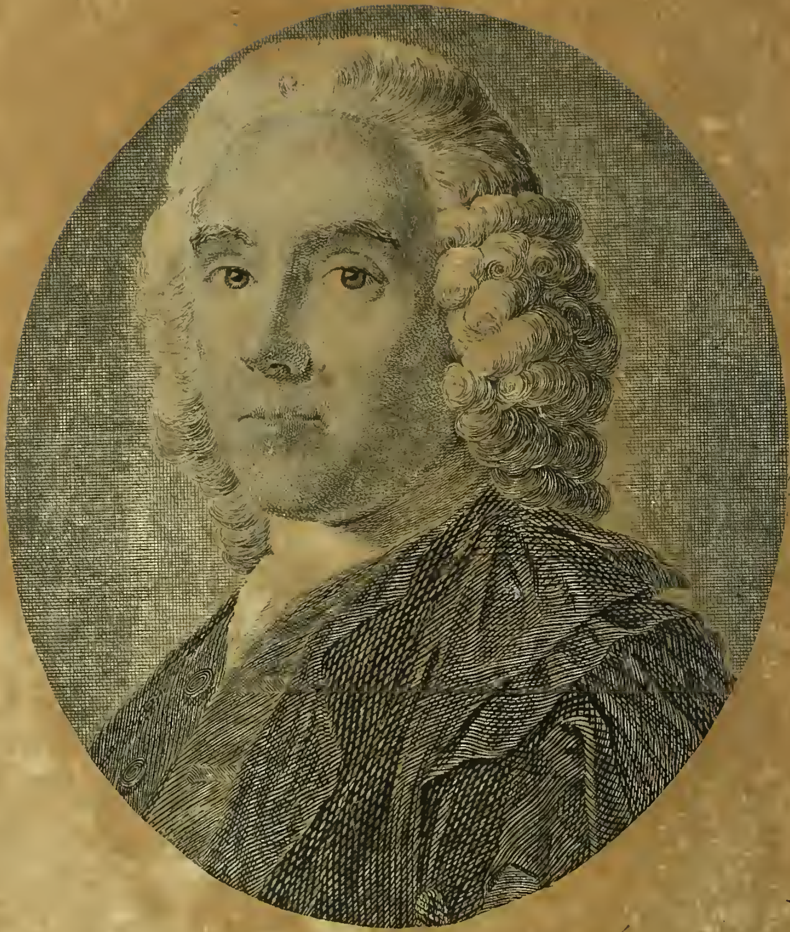
A

SYSTEM

OF

ANATOMY,

PHYSIOLOGY, &c.



Alexander Monro Sen.r M.D.

Professor of Anatomy, Fellow of the

Royal College of Physicians at Edinburgh and F.R.S.

A

SYSTEM

OF

ANATOMY

AND

PHYSIOLOGY,

WITH THE

COMPARATIVE ANATOMY OF ANIMALS.

COMPILED FROM

THE LATEST AND BEST AUTHORS,

AND ARRANGED,

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DR ALEXANDER MONRO, SENIOR.

VOL. I.

EDINBURGH:

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FOR WILLIAM CREECH.

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I

Edinburgh

V.1

TO

ALEXANDER MONRO, M. D.

FELLOW OF THE ROYAL SOCIETY,

AND OF THE COLLEGE OF PHYSICIANS,

AND PROFESSOR OF PHYSIC, ANATOMY, AND SURGERY,

IN THE UNIVERSITY OF EDINBURGH.

SIR,

THE great number and variety of books neceſſary for Students in Anatomy, many of which had become extremely ſcarce and valuable, rendered an Anatomical library very expenſive. In order to remove ſo great an inconvenience, a Gentleman connected with this Univerſity, whoſe great Anatomical knowledge and accuracy fully qualified him for the taſk, compiled from the beſt Authors the following Syſtem, which has already gone through three Editions, in the ſpace of a very few years.

Mr Creech, whoſe indefatigable zeal for promoting literature, and the intereſts of this Univerſity, is well known, bought the copy-right of this Work; and the urgent demand for a new Edition induced him to put each of the volumes un-

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der different preſſes, leſt, at the commencement of your Lectures, the Students might be diſappointed in not having aſſiſtance from this uſeful Compilation. Being unable, from the multiplicity of his buſineſs, to ſuperintend the Publication, he requeſted me to reviſe the Work for the preſs. As I was acquainted with the ſubject, and the Authors whence the ſelection was made, I readily undertook the taſk.

In the firſt volume, which contains chiefly the Oſteology by the late Profeſſor, your illuſtrious father and the founder of the Medical School here, little more was requiſite than to correct ſome typographical errors, and to adapt a few phraſes to the idiom of the Engliſh language, in its preſent improved ſtate.

In the other volumes, where phyſiology was intermixed with anatomical deſcription, the caſe was widely different. This circumſtance, however, happened from no fault of the original Editor or Projector of the Work; for he had choſen the beſt books to ſelect from, and his knowledge and diſcrimination, in this reſpect, are ſufficiently conſpicuous; but theſe works being in foreign languages, and an Engliſh book being wanted, unfortunately erroneous tranſlations had been uſed. The Editor, who directed the choice of the books,

could

could not be ſuppoſed, amid the multifarious and accumulated duties of his office, to attend to the faithfulneſs of the tranſlations; and the Book came before the Public therefore in a very imperfect ſtate.

THESE defects I have endeavoured to remedy in this Edition; and I am not conſcious, that any errors have eſcaped my notice. Should any, however, be diſcovered, I truſt that your candour will attribute them to their true cauſe, viz. the hurry of correcting three large octavo volumes for three preſſes, and preparing tranſlations for two of them in the ſpace of a few weeks.

THE thanks of the Public are juſtly due to you for patroniſing, and to the Editor for projecting, ſo uſeful a work. The faults of the former Editions were unavoidable from the circumſtances above mentioned; and if, by amending them, I have any way contributed to render the work more worthy of your patronage, or more uſeful to the attendants at your crowded theatre, I ſhall think myſelf highly honoured.

I have the honour to be,

With the greateſt reſpect,

SIR,

Your moſt obedient humble ſervant,

JOHN ROTHERAM.

ADVERTISEMENT

TO THIS NEW EDITION,

BY

THE PUBLISHER.

THE firſt Volume of this work contains the Oſteology of Dr Alexander Monro, ſenior, a performance which has been tranſlated and publiſhed in the moſt ſplendid form in foreign countries. The publiſher being in poſſeſſion of the beautifully engraved head of the Author, by Baſire from the original painting of Ramſay, ſo much celebrated by Mr Lavater in his ingenious Book on Phyſiognomy, thought it might not be unacceptable to the public, to be preſented with ſo elegant an engraving of the father of the Medical School of Edinburgh.

IT is therefore given as an embelliſhment to this new edition of the Syſtem of Anatomy and Phyſiology, which contains ſo much of his valuable writings.

THE words of Lavater, on ſeeing an impreſſion from this very plate, ſhall here be added; and

and thofe who knew the man beft, will teftify to the juftnefs of the character drawn of Dr Monro.

Mr Lavater fays,

" A good, gentle, and peaceable character, of a " fanguine phlegmatic temperament. The good- " nefs is depicted in his eyes; the mouth breathes " only peace; and an amiable ferenity is diffuf- " ed over the whole countenance. This man is " incapable of giving offence to any one, and " who could ever fuffer himfelf defignedly to " offend him?—He loves tranquillity, order, " and fimple elegance. He takes a clear view " of the fubject he examines; he thinks accu- " rately; his ideas, and his reafonings, are al- " ways equally well followed up; his mind re- " jects all that is falfe or obfcure. He gives " with a liberal hand, he forgives with a ge- " nerous heart, and takes delight in ferving his " fellow creatures. You may fafely depend on " what he fays, on what he promifes. His " fenfibility never degenerates into weaknefs; " he efteems worth, find it where he may. He " is not indifferent to the pleafures of life; but " fuffers not himfelf to be enervated by them. " This is not what is ufually denominated a

" great

" great man ; but he poſſeſſes a much more exalt-
" ed character ;—he is the honour of humanity,
" and of his rank in life.

" Reſpectable perſonage, I know you not ;
" I am entirely in the dark concerning you ;
" —but you ſhall not eſcape me in the great
" day which ſhall collect us all together ; and
" your form, diſengaged and purified from all
" earthly imperfection, ſhall appear to me, and
" ſtrike my raviſhed eye, in the midſt of my-
" riads."

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Introduction.

THE human body is compofed of firm and liquid parts, commonly called *folids* and *fluids*. Of the folid parts fome are hard, others foft and flexible.

The folid parts are the chief fubject of anatomy properly fo called; by which term, borrowed from the Greek, we underftand not only an artful decompofition of the parts of the body, but alfo a methodical demonftration and defcription of the feveral parts when diffected.

The hiftory of the fluid parts comes into a fyftem of anatomy, only occafionally; becaufe it properly belongs to what is called *phyfiology*, or the *animal economy*.

Anatomifts ordinarily reduce all the folid parts under certain general claffes, expreffed by the common or generical names of *bone*, *cartilage*, *ligament*, *fibre*, *membrane*, *veffel*, *artery*, *vein*, *nerve*, *mufcle*, *gland*, *fat*, *vifcus*, *organ*, *&c.* *.

Thefe terms are anatomical words, which exprefs feveral parts that have nearly the fame ftructure to outward appearance;

* The antients, who fettled a general divifion of the parts of the human body, from the mere outward appearance of the ftructure, called fome *fimilar* or *fimple*, and the reft *organical* or *compound*.

pearance; and as they are often mentioned, we ſhall here give an explanation of them.

Explication of the general Terms of Anatomy.

By Bones, we mean in general the hardeſt, moſt ſolid, and moſt inflexible parts of the human body; the particular hiſtory of which is contained in the deſcription which ſhall be given of the Dry Bones.

A *cartilage* is a whitiſh or pearl coloured ſubſtance, ſofter than a bone, but harder than any other part, ſmooth, poliſhed, pliable, and elaſtic. The cartilages ſhall be explained with the Dry Bones and Joints.

A *ligament* is a white, fibrous, compact ſubſtance, more pliable than a cartilage, difficult to be broken or to be torn, and yielding but a very little when drawn out with force. The ligaments ſhall be explained at full length in the deſcription of the Joints.

The name of *fibre* is given to ſmall filaments, which appear to be the moſt ſimple parts of the body, and which, by their different diſpoſition and connections, compoſe all the other parts. The fibres differ in ſubſtance, being either membranous, fleſhy, tendinous, or bony; in direction, being either ſtraight, oblique, longitudinal, tranſverſe, circular, or ſpiral; and in ſize, being either large, ſmall, long, or ſhort.

By *membrane*, we underſtand a pliable texture of fibres interwoven or diſpoſed together in the ſame plane. They differ in thickneſs, according to the ſmallneſs of their fibres and number of their planes. Theſe particular planes are termed *laminæ*, and are diſtinguiſhed into external, internal, middle, &c.

The difference of membranes in general depends on that of the fibres, of which they are compoſed. Small por-

tions

tions of membranes, efpecially when they are very thin, are called *pelliculæ ;* and fome membranous laminæ are united together by the intervention of a particular fubftance, compofed of this fort of pellicles, and called *the cellular* or *fpongy fubftance.*

Veffels are tubes, ducts, or canals, more or lefs flexible, compofed of different membranes, the ftrata of which are generally termed *tunicæ* or *coats.* Some of them are divided into branches, and thefe again into rami and ramifications, which gradually diminifh, but ftill remain hollow.

The general defign of the veffels is to contain fluids; from the diverfity of which they are diftinguifhed into blood-veffels, vafa lactea, lymphatica, &c. The laft and fmalleft extremities of all forts of veffels are generally termed *capillaries.*

The *blood veffels* are of two kinds; one of which receives the blood from the heart, and diftributes it to all the parts of the body, and are named *arteries ;* the other brings the blood from all the parts back to the heart, and are called *veins ;* and fome of thefe have the name of *finufes.*

The arteries are thicker than the veins, and may be diftinguifhed by this mark in diffected dead bodies; and in living bodies they are known by a certain beating called the *pulfe.* The trunks of the veins lie nearer the furface of the body than the arteries, and are furnifhed with valves, that is, with fmall membranous facculi, fixed at different diftances to the fides of their cavities. The openings of thefe valves are broad, and turned toward the heart; but their bottoms are turned the contrary way. In fome places thefe valves are fingle, in others double, triple, &c.

By *nerves*, anatomifts mean the white ropes which proceed from the cerebrum, cerebellum, and fpinal marrow, and are ſpread over all the parts of the body by filaments and ramifications.

Each nervous rope may be conſidered as a membranous veſſel, the cavity of which is filled by a great number of membranous longitudinal ſepta, and by medullary filaments which lie between the ſepta.

Muſcles are bundles of fibres, called by anatomiſts *fibræ motrices*, of a reddiſh colour, and of different lengths.

The middle portion of the moving fibres is the principal, and differs from the extremities in being red, thick, ſoft, and capable of contraction.

This middle portion of each moving fibre is ſaid to be fleſhy, and forms what is properly called *fleſh*. The extremities are called *tendinous*, and the ſubſtance formed by them *tendons*.

Glands are cluſters or moleculæ, diſtinguiſhable from all the other parts of the body by their form, conſiſtence, texture, and connection.

They are, in general, compoſed of arteries, veins, nerves, and other particular veſſels, and of a ſubſtance which unites all theſe together in their different folds, contortions, and intertextures, all inveſted by a membranous covering.

The office of glands is to ſeparate from the maſs of blood, by means of certain ſecretory veſſels, fluids, which they diſcharge, either immediately, or by other veſſels termed *excretory*; and theſe fluids are either accumulated in particular reſervoirs, collected in the common cavities, or forced out of the body.

Fat and *marrow* are equivocal terms. By the firſt, we generally underſtand an oily, ſoft, white, or yellowiſh ſubſtance, of different conſiſtencies, collected between the ſkin and the muſcles, in the interſtices of the muſcles about the viſcera, &c. and compoſed partly of a cellulous or ſpongy

ſubſtance,

ſubſtance, purely membranous, and partly of an oily matter of different thickneſs. This oily matter is called *fat*, eſpecially when ſeparated from the cellulous ſubſtance, and likewiſe *corpus adipoſum* by anatomiſts.

Marrow differs from fat only in the fineneſs of the membranous texture, in the ſubtility of the oily matter, and its ſituation within the bones.

By *viſcera*, we commonly underſtand parts contained in a great cavity, without being connected to it through their whole extent or circumference. Such are the ſtomach, inteſtines, &c. in the abdomen; and the lungs in the thorax.

Organ or *inſtrument* is a term given to every part capable of any function, whether it be ſimple or complex; and in this ſenſe we talk of the organ of ſight, of reſpiration, &c.

General Diviſion of the Human Body.

The Human Body is commonly divided into the *head*, *trunk*, and *extremities*. The trunk is again ſubdivided into the *neck*, *thorax*, and *abdomen*; and the extremities into *ſuperior*, called the *arms*, and *inferior*, called the *legs*.

The ancients divided the body into three great cavities, which they termed *venters*, and into four extremities. They called the head the *upper venter*, the thorax the *middle venter*, and the abdomen the *lower venter*. The neck was by ſome joined to the head; by others, to the thorax.

The moſt natural and plaineſt diviſion of the body, is into the head, neck, thorax, abdomen, arms, and legs; each of which portions may afterwards be ſubdivided.

Each portion is to be examined not only with regard to its ſurface or external confirmation, but alſo with regard to its internal ſtructure or compoſition, and to the viſcera or organs which it contains or ſupports.

This is what gave occaſion to the antients to divide the body into parts containing and parts contained; and to ſubdivide the containing parts into common and proper. The common containing parts have been named *integuments*, by which they meant chiefly the ſkin and fat.

External Parts of the Head.

The HEAD, viewed on the outſide, is divided into the *hairy ſcalp* and *face.*

The inner parts of the head are ſurrounded by the bones of the cranium.

The *hairy ſcalp* covers the upper parts of the os frontis, the oſſa parietalia, the os occipitis, and the upper and lower portions of the oſſa temporum.

The uppermoſt part of the hairy ſcalp is termed the *vertex* or *fontanella;* the back part, *occiput*; the lateral parts, the *temples*. The vertex is diſtinguiſhed from the occiput by contorted hair, and from the temples by the ears.

The *arteries* on each ſide of the hairy ſcalp are: Arteria carotis externa, in general; arteria temporalis; arteria occipitalis; arteria angularis, by communication; arteria frontalis, a branch of the internal carotid.

The *veins* on each ſide of the hairy ſcalp are: Vena jugularis externa, in general; vena jugularis externa poſterior; vena temporalis; vena occipitalis; vena jugularis externa anterior, by communication; vena jugularis interna, by communication.

The *nerves* on each ſide of the hairy ſcalp are: Nervi ſuboccipitales, commonly called *the tenth pair from the medulla oblongata;* par primum cervicale; par ſecundum cervicale,

vicale, by communication; ramus frontalis of the orbitary or ophthalmic nerve; nervus ſympatheticus minor, called the *portio dura* of the auditory nerve.

The *face* comprehends all that portion of the ſurface of the head which lies between the hairy ſcalp and the neck, viz. the forehead, eyebrows, palpebræ, eyes, noſe, mouth, chin, cheeks, and ears.

The external parts of the *eye* are: The anterior portion of the globe of the eye, the membrana conjunctiva, the cornea lucida, caruncula lachrymalis, angles of the palpebræ, and the cilia, or hairs of each palpebra. The internal parts are; the globe of the eye, the iris and pupil, the tunica ſclerotica or cornea opaca, the choroides, arachnoides, cryſtalline, vitreous humour, aqueous humour, the anterior and poſterior chambers, the muſcles, and the optic nerve.

The external parts of the *ear* are: The great concha, the convex ſide of this concha, or hinder part of the ear, the great border, the fold or helix, the concavity, the broad eminence or antihelix, the ſmall anterior eminence or tragus, the ſmall poſterior eminence or antitragus, the lobe or lower extremity of the ear, and the meatus.

The external parts of the *noſe* are: The upper extremity or root of the noſe, the arch or back, the ſides of that arch, the tip of the noſe, the alæ, the nares, and the ſeptum narium. The internal parts are the cavity and bottom of the nares, the convolutions, the maxillary, ſphenoidal, frontal, and ethmoidal ſinuſes.

The external parts of the *mouth* are: The lips, one upper, the other lower, the angles or commiſſures of the lips, the border or edge of each lip, the foſſula which runs from the ſeptum narium to the edge of the upper lip, and

the

the transverse fold which separates the upper lip from the chin.

The internal parts of the *mouth* are: The palate, the septum palati, the uvula, the amygdalæ, gums, fræna of the lips, the tongue, its apex, roots, sides, and frænum. The other internal parts of the mouth, eye, nose, and ear, such as the glands, membranes, muscles, &c. must be referred to the particular descriptions of these parts.

The *cheeks* are the lateral parts of the face, reaching downward from the eyes and temples, between the nose and ears. The upper prominent part of the cheek is commonly termed *mala*.

The *chin* is the anterior protuberance, by which the lower part of the face is terminated, from whence it runs all the way to the neck. This under part of the chin, is termed the *basis*; and it is distinguished from the throat by a transverse fold, which reaches from ear to ear. In the middle of the chin, there is sometimes a fossula or depression.

The exterior *arteries* which belong to each side of the *face* are: Arteria carotis externa, in general; arteria facialis; arteria temporalis; arteria carotis interna, by communication.

The exterior *veins* distributed to each side of the face are: Vena jugularis externa; vena jugularis interna, by communication; vena facialis; vena temporalis.

The exterior *nerves* spread on each side of the face are: Nervus olfactorius; nervus orbitarius sive ophthalmicus; nervus maxillaris superior; nervus maxillaris inferior; portio dura of the auditory nerve; the second pair of the nervi cervicales.

The *arteries* of the *forehead* are: Arteria temporalis, arteria angularis, which are branches of the external carotid;

tid; arteria frontalis, which is a branch of the internal carotid.

The *veins* of the forehead are: Vena frontalis; vena temporalis; vena angularis; finus orbitarius.

The *nerves* of the forehead are: Nervus orbitarius five ophthalmicus; nervus maxillaris fuperior; nervus maxillaris inferior; portio dura of the nervus auditorius.

The *arteries* which go to the *eye* are: Arteria occularis, which is a branch of the internal carotid; arteria facialis five angularis; arteria maxillaris interna, which are branches of the external carotid.

The *veins* which belong to the eye are: Vena temporalis, which is a branch of the pofterior external jugular; vena frontalis, and vena angularis, which are branches of the vena fafcialis; finus orbitarius; vena jugularis interna, by communication.

