Side of the *Tibia*, towards the backſide, running as far as its Middle.

4. The *fourth* is called *Semimembranoſus*, becauſe it is *half membranous*. It proceedeth from the ſame Knob, partly nervous, and partly membranous; and endeth by a broader Tendon than the third in the hinder part of the *Tibia*.

5. The *fifth* is called *Biceps*, becauſe it ſeems to have *two Heads*: For firſt it ariſeth from the ſame Knob of the *Iſchium* nervous; and from thence being carried on the outſide of the Thigh about its Middle it becometh fleſhy, as if it begun there with a ſecond Head; from whence deſcending, it is inſerted by a notable Tendon into the outer ſide of the upper Appendix of the *Fibula*.

Five Extenders. The Leg is extended alſo by *five* Muſcles. The *firſt* is *Membranoſus*: This proceeding fleſhy

1. from the upper Part of the Spine of *Os ilium*, on the outſide of the Thigh-bone, near the great Proceſs or *Rotator*, turns into a broad membranous Tendon, wherefore it is called *Faſcia lata*, for it covereth almoſt all the Muſcles of the Thigh and *Tibia*, and at laſt is inſerted a little below the Knee, into the outer and foreſide of the *Tibia* and *Fibula*.

2. The *ſecond* is *Rectus*: This ſpringing from the lower Part of the Spine of *Os ilium*, and paſſing with a carnous and round Belly ſtreight down the Thigh before, when it is come to the *Patella*, it ends in a broad and ſtrong Tendon, by which it adheres cloſe to the *Patella*, as if it would end in it; but it paſſes farther, and is inſerted

into

into the Fore-ſide of the *Tibia*, a little below the Knee.

The *third* is named *Vaſtus externus*: This ſpringing from the Root of the great *Rotator*, and deſcending along the outer and fore-ſide of the Thigh, endeth a little below the *Patella*, near the ſame Place with the former. 3.

The *fourth* is called *Vaſtus internus*: This ariſeth from the Root of the leſſer *Rotator*, and deſcending on the inner and fore-ſide of the Thigh, endeth a little below the *Patella* with the other. The *Vaſtus externus* deſcends on the *outſide* of the *Rectus*, and the *internus* on the *inſide* thereof, whence they have their Name. 4.

To theſe Some add a *fifth Muſcle*, called *Cruræus*, which ſpringeth from the fore-part of the Thigh-bone, between the two *Rotators*, and adhering cloſe thereto in its Deſcent, endeth in the ſame Place with the former. 5.

Note, That theſe four laſt Muſcles being joined together about the Knee, make one common broad and ſtrong Tendon, by which they involve the *Patella* or Knee-pan, and which being inſerted into the *Tibia*, ties it and the Thigh-bone together like a ſtrong Ligament. *Note* alſo, that the Muſcles which extend the Leg, are ſtronger than thoſe which bend it, that the Weight of the Body may be the more firmly upholden when we ſtand.

There is alſo a ſingle Muſcle called *Poplitæus*, or *Subpoplitæus*, which moveth the Leg obliquely: This lieth in the hollow of the Ham, and ſpringeth from the outer Knob at the lower end of the Thigh-bone, and is carried obliquely to the hinder and inner ſide of the Appendix, at the upper end of the *Tibia*. *One Mover obliquely.*

CHAP.

CHAP. XXX.

Of the Muſcles of the Foot, or Tarſus.

THE *Foot* is moved according to the Motion of the *Tarſus* or *Wriſt* (or as ſome call it, the *Inſtep*, though that Name is more proper to the *Metatarſus*, or upper arched Part of the Foot.) Wherefore the Muſcles that perform theſe Motions, are indifferently called the Muſcles of the Foot, or *Tarſus*.

Two Benders of the Foot.

The Foot then is either bended, extended, or moved ſideways, according to the Motion of the *Tarſus*. It is bended when it is drawn forwards or upwards. To perform which Motion it hath two Muſcles. The firſt is *Tibiæus anticus*: this ariſeth from the upper Appendices of the *Tibia*, and *Fibula*, and cleaving unto the whole *Os Tibiæ*, about the middle of it becometh narrower, and turneth by degrees into a Tendon, which paſſing under the annular Ligament of the *Tarſus* or Wriſt, that ſprings from the lower Appendices of the *Tibia* and *Fibula*, is commonly divided into two; whereof the one is inſerted into the firſt of thoſe Bones which are called *innominata*, and the other into that Bone of the *Metatarſus*, or Inſtep, that is ſet before the great Toe. If the Tendon continue one, then it is implanted into the inner ſide of this laſt Bone.

1.

2. The *ſecond* is *Peronæus anticus*: This ariſeth from the outer and upper Part of the *Perone*, or *Fibula*, and being carried thro' the Fiſſure of the outer Ankle, it is inſerted into that Bone of the *Metatarſus* which ſuſtaineth the little Toe. It deſcends all along by the outſide of the fore-

going

going Muſcle, and hath ſometimes two Tendons.

The Foot is extended, when it is drawn downwards or backwards; to perform which Motion it hath three Muſcles. The *firſt* is called *Gemellus externus*, being reckoned by ſome for *two*; alſo *Gaſtrocnemius externus*, becauſe it, with the following, maketh the *Calf of the Leg*, which in Greek is called *Gaſtrocnemia*. It hath two Heads, the firſt of which ariſes in the Ham, from the inner Head of the Thigh-bone, fleſhy and broad; from whence it marcheth down by the Back and inner Part of the *Tibia*, and when it is come to the middle of it, becometh tendinous. The other Head likewiſe ariſeth in the Ham, but from the outer Head or Prominence of the Thigh-bone; and paſſing down by the outward and back Part of the Leg, becometh tendinous a little above the former; and joining with it, they both grow into one ſtrong, broad, and nervous Tendon, which is inſerted into the hinder ſide of the Heel. *Three Extenders.* 1.

The *ſecond* is called *Gemellus internus*, or *Gaſtrocnemius internus*, becauſe it lieth under the former; and laſtly, *Soleus*, from its reſembling the *Sole-fiſh* in Shape. It is of a livid Colour, ſpringing from the Back-ſide of the upper *Appendix* of the *Fibula*, by a ſtrong nervous Beginning; and growing pretty Bulky, it continueth ſo till it hath paſſed the middle of the *Tibia*, when it becometh narrower, and tendinous; and a little above the Heel, it is ſo united to the Tendon of the former *Gemellus*, that both ſeem to turn into one, which is inſerted into the Heel. 2.

The *third* is *Plantaris*. This ſpringeth from the outer Head of the Thigh-bone in the Ham, very ſmall but carnous; from whence it deſcends 3.

but a little way before it ends in a very long and slender Tendon, which joining very closely with those of the two former, is fastened to the Heel, but reaches as far as the middle of the Soal of the Foot: (*Spigelius* says, as far as the Toes, and is inserted into the first Joint of each of them, imitating the *Palmaris* of the Hand.) The three Tendons of these three Muscles thus uniting, make one most strong and thick Tendon, usually called *the great Cord*; and this being implanted into the Heel, makes a Wound there so very dangerous.

Two Movers sideways.

The Foot is moved sideways by *two*. The *first* is called *Tibialis posticus, adducens pedem*, or *Nauticus*, because Sailers use it much when they climb up the Mast. It springeth both from the *Tibia* and *Fibula*, and from the Ligament which tieth them together; whence descending among the hinder Muscles, near to the inner Ankle, it becometh tendinous; then passing by it, it goeth to the Soal of the Foot, and is inserted into the under side of that Bone of the *Tarsus*, which is next to the *Cubiforme*, *viz.* the third *Cuneiforme*. This moveth the Foot inwards.

1.

2. The *second* is called *Peronæus*, or *Fibulæus posticus*: This ariseth from the upper and hinder Part of the *Fibula* or *Perone*, by a nervous and strong Beginning; and in its Descent becoming fleshy and round, it cleaves to the outside of the *Fibula*, having its outer Part of a livid Colour, but the inner of a red. When it is come to the middle of the *Fibula*, it becometh tendinous, and descends with the *Peronæus anticus*, by the Fissure of the outer Angle, but joins not with its Tendons, for it goes under the Soal of the Foot, and is inserted into the Root of the first or greatest of the three *Ossa cuneiformia*, that is seated before the great Toe. Some-

Sometimes, though ſeldom, there is another Muſcle, called *Peronæus tertius*, which being very ſlender, accompanies the *Poſticus* in its whole Progreſs, and is inſerted into the ſame Place, aſſiſting its Action, which is, to bend the Foot outwards.

CHAP. XXXI.

Of the Muſcles of the Toes.

THE great *Toe* is moved by its *proper* Muſcles, as the Thumb of the Hand was; but the other four by *common*, which we will firſt deſcribe.

They are either extended, bended, or moved obliquely.

Two Extenders of the four Toes.

The Extenders are *two*. The *firſt* is *Tenſor longus*. This ariſeth by a nervous and acute Beginning, from the fore and inſide of the upper *Appendix* of the *Tibia*, and preſently becoming carnous, it goeth ſtreight down along the *Fibula*, and being come to the *Tarſus*, it is divided into four Tendons; which paſſing under the annular or tranſverſe Ligament thereof, go each to one of the four leſſer Toes, and are inſerted into their ſecond and third Joint on the upper ſide. As they run along the back-ſide of the Foot, they are tied one to another by a membranous Ligament, for the ſtrengthning of them. 1.

The *ſecond* is *Tenſor brevis*. This lieth under the former, having its Beginning from the tranſverſe or annular Ligament of the *Tarſus*, fleſhy and broad, and by its four Tendons is inſerted into the firſt Joints of the four Toes; (*Spigelius* ſays, into the ſecond.) 2.

Six Benders. The *Benders* of the four Toes are in like manner *two*, and *four Lumbricales*. The *firſt* is
1. *Flexor longus*, or *perforans*: It lieth under the *Gemellus internus*, and ariſeth from the upper and hinder Part of the *Tibia* by a long and fleſhy Beginning; and paſſing down along the *Tibia* (unto which it cleaveth) when it is paſt the middle of it, it becometh tendinous: Then running by the inner Ankle, under the Ligament of the *Tibia* and Heel, to the Soal of the Foot, it is there divided into four Tendons, which paſſing through the Holes of the *Flexor brevis*, are inſerted into the third or laſt Joint of the four Toes.

2. The *ſecond* is *Flexor brevis*, or *perforatus*: This ſpringeth from the under and inner ſide of the Heel-bone, and when it hath paſſed the middle of the Foot, it is parted into four round Tendons, which are inſerted into the ſecond Joint of the four Toes, being perforated to give way to the Tendons of the former Muſcle to paſs to the third Joint.

Lumbricales. They are alſo bended by *four Lumbricales*, which agree altogether with the *Lumbricales* of the Hand, both in their Uſe, Figure and Riſe. Theſe ſpring from the Tendons of the two former, ſmall and round (or rather from the membranous Ligament that incloſes them) and are inſerted by a ſmall Tendon into the Side of the firſt Joint, which they help to bend. The fleſhy Subſtance, which riſeth with two acute Beginnings from the fore-part of the lower Side of the Heel-bone, and reacheth to the Riſe of theſe Muſcles, ſeemeth much to further their Action, and to afford them their carnous Subſtance.

Ten Movers obliquely. The Toes are moved obliquely by the *Interoſſei*, which are ſo called, becauſe they are placed

between

between the Bones of the *Metatarſus*. They are *Ten* in Number, whereas they are but eight in the Back of the Hand, becauſe the *Metatarſus* hath one Bone more than the *Metacarpus*, there being one to ſuſtain the great Toe as well as the reſt; whereas the Thumb hath none. Each of them doth ſpring from the under ſide of that Bone upon which it is placed, but preſently turning to its ſide, it keeps its Courſe along the Interſtice of the Bones, till it arrive at the firſt Joint of the Toe, into the ſide whereof it is inſerted by a ſhort and ſomewhat broad Tendon. If the inner be contracted, the Toe is moved inwards; if the outer, outwards. But if they both act together, then are the Toes extended. In the four Diſtances between the Bones, there are eight ſuch Muſcles; at the outſide of the great Toe one, and another at the outſide of the little Toe. But beſide it, the little Toe hath a proper *Abductor* to move it outwards, which ariſing from the Heel, paſſes on the outſide of the fifth Bone of the *Metatarſus*, and is inſerted into the outſide of the firſt Joint or Bone of this Toe.

The *great Toe* hath *five* peculiar or *proper* Muſcles. The *firſt* is *Extenſor*; this ſpringeth by a fleſhy Beginning from the outſide of the *Tibia*, where the *Fibula* ſtands out from it: After a ſhort Space it paſſeth into a Tendon, which running under the annular Ligament of the *Tarſus*, and marching along the upper Part of the Foot, is inſerted into the whole upper Part of the great Toe, which it extends. *One Extender of the* Pollex, *or great Toe.*

The *ſecond* is *Flexor*: This ſpringeth from the upper and back Part of the *Fibula*, and deſcending by the ſide of the *Flexor longus* to the inner Ankle, it there becometh tendinous, and running *One Bender.*

ning with the *Longus* under that Ligament there, which tieth the lower *Appendix* of the *Tibia* to the Heel, it is inſerted into the third or laſt Bone of the great Toe, by one ſtrong Tendon, ſerving to bend it. But ſometimes it is divided into two Tendons, whereof one is inſerted as aboveſaid, and the other into the ſecond Toe: And when this happens, the *Flexor longus* ſends but three Tendons to the three laſt Toes, and none to the ſecond.

Three Movers ſideways.

The *three* following move it ſideways: Of which the *firſt* is called *Abducens pollicem*, becauſe it draweth the great Toe from the reſt, toward the Inſide of the Foot. It ſpringeth nervous from the Ligament, which tieth together the Heel-bone and the *Talus* (or according to ſome, from the inner ſide of the Heel it ſelf) and running forwards on the Inſide of the Foot, it is inſerted by a round Tendon into the outſide of the firſt Joint of the great Toe.

1.

2. The *ſecond* is called *Adducens pollicem major*, drawing the great Toe towards the reſt. This ſpringeth from the Ligament that ties thoſe two Bones of the *Metatarſus* together, which ſuſtain the little Toe, and the next to it, and proceeding obliquely over the other Bones, it is implanted into the inner Side of the firſt Joint of the great Toe.

3. The *third* is called *Adducens pollicem minor* (and otherwiſe, *Tranſverſalis*, from its running *a-croſs* the Foot.) This ariſeth from the Ligament that binds the firſt Joint of the little Toe, and paſſing croſs the firſt Bones of the other Toes, it ends in the inſide of the firſt Bone of the great Toe. Some think this ſerves only to tie together the firſt Bones of the Toes (like a Ligament:) But *Caſſerius* (who firſt found

found it out) ſays, it draws the great Toe to the little one, and ſo makes the Foot hollow, graſping the Ground as it were, when we go in ſtony and uneven Places, to fix the Foot more firmly.

Let not the Reader wonder, that he meets not in this Diſcourſe of the Muſcles, with the ingenious Mr. *Cowper*'s new Diſcoveries: For beſides the New Muſcles which he has found out, he differs ſo very much in his Deſcription of the old from former Anatomiſts, that I have thought it better to refer the Reader to his *Myotomia Reformata*, than to do him any Injury, by curtailing what is fit to be peruſed at large by the Curious.

Having thus finiſhed our Diſcourſe of the Muſcles, I have thought fit to ſubjoin two Figures, wherein are repreſented as many of the Muſcles as can conveniently be ſhewn in two Poſtures of the Body. Which I have added, to let Beginners in this Art of Anatomy ſee the manner of the Lying of the Muſcles in their natural Situation, and of the Running of their Fibres.

TAB. XVIII.

Repreſenteth the Muſcles as they lie to View in the fore Part of the Body.

a *Sheweth the Frontal Muſcle.*
b *The Temporal.*
c *The Muſcle called* Maſſeter.
d *The* Maſtoideus.
e *The* Deltoides.
f f *The* Biceps.
g *The Extender of the Wriſt.*
h *The Bender of the Wriſt.*
* *The Bender of the Thumb.*
i *The Extender of the third Joint of the Thumb.*
k k *The Pectoral Muſcles.*
l l l l *The ſtreight Muſcles of the* Abdomen.
m m *The* Linea alba.
n n *The obliquely deſcending.*
o o *The* Muſculus ſartorius, *or* faſcialis.
p p *The ſtreight Muſcles of the Thigh.*
q q *The* Triceps.
r *Part of the* Membranoſus.
ſ ſ *The* Vaſtus internus.
t *The* Vaſtus externus.