The *nerves* belonging to the eye are: Nervis opticus; nervis motor communis, or the third pair; nervus trochlearis, or the fourth pair; nervus orbitarius five ophthalmicus; and nervus maxillaris fuperior, branches of the fifth pair; nervus motor externus, or the fixth pair; portio dura of the auditory nerve; nervus fympatheticus maximus, by communication.

The *arteries* diftributed to the *nofe* are: Arteriæ maxillaris externæ; arteriæ maxillaris internæ; arteria occularis; arteria labiorum orbicularis, by communication.

The *veins* belonging to the nofe have their names correfponding with thofe of the arteries.

The *nerves* which go to each fide of the nofe are: Nervus olfactorus: nervus orbitarius five ophthalmicus, both immediately and by communication; nervus maxillaris fuperior; portio dura of the auditory nerve.

The *arteries* which go to the *ear* are: Arteria temporalis,

lis, a branch of the external carotid; arteria auricularis, a branch of the temporalis; arteria occipitalis, by communication; arteria vertebralis, by means of the arteria basilaris, which is a continuation of it; arteria carotis interna, by communication with the arteria basilaris.

The *veins* belonging to the ear are: Vena temporalis; vena occipitalis; vena cervicalis; vena jugularis interna, by several communications; sinus petrosus durae matris.

The *nerves* distributed to the ear are: Nervus maxillaris inferior, the third branch of the fifth pair; nervus auditorius, the seventh pair; nervus suboccipitalis, the tenth pair by communication; the second cervical pair; nervus sympatheticus maximus.

The *arteries* which go to the *mouth*, *tongue*, *&c.* are: The artery of the chin; arteria coronaria sive orbicularis labiorum, both being branches of the external carotid; arteria maxillaris interna; arteria palatina, a branch of the maxillaris externa; arteria sublingualis.

The *veins* belonging to each side of the mouth, tongue, *&c.* are: Vena maxillaris externa; vena maxillaris interna; venæ raninæ. All these are branches of the external jugular. Vena jugularis interna, by several communications; vena gutturalis superior, a branch of the internal jugular.

The *nerves* distributed to the mouth, tongue, and salivary glands, &c. are: Nervus maxillaris superior; nervus maxillaris inferior, both branches of the fifth pair; portio dura of the auditory nerve; the eighth pair; the ninth pair; the second pair of cervical nerves; nervus sympatheticus maximus, by communication.

The *cheeks* on each side are furnished with *arteries* and *veins* from the nearest ramifications of the temporal and maxillary arteries and veins; and with *nerves* from the

portio

portio dura of the auditory nerve, and from the ſuperior and inferior maxillary nerves.

Parts within the Cranium.

The CRANIUM comprehends all that portion of the head which reaches from the upper part of the orbit to the upper and back part of the neck; at the ſides it extends as low as the paſſage into the ears.

It is lined internally by the dura mater, and divided by a proceſs of that membrane into a large upper cavity and a ſmall under one. The upper cavity contains the cerebrum, the under one contains the cerebellum and medulla oblongata.

The arteries of the brain are: Arteriae carotides internae; arteriae vertebrales.—The arteries of the dura mater are, the arteriae durae matris, mediae maximae, &c. The veins of the brain run to the ſinuſes, and theſe end in the venae jugulares internae.

Parts of the Neck in general.

The NECK, in general, is divided into the anterior part or throat, and poſterior part or nape. The throat begins by an eminence, and terminates by a foſſula. The nape begins by a foſſula, which, as it deſcends, is gradually loſt. The neck contains the larynx, a part of the trachea arteria, the pharynx, a part of the œſophagus, the muſculi cutanei, ſterno-maſtoidaei, ſterno-hyoidaei, thyro-hyoidaei, omo-hyoidaei, ſplenius complexus, the muſculi vertebrales, which lie upon the firſt ſeven vertebrae, and a portion of the medulla ſpinalis.

The *arteries* which go to the neck are: Arteriae carotides externae, and internae; arteriae vertebrales; arteriae cervicales.

The *veins* belonging to the neck are: Venae jugulares in general; venae jugulares externae, and internae; venae cervicales; venae vertebrales.

The *nerves* diſtributed to each ſide of the neck are: Portio dura of the auditory nerves; the eighth pair; nervus acceſſorius octavi paris; the ninth pair; nervus ſuboccipitalis, or the tenth pair; the ſeventh cervical pair; nervus ſympatheticus maximus.

Parts of the Thorax.

By the Thorax we commonly underſtand all that part of the body which anſwers to the extent of the ſternum, ribs, and vertebrae of the back, both outwardly and inwardly.

The thorax is divided into the anterior part, called commonly the *breaſt;* the poſterior part, called the *back;* and the lateral parts, called the *right* and *left ſides.*

The external parts of the thorax, beſides the ſkin and membrana adipoſa, are principally the mammae, and the muſcles which cover the ribs and fill the ſpaces between them. In the mammae we ſee the papillae or nipples, and a ſmall coloured circle which ſurrounds them. The muſcles are, the pectorales majores and minores, ſubclavii, ſerrati majores, ſerrati ſuperiores poſtici, latiſſimi dorſi, and vertebrales: and to theſe we may add the cuculares rhomboides and muſcles which cover the ſcapula.

The internal parts of the thorax are contained in the large cavity of that portion of the trunk which the antients called the *middle venter;* but the moderns name it ſimply *the cavity of the breaſt.* The cavity is lined by a membrane named *pleura,* and divided into two lateral cavities by a membranous ſeptum named *mediaſtinum,* which is a production or duplicature of the pleura.

Theſe parts are the heart, pericardium, trunk of the aorta, great arch of the aorta, beginning of the carotid and

and ſubclavian arteries, the ſuperior portion of the deſcending aorta, the intercoſtal arteries, the vena cava ſuperior, vena azygos, termination of the ſubclavian veins; a portion of the aſpera arteria, and of the œſophagus; the ductus lacteus or thoracicus, the lungs, pulmonary artery, pulmonary veins, &c.

The *arteries* and *veins* which particularly belong to the thorax are; Arteriae and venae thoracicae, ſuperiores and inferiores; arteriae and venae mammariae, internae and externae; arteriae and venae intercoſtales, ſuperiores and inferiores; arteriae and venae ſpinales, with the venal ſinuſes of the canal of the ſpine.

The *nerves* diſtributed to the thorax are: Nervi ſympathetici medii, or the eighth pair; nervi ſympathetici univerſales, commonly called *intercoſtales;* the twelve dorſal pairs; nervi diaphragmatici; nervi thoracici externi.

The cavity of the thorax is terminated downward by the diaphragm, which parts it from the abdomen.

Parts of the Abdomen.

The Abdomen begins immediately under the thorax, and terminates at the bottom of the pelvis of the oſſa innominata. Its circumference or outer ſurface is divided into regions; of which there are three anterior, *viz.* the epigaſtric or ſuperior region, the umbilical or middle region, and the hypogaſtric, or lower region. There is but one poſterior region, named *regio lumbaris.*

The *epigaſtric region* begins immediately under the appendix enſiformis at a ſmall ſuperficial depreſſion called *the pit of the ſtomach,* and in adult ſubjects ends above the navel at a tranſverſe line ſuppoſed to be drawn between the laſt falſe ribs on each ſide.

This region is ſubdivided into three parts, *epigaſtrium,* already named; and two lateral regions, termed *hypochondria.*

dria. The epigaſtrium takes in all that ſpace which lies between the falſe ribs of both ſides, and the hypochondria are the places covered by the falſe ribs.

The *umbilical region* begins in adults, above the navel, at the tranſverſe line already mentioned; and ends below the navel at another tranſverſe line, ſuppoſed to be drawn parallel to the former, between the two criſtae of the oſſa ilium.

This region is likewiſe divided into three parts; one middle, which is properly the regio umbilicalis; and two lateral, called *ilia* or *the flanks;* and they comprehend the ſpace between the falſe ribs and upper part of the os ilium on each ſide.

The *hypogaſtric region* is extended downward from the inferior limit of the umbilical region, and is divided into three parts; one middle, called *pubis*; and two lateral, called *inguina* or *the groins*.

The *lumbar region* is the poſterior part of the abdomen, and comprehends all that ſpace which reaches from the loweſt ribs on each ſide, and the laſt vertebra of the back, to the os ſacrum and neighbouring parts of the oſſa ilium. The lateral parts of this region are termed the *loins*, but the middle part has no proper name in men.

Laſtly, the bottom of the abdomen, which anſwers to the pelvis of the ſkeleton, is terminated anteriorly by the pudenda or parts of generation; and poſteriorly by the clunes or buttocks, and anus. The buttocks are ſeparated by a foſſa, which leads to the anus, and each buttock is terminated downward by a large fold which diſtinguiſhes it from the reſt of the thigh.

This lumbar region takes in likewiſe the muſculus quadratus lumborum on each ſide, the lower portions of the ſacro-lumbales, of the longiſſimi and latiſſimi dorſi, the multifidus ſpinae, &c.

The

The ſpace between the anus and the parts of generation is called *perinæum*; and is divided into two equal lateral parts by a very diſtinct line, which is longer in males than in females, as we ſhall ſee in another place.

The cavity of the abdomen, formed by the parts already mentioned, and covered by the ſkin and membrana adipoſa, is lined on the inſide by a particular membrane, called *peritonæum*. It is ſeparated from the cavity of the thorax by the diaphragm, and terminated below by the muſculi levatores ani.

This cavity contains the ſtomach and the inteſtines; which are commonly divided into three ſmall portions, named *duodenum*, *jejunum*, and *ileum*; and three large, called *cæcum*, *colon*, and *rectum*. It contains likewiſe the meſentery, meſocolon, omentum, liver, gall-bladder, ſpleen, pancreas, glands of the meſentery, vaſa lactea, receptaculum chyli, kidneys, renal glands, ureters, bladder, and the internal parts of generation in both ſexes.

The principal *arteries* of the abdomen are; Arteriae epigaſtricae ſuperiores, which are the loweſt portions of the mammariae internae; aorta inferior; arteria caeliàca; arteria meſenterica ſuperior; arteriae renales, called formerly *emulgentes*; arteriae ſpermaticae; arteria meſenterica inferior; arteriae lumbares; arteriae iliacae; arteriae hypogaſtricae; arteriae epigaſtricae inferiores; arteriae haemorrhoidales; arteriae pudicae.

The principal *veins* of the abdomen are: The inferior portions of the venae mammariae internae; venae renales; venae lumbares; venae ſpermaticae; venae iliacae; venae hypogaſtricae; vena meſaraica minor, ſive haemorrhoidales internae; vena meſaraica major; vena ſplenica; vena portae ventralis; vena portae hepatica.

The principal *nerves* of the abdomen are: Nervi ſtomachici, formed by the extremity of the eighth pair; nervi

ſympathetici

ſympathetici maximi, the inferior portion; the two ſemilunar or plexiform ganglions; plexus ſtomachicus; plexus hepaticus; plexus ſplenicus; plexus renalis; plexus meſentericus ſuperior; plexus meſentericus inferior; nervi lumbares; nervi ſacri; nervi crurales, their origin; nervi ſciatici, their origin.

Parts of the Upper Extremities.

The whole Arm is divided, as in the ſkeleton, into the ſhoulder, the arm properly ſo called, the fore-arm, and the hand. But to theſe we muſt here add the ſhoulder, the axilla or arm-pit, the elbow, the fold of the arm, and the hollow of the hand.

What is called the ſhoulder, is formed by the fleſhy belly of the muſculus deltoides; and the axilla, by the correſponding edges of the pectoralis major and latiſſimus dorſi. The elbow anſwers to the olecranum; the fold of the arm is on the fore-ſide of the articulation of the os humeri, with the bones of the fore-arm, and the hollow of the hand is in the middle of the palm.

The arm, properly ſo called, is principally covered, from the ſhoulder downward, by the biceps, brachialis, and the triceps. The fore-arm is furniſhed with thoſe muſcles which move the radius on the ulna, and the carpus on the fore-arm. The hand has few very conſiderable fleſhy parts, except the muſcles of the thumb and little finger, the lumbricales and interoſſei.

The *arteries* of the upper extremity are: Arteria axillaris; arteria humeralis; arteriae ſcapulares; arteria articuris; arteria brachialis; arteriae collaterales; arteria cubitalis; arteria radialis; arteria interoſſeae anterior; arteriae interoſſeae poſteriores. The ſuperficial and deep arches in the palm of the hand.

The *veins* of the upper extremity are: Areolae venoſae

dorſi

dorſi manus; vena ſalvatella, ſive auricularis; vena cephalica cubiti, ſive radialis; venae cubiti ſatellites; vena baſilica cubiti, ſive ulnaris; vena mediana, or major; vena mediana cephalica; vena mediana baſilica; vena profunda cubiti; vena profunda ſuperior; venae ſatellites arteriae brachialis; vena brachii cephalica; vena brachii baſilica; venae muſculares; venae ſcapulares; vena axillaris.

The *nerves* of the upper extremity are; Nervi brachiales in general, formed by the laſt four cervical and firſt dorſal pairs; nervus ſcapularis; nervus articularis; nervus cutaneus; nervus muſculo-cutaneus; nervus muſcularis; nervus ulnaris; nervus radialis.

Parts of the Lower Extremities.

The Lower Extremities of the whole body are divided, as thoſe of the ſkeleton, into the thigh, leg, and foot.

The *thigh* begins anteriorly on one ſide of the fold of the groin; and poſteriorly, a little above the lower half of the buttock. It terminates anteriorly at the patella on the knee, and poſteriorly at the poples or ham. It is formed chiefly by the muſcles which ſurround the os femoris, which are themſelves inveſted by the faſcia lata, *viz.* the glutaeus maximus, two vaſti, crureus, biceps, triceps, ſemi-membranoſus, ſemi-tendinoſus, gracilis internus, gracilis anterior or rectus, and ſartorius.

The *leg* has but very few muſcles on the fore-part, but a great many large ones behind: where the gaſtrocnemii and ſoleus, form a kind of belly, called the *calf of the leg.* The leg begins anteriorly at the knee below the patella, and poſteriorly at the poples; and it terminates below at the ancles.

Beſides the parts of the *foot* mentioned in the deſcription of the ſkeleton, that convex part near its articulation with the

the leg is termed the *neck of the foot*: and the under part, which is the basis of the whole lower extremity, the *sole of the foot.* The fleshy parts are not more considerable on the foot than on the hand.

The *arteries* of the lower extremity are: Arteria obturatrix, a branch of the hypogastrica; arteria glutaea, a branch of the hypogastrica; arteria sciatica, by communication; arteria pudica, by communication; arteria circumflexa externa; arteria circumflexa interna; arteria vasta; arteria cruralis; arteria poplitea; arteria tibialis anterior; arteria tibialis posterior; arteria peronaea; arteria plantaris.

The *veins* of the lower extremity are: Vena plantaris; vena parva saphena; vena magna saphena; venae tibiales; venae fibulares; vena poplitea; vena sciatica; vena glutea; venae femorales; vena obturatrix, &c.

The *nerves* of the lower extremity are: Nervus cruralis, formed by a complication of the five lumbares, especially of the first four; nervus sciaticus, formed by the union of the last two lumbares, and first three sacri; nervus sympatheticus maximus by communication with the nervi lumbares and sacri; nervus popliteus; nervus sciaticus internus, sive popliteus internus; nervus sciaticus externus, sive popliteus externus; nervus tibialis; nervus fibularis; nervi plantares.

A

SYSTEM OF ANATOMY,

WITH THE

PHYSIOLOGY.

PART I.

CONTAINING THE

ANATOMY

OF THE

HUMAN BONES.

BY THE LATE

ALEXANDER MONRO, M. D. AND F. R. S.

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TO THE

STUDENTS OF ANATOMY

IN THE

UNIVERSITY OF EDINBURGH.

GENTLEMEN,

WHEN this *Osteology* was first printed in 1726, I did not know that Albinus, Winslow, and Palfyn, were to publish descriptions of the bones; otherwise my papers probably would have remained yet undelivered to the printers. I flatter myself, however, that this *essay* has been of use to the gentlemen who did me the honour to attend my lectures, by assisting them to understand my sense and representation of things in this fundamental part of anatomy; and that it has possibly been of more advantage to them than a more complete work from an abler hand, unless my demonstrations had been in the order and method of such an author.

This view of your improvement, Gentlemen, is a prevailing argument with me to cause this essay to be reprinted; and you cannot reasonably blame me, if I likewise acknowledge another motive for it, which more particularly relates to myself. In a new edition an author has an opportunity of making his works more correct, complete, and consequently more acceptable to the public, who may perhaps be indulgent enough to think this little treatise not altogether useless; since more reasoning on the structure and morbid *phænomena* of bones is to be found in it, than in the other writers, who have confined themselves almost entirely to the descriptive or proper anatomical part of the *osteology*.

I have here kept in the plan of the former editions, by first considering, in the order that seemed to me most natural and methodical, every thing which I thought necessary to be known concerning bones in general; and, in the second place, I have described the several bones composing the skeleton.

The bones of adults are what I principally endeavour to describe; but I have added as much of the *osteogenea* as I think serviceable in the practice of physic and surgery.

That

That little might be omitted of what was formerly done on this ſubject, I have taken all the aſſiſtance I could from books; but have never aſſerted any anatomical fact on their authority, without conſulting nature, from which all the deſcriptions are made; and therefore the quotations from ſuch books ſerve only to do juſtice to the authors, who have remarked any thing in the ſtructure of the parts that was commonly omitted, and to initiate you in the hiſtory of anatomy, which I once propoſed to make complete, ſo far as related to this ſubject. But not being able to procure ſeveral books, and being ſenſible how many more may have never come to my knowledge, I laid aſide this deſign, of purpoſe omitted many I could have inſerted, and in ſome places I have changed an older author for a later one who has more fully or clearly deſcribed what I treated of. Beſide anatomiſts, I have alſo named ſeveral other authors to confirm my reaſoning by practical caſes; of which, it is not to be ſuppoſed, my own experience could furniſh a ſufficient variety.

You will readily obſerve, that I quote no paſſages with a view to criticiſe or condemn them. This precaution of giving no offence, is very neceſſary in thoſe who are ſufficiently conſcious of their being liable to lay themſelves open to juſt cenſure; and it prevents occaſions of uſeleſs wrangling, in which generally both parties are loſers, and the public has little advantage.

In this treatiſe I always make uſe of the moſt common name of each part, and have put the ſynonymous name to be met with in books at the foot of the page, that the reading might be ſmoother, and you might conſult them at your leiſure to aſſiſt you in underſtanding different authors.

The deſcriptions and reaſonings are blended, without which I always find young anatomiſts are ſoon diſguſted with authors. Their imaginations cannot follow a long chain of deſcriptions, eſpecially when they are not taught at the ſame time the uſes which the deſcribed parts ſerve. Their minds muſt have ſome relaxation, by a mixture of reaſoning, which never miſſes to ſtrike the fancy agreeably, and raiſes a ſtrong deſire to underſtand the principles on which it depends.

The phenomena of diſeaſes are all deduced in this eſſay from the ſtructure of the parts, by way of corollaries and queſtions; which ſuch an anatomical work confined me to. And this method has otherwiſe a good effect; for, when a perſon meets with an uſeful propoſition, and is obliged to employ a little thought to find out its ſolution, the impreſſion it makes is deeper, and he acquires a fondneſs for it, as being in part his own diſcovery. My pupils have frequently aſſured me, that they could, with very ſmall reflection, trace out the whole reaſonings from which my concluſions were drawn. I hope that their ſucceſſors will alſo think this an agreeable manner of being inſtructed.

Thoſe gentlemen who deſired I would add the lectures which I pronounce in my college as a commentary upon the text, where the diſeaſes are mentioned, will, I perſuade myſelf, excuſe me for not complying with their deſire, when they conſider the deſign of this is to be a ſchool-book, and how great the difference is between inſtructing youth in private, and pretending to inform the public. *Art.* xxv. *vol.* v. of Medical Eſſays and Obſervations, publiſhed in this place, is one of theſe lectures which I gave as a commentary on the paragraph *(p.* 14.*)* concerning the different kinds of *caries*.

In this edition, I have corrected the miſtakes and obſcure paſſages which I diſcovered in the former, and in ſome places I have made the deſcriptions more full and exact, aiming all I could to ſhun unneceſſary minuteneſs on the one hand, and a blameable inaccuracy on the other. Whether I have hit that juſt medium, is what you and the public muſt now judge.

You have advantageous opportunities in this place of ſtudying all parts of medicine, under the profeſſors of its different branches in the Univerſity, and of ſeeing the practice of pharmacy, ſurgery, and phyſic, with our ſurgeon apothecaries, and in the Royal Infirmary, where the diſeaſed poor are carefully treated. Theſe your intereſt, and, I hope, your inclinations, will lead you, Gentlemen, ſo to improve, as that they become the happy means of your making a conſiderable figure in your ſeveral ſtations. Whatever aſſiſtance is in my power towards ſuch a deſirable event, ſhall be given with the greateſt pleaſure by,

Your humble ſervant,

ALEX. MONRO.