TAB.


a
b
c
d
e
f
g
h
i
k
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m
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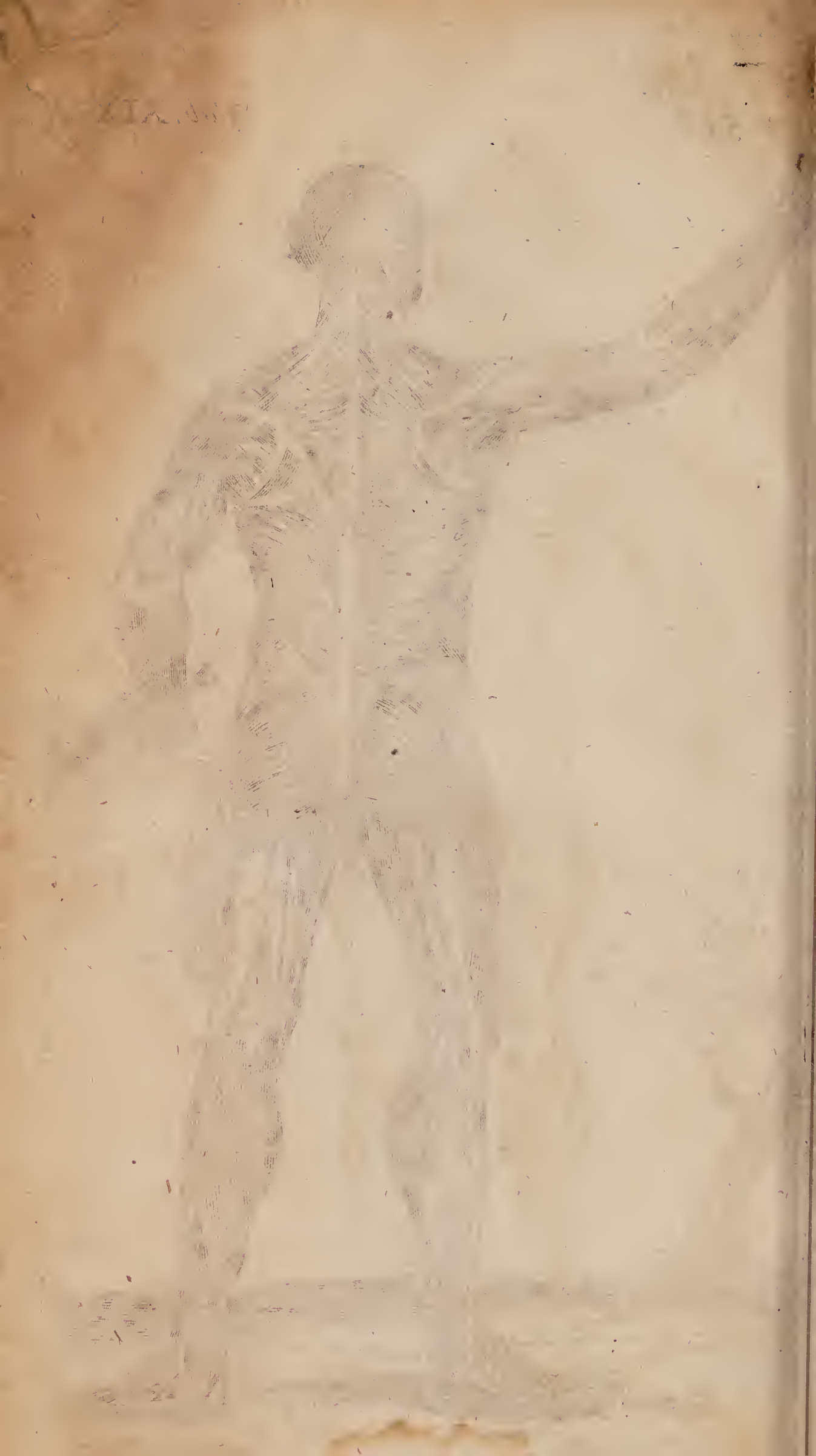
o
p
q
r
s
t



TAB. XIX.

Repreſents the Muſcles as they lie to View in the hinder Part of the Body.

aa *Shew the* Trapezius.
b *The* Deltoides.
c *The* Supraſpinatus.
d *The* Infraſpinatus.
e *The* Teres major.
f *The Extender of the Arm.*
g *The* Brachialis.
h *The outer Extender of the Wriſt.*
i *The other Extender of the Wriſt.*
k *The* Muſculus radii longus.
ll *The* latiſſimus dorſi.
mm *The obliquely deſcending.*
n *The* Quadratus.
oo *The* Glutæus maximus.
p *The* Vaſtus externus.
q *Part of the* Membranoſus.
rr *The* Seminervoſus.
ſſ *The* Semimembranoſus.
t *The* Gracilis.
u *The* Triceps.
x *The* Biceps.
y *The* Subpoplitæus.
zz *The* Gaſtrocnemius.
a *The* Peronæus.

The End of the Fifth Book.

The

The Sixth BOOK.

OF THE BONES.

CHAP. I.

Of Bones in general, their conſtituent and integral Parts.

A *Bone* is called in Greek ὀστέον, from *ἵστημι, to ſtand*; for according to *Hippocrates*, τῷ σώματι στάσιν, καὶ ὀρθότητα, καὶ εἶδος παρέχεται, *it affords Stability, Streightneſs, and Form to the Body.* *Bones, their Name.*

It may be defined to be a *ſimilar Part, moſt dry, cold and hard, inflexible, void of Senſe, affording Stabiliment and Form to the whole Body.* *Definition*

Bones have been commonly taught to be made of the more craſs, tartareous, or earthy Part of the Seed in the Womb, and that they are nouriſhed with the like Particles of the Blood, and moiſten'd with their contained Marrow. And I ſee no Reaſon to recede from this Doctrine, unleſs one would commence *Litem de Nomine*, brangle about a Term; for tho' Women have no true Seed, and the Man's being only an active Principle of Generation, affords nothing of Matter to the Parts of the *Fœtus*, but only impregnates the *Ovum* (as was ſhewn in *B.* I) yet if we will but grant *Matter and Nouriſhment.*

grant the Name of *Seed* to the Humour in the *Ovum* (which we may do without Abſurdity) we may continue the old manner of ſpeaking. Now tho' they are continually nouriſhed; yet towards Manhood, by the increaſed Heat of the Body, the primigenial Moiſture is ſo leſſened, that the Bones thro' their Hardneſs, are not apt to be any longer extended; and ſo Men ceaſe to grow any higher of Stature.

As to the integral and conſtituent Parts of Bones, their *Perioſteum* or inveſting Membrane, their *Subſtance, Pores, Marrow, Glands, Veſſels*, &c. Dr. *Havers* in his *Oſteologia nova*, has far outdone all former Anatomiſts in his account thereof, which is very worthy the Peruſal of all that are curious in Anatomy. Thither therefore I refer the Reader, and ſhall here only exhibit a ſhort Scheme of part thereof. And firſt as to the *Perioſteum* that cloaths them.

Perioſteum. The *Perioſteum* (he ſays) 'has two Sorts or Series of Fibres, the under deriv'd from the *Dura Mater*, the upper from the Membrane of the Muſcle that lies upon it: Which Fibres lie one upon the other, but are not interwoven one with another.

'The under Fibres run all parallel, directly from one end of the Bone to the other, and are continued from one Bone to another, by means of the Ligaments that join them together in their Articulations, upon which they paſs.

'The outer hold the ſame Courſe with the Fibres of the Muſcle, from whence they are derived, ſometimes ſtreight, ſometimes oblique, and ſometimes tranſverſe; and when they have run ſo far, as to make up their part of the *Perioſteum*, he thinks they are inſerted into the Bone, and are ſucceeded by others from ſome

other

'other Muſcles. Some of the Tendons of the Muſ-
'cles alſo propagate Fibres to make ſome part
'of the *Perioſteum*: But others penetrating it,
'are immediately inſerted into the Bone.

'The inner Superficies of the *Perioſteum* ſticks
'as cloſe to the Bone as if it were glued to it;
'and beſides, the *Perioſteum* has little *Fibrillæ*, or
'Threads continued from it, that enter into the
'Subſtance of the Bone, which give them (pro-
'bably) ſome internal Senſe.

The *Uſes* he aſcribes to it, are, 1. 'To be a *Its Uſes.*
'Tegument to the Bones. 2. To convey Spirits
'into the Subſtance of the Bones for maintain-
'ing their Heat, for preſerving their Senſibility,
'and to aſſiſt in the Work of their Accretion and
'Nutrition, by means of the minute Fibres it im-
'mits into them. 3. To help to ſet Limits to the
'Growth and Extention of the Bones; as the
'Bark is ſometimes obſerved ſo to bind young
'Trees, that it is neceſſary to open it before
'they can have the liberty of thriving. 4. It is
'ſerviceable in the Conjunction of the Bones and
'their Epiphyſes (while theſe are cartilaginous)
'alſo of the Bones which are joined by Sutures
'or Harmony, and in the Connexion of the
'Bones and their Cartilages. 5. To join the
'Heads and Tendons of the Muſcles faſt to the
'Bones; namely, of ſuch Tendons as do not
'penetrate it, (as ſome do not.)

Having done with the *Perioſteum*, he comes to *The Sub-*
the *Subſtance* of the Bones, which he deſcribes af- *ſtance or*
ter this manner. He ſays, 'They conſiſt of *La-* *Make of*
'*mellæ* or Plates lying one upon another; and *Bones.*
'theſe of ſmall Strings or Fibres running length-
'ways of the Bones (like as we ſee in Whale-
'bone.) Which Strings, though ſome of them
'run to the very Extremities of the Bones, and

'others

'others approach near to them, do not terminate 'there, ſo as to have diſtinct Ends, but they are, 'where they may be thought to terminate, ſtill 'continued and run tranſverſly, and as it were 'arched, that the Strings of one ſide of the Bone 'proceed ſo as to meet and be united to thoſe 'that are propagated from the Oppoſite; and 'this at both Extremities, that they are a Con-'tinuation, though not of the Figure, yet in the 'manner of a Ring. Therefore they are not all 'of a length, but in every Plate they fall one 'ſhorter than another.

'In ſeveral Bones the *Lamellæ* are diſpoſed di-'verſly: In thoſe Bones which have a large Ca-'vity, they are on every ſide contiguous and 'cloſely united: But in thoſe which have not 'any great Cavity, but are altogether ſpongious 'within, many of the internal *Laminæ* are pla-'ced at ſome Diſtance from one another in all 'their Length, having betwixt them a cavernous 'Subſtance, or ſmall bony Cells. And ſo have al-'ſo thoſe Bones which have a large Cavity, ſome 'of theſe leſſer Cells at both their Extremities.

Their Pores. Next he comes to their *Pores*, and ſays, 'That 'in the Bones whoſe Plates are contiguous, there 'are *Pores* through and between the Plates, be-'ſides thoſe which are made for the Paſſage of 'the Blood-veſſels: And theſe are of two ſorts: 'The one penetrate the *Laminæ*, and are tranſ-'verſe, looking from the Cavity to the external 'Superficies of the Bone: The ſecond ſort are 'formed between the Plates, which are Longi-'tudinal and ſtreight, tending from one end of 'the Bone towards the other, and obſerving the 'Courſe of the bony Strings. The firſt kind are 'formed not only in the firſt internal *Laminæ*, 'but in every one, even to the outermoſt; tho'

'the

'the nearer they are to the Cavity, the greater 'is the number of the Pores. And as they pass, 'they do not observe any such Order, as to lie 'directly one under another to form any continu-'ed Passage from the Cavity to the external 'Plate. The second kind, *viz.* the Longitudinal, 'are not to be observed but by good Glasses, un-'less it be now and then in some particular 'Bones. By these it is that the medullary Oil 'diffuses itself, and is immediately beneficial to 'the Plates. The other (*viz.* the transverse) are 'but subordinate to these, and rather designed 'for the Passage of the Marrow into them, than 'for the immediate Communication of it to the 'Substance of the Bone.

The Marrow and Glands.

'The *Medulla* contained in the Bones, con-'sists (besides the Blood-vessels) of an investing 'Membrane, in which are included membrana-'ceous Lobules or Bags, and in these Bags *Vesiculæ* 'or glandular Bladders, very much like the vesi-'cular Substance of the Lungs. And these glan-'dular Bladders serve both for the Separation of 'the medullary Oil from the Mass of Blood, and 'for the Reception and Conservation of it. In 'an human Bone which he had preserved till the 'medullar Oil was wholly evaporated, he found 'these *Vesiculæ* remaining dry, but intire, and 'their Substance representing in a manner a 'Sponge. They seem to have Pores or immedi-'ate Passages out of one into another (as have 'also the Bags) by which the Oil has a freer 'Course to the Joints, and Substance of the Bone, 'for whose Benefit it was designed. By the strict-'est Enquiry he could never find any thing like 'Ducts (as pass from other Glandules) and in-'deed these are not here necessary, because the 'Oil is not carried from the glandular Vesi-

'cles

'cles to any large Receptacle, but flows out of 'the Superficies of the Marrow in as many Places 'as there are transverse Pores in the internal La-'mel. The *Medulla* serves to oil the Substance of 'every Bone, which the drier it were, the brit-'tler it would be: It lubricates also their Ar-'ticulations, and hinders their Ends from being 'worn, or over-heated with Motion; and it moi-'stens likewise the Ligaments by which they are 'tied one to another. But in these two last Uses, 'it is assisted by the Mucilage, which is separa-'ted by the *Glandulæ mucilaginosæ* (as he calls 'them) which he has observed in all the Articu-'lations of the Bones, and are of the conglome-'rate kind, of which more in the next Chapter.

'Now the manner of the medullary Oil's insi-'nuating itself through a Bone; and its being 'dispensed to all the Parts of it, is this: It first 'passes being liquid (as it all is while the Ani-'mal is alive) out of the Cavity, through the 'transverse Pores of the first internal *Lamina*, 'and not having Pores of the same kind directly 'subjacent in the next Plate, to transmit it to-'wards the outside of the Bone, it flows into the 'longitudinal ones formed between these two '(the first and second) Plates, and being carried 'along in them, till it find some transverse Pores 'in the second Plate, it passes through these, 'which when it has done, it is again obliged to 'alter its Course to run into, and flow along the 'streight Pores, between the second and third '*Laminæ*. Thus it passes through and between 'the Plates successively, till it has made its way 'to the external Plate.

'Thus the medullary Oil is dispensed in all 'the Bones to those Plates which are contigu-'ous, and have no intermediate Cavities to en-

'tertain

'tertain any medullary Glands of their own: 'But where the Plates ſtand at ſome Diſtance '(as they do in ſuch Bones as have not any 'great Cavity) there are the ſmall Caverns '(above-mentioned) which are capable of con- 'taining ſome medullary Glands, from whence 'the Plates have more immediately, and with- 'out the former Method of Conveyance, the 'Benefit of the Marrow.

'He divides the *Blood-Veſſels* of the Bones into *Veſſels.* 'nutritious and *medullary*. The moſt conſiderable 'of the *nutritious* enter at the Ends of the 'Bone, *viz.* the Artery at one End, and the 'Vein at the other. The *medullary* commonly 'enter the Sides of the Bones (and that ob- 'liquely, as the Ureters do the Bladder) both 'by one *Foramen.*] There are no *Nerves* that are inſerted into them (except into the Teeth) but theſe only run thro' the *Perioſteum* that inveſts them.

['Some Bones have *large Cavities* in them, as *Large Ca-* 'Os humeri, and *Femoris*, the *Ulna* and *Radius*, *vities, and* 'Tibia and *Fibula*, the Bones of the *Metacarpus*, *Caverns.* 'and *Metatarſus*, of the Fingers and Toes, and 'of the *Os hyoides*: To which may be added the 'lower Jaw; though the Cavity compared with 'the magnitude of the Bone hardly deſerves to 'be ſtiled large. Beſides theſe large Cavities 'which are in the Inſide of Bones, there are 'leſſer Cells or Caverns in their Subſtance, 'which are found in all the Bones, even thoſe 'which have a large Cavity.] But of theſe before, when we ſpoke of the Diſtribution of the Marrow.

Beſides the large Cavities and Caverns in the *Superficial* Inſide or Subſtance of the Bones, moſt have *Cavities* *ſuperficial Cavities* or *Sinus*'s, which Dr. *Havers* *and* Fora- di- *mina.*

distinguishes into *Sulci* or Furrows (which are the long ones) and *Pits*, as he calls the shorter ones. And they have besides *Holes* for the nutritious and medullary Vessels, as was but just now observed.

Prominences, viz. On the outside of the Bones there are also to be observed their *Prominences* or *Protuberances*, of which there be two Kinds; for it is either a continued Part of the Bone jetting manifestly above its plain Superficies, for the more commodious Insertion of the Muscles, *&c.* and is

Apophysis, *or*, called *Apophysis*, a *Process*; or else it is like an additional Bone, growing to another by simple and immediate Contiguity (and generally softer

Epiphysis. and more porous than it) and is called *Epiphysis*, an *Appendage*. If the Protuberance of the Bone be round, it is called its *Caput*; under which is the *Cervix*, as in the upper End of the Thigh-bone: If it be flat, it is called *Condylus*; if sharp, *Corone*. Other Protuberances or Processes are named from the Similitude they have to other things, as *Styloides*, *Coracoides*, &c.

Use. Their *Uses* are many; for they serve, 1. For the Firmitude and Sustentation of the Body, like Beams and Pillars in Houses. 2. For a Defence to some Parts; so the Skull defends the Brain; the Ribs, the Parts contained in the Breast. 3. For Progression or Walking, of which they with the Muscles are the only Instruments. 4. They give Shape to the Parts of the Body. These are their *general* Uses; as to their *particular* Uses, those will be shewn as we describe them severally.

CHAP.

CHAP. II.

Of the different Conjunctions of Bones one to another.

BOnes are joined to one another, either by *Articulation* or Jointing; or else by *Symphysis* or growing together.

Articulation is either for *manifest* or *obscure* Motion. The former is called *Diarthrosis*, because the Articulation is loose, and the Motion manifest; the latter, *Synarthrosis*, because it is close and compact, and has but an obscure Motion. *Articulation.*

Diarthrosis, or that loose jointing which serves for *manifest* Motion, is threefold. First, *Enarthrosis*, which is, when a large and long Head of a Bone is received into a deep Cavity, as the Thigh-bone into the Hip-bone. Secondly, *Arthrodia*, which is when the Cavity which receiveth is shallow, and the Head of the Bone which is received, flattish: Such is the Articulation of the *Radius* with the Shoulder-bone, or of the Shoulder-bone with the *Scapula*. The third is *Ginglymos*; when the same Bone receiveth, and is received. This falleth out three manner of ways. First, when the Bone is received by another, and receiveth the same; this is seen in the Articulation of the Shoulder-bone with the *Ulna*. Secondly, when a Bone receiveth one Bone, and is received by another: Which is done in the Spondyls or *Vertebræ* of the Back, where the middle Bone receiveth the upper, and is received by the lower. The third is, when the Process of the Bone being long and round, is inserted into another upper Bone, and so is turned in the Cavity, like an Axle-tree in a 1. Diarthrosis.

Wheel; so is the second *Vertebra* of the Neck jointed with the first.

Mucilaginous Glands.

Note, That in all these Articulations are placed those *mucilaginous Glands* above-mentioned, first discovered by Dr. *Havers*, and accurately described by him in his *Osteologia nova*, p. 187. *&c.* from whence take this short Account of them. [They are of two sorts; *some* are *small* and *numerous* in every Joint, which are set thick all over the Membrane, excepting where there are any large Glands, and they are all of an equal Magnitude, so as to render it every where glandulous. But in some Parts of the Membrane, and in the *Sinus*'s of the Bones in the Joints, these Glandules are so conglomerated, as to form *remarkable* Glands, which I reckon as a *second* sort. The Colour of these is something transparent, when they are not discolour'd with Blood-vessels. They are soft and pappy, but not tender and friable, so that they are not easily broken by Compression. They are (as I have said before) *conglomerate*, though they do not consist of several Lobules or Bags of lesser Glandules, as some other Glands do; but of several Membranes superstrated one over another, set thick with small round Bladders, which not only lie contiguous, but tenaciously adhere one to another, as the several Membranes likewise do.—By the Pores of these little Bladders the mucilaginous Liquor is percolated, and distinguished from the rest of the Mass of Blood, which is conveyed to them by the Arteries, and from them it flows into the Interstices of the Joints by the excretory Passages, which all these Glandules have. The *Figure* of the Glands is various, and accommodated to the *Sinus* or Cavity, in which they are seated. Their *Situation* is different

ferent in the ſeveral Joints; and is, in general, ſuch, that they cannot be injured by a Compreſſion from the Bones; and yet there is this Contrivance, that the Bone does either in the Inflexion or Extenſion of the Joint, lightly preſs upon 'em, ſo as to promote the Excretion of the Humour, which they ſeparate into the Joints, when they are moved, and ſtand moſt in need of it.] A more particular Account of the Situation (and Number alſo) of theſe large mucilaginous Glands ſhall be given, when we come to ſpeak of the particular Articulation.

Synarthroſis, or Articulation for *obſcure* Motion, is ſuch as that of the Ribs with the *Vertebræ*, &c. 2. Synarthroſis.

Bones *grow together* either *without* ſome middle heterogeneous Subſtance; *or* with it. *Without* ſome middle Subſtance they are joined three manner of ways. Firſt, by a ſimple Line, as the Bones of the upper Jaw and Noſe; this is called *Harmonia*. Secondly, by a Suture (or *Rhaphe*) as the Bones of the Skull. Thirdly, when one Bone is faſtened in another, as a Nail in Wood; and ſo are the Teeth faſtened in the Jaw-bone: this is called *Gomphoſis*. Symphyſis.

If Bones grow together by a middle Subſtance, it is either by a *Cartilage*, as the Share-bones are joined; which Unition is called *Synchondroſis*: or by a *Ligament*, and ſo the Thigh is joined with the Hip-bone; this is called *Synneuroſis*; or more properly, according to *Spigelius*, *Syndeſmoſis*: Or, laſt of all, by *Fleſh*; and ſo is the Bone of the Tongue by its Muſcles to the adjacent Parts; this is termed *Syſſarcoſis*.

Spigelius reckons two other heterogeneous middle Subſtances by which Bones are united; one when they are joined by a *Tendon*, as the Knee-

pan to the Thigh-bone and *Tibia*, which Unition he calls *Syntenoſis*; the other by a *Membrane*, as in Infants the Bones of the *Synciput* with the *Os Frontis*; and this he calls *Synymenſis*.

CHAP. III.

Of the Skull in general.

WHEN all the Bones of the Body are artificially joined to one another, and ſeated in their proper Places, the whole Structure of them is called a *Skeleton*, from σκέλω, to *dry*, becauſe they are then void of all Moiſture.

This *Skeleton* is commonly divided into the *Head*, *Trunk* and *Limbs*.

The *Head* is again divided into the *Skull* or *Scalp*, and the *Face*.

The Skull. Its Name. The *Skull* is called in Greek κρανίον, *Cranium*, becauſe it defends the Brain *tanquam* κράνος, like an *Helmet*; and in Latin *Calvaria*, *qu. Calva* capitis *area*, becauſe it comprehends all that Part of the Head upon which the Hair grows, and which is ſaid to be *bald*, when the Hair falls off.

Figure. Its *Figure* is globous or round, but not exactly, for it bunches out a little before and behind, and is more flat on the ſides, ſo that it is ſomewhat longiſh. The more it varies in any particular Perſons from this Shape, the more preternatural is its Figure. Some raiſe a nice Queſtion concerning its Shape, whether it be owing to that of the Brain included within it, or whether the Shape of the Brain be owing to this of the Skull. 'Tis true, that they anſwer one to the other in Figure, but whoſe is owing to the others, is needleſs to enquire;

quire; nor ſhall we ſpend time in ſuch a fanciful Diſpute.

In an Embryo its *Subſtance* is membranous; in Infants new-born, 'tis bony, but ſoftiſh and flexible; but it grows harder and harder by Degrees (like the other Bones) yet continues ſpongy in its Middle. *Subſtance.*

It conſiſts of two *Laminæ*, Plates or Tables, (ſo called) the outer thicker and ſmoother, but the inner harder and furrowed on its inner Superficies, to give convenient and ſafe Paſſage to the Veſſels that creep through the *Dura Mater*; yea in ſome Places it is perforated, for the Tranſit of Veſſels from the ſaid *Meninx* to between the *Laminæ*, for the irrigating of the Pith that lies between them. *Tables.*

Which Pith is called *Diploe*, and is a ſpongy and cavernous Subſtance, containing a medullar and ſomewhat bloody Juice, for the Nouriſhment of the Skull. It is more porous in young Bodies than in old, and in ſome Places of the Skull than in others; for in ſome the two Tables grow ſo cloſe together, that 'tis hardly diſcernible. Diploe.

Diemerbroeck writes, that he has ſometimes obſerved (eſpecially in Venereal Perſons) a vicious Humour collected in this ſpongy Pith, which in Tract of Time becoming more acrimonious and virulent, has eat through the very Tables, eſpecially the outer, which is ſofter, and cauſed moſt tormenting Pains in the *Perioſteum* and *Pericranium*; yea ſometimes the inner alſo, and ſo the whole Skull has been perforated.

CHAP. IV.

Of the Sutures of the Skull.

BEfore we come to deſcribe particularly the Bones, which the Skull conſiſts of, we will treat in ſhort of their ſeveral Manners of Commiſſure, or Connexion one with another, or with thoſe that are contiguous to them, *viz.* the upper Jaw, and the three Bones that are common to the Skull and upper Jaw, *viz.* the *Jugale*, *Cuneiforme*, and *Spongioſum*; and laſtly, of theſe common Bones with thoſe next to *them*.

Sutures are proper or common.

Their Connexions among themſelves, and alſo with theſe other Bones, are both called *Sutures* (or Seams, and theſe are divided into *proper* or *common*.

Proper Sutures true or counterfeit.

The *proper* are thoſe which join the Bones of the Skull one with another; and are either (*veræ*) *true* Sutures, or (*mendoſæ*) *counterfeit*.

Three true.

The *true* are when two Bones being mutually indented, cloſe one with the other, as if two Saws were joined together by their Teeth; whence they are called *Serratæ*; and theſe are *three* in Number: The *firſt* is *Coronalis*, which is ſeated in the fore part (where formerly *Crowns* were worn) and paſſeth from one Temple to the other tranſverſely, joining the *Os Frontis* to the *Synciput*. The *ſecond* is *Lambdoides*, oppoſite to this, reſembling the Greek Letter Λ *Lambda*. This beginning at the *Baſis* of the *Occiput*, aſcends obliquely to either Ear, and joins the Bone of the *Occiput* to the Bones of the *Synciput* and Temples. The *third* is *Sagittalis* (being ſtreight as an *Arrow*) which beginning at the Top of the *Lambdoides*, comes

comes ſtreight forward by the Crown to the Middle of the *Coronalis*, and in Children for ſome Years (ſometimes in the Adult) it runs to the Top of the Noſe, dividing the Bone of the Fore-head into two. *Spigelius* notes, that theſe true Sutures are only in the outward *Lamina*, the inner being joined only by *Harmonia*.

Two counterfeit.

The *counterfeit*, or *mendoſæ* reſemble a line only, and are more properly called *Harmoniæ* than Sutures. *Spigelius* reckons *five* of them, and others more, but the chief of them are but *two*. The *firſt* paſſing from the Root of the *Proceſſus mammillaris* upwards, with a circular Duct, circumſcribes the Temple-bone, and deſcends down again to the *Baſis* of the Ear: This Suture joins the Bones of the *Synciput*, *Occiput*, and *Sphenoides* with the Temple-bone, this lying upon thoſe like the Scales upon Fiſh, whence this Suture is called *Squamoſa*. The ſecond runs from the top of this ſquamous Conjunction obliquely downwards, towards the Orbit of the Eye, to the beginning of the firſt common Suture, and joins this Bone *above* with the Bones of the *Synciput*, and *below* with the Bone of the Fore-head.

Common Sutures.

The *common* Sutures are thoſe whereby the Bones of the Skull (as alſo the common Bones) are joined to thoſe which are contiguous to them. And of theſe by *Diemerbroeck* there are reckoned *five*. The firſt is that by which the outer Proceſs of the *Os Frontis* is joined with the firſt Bone of the upper Jaw. The *ſecond* is ſeated in the outer and lower part of the Orbit of the Eye. The third aſcends obliquely from the Inſide of the Orbit to the top of the Noſe. The *fourth* proceeds obliquely, by the middle of *Os jugale*, joining it (or rather the firſt Bone of the upper Jaw) to the Temple-bone. The *fifth* below

low in the Cavity of the Noſtrils, tends from behind forwards: *Spigelius* ſays, this is common to the *Os cuneiforme* with the *Septum* of the Noſe.

The Uſes of the Sutures. The *Sutures* have *three Uſes*. The *firſt* is to help to ſtay the Brain from ſhogging, and its Parts from being miſplaced in violent Motions, by permitting ſome Fibres to paſs through from the *Dura Mater* to the *Pericranium* (or from this to that) by which the ſaid *Mater*, and the Brain inveſted in it, are ſuſpended as it were. The *ſecond* is to permit free Perſpiration. And the *third*, to hinder the Fiſſures that happen in the Skull from Knocks or Falls, *&c.* from extending any farther than thro' one Bone, for they generally ſtop at the next Suture. *Note*, That theſe Sutures in ſome are ſo cloſe, that they are in a manner defaced; and ſuch Perſons are ſubject to great Pains and other Diſtempers in their Heads, for want of due Perſpiration.

CHAP. V.

Of the proper Bones of the Skull.

Six proper Bones of the Skull. THE Bones proper to the Skull are in Number *ſix*, one of the Forehead, another of the *Occiput*, two of the Crown, and two of the Temples.

1. Os frontis. Firſt, *Os frontis*, the Forehead-bone. It is bounded by the Coronal and firſt common Suture, before; and in the ſides by the temporal Bones. It is but one in thoſe of ripe Age, but double in Children, being divided by a Suture paſſing down its Middle from the Coronal to the Noſe.

Be-

Betwixt the *Laminæ* of this Bone, at the Top of the Noſe, there is a large Cavity or Cavern (often two) from whence two Holes paſs to the Noſtrils. The outer *Lamina* that conſtitutes this Cavity, makes the upper plain Part of the Orbit of the Eye; but the inner, on each ſide above the Eyes, forms a bunchy Protuberance, uneven, with many Jettings out like little Hills. The Cavity is inveſted with a very thin greeniſh Membrane, and contains a clammy Humour. What its Uſe may be is hard to ſay; ſome think it gives an Eccho to the Voice, making it more ſonorous; others that it receiveth the odoriferous Air, drawn in by the Noſe, to ſtay it a while before it be ſent to the Brain. But theſe ſeem but vain Conjectures. *Its Cavity.*

It hath two *Holes* in the middle part of the Eye-brow, which come from the Orbit of the Eye, by which the firſt Branch of the Nerve of the fifth Conjugation of the Brain goes to the Muſcles of the Forehead, *&c.* Beſides theſe more manifeſt Holes, Dr. *Havers* has obſerved [‘In this Bone, ‘and in the Bones of the *Synciput*, at thoſe Angles ‘which meet in the coronal Suture, and all along ‘on both ſides the *Sutura Sagittalis*, numerous ‘*Pores* penetrating into their Subſtance, which ‘he conceives to be *Perſpiracula*, by which the offenſive Vapours which ariſe and gather within ‘the *Cranium*, do perſpire. Which Opinion, ſays ‘he, may ſeem the more probable, if we conſider ‘how Sweats do eaſily and frequently ariſe in the ‘Forehead, even when they are not diſcernible ‘in other Parts; to account for which we may ‘reaſonably ſuppoſe that there is ſome other way ‘of Evacuation, beſides what is made from the ‘Maſs of Blood by the cutaneous Glands, ‘which are to be found in any part of the Skin, ‘as well as there. *Holes and Pores.*

It

Proceſſes. It hath alſo four *Proceſſes*; the greater two are ſeated at the greater Corner of the Eye, and the leſſer two at the leſſer, making the upper part of the Orbit.

2, 3. *Two Bones of the* Synciput. The Bones of the *Synciput* or Crown are in Number two. Before they are joined with the Bone of the Forehead, by the Coronal Suture; behind with the *Os occipitis*, by the *Lambdoides*; on each ſide to the Temple-bones, by the *Suturæ ſquamoſæ*; and to one another in the middle of the Crown, by the ſagittal Suture. On the Outſide they are ſmooth, but on the Inſide uneven, for they have a great many Furrows running along their inner *Superficies*, for the Paſſage of the Veins of the *Dura Mater*. Their Subſtance is thinner and more rare even in the Adult, than that of the other Bones (for the better Exhalation of Vapours) but in Infants that abound with much Humidity, they are membranous and ſoft, hardening by Degrees.

4, 5. *Two Temple-Bones.* Below theſe, on each ſide, are the Bones of the *Temples*. They are joined in their upper part to the Outſide of the Bones of the *Synciput*, by the *Suturæ ſquamoſæ*; before, to the Proceſs of the firſt Bone of the upper Jaw; behind, to the *Os occipitis*, by a counterfeit Suture. Theſe Bones are even and thin in their upper part like a Scale (and conſiſt but of one *Lamina*) but below thick, hard, and unequal or craggy; wherefore they are called *Petroſa*.