A

SYSTEM

OF

ANATOMY,

WITH THE

PHYSIOLOGY.

PART I.

OF THE

HUMAN BONES.

CHAP. I.

Of the BONES in general.

THE PERIOSTEUM.

BONES are covered by a membrane, named on that account PERIOSTEUM (*a*), which is ſo neceſſary to them, that we muſt examine its texture and uſes before we can underſtand their ſtructure.

The *perioſteum*, as well as moſt other membranes, can be divided into *layers* of fibres. The *exterior* layers, compoſed of the fibres of the muſcles connected to the bones, vary in their number, ſize, and direction, and conſequently occaſion

(*a*) Membrana circumoſſalis, omentum oſſibus impoſitum.

ſion a very great difference in the thickneſs and ſtrength of the perioſteum of different bones, and even of the different parts of the ſame bone. The *internal* layer is every where nearly of a ſimilar ſtructure, and has its fibres in the ſame direction with thoſe of the bone to which they are contiguous. Ought not then the name *perioſteum* to be applied, ſtrictly ſpeaking, only to this internal layer, to which the others are joined in an uncertain manner and number?

Some authors (*b*) endeavour to prove the internal layers of fibres of the perioſteum to be derived from the *dura mater:* For, ſay they, ſince the membrane covering the ſkull is plainly a production or continuation of the dura mater, which paſſes out between the ſutures; and ſince there are muſcles on the head, as well as in other parts, which might furniſh a perioſteum, it is needleſs to aſſign different origins to membranes which have the ſame texture and uſes. They add farther, in proof of this doctrine, that the perioſteum extends itſelf along the ligaments of the articulations from one bone to another; and therefore is continued from its origin over all the bones of the body.—While anatomiſts were fond of the hypotheſis of all membranes being derived from one or other of the two that cover the brain, a diſpute of this kind might be thought of conſequence: but now that the hypotheſis is neglected as uſeleſs, it is needleſs to examine the arguments for or againſt it.

Except where muſcles, cartilages, or ligaments, are inſerted into the perioſteum, its external ſurface is connected to the ſurrounding parts by thin cellular membranes, which can eaſily be ſtretched conſiderably, but ſhorten themſelves whenever the ſtretching force is removed. When theſe membranes are cut off or broken, they collapſe into ſuch a ſmall ſpace, that the ſurface of the perioſteum ſeems ſmooth and equal.

When

(*b*) Havers, Oſteolog. Nov. diſc. 1. p. 16.

When we attempt to tear off the periofteum from bones, we fee a great number of white threads produced from the membrane into them; and, after a fuccefsful injection of the arteries with a red liquor, numerous veffels are not only feen on the periofteum (*c*), but moft of the fibres fent from the membranes to the bone, fhew themfelves to be veffels entering it, with the injected liquor in them; and when they are broken, by tearing off the periofteum, the furface of the bone is almoft covered with red points.

The veins correfponding to thefe arteries are fometimes to be feen in fubjects that die with their veffels full of blood; though fuch numerous ramifications of them, as of the arteries, can feldom be demonftrated, becaufe few of them naturally contain coloured liquors, and fuch lipuors can difficultly be injected into them. This, however, is fometimes done (*d*).

The great fenfibility of the periofteum in the deep feated fpecies of paronychia, in exoftofes, nodi, tophi, and gummata, from a lues venerea, or whenever this membrane is in an inflamed ftate, is a fufficient proof that it is well provided with nerves, though they are perhaps too fmall to be traced upon it; and therefore it is difficult to determine, whether they are fent along with the arteries in the common way, or are derived from the tendinous fibres of the mufcles expanded on the periofteum (*e*).

Veffels alfo pafs through the periofteum to the marrow; of which more hereafter. And frequently mufcles, ligaments, or cartilages, pierce through the periofteum, to be inferted into the bones.

The

(*c*) Ruyfch. Epift. 5. tab. 5. fig 1. 2. Epift. 8. tab. 9. fig. 1. 9.

(*d*) Sue Traité d'Ofteologie, traduit de l'Anglois de Mr Monro; note in p. 9.

(*e*) See the difpute about the fenfibility of this and other membranes, in Zimmerman. Differt. de irritabilit.—Act. Gotting. vol. 2.——Haller fur la nature fenfible et irritabile.—Whytt's Phyfiolog. effay 2.—Remar. Differt. de fungo articular. § 26. 34.

The chief uſes of the perioſteum are: 1. To allow the muſcles, when they contract or are ſtretched, to move and ſlide eaſily upon the bones; the ſmooth ſurface of this membrane preventing any ill effects of their friction upon each other. 2. To keep in due order and to ſupport the veſſels in their paſſage to the bones. 3. By being firmly braced on the bones, to aſſiſt in ſetting limits to their increaſe, and to check their overgrowth. 4. To ſtrengthen the conjunction of the bones with their epiphyſes, ligaments, and cartilages, which are eaſily ſeparated in young creatures, when this membrane is taken away. 5. To afford convenient origin and inſertion to ſeveral muſcles which are fixed to this membrane. And, laſtly, To warn us when any injury is offered to the parts it covers; which being inſenſible, might otherwiſe be deſtroyed without our knowledge, or endeavouring to procure a remedy.

When the cellular ſubſtance connecting the perioſteum to the ſurrounding parts is deſtroyed, theſe parts are fixed to that membrane, and loſe the ſliding motion they had upon it; as we ſee daily in iſſues, or any other tedious ſuppurations near a bone.——When the veſſels which go from the perioſteum to the bones are broken or eroded, a collection of liquor is made between them, which produces a ſordid ulcer or rotten bone. This often is the caſe after fractures of bones and inflammations of the perioſteum, or after ſmall pox, meaſles, ſpotted fevers, end eryſipelas.——Do not the diſorders of the perioſteum, coming rather along with or ſoon after the cutaneous than other diſeaſes, indicate ſome ſimilarity of ſtructure in the perioſteum and ſkin?

OF THE COMPOSITION OF BONES.

The bones are the moſt hard and ſolid parts of the body: and like all other parts where large veſſels do not en-

ter,

ter, are generally of a white colour; only in a living creature they are bluifh, which is owing to the blood in the fmall veffels under their furface. The lefs therefore and fewer the veffels are, and the thicker and firmer the bony furface covering the veffel is, the bones are whiter. Hence the bones of adults are whiter than thofe of children; and, in both young and old, the white colour of different bones, or of the feveral parts of the fame bone, is always in proportion to their veffels and folidities; which circumftances ought to be regarded by furgeons, when they are to judge of the condition of bones laid bare.

Bones are compofed of a great many plates (*f*), each of which is made up of fibres or ftrings united by fmaller fibrils (*g*); which being irregularly difpofed, and interwoven with the other larger fibres, make a reticular work.—— This texture is plainly feen in the bones of fœtufes, which have not their parts clofely compacted; and in the bones of adults which have been burnt, long expofed to the weather, or whofe compofition has been made loofe by difeafes.—— The chinks which are generally made according to the directions of the larger fibres of bones that have undergone the action of fire or of the weather, fhew the greater ftrength of thefe than of the fibres which connect them.——Numerous accurate obfervations of the different times in which exfoliations are made from the fides or ends of fimilar bones, might bid fair to determine what is the proportional force of cohefion in the two forts of fibres.

The plates are faid (*h*) to be firmly joined to each other by a great number of *claviculi*, or fmall bony proceffes, which, rifing from the inner plates, pierce through fome, and are fixed into the more external ones. Of thefe nails,

(*f*) Squamae, bracteae, laminae.

(*g*) Malpigh. Anat. plant. et oper. pofthum.

(*h*) Gagliard, Anatom, offium nov. invent, illuftrat, cap. 1. obf. 2.

four kinds, viz. the *perpendicular*, *oblique*, *headed*, and *crooked*, have, been described: But in bones fitly prepared, I could only see numerous irregular processes rising out from the plates (*i*).

Though the exterior part of bones is composed of firm compact plates, yet they are all more or less cavernous internally. In some (*e. g.* middle thin part of the *scapula* and *os ilium*) the solid sides are brought so near, that little cavity can be seen; and in others (middle of *os humeri*, *femoris*, &c.) the cavities are so large, that such bones are generally esteemed to be hollow or fistular. But the internal spongy texture is evident in young animals; and some of it may be seen to remain in those of the greatest age, when bones are cautiously opened, after they have been kept so long as to be free of the oil they contain, or after being burnt.

This spongy cavernous internal part of bones is generally called their Cancelli, or Lattice-work, and is formed in the following manner. The plates are fimly joined about the middle of the bone; but as they are extended towards its ends, the more internal parts separate from the exterior, and stretch out their fibres towards the axis of the bone, where they are interwoven with the fibres of other plates that have been sent off in the same way. Seeing the plates are thus constantly going off, the solid sides of the bones must become thinner, and the lattice-work must be thicker and stronger towards their ends. This is evident in many of them, where the solid sides of their middle are very thick, and the cancelli are scarce observable; whereas, at the ends, where their diameter is greatest, the solid walls or sides are not thicker than paper, and the cancelli are numerous, and large enough to fill up the whole space left between the sides.

The

(*i*) Malpigh. Oper. posthum.

The twisting and winding which these cancelli make, and the interstices which they leave, differ considerably in figure, number, and size; and therefore form little cells, which are as different, but communicate with each other. Some writers (*k*) minutely remark these different appearances of the cancelli, after they begin to separate from the plates; and from thence distinguish them into *wrinkled*, *perforated*, and *net-like*.

The cancelli sustain the membranous bags of the marrow which are stretched upon them, and thereby hinder these membranous parts from being torn, or removed out of their proper places, in the violent motions and different postures which the bones are employed in. This support which the cancelli afford to the marrow, also saves its membranes and vessels, in the lower parts of the bones, from being compressed by the weight of the marrow above.

The depressions between the fibres of the external plates of bones appear like so many furrows on their surface, into each of which the periosteum enters; by which the surface of contact, consequently the cohesion, between it and the bone, is considerably increased, and a greater number of vessels is sent from it into the bone than if it was a plain surface.

Both on the ridges and furrows, numerous little pits or orifices of canals are to be seen, by which the vessels pass to and from the bones.

After a successful injection, the arteries can be traced in their course from the pits to the plates and fibres; and, in sawing, cutting, or rasping the bones of living creatures, these vessels discover themselves by the small drops of blood which then ooze out from the most solid part of the bones. But the clearest demonstration of the intimate distribution of these small arteries, is, to observe the effect of such a tinging

(*k*) Gagliard. Anat. ossium, cap. 1. obs. 4. 5. 6. 7.

tinging ſubſtance as can retain its colour, when ſwallowed, digeſted, and mixed with the blood of any living animal, and at the ſame time has particles ſmall enough to be conveyed into the veſſels of the bones; ſuch is rubia tinctorum, madder-root (*l*): For we ſee the gradual advances which this tincture makes from the perioſteum into the more internal parts of the bones, and how univerſally the diſtribution of the liquors is made, the whole bony ſubſtance being tinged by it. Whether the time in which this tinged liquor paſſes from the outer to the internal plates, till all the plates are made of its colour, and the time which the diſappearing of the dye, after giving the creature no more of this ſort of food, makes us think it takes to return, are the ſame in which the natural liquors circulate, is uncertain; becauſe this tinging ſubſtance may move more ſlowly, or may paſs more quickly than the natural liquors do.——The arteries are larger near each end than at the middle of the large bones that are much moved; becauſe they not only ſerve the bony plates near the ends, but paſs through them to the marrow.——As animals advance in age, the arteries of the bones become leſs capacious; as is evident, 1. From the bones of adults having leſs blood in them than thoſe of children have. 2. From many of them becoming incapable in old age of admitting the coloured powders uſed in injections, which eaſily paſs in youth. And, 3. From the bones of old creatures being more difficultly tinged with madder than thoſe of young ones. If authors have not miſtaken, the arteries of bones have ſometimes become very large (*m*).

We may conclude, from arteries being accompanied with veins, ſo far as we can trace them in every other part of the

(*l*) Philoſoph. Tranſact. num. 442. art. 8. num. 443. art. 2. num. 457. art. 4.——Mem. de l'acad. des ſciences, 1739, 1742.

(*m*) Diemerbroek Anat. lib. 9. cap. 1.——Mery Hiſt. de l'acad. des ſciences, 1704.

the body, that there are alſo veins in the bones; and the diſappearing of the tincture of madder, after the bones of living animals are coloured with it, could not be without ſuch veins to carry it away; nay, the veins of bones can ſometimes be injected, and then ſeen (*n*).

The bones of a living animal are ſo inſenſible, that they can be cut, raſped, or burnt, without putting the creature to pain, and the nerves diſtributed in their ſubſtance cannot be ſhewn by diſſection; from which it might be inferred that they have no nerves diſtributed to them: but the general tenor of nature, which beſtows nerves to all other parts, ſhould prevent our drawing ſuch a concluſion. And if ſenſibility is a ſure proof of nerves entering into the compoſition of any part, as it is generally allowed to be, we have ſufficient evidence of nerves here in the bones: for the granulated red fleſh which ſprouts out from them, after an amputation of a limb, or performing the operation of the trepan, or after an exfoliation, is exquiſitely ſenſible; and in ſome ulcers of bones, where the perioſteum was all ſeparated, the patient ſuffered racking pain, if the bone was touched with a rough inſtrument; nor was he free from pain after the bone was perforated (*o*).———The reaſon why the nerves of rigid hard bones become inſenſible, is, that all nerves muſt have a conſiderable degree of flexibility at the part where an object is applied, otherwiſe they cannot be affected by its impreſſions. We ſee this illuſtrated in a very common analogous caſe, the growth of a new nail; when the former one has ſuppurated off, the thin membrane which firſt appears, is exquiſitely ſenſible; but gradually becomes dull in its ſenſation, till it can be cut or ſcraped, without cauſing pain, after it is formed into a hard nail.

From what has been ſaid of the veſſels of bones, it is evident,

(*n*) Sue trad. d'oſteolog. p. 9.

(*o*) Nicol. Maſſa, lib. introd. anat. cap. 30.

dent, that there is a conſtant circulation of fluids in every part of them; and that there is a perpetual waſte and renewal of the particles which compoſe the ſolid fibres of bones, as well as of other parts of the body; the addition from the fluids exceeding the waſte during the growth of the bones; the renewal and waſte keeping nearly equal in adult middle age; and the waſte exceeding the ſupply from the liquors in old age; as is demonſtrable from their weight: for each bone increaſes in weight as a perſon approaches to maturity; continues of nearly the ſame weight till old age begins, and then becomes lighter. The ſpecific gravity of the ſolid ſides, on the contrary, increaſes by age; for then they become more hard, compact, and denſe. In conſequence of this the bones of old people, are thinner and firmer in their ſides, and have larger cavities, than thoſe of young perſons.

The vaſcular texture of bones muſt make them ſubject to obſtructions, ecchymoſes, ulcers, gangrenes, and moſt other diſeaſes with which the ſofter parts are affected; and therefore there may be a greater variety of caries than is commonly deſcribed (*p*).

Hence we can account for the following appearances.

Haemorrhagies from fungous fleſh riſing out from the moſt ſolid part of a cut bone (*q*).

The regular alternate elevation and ſubſiding, or apparent pulſation, frequently to be ſeen in ſome of the cells of a carious bone.

Cells reſembling *cancelli*, ſometimes ſeen in the part of a bone, which, in a natural ſtate, is the moſt ſolid and firm (*r*).

A bone, as a tube, including another bone within it (*s*).

On

(*p*) Edin. Medical eſſays and obſ. vol. 5. art. 25.

(*q*) Medical eſſays, vol. 4. art. 21.

(*r*) Ruyſch. Theſ. 8. num. 8. Theſ. 10. num. 176.

(*s*) Idem, ibid.

On the internal furface of the folid parts of the bones there are orifices of canals, which pafs outwards through the plates to open into other canals that are in a longitudinal direction; from which other *tranfverfe* paffages go out to terminate in other *longitudinal* canals; and this ftructure is continued through the whole fubftance of bones; both thefe kinds of canals becoming gradually fmaller as they approach the outer furface (*t*).——Thefe canals are beft feen in a bone burnt till it is white. When it is broken tranfverfely, the orifices of the *longitudinal* canals are in view; and when we feparate the plates, the *tranfverfe* ones are to be obferved. Here, however, we are in danger of believing both thefe forts of canals more numerous than they really are; becaufe the holes made by the proceffes connecting the plates of bones have the appearance of the *tranfverfe* (*u*), and the paffages for the blood-veffels refemble the *longitudinal* canals. I do not know how we are to keep free of error about the *tranfverfe* canals; but think we may diftinguifh between the two kinds of *longitudinal* ones; for the paffages of the veffels are largeft near the external furface of the bone, and every tranfverfe fection of them is circular; whereas the longitudinal canals are largeft near the cancelli, and their tranfverfe fections appear to me of a flat oval figure, which may be owing to the different momentum of the fluids conveyed in them.——The fituation of the larger longitudinal canals, and of the paffages of the larger veffels, makes a bone appear more denfe and compact in the middle of its folid fides, than towards its outer and inner furfaces, where it is fpongy.

We fee marrow contained in the larger tranfverfe and longitudinal canals juft now defcribed, and from thence judge that it paffes alfo into the fmaller ones. The drops of oil which we difcover with a microfcope every where on the

(*t*) Havers Ofteolog. Nov. p. 43. (*u*) Morgagn. Adverf. 3. animad. 25.

the furface of a recent bone fractured tranfverfely, and the oozing of oil through the moft folid bones of a fkeleton, which renders them greafy and yellow, are a confirmation of the ufe of thefe canals. Of what advantage this diftribution of the marrow through the fubftance of bones is, will be mentioned when the nature and ufe of this animal oil is inquired into.

Moft bones have one or more large oblique canals formed through their fides for the paffage of the medullary veffels, which are to be defcribed afterwards.

Bones expofed to a ftrong fire in chemical veffels, are refolved, in the fame manner as the other parts of animals, into *phlegm*, *fpirit*, *volatile falt*, *fetid oil*, and a black *caput mortuum*. But the proportion of thefe principles varies according to the age, folidities, and other circumftances of bones. Young bones yield the largeft proportion of phlegm; fpongy bones afford much oil; and folid ones give moft falt and black refiduum.——Though this refiduum can fcarce be changed by the force of fire while it is in clofe veffels; yet, when it is burnt in an open fire, the tenacious oil, to which it owes its black colour, is forced away, and a white earth is left that has little or no fixed falt in it (*v*). This earth feems to be the proper conftituent folid part of bones, and the other principles give it firmnefs and tenacity: for the quantity of the earth is fo great, that, after all the other principles are feparated from a bone, its former fhape and fize remain (*w*); but it is very brittle till it is moiftened with water or oil, when it recovers fome tenacity.—The increafe of the proportion of earth in old peoples bones, is one reafon of their being more brittle than thofe of young people.

Left

(*v*) Later chemifts have difcovered this earth to be calcareous earth faturated with phofphoric acid.

(*w*) Havers Ofteolog. Nov. difc. I. p. 32.

Left any imagine the ſalts and oils of bones, while in a natural ſtate, to be of the ſame acrid kind with thoſe obtained from them by the chemical analyſis, it is to be obſerved, that theſe principles may be extracted from bones in the form of a very mild jelly, by boiling them in water.

The bones ſuſtain and defend the other parts of the body.

Bones are lined within, as well as covered externally, with a membrane; which is therefore commonly called PERIOSTEUM INTERNUM.

INTERNAL PERIOSTEUM.

THE *internal perioſteum* is an extremely fine membrane; nay, frequently, it has a looſe reticular texture; and therefore it is compared by ſome to the arachnoid coat of the ſpinal marrow: ſo that we cannot expect to divide it into layers as we can divide the external perioſteum. We can, however, obſerve its proceſſes entering into the tranſverſe pores of the bones, where probably they are continued to form the intermediate canals for the marrow diſtributed through the ſubſtance of the bones; and along with them veſſels are ſent, as from the external perioſteum, into the bone *(y)*. Theſe proceſſes being of a very delicate texture, the adheſion of this membrane to the bone is ſo ſmall, that it ſeparates commonly more eaſily from the bone than from the marrow which it contains: wherefore one might call it the common membrane of the marrow, rather than by the name it now has. But whether the one or the other deſignation ought to be given it, is not worthy a diſpute.

From the internal ſurface of the *internal perioſteum*, a great number of thin membranes are produced; which, paſſing acroſs the cavity, unite with others of the ſame kind, and form ſo many diſtinct bags, which communicate

 with

(y) Winſlow Expoſition anat. des os frais, ſect. 82. 83.

with each other; and theſe again are ſubdivided into communicating veſicular cells, in which the marrow is contained. Hence it is, that the marrow, when hardened, and viewed with a microſcope, appears like a cluſter of ſmall pearls; and that the hardened marrow of bones, buried long under ground, or laid ſome time in water, and then dried, is granulous (z).——This texture is much the ſame with what obtains in other cellular parts of the body, where fat is collected; only that the cells containing the marrow are ſmaller than thoſe of the *tunica adipoſa* or *celluloſa* elſewhere; which probably is owing to their being incloſed in the bones, where they are not ſo much ſtretched or extended as in other parts.