Each has two Sinus's They have each two *Sinus*'s; the *outer* greater, lined with a Cartilage, betwixt the *Meatus auditorius*, and the Proceſs that makes part of the *Os jugale*; this receives the longer Proceſs of the lower Jaw: The *inner* leſs, common to it with the Bone of the *Occiput*, placed on the hinder ſide of the firſt named Proceſs.

By

By these *Sinus*'s there stands a slender, sharp and longish *Appendix*, from its Shape called *Styliformis*, which in Infants is cartilaginous, but in the Adult becomes bony. *One Appendix, viz.* Styloides.

Besides this *Appendix* they have three *Processes*, two *external* and one *internal*. *Three Processes.*

The *first external*, is blunt, thick and short, a little hollow within; and because it somewhat resembles a Cow's Pap, it is called *Mammillaris*. 1. Processus mammillaris.

The *second* is carried forward from the *Meatus* of the Ear, and is joined with the first Bone of the upper Jaw, both of them framing the *Os jugale*, of which in the next Chapter. 2.

The *third*, that is *internal*, is called *Processus petrosus*, and *Os petrosum*, from its Hardness and Craggineſs. It is pretty long, jetting out to the inner *Basis* of the Skull, *within* which it has two Holes, through one of which an Artery, and thro' the other the auditory Nerves pass to the inner Cavities of the Ear, that are excavated in their Process, namely, the *Tympanum*, *Labyrinthus*, and *Cochlea*: And without the Skull it hath three Holes; the first of which is the *Meatus auditorius*; the second is narrow, short and oblique, near to the first, by which the Jugular Vein enters the inner Cavities; the third is seated betwixt the *Processus Mammillaris*, and the *Styloides Appendix*, and ends into that Passage that goes from the Ear to the Mouth. 3. Petrosus

As to the four little Bones that are contained in its first inner Cavity, *viz. Incus*, *Malleus*, *Stapes*, and *Os orbiculare*, we have spoken of them before in *Book* III. *Chap.* 23.

The *Os occipitis*, that makes the hinder and lower part of the Head, is five-corner'd, by two of which Corners it is joined in its upper part to the Bones of the *Synciput*, by the *Lambdoides* Suture, 6. Os occipitis.

Suture, by two other in its fore sides to the Temple-bones by a counterfeit or squamous Suture, and by its fifth Corner to the *Os cuneiforme*. It is but one in the Adult, but it consists of four or more in Infants. It is the thickest and most compact of all the Bones of the Skull.

Its Sinus. It is said to have nine *Sinus*'s, two External, and seven Internal. The External are one on each side of its great Hole behind, by which the spinal Marrow descends. Of the Internal, the two largest are those that receive the Protuberances of the *Cerebellum*.

Processes. It has also five *Protuberances* or *Processes*; four of which are by the Sides of the great *Foramen* aforesaid, and being all covered with a Cartilage, are received into the *Sinus*'s of the first *Vertebræ*, serving for the Articulation of the Head: The fifth is larger than these, ascending inwards from the great *Foramen*, and parting the Protuberances of the Cerebel.

Holes. Lastly, it has five *Foramina*, of which the lowest and largest is that by which the *Medulla oblongata* passes out of the Skull into the *Vertebræ*. The rest are less, and are for the Transit of the Vessels.

CHAP. VI.

Of the Bones common to the Skull, and upper Jaw.

Three common Bones. HItherto of the Bones *proper* to the Skull: Now follow those which are *common* to it and the upper Jaw. These are *three*: *First*, *Sphenoides* or *Cuneiforme*, the Wedg-like Bone; so

1. Os cuneiforme. called,

called, quoth *Schneider*, [‘Not for the Propriety ‘of its Figure, for it endeth in a blunt Point; ‘nor, as many think, only upon the Account of ‘*Scission* or cleaving; but especially with respect ‘to an *Arch* (of which this is the *Cuneus* or ‘Wedge.) For the Bones of the Forehead, *Synci-* ‘*put*, Temples, and *Occiput*, make the Sides of the ‘Arch, and this Bone of which we speak, does, ‘like a *Wedge*, fill up that Space that lies betwixt ‘those rising Sides.] Before it is joined with the Forehead-bone; behind, to the *Os occipitis*. At the Sides it doth accompany a good way the *Os petrosum*. Above, it doth touch the first, fourth and sixth Bone of the upper Jaw; and below the Bones of the Palate of the Mouth, by its Wing-like Processes. It is thick in the Middle, but thinner at the Edges, and in the Adult it consists of two *Laminæ* and a *Diploe*, like the other Bones proper to the Skull. In Infants it consists of three or four. *Lib.* 1. *de catarrhis*, P. 167.

It has four *external Processes*, of which two, that are contiguous to the upper Jaw, are called *Pterygoides*, *Aliformes*, or Wing-like; and four *internal* also, which with the Space betwixt them, compose the *Sella equina*, or *Turcica*, upon which the *Glandula pituitaria* lieth, that receiveth the pituitous Excrements falling from the Brain by the *Infundibulum*. Of this *Sella* and its subjacent Cavity *Schneider* thus writes. [‘In that *Sinus* that is ‘called *Sella equina*, a certain Cavity lieth under ‘the upper *Laminæ* of the *Os cuneiforme*. In the ‘Skull indeed of an Infant, this Cavity is always ‘naturally absent (for in these the Bone in that ‘Place is fungous:) But after the Infant is a ‘Year old (as *Fallopius* teaches) it begins to be ‘made, and according to the Encrease of the ‘Bone, is greater or lesser. A thin Skin cloaths this *Its Processes.* Sella Turcica. *Idem* ib. P. 209, &c.

'this Cavity, which is not of a green Colour, as 'Bauhinus teaches; but is very thin, softish and 'whitish——— This *Antrum* (or Cavity) and 'the like, are formed by Nature, to the end the 'Skull should not be too ponderous———Nothing but Air is contained in it—— In some 'Skulls it is wanting.

Holes. Most of the more ancient Anatomists speak of several Holes in this Bone, for the Transit of such pituitous Humours (into the Nostrils or Palate) as fall upon, or are separated by the *Glandula pituitaria*. But as we intimated from Dr. *Lower* in *Book* III. *Chap.* 5. there are no such *Holes* in it for that Office, but those Excrements are resorbed by the Veins, as that Learned Doctor affirms. Yet it hath sundry Perforations for other Purposes, *viz.* for the Passage of the motory and optick Nerves of the Eye, and of other Nerves for the Motion of other Parts, as also of Veins and Arteries.

Sinus's. It has divers *Sinus*'s: Outwardly or below it has one in each wing-like Process, giving Room to the *Musculus Pterygoides* (or *Pterygostaphilinus*) *internus*; (or rather to Dr. *Croone*'s *Pterygopalatinus*.) Inwardly or above it has one large one, called *Sella equina*, before described out of *Schneider*: And two or three small ones.

2. Os cribriforme. The *second common* Bone is *Os cribriforme*, because like a Sieve it hath many Holes, by which the Filaments of the olfactory Nerves, or *Processus mammillares*, pass into the Nostrils. It is seated in the middle *Basis* of the Fore-head at the Top of the Nostrils, and is covered with the *Dura Mater*, which accompanies the nervous Filaments aforesaid through the Holes. It is joined by the Sutures called *Harmoniæ* to the *Os frontis*, the second Bone of the upper Jaw, and to the *Cuneiforme*.

On

On its upper Side in the Middle it has growing upon it a kind of triangular *Proceſs*, like to the Comb of a Cock, which is therefore called *Criſta Galli*. And oppoſite to this, in its lower Side, it has another that is thin and hard, dividing the Noſe into two Parts or Noſtrils, the right and the left, and is called *Septum Naſi*. *Its Proceſſes.*

To this *Os cribriforme*, in the Cavity of the Noſtrils, there adhere two other Bones, called *Spongioſa*, becauſe they are full of Caverns or Holes like a *Sponge* or Pumice-ſtone. But moſt Anatomiſts conſider them as Parts of the *Os cribriforme*, confounding their Names one with the other, calling this, *Os ſpongioſum*, or *Cribriforme*, indifferently. Oſſa ſpongioſa.

The *third common* Bone is (from its Shape) called *Os jugale*, or the Yoke-bone. This indeed is not truly a diſtinct Bone, but is made up of one Proceſs of a Bone of the Skull, and of another of the upper Jaw: But becauſe it has a diſtinct Name, and is common to the Skull and upper Jaw, as partaking of both, we therefore reckon it for a diſtinct *common* Bone. I ſay it is made up of two Proceſſes, of which the hinder is a Proceſs of the Temple-bone that is carried from the *Meatus auditorius* forwards; and the fore one is a Proceſs of the firſt Bone of the upper Jaw, that maketh the lower Side of the outer Corner of the Eye, which reaching backwards meets the other, and is joined to it by an oblique Suture, and ſo makes the *Os jugale*. 3. Os jugale.

By which Deſcription of this Bone, its *Situation* appears to be on each Side of the Face betwixt the *Meatus auditorius*, and the firſt Bone of the upper Jaw: And its principal Uſe ſeems to be for Defence of the Tendon of the temporal Muſcle, and to give Riſe to one of the Heads of the Muſcle *Maſſeter*. *Its Situation and Uſe.*

CHAP. VII.

Of the upper and lower Jaws.

THUS far of the Bones of the *Calvaria*, or *Scalp:* Next follow those of the *Face*, which are the *Jaw bones* with their *Teeth*; to which we shall subjoin the *Bone of the Tongue.*

The Jaw-bones are two, the upper and lower.

The *Jaws* are two, the *upper* and *lower.*

The upper consists of 12 Bones.

The Substance of the *upper* Jaw, especially on its Inside, is not solid but spongious; and unequal, because it is framed of sundry Bones. They are six Pair, six in each side. The *first* is almost triangular, seated on the lower side of the outer Corner of the Eye, and by its Process maketh up the best Part of the *Os jugale*, as was shewed in the former Chapter. The *second* is a round, little, and thin Bone in the inner Corner of the Eye, having an Hole in its lower Part, called *Foramen lachrymale*, upon which the *Glandula*, or *Caruncula lachrymalis* resteth, and through which a Branch of the fifth Pair of Nerves passeth to the inner Membrane of the Nose. The *third* is thin, as the former, but Quadrangular. It is placed between the two former in the inner-side of the Orbit of the Eye. The *fourth* is called *Os malæ*, the Cheek-bone, and is the greatest and thickest. This maketh up the greatest Part of the Cheek and Palate, and containeth all the upper Teeth in its Caverns. It is joined above, on that Side next the Nose, to the Bone of the Fore-head, but below with the wedge-like Bone; before, with the second Bone of the upper Jaw; behind, with the third, and last of all with its Fellow. Under the Eye it has a Hole for the Passage of a Branch

of

of the fifth Pair of Nerves that is beſtowed on the Face; and another near the Bottom of the Noſe, by which an Artery and a Vein paſs from the Palate to the Noſtrils. The *fifth* is long, hard, and reaſonable thick; it with its Fellow maketh up the bony Part of the Noſe. It is joined with the Cartilages of the Noſe below (to which purpoſe it is very rough on that Side) but to the internal Proceſs of the *Os frontis* above. The *ſixth* is broad and thin, and (with its Fellow) makes the Roof of the Mouth.

Note, That the under-ſide of the Orbit of the Eye is formed by the firſt, ſecond, third, and fourth of theſe Bones of the upper Jaw; and the upper-ſide, by the *Os frontis*: Only the *Os cuneiforme* makes up a little Part in the hinder Side of the outer Corner. *The Orbit of the Eye, how formed.*

The *lower* Jaw in thoſe of ripe Age is but one Bone, but in Children, till they are a Year or two Old (or more) it conſiſts of two, which are joined together at the Chin by *Synchrondroſis*, and afterwards grow into one. This is moveable, but the upper immoveable. It reſembleth in Shape the Greek Letter *υ*. *The lower Jaw conſiſts but of one Bone.*

At each End of it there are two *Proceſſes*, whereof the one from a broad *Baſis* grows ſharp, and is called *Corone*, going under the *Os jugale*, and having the Tendon of the temporal Muſcle firmly inſerted into it. The *other* may be called *Articularis*, becauſe it ſerveth for Articulation. This has a long Neck and a longiſh but flattiſh Head (or *Condylus*) that is covered with a Cartilage for its eaſier Motion. By this Head it is inarticulated into the larger *Sinus* of the *Os temporis* that is alſo lined with a Cartilage, and is knit ſtrongly thereto by a membranous Ligament. *Its Proceſſes.*

Cavity. This Bone has a *Cavity* within, especially in the fore-part toward the Chin, which (as Dr. *Havers* affirms) does not contain a marrowy Juice for its Nourishment, but serves only as a Channel for the Nerve and the Blood-vessels to run along in.

Holes. It has four *Foramina*; of which two are at the Roots of the Processes, by which a Branch of the fifth Pair of Nerves, together with a Vein and Artery, pass to the Teeth (as shall be shewn farther in the next Chapter) and *two* other in its fore-part by the sides of the Chin, by which two Twigs of the said fifth Branch pass out again to the lower Lip, and its Muscles and Skin.

Surface. Its *Superficies* is smooth for the greatest Part, but in some Places there are Asperities, for the firmer Insertion of the Tendons of its Muscles, as was shewn in the Description of those Muscles.

The Alveoli of both Jaws. Both the Jaws have *Alveoli* or Sockets for the Teeth, in Number equal with the Number of the Teeth. But when in old Age the Teeth fall out, the Sockets close together, so that in time there remains no Print of them, but the Bone becomes smooth and sharp.

CHAP. VIII.

Of the Teeth.

The Teeth, their Name and Articulation. THE Teeth are called in Latin *Dentes, quasi edentes*, from their Office of *Eating*. They are fixed in their *Alveoli* three manner of ways: The first and chief is by their Articulation with the Jaw-bones, by *Gomphosis*; the second is by the Nerve, which is inserted into their Root, by

by *Synneurosis*; and the last is by the Gums which cleave to the Outside of their Roots, by *Syssarcosis*.

Their *Substance* is the hardest of all other Bones, but more especially that Part of them that stands out naked above the Gums. This Part, Dr. *Havers* thinks, ought to be esteemed [' rather stony than bony, and yet not the whole ' of it neither, but only the Outside or *Cortex*, ' which like a Shell covers the bony, which being ' broken off or decay'd, the bony quickly rots, ' and moulders away: Upon which Account it is, ' that when the Gums are eaten away, so that ' some part of a Tooth, which is not defended ' with this stony *Cortex*, is laid bare, it is eroded; ' when that Part that naturally stands out of the ' Gums, and is by such a solid Substance secured, ' suffers no such Injury.] The stony Part is not covered with any *Periosteum*; but that Part which is within the Sockets of the Jaw-bones is invested with a thin Membrane, which, he says, [' is not ' the true *Periosteum* (though that invests the ' Socket wherein they stand) but is propagated ' from that Membrane that covers the Gums, ' and is common to the whole Mouth, which ' does not terminate with the Gums, but when it ' comes to their extreme Edge, turns in, and is ' reflected between the other side of the Gum ' and the Tooth, descending into the *Alveolus* or ' Socket, and adhering on one side immediately to ' those Parts of the Teeth which lie within, and ' on the other to the hard fleshy Substance of the ' Gums, which with this is communicated to the ' Roots of some Teeth (especially in the upper ' Jaw) to fasten them more firmly in their ' Sockets; and where none of this hard Flesh in- ' tervenes, it coalesces as it were into one Mem- ' brane

Substance.

'brane with the *Perioſteum* that covers the In-'ſide of the Socket.] By this Membrane, and the Nerve inſerted into the Root of every Tooth, theſe lower Parts of the Teeth become exquiſitely ſenſible.

Cavity and Veſſels. The Grinders have a manifeſt *Cavity* within (but the *Inciſores* and *Canini* but an obſcure one) whereinto by the very ſmall Holes of their Roots, they each receive a capillary Artery from the *Carotides*, a Vein from the Jugulars, and a Twig of a Nerve from the fifth Pair (as aboveſaid.) The Vein, Artery, and Nerve are united together, and clad with a common Membrane when they enter the Jaw, within which they have a proper Channel to run along in under the Roots of the Teeth, ſending Twigs to each as they paſs under them.

Principle. The Rudiments or *Principles* of the Teeth are bred with the other Parts in the Womb, but lie hid for ſome Months within the Jaws and Gums. Theſe Principles are partly bony and partly mucous, and both Parts are at firſt included in a membranous and ſomewhat mucous *Folliculus* or Caſe, which in proceſs of time they break thro' (ſome ſooner, others later) their bony Part aſcending upwards out of the Gums, and their mucous Part (hardening by Degrees) deſcending downward into the Jaw ſo far as there is ſpace for it; the *Folliculus* it ſelf turning to a kind of Cement, whereby the Tooth is faſtened to the ſides of the *Alveolus*.