OF THE MARROW.

THE *Marrow* is the oily part of the blood, ſeparated by ſmall arteries, and depoſited in theſe cells. Its colour and conſiſtence may therefore vary according to the ſtate of the veſſels, and their diſtribution on the membranes of the cells.

The marrow, as well as the other fat of the body, chemically analized, yields, beſides oil and water, a conſiderable proportion of an acid liquor, but no alkali (*a*). This may be the reaſon of its being leſs putreſcent than the blood or moſt other parts of animals (*b*); which is a neceſſary quality in a ſubſtance that is conſtantly expoſed to a conſiderable degree of heat, and is more in a ſtagnating condition than the other liquors.

Beſides the arteries, which I mentioned already, (p. 12.) to be ſent from the bones to the marrow, there is at leaſt one artery for each bone; ſeveral bones have more, whoſe principal

(z) Ruyſch. Theſaur. 9. num. 2. et Adverſ. dec. III. obſ. 9.

(*a*) Grutzmaker Diſſert. de oſſium medulla.—Haller element. phyſiolog. lib. 4. ſect. 4.

(*b*) Pringle Appendix to camp diſeaſes, exper. 47.

principal ufe is to convey and fecern this oily matter. After thefe arteries have pierced the folid fide of a bone, they are divided into feveral branches; which are foon diftributed every where on the internal periofteum, and afterwards fpread their branches inwards on the medullary cells, and outwards through the tables of the bone.

The blood which remains after the fecretion of the marrow is returned by proper veins, which are collected from the membranes into one or more large trunks, to pafs out at the fame holes or paffages at which the artery or arteries enter.

The general rule of the fmall veffels decreafing in their capacities as animals advance in age, to which many phenomena in the animal oeconomy are owing, obtains here: for though the trunks of the medullary veffels enlarge as animals turn older, yet the fmall branches become fmaller; as is evident from injections, which cannot be made to pafs near fo far in thefe veffels of adults as of children. Hence the marrow is bloody in children, oily and balmy in middle age, and thin and watery in old people.

By experiments made on the marrow when bones of living animals are opened or cut through (*c*), and from the racking pain with which fuppurations within bones are frequently attended, we have fufficient proof that the membranes here are fenfible, and confequently have nerves diftributed to them. Hippocrates (*d*) might therefore fay juftly, that a wound penetrating into the cavity of a bone may produce a delirium.

The veffels of the marrow, wrapt up in one common coat from the periofteum, pafs through the bones by proper canals; the moft confiderable of which are about the middle of each bone, and are very oblique. Sometimes thefe veffels

(*c*) Du Verney, Memoires de l'acad. des fciences, 1700.
(*d*) Aphorifm. § 7. aph. 24.

veſſels continue at a little diſtance in their paſſage, when the canal is divided by a ſmall bony partition or two.

From the ſtructure of the contents of the bones, we may judge how theſe parts, as well as others, may be ſubject to œdema, phlegmon, eryſipelas, ſcirrhus, &c. and may thence be led to a cure of each, before the common conſequence, putrefaction, takes place, which frequently occaſions the loſs of the limb, if not of the patient.

The marrow is of very conſiderable uſe to the bones: for by entering their tranſverſe canals, and paſſing from them into the longitudinal ones, it is communicated to all the plates to ſoften and connect their fibres, whereby they are preſerved from becoming too brittle; as we ſee they do in burnt bones, or thoſe long expoſed to the air, in people labouring under old age, pox, or ſcurvy. In all which caſes, the oil is either in too little quantity, or has its natural good qualities changed for worſe ones.

Beſides this advantage which the ſubſtance of bones has from the marrow, their articulations are ſaid (*e*) to receive no leſs benefit from it: for it is thought that the marrow paſſes into the articular cavities through the holes which are in the bones near the large joints. And as a proof of this it is alleged, that butchers, upon ſeeing the greater or leſſer quantity of marrow in the bones of cows, can tell whether they have travelled far or little before they were ſlaughtered.

When the marrow, after having ſerved the uſes above mentioned, is reaſſumed into the maſs of blood (as it is continually in common with all other ſecreted liquors that have not paſſages formed for conveying them out of the body), it corrects the too great acrimony communicated to the ſaline particles of our fluids by their circulation and heat, in the ſame manner as lixivial ſalts are blunted by oil in making

(*e*) Joan de Muralto Vade-mecum Anat. exercit. 5. § 3. Havers Oſteolog. Nov. diſ. 3. p. 170.

making ſoap. Hence, in acute diſeaſes, the marrow, as well as the other fat of the body, is quickly waſted, but muſt be immediately ſupplied by liquors from the veſſels; ſeeing the cells within the bones, which have no aſſiſtance to their contraction from the preſſure of the atmoſphere, cannot collapſe, as the tela cellularis under the ſkin does when the liqour in its cells is abſorbed; the bones therefore are always full.

Since it is the nature of all oil to become thin and rancid when expoſed long to heat, and bones have much oil in their firm hard ſubſtance, we may know why an ungrateful ſmell and dark-coloured thin ichor proceed more from corrupted bones than from the other parts of the body; and we can underſtand the reaſon of the changes of colour which bones undergo, according to their different degrees of mortification.—Hence likewiſe we may learn the cauſe of a ſpina ventoſa, and of the difficulty of curing all caries of bones proceeding from an obſtruction and conſequent putrefaction of the marrow; and of the quick pulſe, thirſt, and hectic paroxyſms, ſo often attending theſe diſeaſes. Theſe phenomena alſo teach us the reaſon of the fatal prognoſis taken from black fetid urine in fevers.

Though bones ſo far agree in their ſtructure and annexed parts, yet we may obſerve a conſiderable difference among them in their magnitude, figure, ſituation, ſubſtance, connection, uſes, &c. From which authors have taken occaſion to diſtinguiſh them into as many claſſes as they could enumerate of theſe different circumſtances. But theſe being obvious to every perſon that looks on bones, I ſhall only mention one of them; which comprehends very near the whole bones of the body, and at the ſame time leads us to examine the moſt conſiderable variety that is to be found in the diſpoſition of their conſtituent parts, and in their uſes. It is this, that ſome bones are *broad* and *flat*, while others are *long* and *round*.

THE

THE DIFFERENT CLASSES, &c. OF BONES.

The *broad* bones have thin ſides, by the plates being ſoon and equally ſent off to form the lattice-work; which therefore is thicker, and nearly of an equal form all through. By this ſtructure they are well adapted to their uſes, of affording a large enough ſurface for the muſcles to riſe from and move upon, and of defending ſufficiently the parts which they incloſe.

The *round* bones have thick ſtrong walls in the middle, and become very thin towards their ends; which is owing to very few plates ſeparating at their middle; where, on that account, the cancelli are ſo fine and ſmall, that they are not taken notice of: but ſuch bones are ſaid to have a large reſervoir of oil in this place. Towards their ends the lattice-work becomes very thick, and rather more complete than in the other ſort of bones.—Theſe round bones having ſtrong forces naturally applied to them, and being otherwiſe expoſed to violent injuries, have need of a cylindrical figure to reſiſt external preſſure, and of a conſiderable quantity of oil to preſerve them from becoming too brittle. Beſides which, they are advantageouſly provided with thick ſides towards their middle, where the greateſt forces are applied to injure them; while their hollowneſs increaſes their diameter, and conſequently their ſtrength to reſiſt forces applied to break them tranſverſely (*f*). Thus, for inſtance, in eſtimating the proportional reſiſtance of two cylindrical bones of unequal diameters, but conſiſting of an equal number of ſimilar fibres uniformly diſpoſed round each, it is plain,

1. That the abſolute force of theſe two bones is equal, becauſe they conſiſt of equal numbers of ſimilar fibres.

2. That the abſolute forces of all the fibres in each bone have

(*f*) Galilei Mechanic. dialog. 1.

have the ſame effect in reſiſting any power applied to break them, as if the ſum of all their forces was united in the reſpective centres of the tranſverſe ſections where the fractures are to be made. For, by hypotheſis, the fibres being uniformly diſpoſed in each, there is not any fibre in either bone that has not a correſponding fibre; the ſum of both whoſe diſtances from the axis of revolution (about which all the parts of the bone muſt revolve in breaking) is equal to two ſemi-diameters of the bone: conſequently each fibre, and all the fibres, may be regarded as reſiſting at the diſtance of one ſemi-diameter or radius from this axis, that is, in the centre.

3. Since the united force of all the fibres is to be regarded as reſiſting at a diſtance from the centre of motion equal to the ſemi-diameter, it follows that the total reſiſtance of all theſe fibres, or the ſtrength of the bone is proportional to its ſemi-diameter, and conſequently to its diameter.

I have here taken for an example one of the moſt ſimple caſes for calculating the proportional forces of bones. But, were it not too foreign to the preſent deſign, it might be univerſally demonſtrated, that of whatever figure bones are, and in whatever manner their fibres are diſpoſed, their ſtrength muſt always be in a ratio, compounded of the area of their tranſverſe ſections, or of their quantity of bony mater, and of the diſtance of the centre of gravity of theſe ſections from the centre of motion or fulcrum, on which the bone is ſuppoſed to be broken (*g*).

Since, therefore, the ſtrength of bones depends on their number of fibres, or quantity of matter, and the largeneſs of their diameters, one may conclude, that the part of a bone formerly fractured, and reunited by a *callus*, muſt be ſtronger than it was before the fracture happened; becauſe both

(*g*) See the demonſtration of this theorem by Dr Porterfield in the Edinburgh medical eſſays, vol. I. art. 10.

both theſe advantages are obtained by a callus: which is a wiſe proviſion, ſince bones are never ſet in ſuch a good direction as they were naturally of; and then wherever a callus is formed, there is ſuch an obſtruction of the veſſels, that if the bone was again broken in the ſame place, the oſſific matter could not ſo eaſily be conveyed to reunite it. This callus may indeed, for want of compreſſion, be allowed to form into a ſpongy cellular ſubſtance (*h*); but even in this caſe the ſtrength of the bone is here increaſed by one or both of the cauſes above-mentioned.

Many bones have protuberances or *proceſſes* (*i*) riſing out from them. If a proceſs ſtands out in a roundiſh ball, it is called *caput* or *head*.—If the head is flatted, it obtains the appellation of *condyle*.—A rough unequal protuberance is called *tuberoſity*.—When a proceſs riſes narrow, and then becomes large, the narrow or ſmall part is named *cervix* or *neck*.—Long ridges of bones are called *ſpines*.—Such proceſſes as terminate in a ſharp point have the general name of *coronæ* (*k*) or *coronoid* beſtowed on them; though moſt of them receive particular names from the reſemblance they have, or are imagined to have, to other ſubſtances, *e. g. maſtoid*, *ſtyloid*, *anchoroid*, *coracoid*, *ſpinal*, &c.—Such proceſſes as form brims of cavities, are called *ſupercilia* (*l*).

Proceſſes ſerve for the advantageous origin and inſertion of muſcles, and render the articulations firm and ſtable.

Before leaving this ſubject, we muſt remark, that much the greater number of what are called proceſſes in adult bones, diſcover themſelves in children to be *epiphyſes*, or diſtinct bones, which are afterwards united to the other parts:

(*h*) Ruyſch. Theſaur. 8. n. 49. Muſ. anat. thec. B. repoſit. 2. n. 2.

(*i*) Αποφυσεις, εκφυσεις, εξοχη, προβολη, προβλημα, Exceſſus, explanatio, tuberculum, gibbus, eminentia, productio, extuberantia, protectura, enaſcentia.

(*k*) Roſtra, glandes.

(*l*) Ιτυει, οφρυες, αμβωνις, χειλη, Labra.

parts: ſuch are the *ſtyloid* proceſſes of the temporal bones, proceſſes of the *vertebræ, trochanters* of the thigh, &c. However, as I deſign to inſiſt chiefly on the deſcription of the adult ſkeleton, in which the union of theſe parts is ſo intimate, that ſcarce any veſtige remains of their former ſeparation, I ſhall retain the common appellation of *apophyſe*, or *proceſs*, to all ſuch protuberances; but ſhall remark the principal ones that have no juſt title to this name, when they occur in the deſcription of particular bones.

On the ſurface of a great many of the bones there are cavities or depreſſions. If theſe are deep, with large brims, authors name them *cotylæ* (*m*).—If they are ſuperficial, they obtain the deſignation of *glenæ* or *glenoid*. Theſe general claſſes are again divided into ſeveral ſpecies:—Of which, *pits* are ſmall roundiſh channels ſunk perpendicularly into the bone;—*furrows*, long narrow canals formed in the ſurface; —*nitches*, or *notches*, ſmall breaches in the bone;—*ſinuoſities*, broad, but ſuperficial depreſſions without brims;—*foſſæ*, large deep cavities, which are not equally ſurrounded by high brims;—*ſinuſes*, large cavities within the ſubſtance of the bones, with ſmall apertures;—*foramina*, or holes, canals that pierce quite through the ſubſtance of the bones.—When this laſt ſort of cavity is extended any long way within a bone, the middle part retains the name of *canal*, and its ends are called *holes*.

The cavities allow the heads of bones to play in them; they lodge and defend other parts; they afford ſafe paſſage to veſſels, muſcles, &c. To mention more would engage us too much in the hiſtory of particular bones, which more properly belongs to the demonſtration of the *ſkeleton*, where we ſhall have occaſion to obſerve theſe ſeveral ſpecies of cavities.

To far the greater number of bones, whoſe ends are not

 joined

(*m*) Κοτυλδες, οξυβαφοι, Acetabula, pyxides, buccellæ.

joined to other bones by an immoveable articulation, there are fmaller ones annexed, which afterwards become fcarce diftinguifhable from the fubftance of the bone itfelf. Thefe are called *epiphyfes* or *appendices* (*n*). Some bones have one, others have two, three, or four of thofe appendices annexed by the means of cartilages, which are of a confiderable thicknefs in children, but by age become thinner, the offification proceeding from the end of the bone on one fide, and from the epiphyfes on the other, till at laft, in adults, the place of their conjunction can fcarcely be feen on the external furface; and it is only fometimes that we can then fee any mark of diftinction in the cancelli (*o*).

Several proceffes (*e. g. trochanters* of the thigh, *fpine* of the fcapula, &c.) have *epiphyfes*; and proceffes frequently rife out from epiphyfes; for example, at the lower end of the femur, ulna, tibia, &c. (*p*).

The epiphyfes are united chiefly to fuch bones as are deftined for frequent and violent motion; and for this purpofe they are wifely framed of a larger diameter than the bone they belong to: For, by this means, the furface of contact between the two bones of any articulation being increafed, their conjunction becomes firmer, and the mufcles inferted into them act with greater force by reafon of their axes being further removed from the centre of motion. Thefe advantages might indeed have been obtained by the expanfion of the end of the bone itfelf to a thicknefs equal to that of the epiphyfes; but then the conftant feparation of new plates to form fo wide a cellular ftructure, muft have left the folid fides of the bones fo thin as to yield eafily, either to the action of the mufcles fixed to them and paffing over them, to the

(*n*) Applantatio, additamentum, adnafcentia, adnexum, perone.

(*o*) Winflow, Expofition anatomique de corps humain, traité des os fecs, § 116.

(*p*) Vefal. De human. corp. fabrica, lib. I. cap. 3.

the weight ſeveral of them are obliged to ſupport, or to the application of any other external force.

Several anatomiſts (*q*) thought that the *epiphyſes* ſerve other purpoſes; ſuch as ſecuring the ligaments of the articulations which riſe out from between the bones and them; for, as ſoon as theſe parts are intimately joined, the ligaments inſinuated betwixt them muſt have a much ſtronger connection than they could have to the ſmooth ſurface of the bones. Such an interception of the ligament between the body of the bone and its epiphyſe is not to be ſeen; but, the adheſion of the perioſteum and ligaments to bones being always ſtronger in proportion to the ſimilarity of their conſiſtence, and the bones remaining longer ſoft, or of a ſimilar conſiſtence with ligaments, at theſe places than any where elſe, the opinion of theſe writers, concerning the ſtronger connection of the ligaments where the bones and epiphyſes join, is not without ſome foundation.

Poſſibly too, by the fibres of epiphyſes not extending themſelves ſo longitudinally as thoſe of the bones, there may be leſs chance of the former running into each other than of the latter.

The ſoftneſs of the ends of bones may be of ſome advantage in the womb and in parturition; after which the oſſification begins at different points to form epiphyſes, before the oſſification can extend from the middle to the ends of the bones (*r*).

OF OSSIFICATION.

HOWEVER ſolid and compact adult bones are, yet they were once cartilages, membranes, nay, a mere jelly. This needs no further proof, than repeated obſervations of embryos

(*q*) Collumb. De re anatomica, lib. I. cap. 2.——Fallop. Expoſ. de oſſibus, cap. 14.

(*r*) Haller de ſtudio medic. p. 267.

bryos when diſſected: And how much more tender muſt the bones be before that time, when neither knife nor eye is capable to diſcover the leaſt rudiments of them? By degrees they become more ſolid, then aſſume the nature of griſtles, and at laſt oſſify; the coheſion of their plates and fibres always increaſing in proportion to their increaſed ſolidities; as is evident from the time neceſſary to unravel the texture of bones of people of different ages, or of denſe and of ſpongy bones, or of the different parts of the ſame bone, and from the more tedious exfoliations of the bones of adults than of children.

After any part of a bone is fully oſſified, its fibres are extended little more in length at that part, though they increaſe there in thickneſs, and though their ſofter parts continue to become longer (*s*).

As the ſolidity of bones increaſes, their perioſteum more eaſily ſeparates from them. When bones are membranous, the perioſteum and they cannot be diſtinguiſhed; they appear to be the ſame ſubſtance. When they are cartilages, their membrane adheres ſo firmly to them, that it is difficult to ſeparate it from them. Where the bony fibres are rigid, the perioſteum is eaſily taken off.—Is the ſimiliarity of ſtructure and conſequent greater attraction of the membrane and ſubſtance it incloſes, while they are both flexible, the cauſe of their greater adheſion? or is it owing to the veſſels that go from the one to the other being then larger? or do both theſe cauſes combine to produce this effect? or is the membrane or cartilage, which becomes bone afterwards, to be conſidered as the ſame ſubſtance with the perioſteum (*t*)? and muſt all theſe plates of bones be therefore ſaid to be layers of the perioſteum hardened (*u*)?

The

(*s*) Hale's Vegetable ſtatics, p. 293.——Du Hamel. Memoires de l'acad. des ſciences, 1743.

(*t*) Memoires de l'acad. des ſciences, 1744.

(*u*) Ibid. 1743.

The offification of bones depends principally on their veffels being fo difpofed, and of fuch diameters, as to feparate a liquor, which may eafily turn into a bony fubftance, when it is deprived of its thinner parts; as feems plain from the obfervation of the callous matter feparated after fractures and ulcers, where part of the bone is taken out: For, in thefe cafes, the veffels extending themfelves, and the liquors added to them, are gradually formed into granulated flefh; which fills up all the fpace where the bone is taken from, then hardens till it becomes as firm as any other part of the bone. This happens frequently, even when the ends of the difeafed bone are at a confiderable diftance from each other (*v*).

The induration of bones is alfo greatly affifted by their being expofed, more than any other parts, to the ftrong preffure of the great weights they fupport, to the violent contraction of the mufcles fixed to them, and to the force of the parts they contain, which endeavour to make way for their own further growth. By all this preffing force, the folid fibres and veffels of bones are thruft clofer, and fuch particles of the fluids conveyed in thefe veffels as are fit to be united to the fibres are fooner and more firmly incorporated with them, while the remaining fluids are forcibly driven out by the veins, to be mixed with the mafs of blood. In confequence of this, the veffels gradually diminifh as the bones harden. From which again we can underftand one reafon why the bones of young animals fooner reunite after a fracture than thofe of old, and why cattle that are put too foon to hard labour feldom are of fuch large fize as others of the fame brood who are longer kept from labour.

That

(*v*) Hildan. de vuln. gravif.—Med. effays, vol. I. art. 23.———Job a Meckren, obf. 69.—Mem. de l'acad. des fciences, 1742.—See a collection of fuch cafes in Bochmer de offium callo.

That the oſſifying of bones greatly depends on preſſure, ſeems to be evinced from the frequent examples we meet with of other parts turning bony, when long expoſed to the preſſing force of the ſurrounding parts, or when they are ſubjected to the like circumſtances by their own frequent and violent contraction. Witneſs the bones found frequently near the baſe of the heart in ſome old men (*y*), and in ſeveral other creatures. Nay, the muſcular ſubſtance of the heart has been oſſified in ſuch (*z*), and the arteries of old men often become bony.——The cartilages of the larynx are generally oſſified in adults.——In beaſts of burden, the cartilages between the vertebrae of the back very often change into complete bones; and, being intimately united with the vertebrae, the whole appears one continued bone:——Nor is the perioſteum exempted from ſuch an induration (*a*).

To confirm this argument ſtill farther, we may obſerve, that bones begin their oſſification at the places where they are moſt expoſed to theſe cauſes, viz. in the cylindrical bones, from a middle ring; and in the broad ones, at or near their centre, from one or more diſtinct points. The reaſon of which is, That theſe parts are contiguous to the bellies of the muſcles annexed to the bones, where the ſwelling of theſe moving powers is greateſt. The effects of this may be ſeen in ſome of the bones, as the ſcapula and oſſa ilium, which are covered with muſcles on each ſide; how compact and thin they are in adults, where the bellies of the muſcles were lodged; whereas in children they are thicker. But this being the middle part of theſe bones, where the greateſt number of fibres are, this particular place would

(*y*) Riolan. Comment. de oſſib. cap. 32.—Bartholin. Hiſt. medic. cent. 1. hiſt. 50.———Ibid. cent. 2. hiſt. 45.

(*z*) Cheſelden's Anatomy, book 1. introd.——Garengeot, Hiſt. de l'acad. des ſciences, 1726.

(*a*) Peyer. Ephemerid. German. decur. 2. ann. 7. obſerv. 205.

would have been much thicker in adults, had not this forcible cauſe been applied, which has not had ſuch effects in children, whoſe muſcles have not been much exerciſed.—— Beſides, if we allow that all the parts of a bone are equally increaſed by the conſtant ſupply of new particles, each fibre, and every particle of a fibre, endeavours to make way for its own growth, by puſhing the one next to it; and conſequently by far the greateſt preſſure is on the middle, to make the particles firm, and therefore to begin their oſſification there. Laſtly, the pulſation of the medullary arteries, which enter the bones near to this middle part, may, as authors have alleged, contribute perhaps ſomewhat to this induration.

From the effects of preſſure only it is that we can account for the bones of old people having their ſides much thinner, yet more denſe and ſolid, while the cavities are much larger than in thoſe of young people; and for the prints of muſcles, veſſels, &c. being ſo much more ſtrongly marked on the ſurfaces of the former than of the latter, if they belong to people of near the ſame condition in life.—Preſſure muſt likewiſe be the cauſe which, in people of equal ages, make theſe prints ſtronger in the bones of thoſe who had much labour and exerciſe, than they are in people who have led an indolent and inactive life.

Perhaps both the cauſes of oſſification above mentioned may be aſſiſted by the nature of the climate people live in, and the food they uſe. Whence, in hot countries, the inhabitants ſooner come to their height of ſtature than in the northerly cold regions: And thence ſeems to have ariſen the common practice among the ladies, of making puppies drink brandy or ſpirit of wine, and of bathing them in theſe liquors, to prevent them growing big. Nay, it has been obſerved, that much uſe of ſuch ſpirits has occaſioned parts, naturally

turally ſoft, to petrify in ſome, and to oſſify in other people of no great age (*b*).

From the foregoing account of the ſtructure of bones, and of their oſſification, we may underſtand the reaſons of the following phenomena.

How the natural colour of bones may be changed by ſome ſorts of food (*c*).

Why the bones of ſome people are ſo long in hardening, and in others never completely indurate.

Why, in ſuch whoſe oſſification is ſlow, the bones are generally thicker in proportion to their lengths, eſpecially at their ends; as in the rickets.

How hard firm bones have become ſoft and pliable by diſeaſes (*d*).

Why, in ſome diſeaſes, epiphyſes ſeparate from bones (*e*), and the ends of fractured bones come aſunder many years after their fractures appeared to be cured (*f*).

How bones may waſte and diminiſh (*g*).

How bones may become ſolid all through, without any appearance of cancelli (*h*).

How nodes, tophi, and exoſtoſes, happen after the eroſion

(*b*) Littre, Hiſtoire de l'acad. des ſciences, 1706——Geoffry, Mem. de l'acad. des ſciences, 1706.

(*c*) Philoſoph. tranſact. n° 442. art. 8. n° 443. art. 2. n° 457. art. 4.——Mem. de l'acad. des ſciences, 1739, 1742.

(*d*) Hiſtoire de l'acad. des ſciences, 1704.——Mem. 1722. Gagliardi, Anatom. oſſium, cap. 2. obſerv. 3.——Ephem. Germ. decur. 1. ann. 1. obſ. 37. et ſchol. decur. 2. ann. 7. obſer. 212, 235. decur. 3. ann. 2. obſ. 3. ——Philoſ. tranſ. n° 470. § 3. Ibid. vol. 48. § 4. and 44.

(*e*) Memoires de l'acad. des ſciences, 1699. Diemerbroek, lib. 9. cap. 19. —Cowper's Anat. Explic. tab. 96. fig. 1.

(*f*) Anſon's Voyage.

(*g*) Cheſelden's Anat. book 1. introd.——Hiſt. de l'acad. des ſciences, 1700.

(*h*) Ruyſch. Theſaur. 2. arc. 5. theſ. 3. loc. 1. n° 5. theſ. 9. n° 2. not. 3. —Boehmer. de callo oſſium.

ſion of the external plates of bones in the lues venerea, ſcurvy, rheumatiſm, and gout.

How bones exfoliate by the riſing of granulated fleſh from their ſurface.

How and from what callus is formed after a fracture (*i*).

Why callus appears to be rather the continued ſubſtance of the perioſteum than of the bone, while it remains ſoft and flexible; but ſeems continued with the bone after it oſſifies (*k*).

Why callus is ſenſible while it is ſoft, but becomes inſenſible when it hardens.

What occaſions ſometimes ſuch difficulty in curing fractured bones; or why they never re-unite, though they are reduced, and all proper means towards a cure are uſed (*l*) — Are the bones of women with child more tedious in re-uniting than thoſe of other people (*m*).

Why calluſes, after fractures, are ſometimes very thick and protuberant.

What difference there ought to be in the application of bandages to fractures of the bones of old and of young patients.

How bones, remaining long unreduced after a luxation, may have their form ſo changed as to make their reduction very difficult, if not impoſſible (*n*).

Whoever is deſirous to know in what time and order each bone and its ſeveral parts begin to aſſume a bony na-

(*i*) Memoires de l'acad. des ſciences, 1741.—Dehtleef de oſſium callo.

(*k*) Mem. de l'acad. 1741.

(*l*) Meckren Obſerv. medico-chirurg. obſ. 71.—Ruyſch. Adverſ. dec. 2. § 2. Obſerv. anat.-chir. obſ. 4. —Van Swieten in Boerhaave Aphor. § 354.

(*m*) Hildan. centur. 5. obſ. 87. et cent. 6. obſ. 68.—Philoſoph. tranſact. n°. 494. § 21.

(*n*) Saltzman, Obſ. decur. obſ. 6.—Memoires de l'acad. de chirurgie, tom. 3. p. 155.—Boehmer Inſtit. oſteolog. §. 596.

ture, let him conſult Kerchingius (*o*), who gives us the delineations of abortions from three days after conception, and traces the oſſification of the bones from three weeks and a month, till the time of the birth: To whom ſhould be added Coiterus (*p*) and Eyſſonius (*q*). An account of this ſubject might alſo be collected out of Ruyſch's works, where ſome of the miſtakes committed by the former authors are corrected; and ſeveral more particulars, to make the hiſtory of the oſteogenea more accurate, have ſince been added by Neſbit (*r*) and Albinus (*s*).

I muſt refer to the authors now quoted for the more curious part of the human oſteogeny; not having preparations enough to give ſuch a full hiſtory of it as is done by them. But I ſhall endeavour to explain the more uſeful and neceſſary part of the oſteogeny, by ſubjoining to the deſcription of each bone of an adult, its condition in ripe children; that is, in ſuch as are born at the ordinary time; and ſhall point out what parts of each are afterwards joined in form of epiphyſes. This, with the following general rules, ſeem to me ſufficient for underſtanding as much of this ſubject as is neceſſary in the practice of phyſic and ſurgery.

1. Wherever I mention any parts being cartilaginous, or their being ſtill ſeparable from the other parts of the bone to which they belong, I would be underſtood to hint, that, about ſeven or eight years of age, ſuch parts are oſſified and united to their proper bones, unleſs when it is ſaid that they are afterwards formed into epiphyſes.

2. Such as become epiphyſes are generally oſſified at ſeven or eight years of age; but, being for the moſt part moiſten-

ed

(*o*) Anthropograph. ichnograph. et oſteogenea fœtuum.

(*p*) De oſſibus fœtus abortivi.

(*q*) De oſſibus infant, cognoſcend. et curand.

(*r*) Human oſteogeny explained.

(*s*) Icones oſſium fœtus humani; accedit oſteogeneæ brevis hiſtoria.

ed by ſynovia, their external ſurface is ſtill ſomewhat cartilaginous, and they are not yet united to their bones.

3. At eighteen or twenty years of age the epiphyſes are entirely oſſified, and have blended their fibres ſo with the body of the bone, as to make them inſeparable without violence.

The knowledge of this part of the oſteogeny I think neceſſary to prevent dangerous miſtakes in the cure of ſeveral diſeaſes. As for example: Without this knowledge, the ſeparation of an epiphyſe might be miſtaken for a fracture or luxation.—The interſtice of two parts of a bone not yet joined might be judged to be a fiſſure.—A diaſtaſis, or ſeparation of ſuch disjointed pieces of a bone, might be thought a fracture.—The protruſion of one piece, or its overlopping any other, could be miſtaken for an excreſcence or exoſtoſis.—Such errors about the nature of a diſeaſe would give a perſon very different indications of cure from what he would have if he really underſtood his patient's caſe: And very often the knowledge of the different inequalities on the ſurfaces of bones, muſt direct us in the execution of what is proper to be done to cure ſeveral of their diſeaſes.

OF THE CONNECTION OF BONES.

Having thus conſidered the bones when ſingle, we ought next to ſhew the different manner of their conjunctions (*t*). To expreſs theſe, anatomiſts have contrived a great number of technical terms; about the meaning, propriety, and claſſing of which, there has unluckily been variety of opinions. Some of theſe terms, it is neceſſary to retain, ſince they

(*t*) Συνταξις, συνδεσις, συμβολη, ὁμιλια, Compoſitio, connexio, articulatio, conjunctio, nodus, commiſſura, ſtructura, compages.

they ferve to exprefs the various circumftances of the articulations, and to underftand the writers on this fubject.

The ARTICULATIONS are moft commonly divided into three claffes, *viz.* Symphyfis, Synarthrofis, and Diarthrofis.

I. SYMPHYSIS, which properly fignifies the conception or growing together of parts, when ufed to exprefs the articulations of bones, does not feem to comprehend, under the meaning generally given to it, any thing relating to the form or motion of the conjoined bones; but by it moft authors only denote the bones to be connected by fome other fubftance; and as there are different fubftances which ferve this purpofe, therefore they divide it into the three following fpecies.

1. *Synchondrofis* (*u*), when a cartilage is the connecting fubftance: thus the ribs are joined to the fternum; thus the bodies of the vertebrae are connected to each other; as are likewife the offa pubis.

2. *Synneurofis* or *fyndefmofis*, when ligaments are the connecting bodies, as they are in all the moveable articulations.

3. *Syffarcofis*, when mufcles are ftretched from one bone to another, as they muft be where there are moveable joints.

II. The fecond clafs of articulations, the SYNARTHROSIS, which is faid to be the general term by which the immoveable conjunction of bones is expreffed, is divided into three kinds.

1. The *future* (*x*) is that articulation where two bones are mutually indented into each other, or as if they were fewed

(*u*) Amphiarthrofis.

(*x*) Ῥαφη.

fewed together; and is formed by the fibres of two bones meeting while they are yet flexible and yielding, and have not come to their full extent of growth; fo that they mutually force themfelves into the interftices of each other, till, meeting with fuch refiftance as they are not able to overcome, they are ftopped from fprouting out farther, or are reflected; and therefore thefe indentations are very different both in figure and magnitude: thus the bones of the head are joined; thus epiphyfes are joined to the bones, before their full connection and union with them.

Under this title of *future*, the *harmonia* of the ancients may be comprehended; fcarce any unmoved bones being joined by plain furfaces (*y*).

2. *Gomphofis* (z) is the fixing one bone into another, as a nail is fixed in a board: thus the teeth are fecured in their fockets.

3. *Schindylefis* or *ploughing* (*a*), when a thin lamella of one bone is received into a long narrow furrow of another: thus the proceffus azygos of the fphenoid, and the nafal procefs of the ethmoid bone, are received by the vomer.

III. The third clafs, or DIARTHROSIS (*b*), is the articulation where the bones are fo loofely connected as to allow large motion. This is fubdivided into three kinds.

1. *Enarthrofis*, or the ball and focket, when a large head is received into a deep cavity; as the head of the os femoris is into the acetabulum coxendicis.

2. *Arthrodia*, when a round head is received into a fuperficial cavity; as in the articulation of the arm bone and fcapula. Thefe two fpecies of diarthrofis allow motion to all fides.

3. *Gin-*

(*y*) Vefal. obferv. Fallop. examen.

(*z*) Conclavatio.

(*a*) Keil's Anat. chap. 5.

(*b*) Αποϑρωσις, Dearticulatio, abarticulatio.

3. *Ginglimus* (*c*), which properly fignifies the hinge of a door or window; in it the parts of the bones mutually receive and are received, and allow of motion two ways: Workmen call it *charnal.*

The *ginglimus* is generally divided into three kinds; to which fome (*d*) give the name of *contiguous* (*e*), *diftant* (*f*), and *compound* (*g*).

The firft kind of ginglimus is when a bone has feveral protuberances and cavities, which anfwer to as many cavities and proceffes of the other bone with which it is articulated; as in the conjunction of the femur with the tibia.

The fecond fpecies is, when a bone receives another at one end, and is received by the fame bone at the other end; as in the radius and ulna.

The laft fort is, when a bone receives another, and is received by a third; as in the oblique proceffes of the vertebrae.

When I firft mentioned the articulations of bones, I faid there were different opinions concerning the ufe of their technical names; *e. g.* It has been faid, that *fymphyfis* fhould be the name for the immoveable articulations, and *fynarthrofis* fhould be underftood to be the conjunction of bones by fome connecting medium.——Thofe who have taken *fymphyfis* in the fenfe I did, of its expreffing the conjunction of bones with a connecting fubftance, have difagreed in their definition of it; fome inferting, and others leaving out, its allowing motion. When they have agreed in their definition, they have not been of the fame mind concerning the fpecies of it; for feveral think the *fyffarcofis* and *fyndefmofis* applicable to fo many joints which are univerfally allowed to be claffed

(*c*) Articulatio mutua.

(*d*) Baker, Curf. Ofteolog. demonft. 1.

(*e*) Proximus.

(*f*) Longus.

(*g*) Compofitus.

claſſed under the *diarthroſis*, that it muſt create confuſion to name them by any ſpecies of the *ſymphyſis*. Few keep to ſuch a general definition of the ſynchondroſis as I have done; and whether they determine it to allow no motion, or an obſcure or a manifeſt one, they bring themſelves into difficulties, becauſe there are examples of all theſe three kinds.——Some again, by too nicely diſtinguiſhing obſcure and manifeſt motions of bones, have blended the *ſynarthroſis* and *diarthroſis*; and from thence have branched out the different compound ſpecies of articulations that may be formed of them, ſo far, that they could find no examples in the body to illuſtrate them by.—It would be tedious to enumerate more of the jarring opinions, and it would be far more ſo to give a detail of the arguments uſed by the diſputants. It is ſufficient for my purpoſe that it is underſtood in what ſenſe I take theſe technical terms; which I do in the following manner.

When I mention the ſymphyſis or ſynarthroſis, or any ſpecies of them, I ſhall always underſtand them according to the explication already given of them. But though the preceding account of the diarthroſis, or articulation of moveable bones, has been almoſt univerſally received; yet as it does not comprehend all the moveable articulations of the body, and one of its ſpecies does not anſwer to any notion we can have of the conjunction of two bones, I muſt beg leave to change the definitions and kinds of theſe joints.

I would call *diarthroſis*, That conjunction of bones whereby they are fitted for motion, being each covered with a ſmooth cartilage, connected by one or more common ligaments, and lubricated with liquor at the conjoined parts: In which definition I have no regard to the quantity of motion which they really do perform; the motion being often confined or enlarged by ſome other cauſe not immediately

diately depending on the frame of the two ſurfaces of the bones forming the particular joint, which then is conſidered.

The firſt ſpecies of the diarthroſis, viz. the *enarthroſis*, or ball and ſocket, I would define more generally than above, That articulation where a round head of one bone is received into a cavity of another; and conſequently, without ſome foreign impediment, is capable of motion to all ſides. Examples of this kind are to be ſeen in the articulation of the thigh-bone and oſſa innominata; arm-bone and ſcapula; aſtralagus and os naviculare; magnum of the wriſt with the ſcaphoides and lunare; firſt bone of the thumb with the ſecond, &c.

The ſecond ſort, or the *arthrodia*, differing from the enarthroſis, in the preceding account, only in the cavity's being more ſuperficial, (which makes no eſſential difference, eſpecially that, in the recent ſubject, cartilages or ligaments ſupply the deficiency of bone), ought, in my opinion, to be called with Veſalius (*h*), that articulation of two bones adapted for motion, where it is not at firſt ſight obvious which of the two has the head or cavity, or where they are joined by plain ſurfaces, or nearly ſo; ſuch is the conjunction of the clavicle with the ſcapula, oſſa cuneiformia with the os naviculare, metatarſal bones with the oſſa cuneiformia, &c. From the nature of this ſort of joint it is plain, that very great motion cannot be allowed, without the bones going further out of their natural ſituation than is convenient or ſafe.

Ginglimus, I would reckon that articulation by the form of which the motion of the joined bones muſt be chiefly confined to two directions, as hinges of doors are.

The firſt ſpecies of this is the *trochoides*, when one bone turns

(*h*) De corp. human. fabrica, lib. I. cap. 4.

turns on another, as a wheel does on its axis. Thus the firſt vertebra of the neck moves on the tooth-like proceſs of the ſecond. This is the moſt proper kind of ginglimus.

The ſecond ſpecies ſhould be eſteemed the articulation where ſeveral prominent and hollow ſurfaces of two bones move on each other within the ſame common ligament; as in the knee, &c.

The third ſort of ginglimus is, when two bones are articulated to each other at different parts, with a diſtinct apparatus of the motory machines at each; ſuch is the articulation of the os occipitis with the firſt vertebra of the neck; of any two contiguous vertebrae by their oblique proceſſes; of the ribs with the bodies of tranſverſe proceſſes of the vertebrae; of the radius with the ulna, tibia with the fibula, aſtragalus calcaneum, &c.

I would entirely throw out what is commonly called the third kind of ginglimus; for in examining the conjunction of a bone with two others, as in the common example of a vertebra joined with the one above and below, the connection of the middle one with each of the other two ought to be conſidered ſeparately; otherwiſe we might, with the ſame propriety, eſteem the articulations that the long bones, the femur, tibia, humerus, &c. have at their different ends, as one articulation; which is abſurd.

If the moveable bones are not connected and kept firm by ſome ſtrong ſubſtance, they would be luxated at every motion of the joints; and if their hard rough unequal ſurfaces were to play on each other, their motion would not only be difficult, but the loſs of ſubſtance from attrition would be great. Therefore ligaments are made to obviate the firſt, and cartilages to prevent the other inconveniency. But becauſe ligaments and cartilages turn rigid, inflexible, and rough, unleſs they are kept moiſt, a ſufficient quantity of proper liquors is ſupplied for their lubrication, and to preferve them in a flexible ftate. Seeing, then, thefe parts are fo neceffary to the articulations, I fhall next confider their ftructure, fituation, and ufes, fo far as they are fubfervient to the bones and their motions.

OF THE LIGAMENTS.

Ligaments (*i*) are white flexible bodies, thicker and firmer than membranes, and not fo hard or firm as cartilages, without any remarkable cavity in their fubftance, difficultly ftretched, and with little elafticity; ferving to connect one part to another, or to prevent the parts to which they are fixed from being removed out of that fituation which is ufeful and fafe.

After maceration in water, the ligaments can eafily be divided; and each ligamentous layer appears compofed of fibres, the largeft of which are difpofed in a longitudinal direction.

The arteries of ligaments are very confpicuous after a tolerable injection, and the larger trunks of their veins are fometimes to be feen full of blood.