Eruption and Growth. At what time, and in what Order they *break forth* out of the *Alveoli*, is known to every Nurſe: Omitting therefore to ſpeak of that, I ſhall only note, That the Teeth alone, of all the Bones in the Body, continue to *grow* ſo long as a Man lives (and they continue in his Head) for elſe would

would they be ſoon worn to the Stumps by their daily Uſe; and we ſee that when a Tooth is loſt out of either Jaw (in the oldeſt People) that which is oppoſite to it in the other Jaw, will commonly grow longer than the reſt, having none to grind againſt; though it muſt be confeſs'd, that the ſeeming Length of old Peoples Teeth, is more owing to the falling away of their Gums, than the Growth of their Teeth.

Change. When Children come to be ſeven or eight Years old, they *change* ſeveral of their Teeth; but very rarely, if ever, all. The *Inciſores* or Fore-teeth, the *Canini*, or Eye-teeth, and the foremoſt Double-teeth moſt change; but the reſt of the Double-teeth very few. Now concerning this changing of the Teeth, we muſt know that the old ones do not come out by the Roots, but their upper Part only drops off, their Root remaining ſtill in the Socket of the Jaw, which (being like Seed for the new ones) by degrees grows up above the Gums to ſupply the Place of that which was fallen off. Commonly about the twentieth Year (or upwards) there ſpring out two double Teeth behind the reſt, which till then had lain hid in their Sockets. Theſe are called genuine Teeth, or *Dentes Sapientiæ*, becauſe Men are then come to Years of Diſcretion.

Dentes ſapientiæ.

Number. As for the *Number* of them, commonly there are found ſixteen in each Jaw; if there fall out any Difference in Number as to individual Perſons, it generally falleth out in the *Molares*.

Sorts. There are *three* Ranks, or Sorts of Teeth. Thoſe of the *firſt* Rank (or the foremoſt) are called *Inciſores*, Cutters. Moſt commonly four are found in each Jaw: They have but one

Root or Phang, and ſo eaſily fall, or are pulled out. Theſe firſt make way out of the Gums, in Children, becauſe the Tops of them are ſharpeſt. Thoſe of the *ſecond* Rank are called *Canini*, or Dog-teeth, from their Length, Hardneſs and Sharpneſs above the reſt. In each Jaw there are two, at each ſide of the Cutters one. They are otherwiſe called *Eye teeth*, either from an Opinion that their Roots (*viz.* of the upper) reach as far as the Eyes; or that the ſame Nerve that moves the Eye, ſends a Twig to theſe Teeth; neither of which Conceits are true. The Roots of theſe are ſingle, as thoſe of the *Inciſores*, but they are both ſometimes crooked; and if ſuch People, in whom they are ſo, chance to have one of them drawn, they can hardly be pulled out, without breaking off a Piece of the *Alveolus*, in which they are fix'd. Thoſe of the *third* Rank are called *Molares*, Grinders; becauſe, like Mill-ſtones, they grind the Meat. Moſt commonly they are twenty in Number, five in each ſide of both Jaws. The two foremoſt, that ſtand next to the Dog-teeth, are leſs than the reſt, having but two Knobs at the Top; but the three hindmoſt are larger, and have four, being in a manner fourſquare. The two foremoſt alſo have but two Roots at moſt, but the three hindmoſt commonly three or four. But thoſe of the upper Jaw have, for the moſt Part, one Root more than thoſe which are oppoſite to them in the lower, or however their Roots are larger. The Reaſon whereof may be, firſt, becauſe they are pendulous, and ſo are the apter to drop out; and, ſecondly, becauſe the Subſtance of the upper Jaw is not ſo firm as that of the lower.

The

The *Use* of the Teeth is principally to chew the Meat to prepare it for the Stomach, that it may the easilier concoct it into Chyle. The *Incisores* bite off the Morsel, the Dog-teeth break it, and the Grinders make it small; wherefore they are flat in the top, that they may the better receive and keep the Meat; and rough, that they may grind it the better. The Teeth contribute also to the Formation of the Speech, especially the Fore-Teeth; for those that have lost them, lisp, as we say, and cannot pronounce plainly such Syllables as have C, X, *&c.* in them. *Use.*

CHAP. IX.

Of the Bone of the Tongue, called Os Hyoides.

THE *Os Hyoides* is seated at the Root of the Tongue, under the lower Jaw, and above the *Larynx*. It is shaped like the Greek Vowel *υ*, (whence it is also called *Os Ypsiloides*) or like the lower Jaw, being arched before, and extending its two Points or Horns backward. Os Hyoides, *its Situation and Shape.*

It is commonly composed of three Bones. That in the middle is gibbous forwards, and hollow inwards; by its gibbous side it is joined to the *Basis* of the Tongue, and into its Concave it receives the *Epiglottis*. The other two are lateral, and are called *Cornua*, or Horns. Each of these has a Cartilage adhering to it; and the middle, two. They are all tied to the adjacent Parts, partly by a fleshy, partly by a nervous or membranous Substance. *Parts.*

It

Use. It serves for the Insertion of several of those Muscles that are designed to move the Tongue, (described *Book* V. *Chap.* 10.) and also for keeping the Throat open, that the Meat may have Passage out of the Mouth into the Stomach, and the Air into and out of the Wind-pipe, while we speak and breathe.

CHAP. X.

Of the Bones of the Neck, viz. *the* Claviculæ *and* Vertebræ.

HItherto of the Bones of the *Head*; we should next proceed to those of the *Trunk* (according to our Division of the Parts of a *Skeleton*) but betwixt these lieth the *Neck*, whose Bones we must describe in our way.

These are of two sorts, to wit, the *Claviculæ* or Chanel-bones, and the *Vertebræ*.

Claviculæ *Their Situation, Figure, Substance, Number, and Connexion.*

As to the *Claviculæ*, some reckon them to the *Thorax*, others to the Shoulder; but considering their *Situation*, they may as fitly be reckoned as pertaining to the Neck. They are called *Claviculæ*, from their resembling the Shape of old fashioned Keys, which were of the Figure of an Italick *ſ*; such as *Spigelius* says he has seen belonging to old Houses at *Padua*. They are not so crooked in Women as in Men. Their Substance is thick and spongy, but more about the Heads than about the middle. In *Number* they are two, one on each side. Near the Throat, they are round; but towards the Shoulder, flattish. They are *joined* to two Bones, to wit, by one end to the upper Process of the Shoulder-blade, by a large

and

and oblong Head; and by the other to the Top of the *Sternum*.

Their *Use* is to uphold the Shoulder-blades, that they ſhould not ſlide down upon the *Thorax* together with the Shoulder-bone; which falleth out when there happens a Fracture in theſe Bones. *Uſe.*

The other Bones of the *Neck* are the ἀσπόνδυλοι, or *Vertebræ*; but before we come particularly to deſcribe theſe, it will be convenient to premiſe ſomething concerning all the *Vertebræ* of the Spine in general.

There are reckoned thirty *Vertebræ* of the Spine in all; *viz.* ſeven of the Neck, twelve of the *Thorax*, five of the *Loins*, and ſix of *Os ſacrum*. Each conſiſts of a *Body*, that is convex forwards, and ſomewhat hollow behind, but above and below plain: Which Body is of a ſolid and hard Subſtance, but ſomewhat fungous and ſoftiſh. This Body has three ſorts of *Proceſſes* growing out of it toward its hinder Side, two tranſverſe, four oblique, and one poſterior or acute, which are of an harder Subſtance than itſelf. Beſides theſe Proceſſes, *Dionis* allows to each of them five *Epiphyſes* or Appendages, to wit, two at their Body, two at the Extremities of their tranſverſe *Proceſſes*, and one at the End of their acute Proceſs. There is alſo in each a large *proper Hole* in its Middle (or rather betwixt it and its Proceſſes) for the Deſcent of the Spinal Marrow: And on its upper and under Sides two ſmall lateral *common* ones that is common to itſelf and that next it; for one half of theſe Holes is excavated out of the lower Side of the upper *Vertebra*, and the other half out of the upper part of the lower; and they ſerve for the Entrance of the Blood-veſſels into the Spine, and for the Exit of the Nerves that ſpring out of the ſame. Vertebræ *of the whole Spine, their Number, Subſtance, Parts and Holes.*

The

Connexion. The *Vertebræ* are joined to one another *behind* by *Ginglymus*, *forwards* by *Harmonia*; on the *Outside* by an hard Membrane, on the *Inside* by a membranous, hard and ſtrong Ligament, reaching from the firſt *Vertebra* of the Neck to the *Os ſacrum*.

Thus far of what is *common* to all the *Vertebræ*: As for what is *proper* to thoſe of each of the four *Diviſions*, that ſhall be ſhewn in their particular Deſcription.

Vertebræ *of the Neck ſeven.* And firſt for the *Vertebræ* of the *Neck*, which are in Number *ſeven*. The *Bodies* of theſe are leſs, but harder than thoſe of the other, which was convenient, becauſe they are more moved. They are not of a ſemicircular ſhape like the other, but rather four-ſquare as it were. Their tranſverſe Proceſſes have each an Hole in them (which the reſt have not) through which Veins and Arteries paſs to the Head. Their *poſteriour* Proceſſes or Spines are forked or cleft into two, except in the firſt and laſt *Vertebræ*.

1. Atlas. The *firſt* or uppermoſt *Vertebræ* is called *Atlas*, becauſe the Head ſtands upon it like the Globe of the World. It hath no Spine behind (only a little blunt Knob) leſt the two ſmall Muſcles (called *Obliqui inferiores*) ſpringing from the ſecond *Vertebra*, and inſerted into this (or, as ſome ſay, into the *Occiput*) ſhould be hurt, when the Head is bowed forward. *Spigelius* ſays it has no true *Body* but rather (inſtead of it) a Tubercle in its foreſide. Both its obliquely aſcending and obliquely deſcending Proceſſes have each a *Sinus* in them: The upper receiving the Tubercles of the *Occiput*, and the lower the aſcending Proceſſes of the ſecond *Vertebra*. Upon theſe the Head is moved forwards and backwards. The Subſtance of this *Vertebra* is harder, ſolider, but thinner than

that

that of the reſt, becauſe it is the leaſt, and yet its Cavity is biggeſt. Within on the foreſide of its great *Foramen*, it has a ſemicircular *Sinus* lined with a Cartilage, whereinto it receiveth the Tooth-like Proceſs of the ſecond *Vertebra*; round which Proceſs (ſays Dr. *Havers*) are ſome mucilaginous Glands planted, and one on each ſide.

The *ſecond* is called *Vertebra dentata*, becauſe out of its upper ſide, between its two aſcending Proceſſes, there ſprings a round, longiſh and hard Proceſs, in Shape like a *Tooth*, which being inveſted with a Cartilage, is jointed into the foreſaid *Sinus* of the firſt *Vertebra*, upon which, as upon an *Axis*, the Head with the ſaid firſt *Vertebra* turns round. And when a Luxation happens here, the Neck is ſaid to be broken. This Toothleſs Proceſs in that Part, which enters not into the ſaid *Sinus*, is environed with a Ligament, by which it is knit to the *Occiput*. The hinder Proceſs of this *Vertebra* is cleft into two, as thoſe of the four following are, for the more convenient Inſertion of the Muſcles and Ligaments. Its *tranſverſe* Proceſſes are leſs than theirs, and have alſo ſmaller Holes. 2. Dentata.

The *four* that lie next under this, are in all things like it, ſave that their tranſverſe or lateral Proceſſes are larger, and divided into two, as well as the hinder. The *ſeventh* is the largeſt of all. It is liker to the *Vertebræ* of the *Thorax* than of the Neck; for neither its tranſverſe nor hinder Proceſſes are cleft like the foregoing, but both are like thoſe of the *Vertebræ* of the *Thorax*, to be deſcribed in the next Chapter. *The other five.*

CHAP.

CHAP. XI.

Of the Vertebræ *of the* Thorax.

IN the next Place we come to the Bones of the *Trunk*, which is divided into the *Thorax* and *Abdomen*.

The Bones of the *Thorax* are the *Vertebræ* of the *Back*, the *Ribs* and *Breaſt-bone*.

Vertebræ *of the Back twelve.*

Firſt, as for the *Vertebræ*, they are *twelve* in Number, unto which ſo many Ribs (of a ſide) anſwer; there are ſeldom thirteen of each, but more ſeldom eleven. Their *Spines* or *hinder* Proceſſes are not divided into two, as thoſe of the Neck, but are ſolid and ſimple. The *tranſverſe* are ſhort and blunt, and have each a ſhallow *Sinus* for the Inarticulation of the Ribs; but are not perforated like thoſe of the Neck. The *oblique* Proceſſes (which are four, two aſcending, and two deſcending) ſerve for the Articulation of one *Vertebra* with another. The deſcending are a little hollowed, and receive the (ſomething protuberant) Heads of the aſcending Proceſſes of the next *Vertebra* below them, ſucceſſively. The fore-part of their *Body*, next to the Cavity of the *Thorax*, is round, or convex; and the hinder part lunated, or concave. On each ſide they have a ſmooth *Sinus* for the reception of the Heads of the Ribs; for into theſe *Sinus*'s they are receiv'd as well as into thoſe of the tranſverſe Proceſſes. As for their *Holes*, they have one large proper one in their middle, which containeth the Spinal Marrow; and the one half of two *common* leſſer ones, that is, one half on their upper ſide, and another on their lower, as they join

to

to one another, for the Egreſs of the Nerves, and Ingreſs of the Veins and Arteries, as was ſhewn before in the general Deſcription of the *Vertebræ*.

CHAP. XII.

Of the Ribs.

THE *ſecond* ſort of Bones in the *Thorax* are the *Ribs*, which (as was ſhewn in the former Chapter) are uſually twelve in Number. *The Ribs; Their Subſtance.*

Their Subſtance is partly bony, partly cartilaginous; the firſt ſerving for Firmneſs and Strength, the ſecond for Articulation, and the eaſier Motion of the Breaſt in Reſpiration. The Bony Subſtance towards the *Vertebræ* of the Back is thick and roundiſh, but towards the *Sternum*, flat and thin, and ends in a Cartilage. Within, their bony part is fungous or ſpongy; whence the Ribs being broken, are more readily joined together by a *Callus*, than moſt other Bones. The Cartilages in Bigneſs anſwer the Bigneſs of the Ribs: For the bigger Ribs have the bigger Cartilages; and on the contrary. The Ribs in the upper ſide are blunt or broadiſh, but in the under ſharper. In their lower and inner ſide they have a Furrow, that runs along them, to receive the intercoſtal Veſſels, the Veins, Arteries and Nerves. On their Inſide towards the Cavity of the *Thorax*, they are cloathed with a *Perioſteum*, underneath the *Pleura*, and (according to Dr. *Ruyſch*) the Veſſels run along it, and not between the two Skins or Membranes which compoſe the *Pleura*.

The Ribs are of two ſorts, *viz. long*, or *ſhort*.

The

Seven Vertæ. The *long* (otherwiſe called the *true* Ribs) are *ſeven* in Number (being the uppermoſt:) Theſe are articulated both with the *Vertebræ* and *Sternum.* Their cartilaginous Ends or Heads, are received into ſhallow *Sinus*'s in the Breaſt-bone; and their bony Heads being covered with a Cartilage, are received into the *Sinus*'s in the Bodies of the *Vertebræ*; and the ſame Heads have each a Tubercle (except the two loweſt) that being alſo lined with a Cartilage, are articulated into the ſhallow *Sinus*'s of the tranſverſe Proceſſes. ['In both theſe Articulations with the *Vertebræ* '(Dr. *Havers* ſays) are mucilaginous Glands to be 'found, but the largeſt is in the lower Articula-'tion, and on that ſide which is next the Cavity 'of the *Thorax.*] The Articulation into the Breaſt-bone, is by *Arthrodia*; but that into the *Vertebræ*, by *Synarthroſis*; for the Motion of the Ribs at that end is very obſcure, as being ſtraitly tied to the *Vertebræ* by Ligaments.

Note, That the Cartilages of theſe true Ribs are uſually obſerved to be harder in Women than in Men; which may ſeem to be for the better ſuſtaining of the Weight of their Breaſts that lie upon them.

Five Nothæ. The *ſhort* (otherwiſe called *Nothæ* or *Spuriæ*, baſtard-Ribs) are *five* in Number; of which the four uppermoſt having their Cartilages bending upward, and cleaving one to another, are joined before to the lower ſide of the Cartilage of the ſeventh true Rib: But the laſt, which is the leaſt, is looſe from the reſt, and grows ſometimes to the Diaphragm, and ſometimes to the *Muſculus rectus* of the *Abdomen*, as alſo ſometimes does the loweſt of the four next above it. Behind they are joined to the *Vertebræ* of the Back, like as the true Ribs were, only the two loweſt (and ſometimes

times the third) are received only into the Bodies of the *Vertebræ*, and not into the tranſverſe Proceſſes, which here have no *Sinus* for their Reception.