Such ligaments as form the fides of cavities, have numerous orifices of their arteries opening upon their internal furface, which keep it always moift. If we rub off that moifture, and then prefs the ligament, we can fee the liquor oozing out from fmall pores; and we can force thin liquors injected by the arteries into the cavities formed by ligaments.

Thefe exhalent arteries muft have correfponding abforbents, otherwife the cavities would foon be too full of liquor.

Ligaments, then, muft be fubject to the difeafes common to other parts, where there is a circulation of fluids, allowance

(*i*) Συνδεσμοι, νευροι, copulae, vincula.

allowance always being made for the ſize of veſſels, the nature of the fluids, and the firmneſs of the texture of each part.

Authors generally ſay that ligaments are inſenſible; and conſequently it may be inferred, that they have no nerves beſtowed on them. But the violent racking pain felt on the leaſt motion of a joint labouring under a rheumatiſm, the ſeat of which diſeaſe ſeems often to be in the ligaments, and the inſufferable torture occaſioned by inciſions of ligaments, and by a collection of acrid matter in a joint, or by tophi in the gout, would perſuade us that they are abundantly ſupplied with nerves.

The ligaments which connect the moveable bones commonly riſe from the conjunction of the epiphyſes of the one bone, and are inſerted into the ſame place of the other; or, where epiphyſes are not, they come out from the cervix, and beyond the ſupercilia of the articulated bones; and after ſuch a manner, in both caſes, as to include the articulation in a purſe or bag; with this difference, depending on their different motions, that where the motion is only to be in two directions, the ligaments are ſtrongeſt on thoſe ſides towards which the bones are not moved; and when a great variety of motion is deſigned to be allowed, the ligaments are weaker than in the former ſort of articulations, and are nearly of the ſame ſtrength all round.

Part of the capſular ligaments is compoſed of the perioſteum, continued from one bone to another, as was obſerved, p. 6. and their internal layer is continued on the parts of the bone or cartilage which the ligament includes (*k*).

Beſides theſe common capſular ligaments of the joints, there are particular ones in ſeveral places, either for the firmer connection of the articulated bones, or for reſtraining

(*k*) Neſbit, Oſteogen.—Philoſ. tranſact. N°. 470. § 6.

ing and confining the motion to ſome one ſide; ſuch are the *croſs* and *lateral* ligaments of the knee, the *round* one of the thigh, &c.

From this account of the ligaments, we may conclude, that, *cæteris paribus*, in whatever articulation the ligaments are few, long, and weak, the motion is more free and quick; but luxations happen frequently: and, on the contrary, where the ligaments are numerous, ſhort, and ſtrong, the motion is more confined; but ſuch a joint is leſs expoſed to luxations (*l*).——Whence we may judge how neceſſary it is to attend to the different ligaments, and the changes which have been made on them by a luxation, when it is to be reduced.

Ligaments alſo ſupply the place of bones in ſeveral caſes to advantage. Thus the parts in the pelvis are more ſafely ſupported below by ligaments than they could have been by bone.——The ligaments placed in the great holes of the oſſa innominata and between the bones of the fore-arm and leg, afford convenient origin to muſcles.——Immoveable bones are firmly connected by them; of which the conjunction of the os ſacrum and innominatum is an example.——They afford a ſocket for moveable bones to play in, as we ſee part of the aſtragalus does on the ligament ſtretched from the heel-bone to the ſcaphoid.

Numerous inconveniencies may ariſe from too long or ſhort, ſtrong or weak, lax or rigid ligaments.

OF THE CARTILAGES.

Cartilages (*m*) are ſolid, ſmooth, white, elaſtic ſubſtances, between the hardneſs of bones and ligaments, and covered with a membrane named *perichondrium*; which is of

(*l*) Fabric. ab. Aquapend. de articul. part. utilit. pars 3.

(*m*) Χονδροι.

of the ſame ſtructure and uſe to them as the perioſteum is to the bones.

Cartilages are compoſed of plates, which are formed of fibres, diſpoſed much in the ſame way as thoſe of bones are; as might be reaſonably concluded from obſerving bones in a cartilaginous ſtate before they oſſify, and from ſeeing, on the other hand, ſo many cartilages become bony. This may be ſtill further confirmed by the exfoliation which cartilages are ſubject to as well as bones.

The perichondrium of ſeveral cartilages, for example thoſe of the ribs and larynx, has arteries, which can be equally well injected with thoſe of the perioſteum: but the veſſels of that membrane in other parts, *e. g.* the articular cartilages, are ſmaller, and in none of them does injection enter deep into the ſubſtance of the cartilages; nay madder, mixed with the food of animals, does not change the colour of cartilages as it does that of bones (*n*).

The granulated fleſh which riſes from the ends of metacarpal or metatarſal bones, when the cartilage exfoliates, after a finger or toe has been taken off at the firſt joint, is very ſenſible; from which the exiſtence of nerves in cartilages may be inferred.

While cartilages are in a natural ſtate, it is to be remarked, firſt, That they have no cavity in their middle for marrow. Secondly, That their outer ſurface is ſofteſt, which renders them more flexible. Thirdly, That they do not appear to change their texture near ſo much by acids as bones do. And, laſtly, That as the ſpecific gravity of cartilages is near a third leſs than that of bones; ſo the coheſion of their ſeveral plates is not ſo ſtrong as in bones: Whence cartilages laid bare in wounds or ulcers, are not only more liable to corrupt, but exfoliate much ſooner than bones do.

Cartilages

(*n*) Philoſ. Tranſact. N° 442. art. 8. N° 443. art. 2. N° 457. art. 4. Mem. de l'acad. des ſciences, 1739 et 1742.—Dehtleef de oſſium callo.

Cartilages ſeem to be principally kept from oſſifying, either by being ſubjected to alternate motions of flexion and extenſion, the effects of which are very different from any kind of ſimple preſſure; or by being conſtantly moiſtened (*o*). Thus the cartilages on the articulated ends of the great bones of the limbs, and the moveable ones placed between the moving bones in ſome articulations, which are obliged to ſuffer many and different flexions, and are plentifully moiſtened, ſcarce ever change into bone; while thoſe of the ribs and larynx are often oſſified. The middle angular part of the cartilages of the ribs, which is conſtantly in an alternate ſtate of flexion and extenſion, by being moved in reſpiration, is always the laſt of becoming bony. In the larynx, the epiglottis, which is oftener bended and more moiſtened than the other four cartilages, is ſeldom oſſified, while the others as ſeldom eſcape it in adults.

The cartilages ſubſervient to bones are ſometimes found on the ends of bones which are joined to no other; but are never wanting on the ends and in the cavities of ſuch bones as are deſigned for motion (*p*). Cartilages alſo are interpoſed between ſuch other cartilages as cover the heads and cavities of articulated bones; nay, they are alſo placed between immoveable bones.

The *uſes* of cartilages, ſo far as they regard bones, are, to allow, by their ſmoothneſs, ſuch bones as are deſigned for motion, to ſlide eaſily, and without detrition, while, by their flexibility, they accommodate themſelves to the ſeveral figures neceſſary in different motions, and, by their elaſticity, they recover their natural poſition and ſhape as ſoon as the preſſure is removed.——This ſpringy force may alſo render the motion of the joints more expeditious, and may likewiſe leſſen the ſhocks in running, jumping, &c.——To theſe cartilages

(*o*) Havers Oſteolog. Nov.

(*p*) Celſ. de re medic. lib. 8. cap. 1.

tilages we chiefly owe the ſecurity of the moveable articulations; for, without them, the bony fibres would ſprout out, and intimately coaleſce with the adjoining bone; whence a true anchyloſis muſt neceſſarily follow; which always happens when the cartilages are eroded by acrid matter, or oſſified from want of motion or defect of liquor, as is frequently the caſe after wounds of the joints, paidarthrocace, ſcrophula, and ſpina ventoſa, or from old age, and long immobility of joints (*q*). Hence we may know what the annihilation is, which is ſaid to be made of the head of a bone, and of the cavity for lodging it, after an unreduced fracture (*r*). The moveable cartilages interpoſed in joints ſerve to make the motions both freer and more ſafe than they would otherwiſe be. Thoſe placed on the ends of bones that are not articulated, as on the ſpine of the os ilium, baſe of the ſcapula, &c. ſerve to prevent the bony fibres from growing out too far. Cartilages ſometimes ſerve as ligaments, either to faſten together bones that are immoveably joined, ſuch are the cartilages between the os ſacrum and oſſa ilium, the oſſa pubis, &c. or to connect bones that enjoy manifeſt motion, as thoſe do which are placed between the bodies of the true vertebrae, &c. Cartilages very often do the office of bones to greater advantage than theſe laſt could; as in the cartilages of the ribs, thoſe which ſupply brims to cavities, &c.

Too great thickneſs or thinneſs, length or ſhortneſs, hardneſs or ſuppleneſs, of cartilages, may therefore cauſe great diſorders in the body.

OF

(*q*) Columb. de re anat. lib. 15.—Deſlandes, Hiſt. de l'acad. des ſciences, 1716.—Phil. Tranſ. N° 215.—Ibid. N° 461. ſect. 16.

(*r*) Hildan. de ichor. et melicer. acri Celſi, cap. 5.——Ruyſch. Theſ. 8. No 103.——Saltzman, in Act. Petropolit. tom. 3. p. 275.

OF THE SYNOVIA.

The liquor which principally ſerves to moiſten the ligaments and cartilages of the articulations is ſupplied by glands, which are commonly ſituated in the joint, after ſuch a manner as to be gently preſſed, but not deſtroyed by its motion. By this means, when there is the greateſt neceſſity for this liquor, that is, when the moſt frequent motions are performed, the greateſt quantity of it muſt be ſeparated. Theſe glands are ſoft and pappy, but not friable: in ſome of the large joints they are of the conglomerate kind, or a great number of ſmall glandules are wrapt up in one common membrane. Their excretory ducts are long, and hang looſe, like ſo many fringes, within the articulation; which, by its motion and preſſure, prevents obſtructions in the body of the gland or its excretories, and promotes the return of this liquor, when fit to be taken up by the abſorbent veſſels, which muſt be in the joints, as well as in the other cavities in the body; and, at the ſame time, the preſſure on the excretory ducts hinders a ſuperfluous unneceſſary ſecretion, while the fimbriated diſpoſition of theſe excretories does not allow any of the ſecreted liquor to be puſhed back again by theſe canals towards the glands (*s*).

Very often theſe fountains of ſlimy liquor appear only as a net-work of veſſels.—Frequently they are almoſt concealed by cellular membranes containing the fat—and ſometimes ſmall ſimple mucous folliculi may be ſeen (*t*).

The different joints have theſe organs in different numbers and ſizes: the conglomerate ones do not vary much, eſpecially as to ſituation, in the ſimilar joints of different bodies; but the others are more uncertain.

Upon

(*s*) Cowper, Anatom. explicat. tab. 79. lit. E. E.

(*t*) Morgagn. Adverſar. 2. animad. 23.

Upon preffing any of thefe glands with the finger, a mucilaginous liquor may be fqueezed out of their excretories, which fomewhat refembles the white of an egg or ferum of the blood; but it is manifeftly falt to the tafte. It does not coagulate by acids nor by heat, as the ferum does; but by the latter turns firft thinner, and, when evaporated, leaves only a thin falt film.

The quantity of this mucilage, conftantly fupplied, muft be very confiderable, fince we fee what a plentiful troublefome difcharge of glary matter follows a wound or ulcer of any joint: of which liquor the mucilage is a confiderable part.

The veffels which fupply liquors for making the fecretion of this mucilage, and the veins which bring back the blood remaining after the fecretion, may be feen without any preparation; and, after a tolerable injection of the arteries, the glands are covered with them.

In a found ftate, we are not confcious of any fenfibility in thofe glands: but, in fome cafes which I have feen, when they inflame and fuppurate, the moft racking pain is felt in them; a melancholy, though a fure, proof that they have nerves.

Thefe mucilaginous glands are commonly lodged in a cellular fubftance; which is alfo to be obferved in other parts of the bag formed by the ligaments of the articulation; and which contains a fatty matter, that muft neceffarily be attenuated, and forced through the including membranes into the cavity of the joint, by the preffure which it fuffers from the moving bones.

If, then, the oil is conveyed from this cellular fubftance; and if the attenuated marrow paffes from the cancelli of the bones by the large pores near their ends, or in their cavities, and fweats through the cartilages there into the articulations; which it may, when affifted by the conftant heat and action of the body, more easily do, than when it escapes through the compact substance of the bones in a skeleton: If, I say, this oil is sent to a joint, and is incorporated with the mucilage, and with the fine lymph that is constantly oozing out at the extremities of the small arteries distributed to the ligaments, one of the fittest liniments imaginable must be produced; for the mucus diluted by the lymph contributes greatly to its lubricity, and the oil preserves it from hardening. How well such a mixture serves the purpose it is designed for, Boyle (*u*) tells us he experienced in working his air-pump; for the sucker could be moved with much less force after being moistened with water and oil, than when he used either of these liquors singly. And I believe every one, at first view, will allow the diluted mucilage to be much preferable to simple water. The synovia (*x*), as this liquor composed of oil, mucilage, and lymph, is commonly now called, while in a sound state, effectually preserves all the parts concerned in the articulations soft and flexible, and makes them slide easily on each other, by which their mutual detrition and overheating is prevented, in the manner daily practised in coach and cart wheels by besmearing them with grease and tar.

After the liquor of the articulations becomes too thin and unserviceable, by being constantly pounded and rubbed between the moving bones, it is reassumed into the mass of blood by the absorbent vessels.

When the synovia is not rubbed betwixt the bones, it inspissates. And sometimes, when the head of bone has been long out of its cavity, this liquor is said to fill up the place of the bone, and hinder its reduction; or if a joint continues long unmoved, it is also said to cement the bones, and

(*u*) Physico-mechanic. experim.

(*x*) Μύξα, mucus, axungia.

and occaſion a true anchyloſis (*y*).——If the ſynovia becomes too acrid, it erodes the cartilages and bones; as frequently happens to thoſe who labour under the lues venerea, ſcurvy, ſcrophula, or ſpina ventoſa.——If this liquor is ſeparated in too ſmall a quantity, the joint becomes ſtiff; and, when with difficulty it is moved, a crackling noiſe is heard, as people advanced in years frequently experience (*z*).——If the mucilage and lymph are depoſited in too great a quantity, and the abſorbent veſſels do not perform their office ſufficiently, they may occaſion a dropſy of the joints (*a*).——From this ſame cauſe alſo the ligaments are often ſo much relaxed, as to make the conjunction of the bones very weak: Thence ariſe the luxations from an internal cauſe, which are eaſily reduced, but difficultly cured (*b*). Frequently, when ſuch a ſuperfluous quantity of this liquor is pent up, it becomes very acrid, and occaſions a great train of bad ſymptoms; ſuch as ſwelling and pain of the joints, long ſinous ulcers, and fiſtulae, rotten bones, immobility of the joints, marcor and atrophia of the whole body, hectic fevers, &c. (*c*).——From a depravity in the blood, or diſeaſes in the organs that furniſh the ſynovia of the joints, it may be greatly changed from its natural ſtate; it may be purulent after inflammation, mucous in the white ſwellings, gelatinous in the rheumatiſm, chalky from the gout, &c.: hence a great variety of diſorders in the joints (*d*).

CHAP.

(*y*) Paré, Chirurgie, livre 15. chap. 18. et livre 16. chap. 5.

(*z*) Galen. de uſu part. lib. 12. cap. 2.——Fabric. ab Aquapend. de articul. part. utilitat. pars 3.——Bartholin. hiſt. medic. cent. 3. hiſt. 11.

(*a*) Hildan. de ichore et melicer. acri Celſi.

(*b*) Hippocrat. de locis in homine, ſect. 14. et de articul.

(*c*) Hildan. de ichore et meliceria acri Celſi.

(*d*) See Reimar, Diſſert. de fungo articulor.

CHAP. II.

Of the SKELETON.

THOUGH any dry ſubſtance may be called *ſkeleton*, yet, among anatomiſts, this word is univerſally underſtood to ſignify the bones of animals connected together, after the teguments, muſcles, bowels, glands, nerves, and veſſels, are taken away (*a*).

A ſkeleton is ſaid to be a *natural* one when the bones are kept together by their own ligaments; and it is called *artificial* when the bones are joined with wire, or any other ſubſtance which is not part of the creature to which they belonged. Small ſubjects, and ſuch whoſe bones are not fully oſſified, are commonly prepared the firſt way; becauſe, were all their parts divided, the niceſt artiſt could not rejoin them, by reaſon of their ſmallneſs, and of the ſeparation of their unoſſified parts; whereas the bones of large adult animals are ſooneſt and moſt conveniently cleaned when ſingle, and are eaſily reſtored to and kept in their natural ſituation.——Sometimes the ſkeleton of the ſame animal is prepared in both theſe ways; that is, the ſmaller bones are kept together by their natural ligaments, and the larger ones are connected by wires or ſome ſuch ſubſtances.

Before we proceed to the diviſion and particular deſcription of the ſkeleton, it is to be obſerved, that, when the bones are put into their natural ſituation, ſcarce any one of them is placed in a perpendicular bearing to another; though the fabric compoſed of them is ſo contrived, that, in an erect poſture, a perpendicular line, for their common centre of gravity, falls in the middle of their com-

mon

(*a*) Cadaveris crates.

mon bafe (*b*). On this account, we can fupport ourfelves as firm as if the axis of all the bones had been a ftraight line perpendicular to the horizon; and we have much greater quicknefs, eafe, and ftrength, in feveral of the moft neceffary motions we perform. It is true, indeed, that wherever the bones, on which any part of our body is fuftained, decline from a ftraight line, the force required in the mufcles to counteract the gravity of that part is greater than was otherwife neceffary: But then this is effectually provided for in fuch places, by the number and ftrength of the mufcles. So long, therefore, as we remain in the fame pofture, a confiderable number of mufcles muft be in a conftant ftate of contraction; which we know, both from reafon and experience, muft foon create an uneafy fenfation. This we call *being weary of one pofture*: An inconvenience that we fhould not have had in ftanding erect, if the bearing of all the bones to each other had been perpendicular; but it is more than compenfated by the advantages above-mentioned.

The human fkeleton is generally divided into the HEAD, the TRUNK, the SUPERIOR and the INFERIOR EXTREMITIES.

SECT. I. OF THE HEAD.

BY the HEAD is meant all that fpheroidal part which is placed above the firft bone of the neck. It therefore comprehends the cranium and bones of the face.

§ 1. *The* CRANIUM.

THE cranium (*c*), helmet, or brain-cafe, confifts of feveral pieces, which form a vaulted cavity, for lodging and defending

(*b*) Cowper, Anat. of human bodies, explic. of tab. 87. 88.

(*c*) *Κολχος, κυτος, κωδεα, σκαφιον*, calva, calvaria, cerebri galea, theca, et olla capitis, tefta capitis, fcutella capitis.

defending the brain and cerebellum, with their membranes, veſſels, and nerves.

The cavity of the cranium is proportioned to its contents. Hence ſuch a variety of its ſize is obſerved in different ſubjects; and hence it is neither ſo broad nor ſo deep at its fore-part, in which the anterior lobes of the brain are lodged, as it is behind, where the large poſterior lobes of the brain, and the whole cerebellum, are contained.

The roundiſh figure of the ſkull, which makes it more capacious, and better able to defend its contents from external injuries, is chiefly owing to the equal preſſure of theſe contained parts as they grow and increaſe before it is entirely oſſified.——It is to be obſerved, however, that the ſides of the cranium are depreſſed below a ſpherical ſurface by the ſtrong temporal muſcles, whoſe action hinders here the uniform protruſion of the bones, which is more equally performed in other parts where no ſuch large muſcles are. In children whoſe muſcles have not acted much, and conſequently have not had great effects on the bones, this depreſſion is not ſo remarkable; and therefore their heads are much rounder than in adults. Theſe natural cauſes, differently diſpoſed in different people, produce a great variety in the ſhapes of ſkulls, which is ſtill increaſed by the different management of the heads of children when very young: So that one may know a Turk's ſkull by its globular figure, a German's by its breadth and flatneſs of the occiput, Dutch and Engliſh by their oblong ſhapes, &c. (*d*). Two advantages are reaped from this flatneſs of the ſides of the cranium, viz. the enlargement of our ſphere of viſion, and more advantageous ſituation of our ears for receiving a greater quantity of ſound, and for being leſs expoſed to injuries.

The

(*d*) Veſal. lib. 1. c. 5.

The external ſurface of the upper part of the cranium is very ſmooth and equal, being only covered with the perioſteum (common to all the bones, but in the ſkull diſtinguiſhed by the name of *pericranium*), the thin frontal and occipital muſcles, their tendinous aponeuroſis, and with the common teguments of the body; while the external ſurface of its lower part has numerous riſings, depreſſions, and holes, which afford convenient origin and inſertion to the muſcles that are connected to it, and allow ſafe paſſage for the veſſels and nerves that run through and near it.