The *Uſe* of all the Ribs is, *firſt*, to keep the Breaſt, and the upper part of the *Abdomen*, diſtended, that in the former the Heart and Lungs may have free Space for their Motion; and in the latter the Stomach and Liver might not be preſt upon by the circumjacent Parts. *Secondly*, to preſerve thoſe Parts from external Injuries, as from Bruiſes, or the like. And, *Laſtly*, to ſuſtain the Muſcles that ſerve for Reſpiration, and to yield to, or obey their Motions; for if the Breaſt had been environ'd with one continued Bone, it had not been capable of Dilatation in Inſpiration, nor of Contraction in Expiration. *Uſe.*

CHAP. XIII.

Of the Breaſt-bone or Sternum.

THE *Sternum* (which is the laſt Bone of the *Thorax*) is ſeated in the middle of the Breaſt before, ſerving as a Breaſt-plate, and having the cartilaginous Productions of the true Ribs inarticulated into it. It is of a red fungous *Subſtance*, and in Children almoſt wholly cartilaginous; only its uppermoſt part is in them ſomewhat more bony than the reſt, perhaps becauſe one end of the *Clavicula* is jointed into it. In Infants it conſiſts of ſeven or eight, but after ſome Years they ſo coaleſce one to another, that in the Adult it is compounded but of three, and in aged Perſons it ſeemeth but one Bone; yet it is diſtinguiſhed by *The* Sternum, *its Subſtance.*

two transverse Lines, shewing the former Division, which are more conspicuous in the Inside than Outside.

It consists of three Bones and a Cartilage

The *uppermost* Bone is thickest and broadest; it hath in each Side a longish Cavity lined with a Cartilage, to receive the Heads of the Clavicles: Between these in its middle and upper Part, is a lunated Pit called *Jugulum*. It hath also a small *Sinus* or Dent on the Inside, to give way to the Wind-pipe descending. The *second* Bone is neither so thick nor so broad, yet a good deal longer. It is joined to the former by an intervening Cartilage, and in each side has five or six *Sinus*'s for the Inarticulation of so many of the true Ribs. The *third* is the shortest of all, yet it is broader than the second, unto the lower end of which it is joined. What true Ribs were not jointed into the middle Bone, are received by this. To its lower end is annexed the Cartilage called *Mucronata* or *Ensiformis*, Sword-like. This Cartilage is triangular, about an Inch long, and on the outside of it there is formed a Cavity in the Breast, called *Scrobiculus Cordis*, or the Heart-Pit; and the gnawing Pains sometimes felt there, *Cardialgiæ*; tho' those Pains are not from any primary Affection of the *Heart*, but of the *upper Orifice of the Stomach*, which lies under their Cartilage, and has the Name of *Cardia*, from its great Consent with the Heart, (as some derive the Reason of its Name.)

Its Uses.

Its *Uses* are four: The first is for the forming the fore and middle part of the *Thorax*; the second is to articulate the Clavicles and Ribs; the third is to contain and defend the Heart and the Parts for Respiration; and the fourth is to support the *Mediastinum*, which cleaves to the middle of the Inside of it in its whole length.

CHAP.

CHAP. XIV.

Of the Vertebræ *of the Loins.*

THE Bones belonging to the *Abdomen* (which is the *ſecond*, or lower Part of the *Trunk*) are theſe: five *Vertebræ* of the Loins, five or ſix of *Os ſacrum*, *Os coccygis*, and *Oſſa innominata*.

The five *Vertebræ* of the Loins are larger than thoſe of the *Thorax*, and the loweſt of them are biggeſt. They are jointed with the laſt *Vertebra* of the Back, and the firſt of *Os ſacrum*, and with one another, by an intervening clammy Cartilage, but more looſely than thoſe of the Back, becauſe the Body bends more upon them. Their *Bodies* are larger than thoſe above them; and among themſelves the lower the larger: but they are of a very rare and Pumice-like Subſtance. Their middle and lateral *Holes* are like thoſe of the Back, only the larger half of the lateral is excavated out of the lower *Vertebra*, whereas thoſe of the Back are formed equally out of both. As for their *Proceſſes*, their *poſterior* (or Spines) are ſhorter and more blunt, but broader and thicker than thoſe of the *Vertebræ* of the *Thorax*, and turn ſomething upwards; but their *lateral* are *longer*. They alſo differ in their Inarticulation one with another; for whereas in thoſe of the *Thorax*, the upper (*oblique*) Proceſſes were knobby, and the lower hollow to receive them; in theſe the contrary is ſeen; for the upper Proceſſes are hollow, and the lower knobby. Only the laſt or twelfth *Vertebra* of the *Thorax*, hath both it's aſcending and deſcending

Vertebræ *of the Loins five.*

oblique Proceſſes hollowed, to receive the Heads or Knobs of the Proceſſes of the laſt but one of the *Thorax*, and of the firſt of the Loins.

CHAP. XV.

Of the Os ſacrum, *and* Os Coccygis, *or Rump-bone.*

Vertebræ *of* Os ſacrum, *five or ſix.*

THE *Os ſacrum* is the broadeſt of all the Bones of the Back, and doth ſuſtain all the other *Vertebræ*. On the Inſide it is ſmooth and hollow, on the Outſide convex and uneven, being of ſomething a triangular Shape. In its upper part, on each ſide, it is knit firmly to the *Oſſa ilia*, by an intervening Cartilage. It conſiſts of five or ſix Bones, plainly diſtinguiſhable in Infants, but more obſcurely in grown Perſons. Theſe Bones have the Reſemblance of (and are uſually called *Vertebræ*, for each of them hath a *Body* and *Proceſſes*, and a large *Hole* to receive the *Spinalis medulla*. The Bodies of theſe differ from thoſe of the other *Vertebræ* in this reſpect; that whereas in thoſe, the lower part is always bigger, in theſe it is the leſs; by which means the uppermoſt of them is the biggeſt, and the loweſt the leaſt. Their ſmaller Holes which ſerve for the Ingreſs and Egreſs of Veſſels, differ alſo from thoſe of the other, in that they are not in their ſides, but before and behind; of which thoſe before are much the larger. As for their *Proceſſes*, the *oblique* can hardly be diſcerned, except in the firſt. The *tranſverſe* are pretty long, but ſo united, that all ſeem but one. The hinder or Spines are like thoſe of the Loins, but leſs, and

ſtill

still the lower the lesser; insomuch that the lowest hath no Process, but only a round Protuberance.

To the *Os sacrum* the *Os Coccygis* or Rump-bone is joined by a Cartilage, somewhat loosely, that it may bend a little backwards in Women in Travail for the freer Passage of the *Fœtus*, &c. It is compounded of three or four Bones, of which the first hath a small Hollowness which receiveth the last *Vertebra* of *Os sacrum*. The rest of its Bones grow each less than other, so that the lowest ends in a cartilaginous Point. It is called *Os Coccygis*, because in Shape it resembleth the Cuckow's Bill. Its lower end bends inward, to stay the streight Gut and the Sphincter Muscle, which are tied to it. The Bones of it are spongy and soft, and have neither Process nor any Hollowness, for the spinal Marrow descends no further than the Bottom of *Os sacrum*, Os Coccygis.

CHAP. XVI.

Of the Ossa innominata.

AT the lower end of the *Abdomen*, by the Sides of the *Os sacrum*, there stand two large Bones called by *Galen*, *Ossa innominata*, (nameless Bones) because they had then no proper Name imposed on them, that he had met with. But *Spigelius* says, that *Homer* had long before called them ἰσχία, and that they have been generally, by later Anatomists, known by that Name: (Tho', by his leave, I think that *Ischium* is more commonly taken only for one Part of these Bones called *Coxendix*.) Ossa innominata, their Name.

Situation and Connexion. But be their Name what it will, there is one on each side the *Os sacrum*, to which they are joined (through the Intervention of a Cartilage) by a most strong Ligament, and together with it frame the *Pelvis*, or that Cavity in which the Womb, Bladder, and part of the Intestines are contained.

Parts. In Children each of them plainly appeareth to be framed of *three* Bones (called *Os ilium, Coxendicis*, and *Pubis*) joined by a Cartilage, until the seventh Year; but in Men of ripe Age these three, the Cartilage being dried and hardened into a Bone, seem but one entire Bone. However for the more exact description of its Parts, we must consider it as consisting of *three*.

1. Os ilium. The *first* is called *Os ilium*, because under it lieth the small Gut called *Ileum*. This is the uppermost and broadest; in Figure semicircular; arched without, within hollow. It is joined with the *Os sacrum* by a common membranous and most firm Ligament, with a Cartilage intervening, as abovesaid.

2. Coxendix. The *second* is called *Os coxendicis* (or *Ischium*) and in English the Hip-bone: tho' sometimes both these last Names are taken in a larger Signification, and include all the three. This Bone is the lower and outer Part of the *Os innominatum*, and has a large Cavity in it (called *Acetabulum coxendicis*) which receives the round Head of the Thigh-bone, by the Articulation called *Enarthrosis*. The Brims of this Cavity are tip'd as it were with a Cartilage, called its *Supercilium*; and in the Bottom of it (according to Dr. *Havers*) there is [‘a *Sinus* formed on purpose to receive the large ‘mucilaginous Gland lodged there, the great‘est of this kind in the whole Body. Which ‘*Sinus*, he says, is in an human Skeleton almost

‘of

'of an oval Figure, which he has found an Inch 'and five Eighths in Length, and in the wideſt 'Place very near one Inch one Eighth in Breadth, 'and about three Eighths of an Inch deep; occu- 'pying at one end, and on both ſides, only the 'bottom of the *Acetabulum*, but at the other end 'it runs up by the Ligament, which is inſerted 'into the tip of the Head of the *Os femoris*, to 'the Brim of the Cavity.] Beſides this *Sinus* in the bottom of the *Acetabulum*, there is another in the hinder and inner ſide of this Bone, in which the Muſcle of the Thigh, called *Obturator internus*, winds about that part of this Bone (as a Rope in a Pulley) according to *Spigelius*. Its lower end has a large *Appendix*, which we reſt or bear upon when we ſit.

The *third* Bone is called *Os Pubis*, and *Pectinis*, or the Share-bone. This is the lower and fore-part of the nameleſs Bone, and even before is joined to its Fellow by *Synchondroſis*, that is, by the Intervention of a Cartilage, which is much thicker, but looſer and ſofter in Women than in Men; for in the former, one Bone does uſually recede a little from the other in hard Travail, to give way to the *Fœtus*. It has a very large *Foramen* between the *Sinus* of the *Coxendix*, and that part whereby it is joined to its Fellow, making Room for two Muſcles of the Thigh. And above this *Foramen* is a *Sinus*, by which the crural Veins and Arteries paſs to the Thighs. The upper part of this Bone is called its Spine, into which the Muſcles of the *Abdomen* are inſerted. 3. Os pubis.

Note, That the *Cotyla* or *Pelvis* that is compoſed by theſe three Bones and the *Os ſacrum*, is bigger in a Woman than in a Man, to make the larger Room for the *Fœtus*. *The* Pelvis.

CHAP. XVII.

Of the Scapula, *or Shoulder-blade.*

The Bones of the Limbs.

HAving done with the Bones of the *Head* and *Trunk*, there remain to be deſcribed the Bones of the *Limbs*, which are the *Arms* and *Legs*. The Bones of the Arms are either *above the* Joint of the Shoulder, or *under*.

The Scapula.

Above the Joint lieth the *Shoulder-blade*, in Greek called ὠμόπλατη, in Latin, *Scapula*. Some reckon this to the *Thorax*, becauſe of its Situation, as lying upon its upper and back Part: But ſeeing its principal Uſe ſeems to be for the ſuſtaining and Motion of the Arm, we have conſider'd it as a Part thereof. Its *Subſtance* is for the greateſt Part thin, but hard and ſolid. Its outſide is a little arched, and its inſide hollow. It is ſomewhat of a triangular *Figure*, and joined to ſundry Parts by means of the Muſcles; which ſort of Union we called above, *Syſſarcoſis*. Thus it is joined to the Bone of the *Occiput* by the cucullar Muſcles, or the firſt Pair of the *Scapula*; to the *Vertebræ* of the Neck by the ſame Pair, as alſo by the ſecond and fourth Pairs, *&c.* It is joined alſo to the Shoulder-bone by *Arthrodia*, and to the Clavicle by *Synchondroſis*.

Its Subſtance, Figure and Connexion.

Proceſſes.

It has three *Proceſſes*: Of which *one* is extended along its Middle, and is called its Spine; and that End of it that by a ſhallow *Sinus* receives the *Clavicula*, *Acromium*, its Point or Tip: *Another* is lower and leſs than this, and acute, ſomething like a Crow's Bill, whence it has the Name of *Coracoides*; by others it is called *Ancyroides*, Anchor-like: The *laſt* is the ſhorteſt, called *Cervix*,

its

its Neck. In the end of this is a *Sinus*, that in its upper part is acute, but in its lower round: This Cavity being but ſhallow of itſelf, has its Brims tipt with a Cartilage, which makes it the deeper, into which the Head of the Shoulder-bone is received. Dr. *Havers* ſays, [‘There is ‘a conſiderable mucilaginous Gland joining to ‘the upper Brim of this *Sinus* or *Acetabulum*, juſt ‘by the tendinous Origination of the *Muſculus biceps* on the foreſide of it, which runs ‘downwards upon the Membrane, for ſome ‘way towards the Arm-pit. And on the other ‘ſide of that Origination, there is another at ‘a little Diſtance from it.] This Articulation is ſtrengthned by very ſtrong Ligaments and Tendons, and is partly hindred from Luxation, by the top of the ſecond Proceſs.

The Shoulder-blade hath a three-fold *Uſe*. *Uſe.* Firſt, it receiveth the *Os humeri* in the *Sinus* of its *Cervix*, by the Articulation called *Arthrodia*; as it does the *Clavicula* in the *Sinus* of its *Acromium*, by *Synarthroſis*. Secondly, ſundry Muſcles ſpring from the Shoulder-blade, which ſerve for the Motion of the *Os humeri*. Thirdly, it defendeth the Back ſo far as it reacheth, from external Injuries, like a Shield.

CHAP. XVIII.

Of the Os humeri, *or Shoulder-bone.*

THE Bones of the Arm, under the Joint of the Shoulder, are the *Shoulder-bone*, the *Cubit-bones*, and the *Bones of the Hand*.

The

Os humeri. The *Shoulder-bone* is but one in each Arm, reaching from the Shoulder to the Elbow. In Figure it is round, only a little flattish behind towards the Elbow; of a hard and solid Substance. It is hollow all along like a Pipe, wherein a marrowy Substance is contained.

Its upper end. Its *upper* end, that is jointed to the *Scapula*, has a great and round Head, cover'd with a Cartilage, which is received into the Cavity of the *Scapula* by that kind of Articulation which is called *Arthrodia*. On the hinder Side of this Head there stand two rough and uneven Prominences, (which *Spigelius* reckons for another Head) into which the Ligaments are inserted. And betwixt these two Prominences, there is a round and long Chink, through which the nervous Head of the *Musculus biceps* doth pass.

The lower. Its *lower* end is articulated with two Bones, *viz.* the *Ulna* and *Radius*, by *Ginglymus*, for it both receives them, and is received by them, having three Processes and two *Sinus*'s betwixt them; so that this End resembles a Pulley, whence it is called *Trochlea*. The *Ulna* is jointed with its inmost Process, and the *Radius* with the outmost. On its Inside, besides the three foregoing, it has a large Process or Tubercle, from whence those Muscles arise that lie on the Inside of the Cubit; and another less on its Outside, from which those Muscles spring that lie on the Outside. On the hinder Side of the *Trochlea* there is one deep large Cavity; and on the foreside two small ones, into which the Bones of the Cubit hit, when they are moved backward or forward, and are stopped from being carried further. In the Cavity on the hinder side Dr. *Havers* has observed a mucilaginous Gland; and another large and fair one, in one of the *Sinus*'s which are on the foreside. About

bout the middle of this Bone, in the Inside, there is an Hole, through which Vessels pass to the marrowy Substance, for its Nourishment.

CHAP. XIX.

Of the Bones of the Cubit.

THE Bones of the *Cubit* are *two*, to wit, the *Ulna* and *Radius*. Their Substance is firm and solid, all but their Appendages. They are near of the same length (but the *Ulna* is the longer of the two) and both are hollow within, containing a marrowy Substance. They are in some Places rough in their Superficies, by Reason of their Lines that are appointed for the Rise or Insertion of the Muscles. *Two Bones of the Cubit*, viz.

The *Ulna* (otherwise called *Os Cubiti*, and *Cubitus*) is larger in its upper end that joints with the *Os humeri*, and grows smaller and smaller towards the Hand, ending in a round Tubercle, or small Head, with a round *Sinus* in it (on whose hinder side there grows a small sharp Process, from its shape called *Styloides*) receiving one of the Bones of the *Carpus*, to which it is knit by Ligaments (a Cartilage intervening.) Its upper end is articulated with the *Os humeri* by *Ginglymus*, to which end it has two Processes, one before and another behind. That before is received into one of the fore *Sinus*'s of the *Os humeri* (mention'd in the former Chapter) in bending the Elbow-joint: And the hinder upon stretching out the Arm, enters into the hinder Cavity of the same Bone, behind the *Trochlea* (by which the Cubit 1. Ulna.

Cubit is ſtayed from further Extention than to a ſtreight Poſture) and is called *Ancon*, or *Olecranum*. And at the ſame End it has alſo two *Sinus*'s, the one of which is lateral and external, receiving the Head of the *Radius*; and the other (which is betwixt its two Proceſſes) one of the Proceſſes of the *Os humeri*, which moves in it as a Rope in a Pully. As it receives the *Radius* in its upper End, ſo is it received by it in its lower: But in the midſt it bends or recedes a little from it, yet is knit to it by a long Ligament.

2. Radius. The *ſecond* Bone is called *Radius*, and lies on the outſide of the Cubit. Its upper End is ſlenderer, having a round Head, one ſide of which is received by the *Ulna*; but its Tip has a round ſhallow Cavity in it, which receives the outer Proceſs of the *Os humeri*, by *Diarthroſis*. Its lower End is Thicker and Broader, and by a little *Sinus* in its ſide, receives the *Ulna*; and at its Extremity it has two other ſmall *Sinus*'s for the Reception of the little Bones of the Wriſt, where the often quoted Author ſays, 'There 'are a Row of mucilaginous Glands, or one of 'them lying like a Ridge of little Hills from 'one ſide to the other on the back part; and 'on the inſide there are ſome alſo, but not ſo 'conſiderable; as there are likewiſe at the 'Bones of the *Carpus*, which are like a *Fimbria*.

CHAP.

CHAP. XX.

Of the Bones of the Hand.

THE *Hand* is divided into three Parts: the Wriſt, called *Carpus*; the Diſtance between the Wriſt and Fingers, called *Metacarpus*; and the Fingers themſelves. *Four ſorts of Bones of the Hand.*

The Bones of the *Wriſt* are *eight* in Number, placed in two Ranks or Orders. The *upper* Rank hath four Bones, of which three are ſo joined together that they ſeem but one; (theſe are articulated to the *Ulna* and *Radius* by *Arthrodia*:) but the fourth being the leaſt of all, is placed a little out of its Rank on the outſide of the third. The *Inferior* hath alſo four Bones; they are joined to one another by *Harmonia*, but to the Bones of the *Metacarpus* by *Synarthroſis*, having ſome Motion tho' but obſcure. They are firmly knit to one another by both a membranous and cartilaginous Ligament; and beſides, by another called *Annular*, which compaſſing the Wriſt, comprehendeth both them and the Tendons of the Muſcles which paſs to the Fingers. 1. *Eight of the* Carpus.

The *Metacarpus* hath four Bones, they are round, and of a ſolid Subſtance, but hollow within like a Pipe, being full of Marrow. They are bigger than thoſe of the Fingers: That which anſwereth to or ſuſtaineth the Fore-finger, is thickeſt and longeſt, and the reſt grow each ſhorter and ſlenderer than the foregoing. Between each two a Diſtance is left for the *Muſculi interoſſei* of the Fingers. Both in their upper and lower end they have an *Appendix*; that at the upper end hath a Cavity which receiveth the Bones of the *Carpus*; 2. *Four of the* Metacarpus.

but

but that at the lower, a round long Head, cover'd with a Cartilage, which is received by the *Sinus* of the first Bone of the Fingers, to which the Bones of the *Metacarpus* are tied by a transverse Ligament, that lies in the Palm of the Hand.

3. *Fifteen of the Fingers.*

The *Fingers* (taking in the Thumb) have fifteen Bones, each three. The first are largest, the second less, and the third the least. On the Outside they are round, but on the Inside plain, and a little hollow, that they may lay the firmer hold upon things. Each has an *Appendix* (called by some a *Process*) at each end. The *upper Appendices* are round, and those of the first Bones have one round *Sinus* in them, whereby they receive the round Head of the Bones of the *Metacarpus*; but the upper *Appendices* of the second and third Bones have each two *Sinus*'s, parted by a small Protuberance. The lower *Appendices* have each two Heads, divided by a *Sinus*, which are received by the double *Sinus* of the upper *Appendices* of those Bones that join to them; except only the last or third Bone, which is received by none, but is fenced by a Nail. The second Bone is joined to the first, and the third to the second by *Ginglymus*, and by them the Fingers are only stretched out and contracted. For as for their Motion sideways, that depends only upon the Articulation of the first Bones with the Bones of the *Metacarpus*, which is done by *Enarthrosis*, or at least by *Arthrodia*. The Jointings of the Thumb answer to these of the Fingers, saving that its upper *Appendix* is not joined to any Bone of the *Metacarpus*, (with which it has no Communication) but Immediately to the Wrist; and its lower has but one Head, whence the second Bone has but one *Sinus* in its upper *Appendix* to receive it. In every

Joint

Joint of the Fingers (as also of the Toes) on the inside or bending part (Dr. *Havers* says,) ['there 'are two mucilaginous Glands (like a *Fimbria.*) 'One belongs to the remotest, or that which is 'the moving Bone, when the Posture of that 'Joint is altered, and is seated just at the end of 'its Extremity: The other is planted upon the 'Bone, with which the other is articulated at a 'little Distance from the extreme part of it, up 'in a *Sinus*, formed as well for the reception of 'that Gland, as to give the other Bone, when it 'moves that way, the liberty of sliding towards 'it, and of being inflected, at which time it makes 'some little Pressure upon it.

Besides these Bones, there are in the inside of the Hand, at the Joints of the Fingers, some small Bones, called, from their Figure and Bigness, *Sesamoidea*, like the Grains of *Sesama* (a sort of Indian Corn, so called by *Pliny.*) They resemble in Figure the Knee-pan, and seem to serve for the same Use; for in strong Extentions of the Fingers they strengthen the Tendons of the Muscles upon which they are placed, and hinder the Luxation of the Joint. Authors differ very much as to their Number, because being so small, they are seldom all found; but most agree upon the Number of 12 to each Hand, placing them thus. At the jointing of the second Bone of the Thumb with the first there are two. The second and third Joint of the Fore-finger, have each one; but its first Joint, as also the first of the other three, have each two. In Children they are of a cartilaginous Substance, but grow bony by degrees (being invested with a Cartilage) yet not solid, but fungous or porous.

4. Ossa sesamoidea.

CHAP.

CHAP. XXI.

Of the Thigh-bone, and Patella,

THE *Leg* (in a large Senſe) is divided into three Parts, the *Thigh*, the *Shank* (or *Leg* ſtrictly ſo called) and *Foot*.

Os femoris. The *Thigh* hath but one Bone: but of all others it is the longeſt and thickeſt. *Before*, it is round; but *behind*, ſomething depreſſed, and hollow. In the *upper* part it has a round Head; the ſlender Part under this is called its Neck, and is pretty long and oblique. The Neck is an *Apophyſis* or Proceſs to the Bone itſelf, and the round Head an *Epiphyſis*, or Appendix to the Neck. This Head is received by the large Cavity or *Acetabulum* of the *Coxendix*, and is detained therein by two ſtrong Ligaments; one that encompaſſes the Brims of the *Acetabulum*, and another that ſprings out of its Bottom, and is inſerted into the Tip of this round Head or *Appendix*. At the lower End of the Neck, there ſpring two Prominences from the Bone; which, becauſe the Muſcles called *Rotatores* are faſtened to them, are called *Trochanteres*. The hinder and lower is the leſſer *Trochanter*; and the lateral or uppermoſt, the bigger. The *lower* End of the Thigh-bone growing thicker by degrees, hath two pretty large Heads, leaving a Cavity in the Middle that receiveth the *Apophyſis* of the *Tibia* (which is tied therein by a Ligament, as the upper Head of this Bone is into the *Acetabulum* of the *Coxendix*:) And again, theſe are received by the Cavities of the *Tibia*, by a looſe *Ginglymus*, both the Heads and Cavities being lined with Cartilages. The fore-

part

part of this Articulation is called the *Knee*, the hindermoſt the *Ham*.

Upon the Knee appeareth a Bone, not joined with any other Bone, called the *Pan* or *Patella*: It is roundiſh, about two Inches broad, plain without, but convex within, and covered with a Cartilage. It is ſet before the Thigh-bone, and the *Tibia*, to ſtrengthen the Articulation; for otherwiſe the Thigh-bone would be in danger to ſlip out forward in going down a Hill, or the like. Its Subſtance in Infants new-born is ſoft and cartilaginous, and remains ſo for many Months; but in proceſs of time it becomes bony. It is full of little Holes, as all thoſe Bones are which paſs from Cartilages into Bones. It is involv'd by the thick Tendons of the ſecond, third, and fourth Muſcles that extend the *Tibia* (and are implanted into its fore Knob) whereby it is fixed in its Place. The mucilaginous Glands that officiate to this Part (the Knee) both before and behind, are livelily delineated in a Figure of Dr. *Havers*'s often quoted *Oſteologia*, where the Reader may view them. Patella.

Behind there are two *Oſſa ſeſamoidea*, which adhere to the two beginnings of the *Gaſtrocnemius externus* (or firſt Muſcle which extends the Foot) to ſtrengthen them.

CHAP. XXII.

Of the Bones of the Leg.

The Bones of the Leg two.

THE *Shank* (or *Leg* ſtrictly ſo called) is compoſed of two Bones. The greater is called κνήμη, *Tibia*, the leſſer περόνη, *Fibula*. Theſe are ſlightly articulated into one another near each end; but in their middle they recede one from the other, yet ſo as they are tied together by a ſtrong membranous Ligament that comes between them.

1. Tibia. The *Tibia* (commonly called *Focile majus*) is partly three-ſquare, by its ſharp Edge before making what we call the Shin. It has an Appendix at each end. That above is bigger, and in its upper Part hath one Proceſs, which is received by the *Sinus* of the Thigh-bone; and two longiſh Cavities for the receiving of the two Prominences or Heads of the Thigh-bone (ſo that the Articulation is by *Ginglymus*) as was ſaid in the foregoing Chapter. About the Brims of theſe *Sinus*'s there is joined by Ligaments a moveable Cartilage, ſoft, ſlippery, and bedewed with an unctuous Humour, from its ſhape called *Cartilago lunata*, the Moon-like Cartilage. It has alſo a little Head behind (below the foreſaid *Appendix*) which enters into the *Sinus* of the upper *Appendix* of the *Fibula*. Its lower *Appendix* is leſs than the upper, jetting out with a notable Proceſs towards the Inſide of the Foot, making the *Malleolus internus* or inner Ankle. It has two Cavities, one leſs in its ſide, by which it receives the *Fibula*; another greater and lower, divided as it were into two by a ſmall Protuberance in the middle, and lined

lined with a Cartilage, receiving the convex Head of the *Talus* that lies under it; as the said Protuberance is received by the shallow *Sinus* in the convex Head of the *Talus*, the one being articulated into the other by *Ginglymus*; so that the Foot is moved upwards and downwards (or bended and extended) upon this Joint.

The lesser and outer Bone of the Leg, is called *Fibula* (or *Focile minus*;) it is as long as the former, but much slenderer, and the middle part of it is also of a triangular Figure. This has also an *Appendix* at each end; the upper of which reaches not so high as the Knee, nor is it jointed to the Thigh-bone; but in its inner side has a shallow Cavity, which receives the little hinder (or lateral) Head of the *Tibia*, that is seated under its upper *Appendix*, which is jointed with the Thigh-bone. The lower *Appendix* of the *Fibula* is received by the *Sinus* of the *Tibia*, and extending its Process to the side of the *Talus*, makes therewith the *Malleolus externus*, or outer Ankle, which is lower than the inner. 2. Fibula.

CHAP. XXIII.

Of the Bones of the Tarsus.

OF the *Foot* (as of the Hand) there are three Parts, *Tarsus*, *Metatarsus*, and the Toes.

The *Tarsus* is the Distance between the lower end of the two Focils, and the beginning of the five long Bones, which sustain and are articulated with the Toes. Some call it the *Instep*, but we have in the former Book (of the *Muscles*) named

it the *Wriſt*, ſuppoſing that by the Inſtep the *Metatarſus* is rather underſtood.

The Tarſus hath ſeven Bones. It hath *ſeven* Bones, much differing from one another in Bigneſs and Shape.

1. Talus. The *firſt* is called *Talus*, or *Aſtragalus* (in Engliſh the Ankle, or Huckle-bone.) This is of a various Figure: *Above* it has ſomething a convex Head with a ſhallow *Sinus* in it, articulating with the *Tibia* as is deſcribed in the foregoing Chapter. By the Proceſs of the *Tibia* that makes the inner Ankle, it is hedged in as it were on the inſide, as it is by that of the *Fibula* on the outer. *Before*, it has a long Neck, on which grows a round Head, that enters into the *Sinus* of *Os naviculare*; upon which jointing the Foot is moved ſideways. Its *hinder* ſide is rough, and in its upper part has a tranſverſe *Sinus*, for the receipt of the Ligament of the *Tibia*, and in its lower a little deſcending *Sinus*, by which the Tendons of the Muſcles of the Foot paſs. *Below*, it has a *Sinus* behind, and a Protuberance before, by which it is articulated with the Heel-bone by *Ginglymus*. Betwixt the *Sinus* and Protuberance, there is a long and pretty deep Cavity, and over-againſt it another ſuch in the Heel-bone. In theſe is contained a mucous Subſtance, which moiſtens the cartilaginous Ligaments that join the *Talus* to the Heel-bone, keeping them from drying by continued Motion.

2. Os Calcis. The *ſecond* Bone of the *Tarſus* is called *Os Calcis*, or *Calcaneum*, the Heel-bone, and is the biggeſt of the ſeven. It lies under the *Talus*, with which in its upper ſide it is articulated in the manner juſt now deſcribed. *Behind*, it receiveth the great Tendon, called *Nervus Hectoreus* (or the great Cord) compoſed of the Tendons of the three Muſcles that form the Calf of the Leg, and extend

extend the Foot. Its *fore* End is received by the *Os Cubiforme*. On its inside it has a large *Sinus*, by which the Tendons and larger Vessels descend to the under side of the Foot; and on its *Outside* it is uneven with several Knobs, for the firmer Connexion of the Ligaments and Tendons.

The *third* is called *Os scaphoides, naviculare*, or *Cymbiforme*, from its Figure. *Behind*, it receiveth the *Talus* in a large *Sinus*; but *before*, it is convex, with three flattish smooth Heads that are admitted into the very shallow *Sinus* of the three *Ossa cuneiformia*, to be described presently. 3. Os naviculare.

The remaining *four* are less than the three already described, and stand all in one Rank; the first of them articulates with the Heel-bone, the other three with the *Os naviculare*. There is no Cartilage betwixt them, but they are knit one to another on the Outside by a cartilaginous Ligament; and are cover'd both in their hinder and fore-part with a smooth Cartilage, where they are jointed with other Bones. The first is called *Cubiforme*, or Dye-like, having six Sides. This is bigger than the other three that follow; and is seated on the Outside of the Foot. In its *foreside* it is joined to the fourth and fifth Bone of the *Metatarsus*; in the *hinder* with the Heel-bone; and in the *inside*, to the third Bone of the *Cuneiformia*; but its other three sides, *viz.* the *outer*, *upper* and *lower*, are joined to none. 4. Os cubiforme.

The three ensuing are called *Cuneiformia*, or Wedge-like Bones; for above they are thick, and below thinner, so that being joined, they all of them represent a Vault, being convex on the upper side, but on the under hollow: In which Hollowness the Tendons and Muscles are lodged, so that one does not press upon and bruise 5. Three Cuneiformia.

them in going. The firſt of theſe Bones is the greateſt, ſeated in the Inſide of the Foot; the ſecond is the leaſt, placed in the middle: The third is in the mean betwixt both in Bigneſs, and ſtands next to the *Cubiforme*. Theſe three, *behind*, are joined to the *Os naviculare*, and *before*, to the three firſt Bones of the *Metatarſus*.

CHAP. XXIV.