The internal ſurface of the upper part of the ſkull is commonly ſmooth, except where the veſſels of the dura mater have made furrows in it, while the bones were ſoft.—— Surgeons ſhould be cautious when they trepan here, leſt in ſawing or raiſing the bone where ſuch furrows are, they wound theſe veſſels.——In the upper part of the internal ſurface of ſeveral ſkulls, there are likewiſe pits of different magnitudes and figures, which ſeem to be formed by ſome parts of the brain being more luxuriant and prominent than others. In theſe pits, the ſkull is ſo much thinner than any where elſe, that it is often rendered diaphanous, the two tables being cloſely compacted without a diploë; the want of which is ſupplied by veſſels going from the dura mater into a great many ſmall holes obſervable in the pits. Theſe veſſels are larger, and much more conſpicuous than any others that are ſent from the dura mater to the ſkull; as evidently appears from the drops of blood they pour out, when the ſkull is raiſed from the dura mater in a recent ſubject; and therefore they may furniſh a ſufficient quantity of liquors neceſſary to prevent the brittleneſs of this thin part.—The knowledge of theſe pits ſhould teach ſurgeons to ſaw cautiouſly and ſlowly through the external table of the ſkull, when they are performing the operation of the trepan; ſince,

ſince, in a patient whoſe cranium has theſe pits, the dura mater and brain may be injured, before the inſtrument has pierced near the ordinary thickneſs of a table of the ſkull.— The internal baſe of the ſkull is extremely unequal, for lodging the ſeveral parts and appendices of the brain and cerebellum, and allowing paſſage and defence to the veſſels and nerves that go into or come out from theſe parts.

The bones of the cranium are compoſed of two tables, and intermediate cancelli, commonly called their *diploë* (*e*). The external table is thickeſt; the inner, from its thinneſs and conſequent brittleneſs, has got the name of *vitrea*. Whence we may ſee the reaſon of thoſe miſchievous conſequences which ſo often attend a collection of matter in the diploë, either from an external or internal cauſe, before any ſign of ſuch a collection appears in the teguments which cover that part of the ſkull where it is lodged (*f*).

The diploë has nearly the ſame texture and uſes in the ſkull with the cancelli in other bones.

The diploë of ſeveral old ſubjects is ſo obliterated, that ſcarce any veſtige of it can be ſeen; neither is it obſervable in ſome of the hard craggy bones at the baſe of the ſkull. Hence an uſeful caution to ſurgeons who truſt to the bleeding, want of reſiſtance, and change of ſound, as certain marks, in the operation of the trepan, that their inſtrument has ſawed through the firſt table, and reached the diploë (*g*). In other people, the diploë becomes of a monſtrous thickneſs, while the tables of the ſkull are thinner than paper.

The cranium conſiſts of eight bones, ſix of which are ſaid to be proper, and the other two are reckoned common to

(*e*) Meditulium, commiſſura.

(*f*) Boneti Sepulchret. anat. lib. 1. § 1. obſ. 96.—103.

(*g*) Bartholin. Anat. reform. lib. 4. cap. 4.

to it and to the face.—The ſix proper are the *os frontis*, two *oſſa parietalia*, two *oſſa temporum*, and the *os occipitis*.—The common are the *os ethmoides* and *ſphenoides*.

The *os frontis* forms the whole fore-part of the vault; the two *oſſa parietalia* form the upper and middle part of it; the *oſſa temporum* compoſe the lower part of the ſides; the *os occipitis* makes the whole hinder part, and ſome of the baſe; the *os ethmoides* is placed in the fore-part of the baſe, and the *os ſphenoides* in the middle of it.

THE SUTURES.

THE above bones are joined to each other by five ſutures; the names of which are the *coronal*, *lambdoidal*, *ſagittal*, and two *ſquamous*.

The *coronal* (*h*) ſuture is extended over the head, from within about an inch of the external canthus of one eye, to the like diſtance from the other; which being near the place where the ancients wore their vittæ, coronæ, or garlands, this ſuture has thence got its name.—Though the indentations of this ſuture are conſpicuous in its upper part, yet an inch or more of its end on each ſide has none, but is ſquamous and ſmooth.

The *lambdoidal* (*i*) ſuture begins ſome way below, and farther back than the vertex or crown of the head, whence its two legs are ſtretched obliquely downwards and to each ſide in form of Greek letter Λ, and are now generally ſaid to extend themſelves to the baſe of the ſkull: but formerly anatomiſts (*k*) reckoned the proper lambdoidal ſuture to terminate at the ſquamous ſutures; and what is extended at an angle down from that on each ſide, where the indentations

(*h*) Στεφαναια, Arcualis, puppis.

(*i*) Laudæ, proræ, hypſyloides.

(*k*) Veſal. Anat. lib. I. cap. 6.

are lefs confpicuous than in the upper part of the future, they called *additamentum futuræ lambdoidis* (*l*).

This future is fometimes very irregular, being made up of a great many fmall futures, which furround fo many little bones that are generally larger and more confpicuous on the external furface of the fkull than internally. Thefe bones are commonly called *triquetra* or *Wormiana*: but fome other name ought to be given them, for they are not always of a triangular figure, and older anatomifts (*m*) than Olaus Wormius (*n*) have defcribed them.—The fpecific virtue which thefe bones were once thought to have in the cure of the epilepfy (*o*), is not afcribed to them now; and anatomifts generally agree, that their formation is owing to a greater than ordinary number of points of offification in the fkull, or to the ordinary bones of the cranium not extending their offification far enough or foon enough; in which cafe, the unoffified interftice between fuch bones begins a feparate offification in one or more points; from which the offification is extended to form as many diftinct bones as there were points, that are indented into the large ordinary bones, and into each other.—Probably thofe children who have a large opening in this place at their birth, will have the largeft offa triquetra.—To confirm this account of the formation of thefe little bones, we may remark, that fuch bones are fometimes feen in other futures, as well as in the lambdoidal (*p*); and

(*l*) Lambdoides harmonialis, lambdoides inferior, occipitis corona.

(*m*) Euftach. Offium examen.——Bauhin. Theat. Anat. lib. 3. cap. 5.——Paaw in Hippocrat. de vulner. capit. p. 50.

(*n*) Mufæum, lib. 3. c. 26.

(*o*) Bauhin. et Paaw ibid.—Bartholin. Anat. reform. lib. 4. c. 5.—Hildan. Epiftol. 65.

(*p*) See examples in Vefal. lib. 1. cap. 6. fig. 4.—Paaw in Hippocrat. de cap. vuln.—Bartholin. Hift. Anat. cent. 1. Hift. 51.—Ruyfch. Muf. Anat.—Sue Trad. d'ofteolog. p. 47.

and they are ſometimes in one table of the ſkull, and not in the other (*q*).

The *ſagittal* future (*r*) is placed longitudinally in the middle of the upper part of the ſkull, and commonly terminates at the middle of the coronal and of the lambdoidal futures; between which it is ſaid to be placed, as an arrow is between the ſtring and the bow.—However, this future is frequently continued through the middle of the os frontis down to the root of the noſe; which, ſome (*s*) ſay, happens oftener in women than men; but others (*t*) allege, that it is to be met with more frequently in male ſkulls than in female: Among the ſkulls which I have ſeen thus divided, the female are the moſt numerous.——Several (*u*) have delineated and deſcribed the ſagittal future, ſometimes dividing the occipital bone, as far down as the great hole through which the medulla ſpinalis paſſes. This I never ſaw.

In ſome old ſculls that are in my poſſeſſion, there is ſcarce a veſtige of any of the three futures which I have now deſcribed. In other heads, one or two of the futures only diſappear; but I never could diſcover any reaſon for thinking them diſpoſed in ſuch different manners in ſkulls of different ſhapes, as ſome ancients allege they are (*x*).

The *ſquamous agglutinations*, or *falſe futures* (*y*), are one on

(*q*) Hunald in Mem. de l'acad. des ſciences, 1730.

(*r*) Ῥαβδοειδης, οβελαια, επιζευγνυσα, Inſtar virgae, nervalis, inſtar teli, inſtar veru, ſecundum capitis longitudinem prorepens, conjungens, columnalis, recta, arcualis.

(*s*) Riolan. Comment. de oſſib. cap. 8.

(*t*) Veſal. lib. 1. cap. 6. et in epitome.

(*u*) Veſal. lib. 1. cap. 5. fig. 3. 4. et in text. cap. 6.———Paaw in Celſ. de re medic. cap. 1.———Laurent. Hiſt. Anat. lib. 2. cap. 16.

(*x*) Hippocrat. de vulner. capitis, § 1.———Galen. de oſſib. et de uſu part. lib. 9. cap. 17.

(*y*) Λεπιδοειδη, προσκολληματα, κροταφαιαι. Temporales, corticales, mendoſae; harmonialis, commiſſurae in unguem.

on each ſide, a little above the ear, of a ſemicircular figure, formed by the overlapping (like one ſcale upon another) of the upper part of the temporal bones on the lower part of the parietal, where, in both bones, there are a great many ſmall riſings and furrows, which are indented into each other; though theſe inequalities do not appear till the bones are ſeparated. In ſome ſkulls, indeed, the indentations here are as conſpicuous externally as in other ſutures (z); and what is commonly called the poſterior part of this ſquamous ſuture, always has the evident ſerrated form; and therefore is reckoned by ſome (*a*) a diſtinct ſuture, under the name of *additamentum poſterius ſuturae ſquamoſae*.—I have ſeen two ſquamous ſutures on the ſame temple, with a ſemicircular piece of bone between them (*b*).

We ought here to remark, that the true ſquamous ſort of ſuture is not confined to the conjunction of the temporal and parietal bones, but is made uſe of to join all the edges of the bones on which each temporal muſcle is placed (*c*): For the two parts of the ſphenoidal ſuture which are continued from the anterior end of the common ſquamous ſuture juſt now deſcribed, of which one runs perpendicularly downwards, and the other horizontally forwards, and alſo the lower part of the coronal ſuture already taken notice of, may all be juſtly ſaid to pertain to the ſquamous ſuture.——The manner how, I imagine, this ſort of ſuture is formed at theſe places is, that, by the action of the ſtrong temporal muſcles on one ſide, and by the preſſure of the brain on the other, the bones are made ſo

(z) Columb. de re anat. lib. 1. cap. 4.——Dionis, Anat. 3. demonſtrat. des os.

(*a*) Albin. de oſſib. § 54.

(*b*) Sue Trad. d'oſteol. p. 48.

(*c*) Veſal. Anat. lib. 1. cap. 6.--Winſlow, Mem. de l'acad. des ſciences, 1720.

fo thin, that their edges oppofed to each other are not fufficiently thick to ftop the extenfion of their fibres in length, and thus to caufe the common ferrated appearance of futures explained in p. 36.; but the narrow edge of the one bone flides over the other. The fquamous form is alfo more convenient here; becaufe fuch thin edges of bones, when accurately applied one to another, have fcarce any rough furface, to obftruct or hurt the mufcle in its contraction; which is ftill further provided for, by the manner of laying thefe edges on each other; for, in viewing their outfide, we fee the temporal bones covering the fphenoidal and parietal, and this laft fupporting the fphenoidal, while both mount on the frontal: From which difpofition it is evident, that, while the temporal mufcle is contracting, which is the only time it preffes ftrongly in its motion on the bones, its fibres flide eafily over the external edges. Another advantage of this ftructure is, that the whole part is made ftronger by the bones thus fupporting each other.

The bones of the fkull are joined to thofe of the face, by fchindylefis and futures.——The fchindylefis is in the partition of the nofe.——The futures faid to be common to the cranium and face are five; viz. the ethmoidal, fphenoidal, tranfverfe, and two zygomatic.———Parts, however, of thefe futures are only at the junction of the bones of the fkull.

The *ethmoidal* and *fphenoidal* futures furround the bones of thefe names; and in fome places help to make up other futures, particularly the *fquamous* and *tranfverfe;* and in other parts there is but one future common to thefe two bones.

The *tranfverfe* future is extended quite crofs the face, from the external canthus of one orbit to the fame place of the other, by finking from the canthus down the outfide of the

the orbit to its bottom; then mounting upon its inſide, it is continued by the root of the noſe down the internal part of the other orbit, and riſes up again on its outſide to the other canthus. It may be here remarked, that there are ſome interruptions of this ſuture in the courſe I have deſcribed; for the bones are not every where contiguous, but are ſeparated, to leave holes and apertures, as ſhall be mentioned hereafter.

The *zygomatic* ſutures are one on each ſide, being ſhort and ſlanting from above obliquely downwards and backwards, to join a proceſs of the cheek bone to one of the temporal bones, which advance towards the face; ſo that the two proceſſes thus united, form a ſort of bridge or jugum, under which the temporal muſcle paſſes, on which account the proceſſes, and ſuture joining them, have been called *zygomatic*.

It muſt be obſerved, that the indentations of the ſutures are not ſo ſtrongly marked on the inſide as on the outſide of the cranium; and ſometimes the bones ſeem to be joined by a ſtraight line: Nay, in ſome ſkulls, the internal ſurface is found entire, while the ſutures are manifeſt without; which may poſſibly be owing to the leſs extent of the concave than of the convex ſurface of the cranium, whereby the fibres of the internal ſide would be ſtretched farther out at the edges of the bones than the exterior ones, if they were not reſiſted. The reſiſtances are, the fibres of the oppoſite bone, the parts within the ſkull, and the diploë: the laſt of which being the weakeſt, the moſt advanced fibres or ſerrae run into it, and leave the contiguous edges equal, and more ready to unite; whereas the ſerrae of the external table have ſpace enough for their admiſſion between the fibres of the oppoſite bone, and therefore remain of the indented form, and are leſs liable to the concretion whereby the ſutures are obliterated (*d*).——By this mechaniſm,

(*d*) Hunald. Memoires de l'acad des ſciences, 1730.

mechaniſm, there is no riſk of the ſharp points of the bones growing inwards, ſince the external ſerræ of each of the conjoined bones reſt upon the internal ſmooth-edged table of the other; and external forces applied to theſe parts are ſtrongly reſiſted, becauſe the ſutures cannot yield, unleſs the ſerrated edges of the one bone, and the plain internal plate of the other, are broken (*e*).

The advantages of the ſutures of the cranium are theſe: 1. That this capſula is more eaſily formed and extended into a ſpherical figure, than if it had been one continued bone. 2. That the bones which are at ſome diſtance from each other at birth, might then yield, and allow to the head a change of ſhape, accommodated to the paſſage it is engaged in. Whence, in difficult parturition, the bones of the cranium, inſtead of being only brought into contact, are ſometimes made to mount one upon the other. 3. It is alledged, that, through the ſutures there is a tranſpiration of ſteams from the brain, which was the old doctrine; or ſome communication of the veſſels without, and of thoſe within the ſkull, larger here than in any other part of the cranium, according to ſome moderns; and therefore cucuphae, fomentations, cataplaſms, cephalic plaſters, bliſters, are applied, and iſſues are eroded or cut in the head, at thoſe places where the ſutures are longeſt in forming, and where the connection of the bones is afterwards looſeſt, for the cure of a phrenitis, mania, inveterate headach, epilepſy, apoplexy, and other diſeaſes of the head. The favourers of the doctrine of tranſpiration, or communication of veſſels at the ſutures, endeavour to ſupport it by obſervations of perſons ſubject to headachs which cauſed death, from the ſutures being too cloſely united (*f*). 4. That the dura mater may be more firmly ſuſpended by its proceſſes, which inſinuate themſelves into this

(*e*) Winſlow, Memoires de l'acad. des ſciences, 1720.

(*f*) Columb. de re. anat. lib. 1. cap. 5.—Verduc. Nouvelle Oſteologie, chap. 14.—Dionis, Anat. 3. demonſt. des os.

this conjunction of the bones: for doing this equally, and where the greateſt neceſſity of adheſion is, the ſutures are diſpoſed at nearly equal diſtances; and the larger reſervoirs of blood, the ſinuſes, are under or near them. 5. That fractures might be prevented from reaching ſo far as they would in a continued bony ſubſtance. 6. That the connection at the ſutures being capable of yielding, the bones might be allowed to ſeparate; which has given great relief to patients from the violent ſymptoms which they had before this ſeparation happened (*g*). And it ſeems reaſonable to believe, that the opening of the ſutures was of great benefit to ſeveral others who were rather thought to have been hurt by it (*h*): for the conſequences of ſuch a force acting upon the brain, as was capable of thruſting the bones aſunder, muſt have been fatal, unleſs it had been thus yielded to.

Having gone through the general ſtructure of the cranium, I now proceed to examine each bone of which that brain caſe conſiſts, in the order in which I firſt named them.

OS FRONTIS.

The os frontis (*i*) has its name from its being the only bone of that part of the face we call the *forehead*, though it reaches a good deal farther. It has ſome reſemblance in ſhape to the ſhell of the concha bivalvis, commonly called the *cockle*: for the greateſt part of it is convex externally, and concave internally, with a ſerrated circular edge; while the

(*g*) Ephemerid. Germanic. dec. 1. ann. 4. et 5. obſerv. 33.

(*h*) Ephemerid. Germ. dec. 2. ann. 9. obſ. 230. Ibid. cent. 10. obſ. 31.—Vander Linden Medicin. phyſ. cap. 8. art. 4. § 16.—Hildan. Obſerv. cent. 1. obſ. 1. cent. 2. obſ. 7.—Bauhin. Theat. Anat. lib. 3. cap. 6.—Pechlin. Obſerv. lib. 2. obſ. 39.

(*i*) Μετωπον, Βρεγμα, Coronale, inverecundum, puppis, ſenſus communis, ſincipitis.

the ſmaller part has proceſſes, and depreſſions, which make it of an irregular figure.

The external ſurface of the os frontis is ſmooth at its upper convex part; but ſeveral proceſſes and cavities are obſervable below: for at each angle of each orbit, the bone juts out to form four proceſſes, two internal, and as many external; which, from this ſituation, may well enough be named *angular*. Between the internal and external angular proceſſes on each ſide, an arched ridge is extended, on which the eye-brows are placed.——Very little above the internal end of each of theſe ſuperciliarly ridges a protuberance may be remarked, in moſt ſkulls, where there are large cavities, called *ſinuſes*, within the bone; of which hereafter.——Between the internal angular proceſſes a ſmall proceſs riſes, which forms a ſmall part of the noſe, and thence is named *naſal*.—Some obſerve a protuberant part on the edge of the bone behind each external angular proceſs, which they call *temporal* proceſſes; but theſe are inconſiderable.——From the under part of the ſuperciliary ridges, the frontal bone runs a great way backwards: theſe parts may juſtly enough be called *orbitar* proceſſes, which, contrary to the reſt of this bone, are concave externally, for receiving the globes of the eyes, with their muſcles, fat, &c.

In each of the orbitar proceſſes, behind the middle of the ſuperciliary ridges, a conſiderable ſinuoſity is obſerved, where the glandula innominata Galeni, or lacrymalis, is lodged.——Behind each internal angular proceſs, a ſmall pit may be remarked, where the cartilaginous pully of the muſculus obliquus major of the eye is fixed.—— Between the two orbitar proceſſes, there is a large diſcontinuation of the bone, in which the cribriform part of the os ethmoides is incaſed.——The frontal bone has frequently little caverns formed in it where it is joined to the ethmoid bone.—

Behind each external angular procefs, the furface of the frontal bone is confiderably depreffed where part of the temporal mufcle is placed.