Of the reſt of the Bones of the Foot.

The Bones of the Inſtep five.

THE *Metatarſus*, or Inſtep, hath *five* Bones; for one is appointed for the ſuſtaining of the great Toe, as well as others for each of the reſt; tho' in the Hand it is not ſo, where the Thumb has no Bone in the *Metacarpus* anſwering to it.

Their Subſtance is very hard and ſolid, but they are hollow within like ſo many Pipes, and are longer than the Bones of the back of the Hand. They are very compactly join'd together at that end where they are united with the *Tarſus*, for the ſtronger Articulation; but they ſeparate from one another in their middle, for the Paſſage of the *Muſculi interoſſei*. That which ſtayeth (or is articulated with) the great Toe, is thickeſt, but the longeſt is that which ſtayeth the next Toe: The other three grow each ſhorter than other, but are almoſt of an equal Thickneſs. Their lower Ends being round, are inſerted into the *Sinus* of the firſt Joints of the Toes; but the upper in their own ſhallow *Sinus* receive the Bones of the *Tarſus*.

The

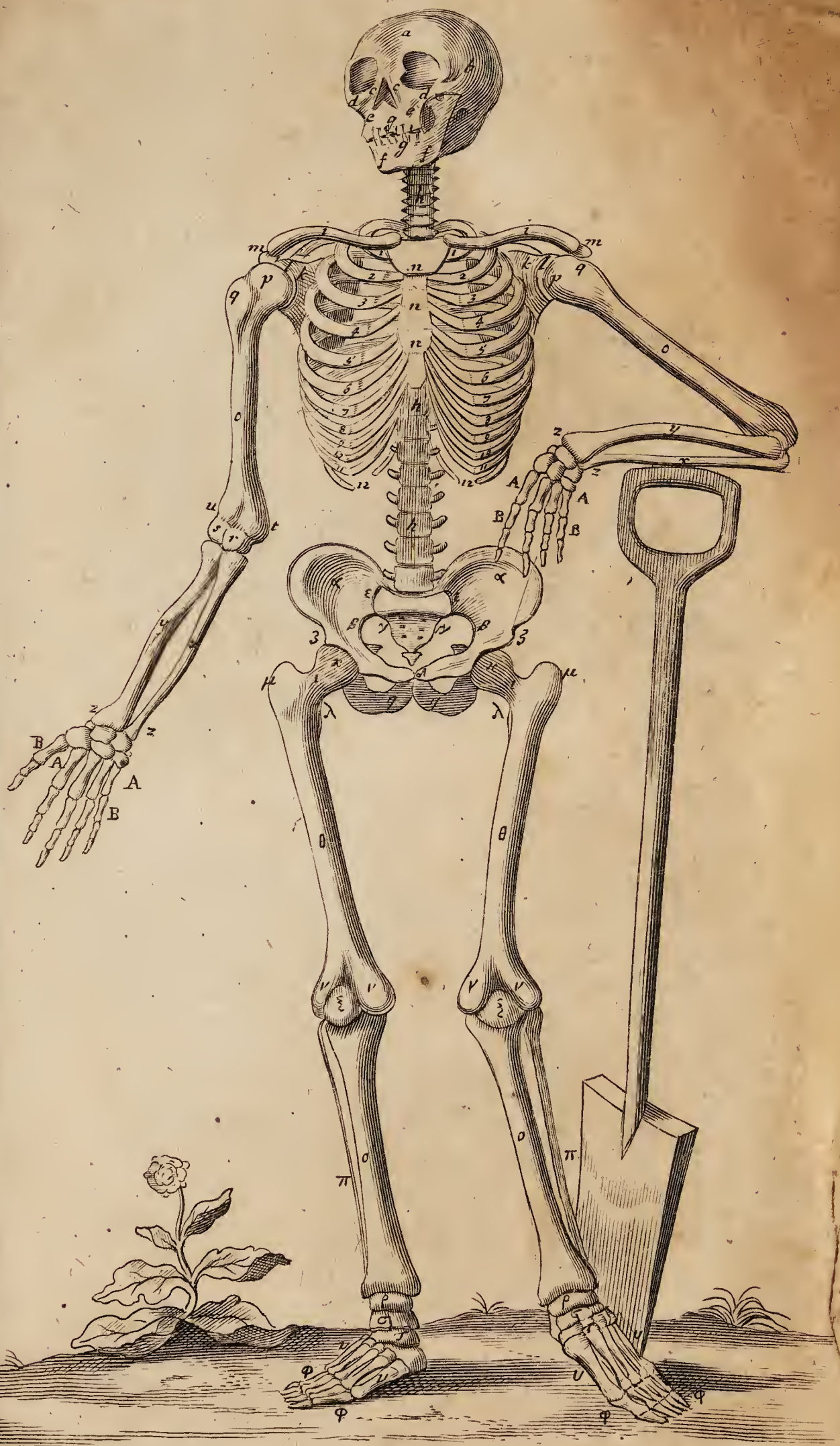
The Bones of the *Toes*, are in number *fourteen*; for the great Toe hath only two, but the reſt three. The Reaſon of which is this: The firſt Bone of the great Toe is numbred with thoſe of the *Metatarſus*, as having no more Motion than the four others; which Account cauſes the *Metatarſus* to conſiſt of five Bones, whereas the *Metacarpus* has but four. Theſe Bones are ſolid without, and hollow within like thoſe of the Inſtep. Their Articulation is altogether like that of the Fingers, ſo that we ſhall not need here to deſcribe it over again. And the mucilaginous Glands are likewiſe the ſame. *Of the Toes fourteen.*

Each Foot has twelve *Oſſa ſeſamoidea*, as well as the Hands; which agreeing both in Shape and Situation with one another, the Reader may be ſatisfied concerning theſe of the Feet, in the Deſcription of thoſe of the Hand, in *Chap.* XX.

TAB. XX.

Repreſenteth the *Skeleton* of an adult Body on its fore-ſide.

a *The* Os frontis.
b *The* Os temporis.
cc *The two Bones of the Noſe.*
dd *The* Oſſa jugalia.
ee *The Bones of the upper Jaw.*
f f *The lower Jaw.*
g g *The Teeth in both Jaws.*
hhhh *The* Vertebræ *of the Neck,* Thorax, *Loins and* Os ſacrum.
ii *The* Claviculæ.
kk *The* Scapulæ.
ll *Their firſt Proceſs, which articulates with the* Os Humeri.
mm *Their ſecond, called* Acromium.
nnn *The Bones of the* Sternum.
oo *The* Os humeri.
pp *Its upper and inner Head that articulates with the* Scapula.
qq *Its upper and outer Head, which ſerves for the Implantation of Ligaments.*
r *The inner Head of its lower* Appendix, *which receives the* Ulna.
s *The outer Head of the ſame* Appendix, *which receives the* Radius.
t u *The two Tubercles of the* Os Humeri: t *the internal:* u *the external.*
x *The* Ulna.
y *The* Radius.
zz *The eight Bones of the* Carpus.



AA *The four Bones of the* Metacarpus.
BB *The four Fingers and Thumb, each of which consists of three Bones.*
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12. *The twelve Ribs.*
αα *The* Os ilium.
ββ *The* Coxendix.
γγ *The* Os sacrum.
δ *The* Os pubis.
εε *The Connexion of the* Os Ilium *and* Coxendix *with the* Sacrum.
ζζ ηη *The Tubercles of the* Coxendix : ζζ *The inner,* ηη *the outer.*
θθ *The Thigh-bones.*
ιι *The Neck of the Thigh-bone.*
κκ *The upper Head of the Thigh-bone, that is received into the* Acetabulum *of the* Coxendix.
λλ μμ *The two Trochanters;* λλ *the inner,* μμ *the outer.*
νν *The two lower Heads of the Thigh-bone.*
ξξ *The* Patella.
οο *The* Tibia.
ππ *The* Fibula.
ρρ *The* Talus.
σσ Os Naviculare.
ττ *The other Bones of the* Tarsus.
υυ *The five Bones of the* Metatarsus.
φφ *The fourteen Bones of the Toes.*

AN

AN APPENDIX TO *The Sixth BOOK:*

Describing the

CARTILAGES, LIGAMENTS and NAILS.

CHAP. I.

Of a Cartilage.

AS an *Appendix* to the Doctrine of *Bones*, we will add a Word or two of the *Cartilages* and *Ligaments* of the Body; because the former come nearest to the Nature of Bones; and the latter, as they tie several other Parts one to another, so especially the Bones: and lastly, of the *Nails*, which from their Similitude of Substance, are also conveniently subjoined to the Bones.

A Cartilage (or Griſtle) *is a ſimilar Part, cold, dry, and void of Senſe, flexible, and not ſo hard as a Bone.* But when by Age its glutinous Particles are dried up, it many times degenerates into a Bone. *A Cartilage, what.*

Note, That though a Cartilage be of it ſelf of a dry Subſtance, yet it is always kept moiſt on its Superficies by a mucous or ſlimy Humour that bedews it, whereby it is made ſlippery and fit for Motion. *Note* alſo, that it is an inſenſible Part, becauſe it neither admits of Nerves nor Membranes, by which alone Parts become ſenſible. Which was ſo ordered by Nature, becauſe otherwiſe, ſeeing they are principally ſeated about the Joints, all Motion would have become painful. This has been the common Opinion: But Dr. *Havers* ſays, that the Cartilages are covered with a Membrane (as the Bones are) which he names *Perichondrium* (though it be only a Continuation of the *Perioſteum*) and that from it Fibres paſs into the Cartilages themſelves, whereby they are made (partly) ſenſible. Though he thinks the principal Uſe of this Membrane, eſpecially in ſuch Cartilages as are joined to any of the Bones, is to ſtrengthen their Conjunction. *Why moiſt and inſenſible.*

Dionis divides them into three *ſorts*. Some are hard and become quite bony with time, as thoſe do which make the *Sternum*, and thoſe that tie the Appendages to the principal Bones. Others are ſofter and contribute to the Compoſition of the Parts, as do the Cartilages of the Noſe, the Ears, the *Xiphoides*, and that of the *Coccyx*. And laſtly, ſome are very ſoft, and are of the Nature of Ligaments, which has made them be called Ligamentary Cartilages, or Cartilaginous Ligaments. *Three ſorts of them.*

As

As for the Cartilages of the Eye-brows, Ears, Nose, *Larynx, &c.* we shall not need here particularly to describe them, having done it where we treated of the respective Parts; only we will observe in general, that all the Bones in their Articulations one with another (*viz.* such as admit of manifest Motion) are covered or lined with Cartilages, for their easier and glibber Motion; and sometimes themselves are the *Medium* by which Bones are joined, which Articulation is called *Synchondrosis*, such as that of the *Ossa pubis*; others, by tipping as it were the Brims of the Cavities of the greater Joints, make the *Sinus* deeper; and others, lastly, constitute Parts themselves, as those of the Ears, *Larynx, &c.*

CHAP. II.

Of a Ligament.

A Ligament, what.

A Ligament *is a similar Part, cold and dry, of a middle Substance betwixt a Cartilage and a Membrane, appointed for the tying of sundry Parts together.*

Their Differences.

Note, That as it is either harder or softer than is suitable to its proper Nature, it acquires the Epithets of *cartilaginous* or *membranous* respectively; so, that which proceeds out of the Top of the Thigh-bone, and is inserted into the Cavity of the *Coxendix*, is called a cartilaginous Ligament, for its Hardness; and that which environeth the Joint of the Shoulder, is called membranous, from its Softness.

Those

Thoſe which tie Bones together are without Senſe (for otherwiſe upon every Motion we ſhould have been in Pain:) But thoſe that knit other Parts together (as thoſe that tie the Liver, Womb, *&c.* to the neighbouring Parts) are ſenſible. *Why ſome are inſenſible.*

Ligaments are found in ſeveral Parts of the Body. As *firſt*, the Head being moved upon the firſt and ſecond *Vertebræ* of the Neck, there are four Ligaments to ſtrengthen thoſe Articulations. *Secondly*, a common membranous Ligament begirts the whole Articulation of the lower Jaw with the Temple-bone. *Thirdly*, the Bone at the Root of the Tongue has four, by which it is tied to the neighbouring Parts; and the Tongue it ſelf has one ſtrong one on its under Side (otherwiſe called its *Frænum*) which being too ſhort, or running too near its Tip, hindreth its Motion. Children being ſo troubled, are ſaid to be Tongue-tied, and muſt have it cut. *Fourthly*, both the Bodies and Proceſſes of all the *Vertebræ* of the Back are knit together by Ligaments, as alſo are the Ribs with the *Vertebræ* behind, and with the Breaſt bone before. *Fifthly*, ſundry are to be ſeen in the *Abdomen*. The firſt tieth the *Os ilium* to the *Os ſacrum*. The ſecond knitteth the *Os ſacrum* to the *Coxendix*. The third and fourth knit the Share Bones together, one of them compaſſing them circularly, and the other, which is membranous, poſſeſſing their very *Foramen*, and ſuſtaining the Muſcles in that Place. As for the Ligaments of the Liver, Bladder, *&c.* thoſe were diſcourſed of when we deſcribed thoſe Parts in *B.* I. *Sixthly*, in the Arm theſe appear. 1. Five tie the *Os humeri* to the Shoulder-blade. 2. The Bones of the Cubit, *Ulna*, and *Radius*, are tied firſt one to another: ſecondly, to the Shoul- *An Enumeration of the principal Ligaments of the Body.*

der-

der-bone ; and thirdly, to the Wriſt by (moſtly) membranous Ligaments. 3. There are two ſorts of Ligaments at the Wriſt ; firſt an annular one, which going quite round the Wriſt ſerves to confirm and make ſteady the Tendons of the Muſcles which paſs under it to the Fingers. Some make two of it ; and then that on the outſide is for the Tendons of the extending Muſcles ; and the other in the inner ſide, for the Tendons of the contracting Muſcles. The other Ligament of the Wriſt ariſing from the lower Proceſſes of the *Ulna* and *Radius*, embraces and ſtraitly ties together the Bones of the Wriſt, and ends in the upper *Appendices* of the Bones of the *Metacarpus*. 4. The Bones of the *Metacarpus* are tied one to another, and to the Bones of the *Carpus* by common Ligaments. 5. The Joints of the Fingers are alſo bound by common Ligaments ; and in the Palm of the Hand there lies a tranſverſe Ligament, that ties the firſt Bone of the Fingers to the Bones of the *Metatarſus*. *Seventhly*, In the Leg are theſe. 1. The Thigh-bone is tied to the *Coxendix* by two Ligaments. 2. The lower End of it is tied to the *Tibia* and *Fibula* by ſix Ligaments. 3. The *Tibia* is joined to the *Fibula* by three membranous Ligaments, *viz.* two common, and one proper. 4. The *Tibia* and *Fibula* are joined to the *Talus* by three Ligaments ; and there are three other for the ſtrengthening of the Tendons, that paſs under them, and confirming them in their Places. 5. The *Talus* is tied with the other Bones of the *Tarſus* by five Ligaments. 6. The Bones of the Inſtep and Toes are tied with ſuch Ligaments as thoſe of the Hand are.

CHAP.

CHAP. III.

Of the Nails.

IN the last Place, we shall say something of the *Nails*, which though they are not *truly* Parts of the Body, yet for their Usefulness ought not to be omitted. *The Nails.*

They are of an horny, transparent *Substance*, coming neareſt to that of Bones, fasten'd upon the Ends of the Fingers and Toes for their Defence. They are endued with no Sense, nor is that *Colour* which they appear to be of upon the Fingers, owing to their proper Substance, but to the Colour of the Parts that lie under them: Whence they sometimes look ruddy, sometimes pale, blue or yellow, and thereby give some Intimation of the State of the Body. For thus in a Swoon they look pale, because little Blood is then driven into the Flesh that lies under them: In a Jaundice they look yellow, from the Bile that is mixed with the Blood, *&c.* They grow very firmly to the subjacent Flesh; and to fasten them the better, they are tied about their Root with a Ligament, and on their Sides the Skin closes them in. The Parts that lie under them are very sensible, for there are several Twigs of Nerves and Tendons of Muscles that run to the very Fingers Ends; so that upon handling any hard or rugged thing, we should have been continually in Pain, if these so sensible Parts had not been thus defended by the Nails. Which Defence seems to be their principal Use; for their Use to scratch withal, is but secondary, and less considerable. *Their Substance, Colour, &c.*

The

In what respect they are Parts of the Body.

They may, in some Sense, be reputed *Parts* of the Body, so as that it would not be perfect and intire without them; but that is but an *improper* Notion of a Part: For if they were *properly* Parts, they should live by the common Life of the Body: But that they do not, is plain, seeing *they*, as well as the *Hair*, continue to grow after a Man is dead.

FINIS.

In what respect they are Parts of the Bod