The *foramina*, or holes, obfervable on the external furface of the frontal bone, are three in each fide.——One in each fuperciliary ridge, a little removed from its middle towards the nofe; through which a twig of the ophthalmic branch of the fifth pair of nerves paffes out of the orbit, with a fmall artery from the internal carotid, to be diftributed to the teguments and mufcles of the forehead. —Thefe veffels, in fome fkulls, make furrows in the os frontis, efpecially in the bones of children, as has alfo been obferved of another confiderable veffel of this bone near its middle (*k*); and therefore we ought to beware of tranfverfe incifions on either fide of the os frontis, which might either open thefe veffels, or hurt the nerves, while they are yet in part within the bone: for when veffels are thus wounded, it is difficult to ftop the haemorrhagy, becaufe the adhefion of a part of the artery to the bone hinders its contraction, and confequently ftyptics can have little effect; the fides of the furrow keep off compreffing fubftances from the artery; and we would wifh to fhun cauteries or efcharotics, becaufe they make the bone carious; and nerves, when thus hurt, fometimes produce violent fymptoms.——But to return to the fuperciliary foramina, we muft remark, that often, inftead of a hole, a notch only is to be feen: nay, in fome fkulls, fcarce a veftige even of this is left; in others, both hole and notch are obfervable, when the nerve and artery run feparately. Frequently a hole is found on the one fide, and a notch on the other; at other times we fee two holes, or there is a common hole without, and two diftinct entries internally. The reafon of this variety of a hole, notch, depreffion, or fmoothnefs, in

(*k*) Ruyfch. Muf. Anat. theca D, repofit. 4. N° 3.

in the fuperciliary ridge, is the different length and tenfion of the nerves and veffels; the fhorter they are, the more they are funk into the bone as it grows.—Near the middle of the infide of each orbit, hard by or in the tranfverfe future, there is a fmall hole for the paffage of the nafal twig of the firft branch of the fifth pair of nerves, and of a branch of the ophthalmic artery. This hole is fometimes entirely formed in the os frontis; in other fkulls, the fides of it are compofed of this laft bone and of the os planum. It is commonly known by the name of *orbitarium internum*, though *anterius* fhould be added, becaufe of the next, which is commonly omitted.—This, which may be called *orbitarium internum pofterius*, is fuch another as the former; only fmaller, and about an inch deeper in the orbit: Through it a fmall branch of the ocular artery paffes to the nofe.—Befides thefe fix, there are a great number of fmall holes obfervable on the outer furface of this bone, particularly in the two protuberances above the eye brows. Moft of them penetrate no further than the finufes, or than the diploë if the finufes are wanting; though fometimes I have feen this bone fo perforated by a vaft number of thefe fmall holes, that, placed between the eye and a clear light, it appeared like a fieve.—In the orbit of the generality of fkeletons, we may obferve one, two, or more holes, which allow a paffage to a hog's briftle through the fkull. The place, fize, and number of thefe, are however uncertain: they generally ferve for the tranfmiffion of fmall arteries or nerves.

The internal furface of the os frontis is concave, except at the orbitar proceffes, which are convex, to fupport the anterior lobes of the brain. This furface is not fo fmooth as the external; for the larger branches of the arteries of the dura mater make fome furrows in its fides and back parts. The finuofities from the luxuriant rifings of the brain, mentioned

tioned when defcribing the general ftructure of the cranium, are often very obfervable on its upper part; and its lower and fore parts are marked with the contortions of the anterior lobes of the brain.—Through the middle of this internal furface, where always in children, and fometimes in old people, the bone is divided, either a ridge ftands out, to which the upper edge of the falx is faftened, or a furrow runs, in which the upper fide of the fuperior longitudinal finus is lodged; on both thefe accounts, chirurgical authors juftly forbid the application of the trepan here.—The reafon of this difference in fkulls is alleged by fome authors to be this, That in thin fkulls the ridge ftrengthens the bones, and in thick ones there is no occafion for it. To this way of accounting for the phenomenon, it may juftly be objected, that, generally, very thick fkulls have a large fpine here, and frequently thin ones have only a furrow. Perhaps this variety may be owing to the different times of complete offification of thofe parts in different fubjects; for if the two fides of this bone meet before they arrive at their utmoft extent of growth, they unite very firmly, and all their fibres endeavour to ftretch themfelves out where there is the leaft refiftance, that is, between the hemifpheres of the brain. To fupport this reafoning, we may remark, that thofe adults whofe frontal bone is divided by the fagittal future, never have a ridge in this place.

Immediately at the root of this ridge or furrow, there is a fmall hole, which fometimes pierces through the firft table, and, in other fkulls, opens into the fuperior finus of the ethmoid bone within the nofe. In it a little procefs of the falx is lodged; and a fmall artery, and fometimes a vein, runs (*l*); and the fuperior longitudinal finus begins here.—This hole, however, is often not entirely proper to the os frontis: for, in feveral fkulls, the lower part is formed in the upper part of

(*l*) Morgagn. Adverfar. 6. animad. 31.

of the baſe of the criſta galli, which is a proceſs of the eth-
moid bone (*m*).

The os frontis is compoſed of two tables, and an intermediate diploë, as the other bones of the cranium are: It is of a mean thickneſs between the os occipitis and the parietal bones; and is nearly equally denſe throughout, except at the orbitar proceſſes, where, by the action of the eye on one ſide, and preſſure of the lobes of the brain on the other, it is made extremely thin and diaphanous, and the meditullium is entirely obliterated. In this place there is ſo weak a defence for the brain, that fencers eſteem a puſh in the eye mortal (*n*).

The diploë is alſo exhauſted in that part above the eyebrows, where the two tables of the bone ſeparate, by the external being protruded outwards, to form two large cavities, called *ſinus frontales*.—Theſe are divided by a middle perpendicular bony partition.—Their capacities in the ſame ſubject are ſeldom equal; in ſome the right, in others the left, is largeſt.—And in different bones their ſize is as inconſtant: nay, I have examined ſome where they were entirely wanting; which oftener happens in ſuch as have a flat forehead, and whoſe ſagittal ſuture is continued down to the noſe, than in others (*o*).—In ſome ſkulls, beſides the large perpendicular *ſeptum*, ſeveral bony pillars, or ſhort partitions, are found in each ſinus: in others theſe are wanting.—For the moſt part the *ſeptum* is entire; at other times it is diſcontinued, and the two *ſinuſes* communicate.—When the ſinuſes are ſeen in ſuch ſkulls as have the frontal bone divided by the ſagittal ſuture, the partition dividing theſe cavities is evidently compoſed of two plates, which eaſily ſeparate.—Each ſinus commonly opens by a roundiſh ſmall hole, at the inner

(*m*) Ingraff. Comment. in Galen. de oſſib. cap. 1. comment. 8.

(*n*) Ruyſch. Obſerv. Anat.-chir. obſerv. 54.—Diemerbroek, Anat. lib. 3. cap. 10.—Bonet. Sepulch. Anat. lib. 4. § 3. obſerv. 17.

(*o*) Fallop. Expoſit. de oſſib. cap. 13.

inner and lower part of the internal angular proceſſes, into a ſinus formed in the noſe, at the upper and back part of the os unguis; near to which there are alſo ſome other ſmall ſinuſes of this bone (*p*), the greater part of which open ſeparately near the ſeptum narium, and often terminate in the ſame common canal with the large ones.

In a natural and ſound ſtate, theſe cavities are of conſiderable advantage: for the organ of ſmelling being thus enlarged, the effluvia of odorous bodies more difficultly eſcape it; and their impreſſions being more numerous, are therefore ſtronger, and affect the organ more. That odorous particles may be applied to the membrane of the ſinuſes, is evident from the pain felt in this part of the forehead, when the effluvia of volative ſpirits, or of ſtrong aromatics, are drawn up into the noſe by a quick inſpiration.—Theſe, and the other cavities which open into the noſe, increaſe the ſound of our voice, and render it more melodious, by ſerving as ſo many vaults to reſound the notes. Hence people labouring under a coryza, or ſtoppage of the noſe from any other cauſe, when they are by the vulgar, though falſely, ſaid to ſpeak through the noſe, have ſuch a diſagreeable harſh voice.—The liquor ſeparated in the membrane of theſe ſinuſes runs down upon the membrane of the noſe to keep it moiſt.

From the deſcription of theſe ſinuſes, it is evident, how uſeleſs, nay, how pernicious, it muſt be to apply a trepan on this part of the ſkull: for this inſtrument, inſtead of piercing into the cavity of the cranium, would reach no further than the ſinuſes; or, if the inner table was perforated, any extravaſated blood that happened to be within the ſkull, would not be diſcharged outwardly, but would fall into the ſinuſes, and there ſtagnate, corrupt, and ſtimulate

(*p*) Cowper in Drake's Anthrolopog. book 3. chap. 10.

ſtimulate the ſenſible membranes; from which alſo there would be ſuch a conſtant flow of glairy mucus, as would retard, if not hinder a cure, and would make the ſore degenerate into an incurable fiſtula. Beſides, as it would be almoſt impoſſible in this caſe to prevent the air, paſſing through the noſe, from having conſtant acceſs to the dura mater or brain; ſuch a corruption would be brought on theſe parts as would be attended with great danger. Farther, in reſpiration, the air ruſhing violently into theſe cavities of the os frontis, and paſſing through the external orifice, whenever it was not well covered and defended, would not only prevent the cloſing up of the external orifice, but might otherwiſe bring on bad conſequences (*q*).—The membrane lining theſe ſinuſes is ſo ſenſible, that inflammations of it muſt create violent torture (*r*); and worms, or other inſects crawling there, muſt give great uneaſineſs (*s*).

The upper circular part of the os frontis is joined to the oſſa parietalia, from one temple to the other, by the coronal ſuture. From the termination of the coronal ſuture to the external angular proceſſes, this bone is connected to the ſphenoid by the ſphenoidal ſuture. At the external canthi of the eyes, its angular proceſſes are joined by the tranſverſe ſuture to the oſſa malarum, to which it adheres one-third down the outſide of the orbits; whence to the bottom of theſe cavities, and a little upon their internal ſides, theſe orbitar proceſſes are connected to the ſphenoidal bone by that ſame ſuture.——In ſome few ſkulls, however, a diſcontinuation of theſe two bones appears at the upper part of the long ſlit, near the bottom of the orbit. —On the inſide of each orbit, the orbitar proceſs is indented

(*q*) Paaw de oſſibus, pars 1. cap. 7.——Palfyne Anatom. chir. traite 4. chap. 15. Nouvelle Oſteologie, partie 2. chap. 3.

(*r*) Fernel Pathalog. lib. 5. cap. 7.——Saltzman Decur. obſerv. 10.

(*s*) Fernel Patholog. lib. 5. cap. 7.——Bartholin. Epiſtol. Medic. cent. 2. epiſt. 74.—Hiſt. de l'acad. des ſciences, 1708 & 1733.

dented between the cribriform part of the ethmoid bone and the os planum and unguis.—The tranſverſe ſuture afterwards joins the frontal bone to the ſuperior naſal proceſſes of the oſſa maxillaria ſuperiora, and to the naſal bones. And, laſtly, its naſal proceſs is connected to the naſal lamella of the ethmoid bone.

The frontal bone ſerves to defend and ſupport the anterior lobes of the brain. It forms a conſiderable part of the cavities that contain the globes of the eyes, helps to make up the ſeptum narium, organ of ſmelling, &c. From the deſcription of the ſeveral parts, the other uſes of this bone are evident.

In a ripe child, the frontal bone is divided through the middle; the ſuperciliary holes are not formed; often a ſmall round piece of each orbitar proceſs, behind the ſuperciliary ridge, is not oſſified; and there is no ſinus to be ſeen within its ſubſtance.

OSSA PARIETALIA.

Each of the two Oſſa Parietalia (*t*), or bones ſerving as walls to the encephalon, is an irregular ſquare; its upper and fore ſides being longer than the one behind or below. The inferior ſide is a concave arch; the middle part receiving the upper round part of the temporal bone.——The angle formed by this upper ſide and the fore one, is ſo extended, as to have the appearance of a proceſs.

The external ſurface of each os parietale is convex. Upon it, ſomewhat below the middle height of the bone, there is a tranſverſe arched ridge, generally of a whiter colour than any other part of the bone; from which in bones that have ſtrong prints of muſcles, we ſee a great many converging furrows, like ſo many radii drawn from a circumference

(*t*) Κορυφης, Paria ſyncipitis, verticis, arcualia, nervalia, cogitationis, rationis, bregmatis, madefactiones.

rence towards a centre. From this ridge of each bone the temporal mufcle rifes: and, by the preffure of its fibres, occafions the furrows juft now mentioned.—Below thefe we obferve, near the femicircular edges, a great many rifings and depreffions, which are joined to like inequalities on the infide of the temporal bone, and form the fquamous future. The temporal bone may therefore ferve here as a buttrefs, to prevent the lower fide of the parietal from ftarting outwards when its upper part is preffed or ftruck (*u*).

Near the upper fides of thefe bones, towards the hind part, is a fmall hole in each, through which a vein paffes from the teguments of the head to the longitudinal finus. Sometimes I have feen a branch of the temporal artery pafs through this hole, to be diftributed to the upper part of the falx, and to the dura mater at its fides, where it had frequent anaftomofes with the branches of the arteries derived from the external carotids, which commonly have the name of the arteries of the dura mater, and with the branches of the internal carotids which go to the falx.——In feveral fkulls, one of the offa parietalia has not this hole: In others, there are two in one bone; and in fome, not one in either. Moft frequently this hole is through both tables; at other times the external table only is perforated. ——The knowledge of the courfe of thefe veffels may be of ufe to furgeons when they make any incifion near this part of the head; left, if the veffels are rafhly cut near the hole, they fhrink within the fubftance of the bone, and fo caufe an obftinate hæmorrhagy, which neither ligatures nor medicines can ftop.

On the inner concave furface of the parietal bones, we fee a great many deep furrows, difpofed fomewhat like the branches of trees: the furrows are largeft and deepeft at the

(*u*) Hunauld. in Mem. de l'acad. des fciences, 1730.

the lower edge of each os parietale, eſpecially near its anterior angle, where a complete canal is ſometimes formed. They afterwards divide into ſmall furrows, in their progreſs upwards.—In ſome ſkulls a large furrow begins at the hole near the uper edge, and divides into branches, which join with thoſe that come upwards; ſhewing the communications of the upper and lower veſſels of the dura mater.—In theſe furrows we frequently ſee paſſages into the diploë; and ſometimes I have obſerved canals going off, which allowed a ſmall probe to paſs a few inches into the bony ſubſtance. Some (*x*) authors tell us, that they have obſerved theſe canals piercing the bone towards the occiput.—On the inſide of the upper edge of the oſſa parietalia, there is a large ſinuoſity, frequently larger in the bone of one ſide than of the other, where the upper part of the falx is faſtened, and the ſuperior longitudinal ſinus is lodged.—Part of the lateral ſinuſes generally makes a depreſſion near the angle, formed by the lower and poſterior ſides of theſe bones; and the pits made by the prominent parts of the brain are to be ſeen in no part of the ſkull more frequent or more conſiderable, than in the internal ſurface of theſe bones.

The oſſa parietalia are the moſt equal and ſmooth, and are among the thinneſt bones of the cranium; but they enjoy the general ſtructures of two tables and diploë the completeſt.

Theſe bones are *joined* at their fore-ſide to the os frontis by the coronal ſuture; at their long inferior angles, to the ſphenoid bone, by part of the ſuture of this name; at their lower edge, to the oſſa temporum, by the ſquamous ſuture, and its poſterior additamentum; behind, to the os occipitis, or oſſa triquetra, by the lambdoid ſuture; and above, to one another, by the ſagittal ſuture.

They

(*x*) Cowper. Anatom. explic. of tab. 90. fig. 2.

They have no particular *ufes* befides thofe mentioned in the defcription of their feveral parts, except what are included in the account of the general ftructure of the cranium.

In a child born at the full time, none of the fides of this bone are completed; and there never is a hole in the offified part of it near the fagittal future.

The large unoffified ligamentous part of the cranium, obfervable between the parietal bones and the middle of the divided os frontis of new-born children, called by the vulgar the *open of the head*, was imagined by the ancients to ferve for the evacuation of the fuperfluous moifture of the brain: and therefore they named it *bregma* (*y*), or the fountain; fometimes adding the epithet *pulfatilis*, or beating, on account of the pulfation of the brain felt through this flexible ligamento-cartilaginous fubftance. Hence the parietal bones are very frequently called *offa bregmatis*.

The upper middle part of the head of a child, in a natural birth, being what prefents itfelf firft at the os uteri (*z*), an accoucheur may reach the bregma with his finger, when the os uteri is a little opened. If the bregma is ftretched, and the pulfation of the brain is felt through it, the child is certainly alive: but if it is fhrivelled and flaccid, and without any obfervable pulfation in it, there is fome reafon to fufpect the child to be very weak, or dead. Thofe who practife midwifery fhould therefore examine the ftate of the bregma accurately.

All the bregma is generally offified before feven years of age. Several authors (*a*) fay, they have obferved it unoffified in adults; and phyficians, who order the application of medicines at the meeting of the coronal and fagittal futures, feems yet

(*y*) Pulpitans vertex, foliolum, folium, triangularis lacuna.

(z) Burton's Midwifery, § 51.—Smellie's Midwifery, book I. chap. I. § 5.

(*a*) Bartholin. Anat. reform. lib. 4. cap. 6.—Diemerboeck, Anat. lib. 9. cap. 6.—Kerkring Ofteogen. cap. 2.

yet to think that a derivation of noxious humours from the encephalon is more eaſily procured at this, than at any other part of the ſkull, and that medicines have a greater effect here than elſewere in the internal diſorders of the head.

OSSA TEMPORUM.

Ossa Temporum (*b*), ſo named, ſay authors, from the hair's firſt becoming grey on the temples, and thus diſcovering peoples ages, are each of them equal and ſmooth above, with a very thin ſemicircular edge; which, from the manner of its connection with the neighbouring bones, is diſtinguiſhed by the name of *os ſquamoſum.*——Behind this, the upper part of the temporal bone is thicker, and more unequal; and is ſometimes deſcribed as a diſtinct part, under the name of *pars mamillaris* (*c*).——Towards the baſe of the ſkull, the temporal bone appears very irregular and unequal; and this part, inſtead of being broad, and placed perpendicularly, as the others are, is contracted into an oblong very hard ſubſtance, extended horizontally forwards and inwards, which in its progreſs becomes ſmaller, and is commonly called *os petroſum.*

Three external proceſſes of each temporal bone are generally deſcribed.—The firſt, placed at the lower and hind part of the bone, from its reſemblance to a nipple, is called *maſtoides* or *mamillaris.* It is not ſolid; but within is compoſed of cancelli, or ſmall cells, which have a communication with the large cavity of the ear, the drum; and therefore ſounds, being multiplied in this vaulted labyrinth, are increaſed before they are applied to the immediate organ

(*b*) Κροταφων, κορσων, κορρων, λεπιδοειδη, πολυειδη, λιθοειδη, Temporalia, lapidoſa, mendoſa, dura, arcualia, tympanum, armalia, ſaxea, parietalia.

(*c*) Albin. de oſſib. ſect. 26.

gan of hearing. Into the maſtoid proceſs the ſterno maſtoideus muſcle is inſerted; and to its back part, where the ſurface is rough, the trachelo-maſtoideus and part of the ſplenius are fixed. About an inch farther forward, the ſecond proceſs begins to riſe out from the bone; and having its origin continued obliquely downwards and forwards for ſome way, it becomes ſmaller, and is ſtretched forwards to join with the os malae; they together forming the bony jugum, under which the temporal muſcle paſſes. Hence this proceſs has been named *zygomatic* (*d*). Its upper edge has the ſtrong aponeuroſis of the temporal muſcle fixed into it; and its lower part gives riſe to a ſhare of the maſſeter.—The fore-part of the baſe of this proceſs is an oblong tubercle, which, in a recent ſubject, is covered with a ſmooth poliſhed cartilage, continued from that which lines the cavity immediately behind this tubercle.——From under the craggy part of the os temporum, the third proceſs ſtands out obliquely forwards. The ſhape of it is generally ſaid to reſemble the ancient *ſtylus ſcriptorius*; and therefore it is called the *ſtyloid proceſs* (*e*) Some authors (*f*) however contend, that it ought to be named *ſteloid*, from its being more like a pillar. Several muſcles have their origin from this proceſs, and borrow one half of their name from it; as *ſtylo-gloſſus*, *ſtylo-hyoides*, *ſtylo-pharyngeus*: a ligament of the os hyoides is ſometimes fixed to it; and another is extended from it to the inſide of the angle of the lower jaw. This proceſs is often, even in adults, not entirely oſſified, but is ligamentous at its root, and is ſometimes compoſed of two or three diſtinct pieces.——Round the root of it, eſpecially at the forepart, there

(*d*) Paris, anſae oſſium temporum, oſſa arcualia, paria, jugalia, conjugalia.

(*e*) Γραιφοειδη, βελονοειδη, πληκτρον, Os calaminum, ſagittale, clavale, acuale calcar capitis.

(*f*) Galen, de uſu part. lib. 2. cap. 4.—Fallop. Obſerv. anat.

there is a riſing of the os petroſum, which ſome authors have eſteemed a proceſs: and, from the appearance it makes with the ſtyliform, have named it *vaginalis*.—Others again have, under the name of *auditory* proceſs, reckoned among the external proceſſes, that ſemicircular ridge, which running between the root of the maſtoid and zygomatic proceſſes, forms the under part of the external *meatus auditorius*.

The *ſinuoſities* or depreſſions on the external ſurface of each temporal bone are theſe:——A long foſſa at the inner and back part of the root of the mammary proceſs, where the poſterior head of the digaſtric muſcle has its origin.——Immediately before the root of the zygomatic proceſs, a conſiderable hollow is left for lodging the crotaphite muſcle.——Between the zygomatic, auditory, and vaginal proceſſes, a large cavity is formed; through the middle of which, from top to bottom, a fiſſure is obſervable, into which part of the ligament that ſecures the articulation of the lower jaw with this bone is fixed. The fore-part of the cavity being lined with the ſame cartilage which covers the tubercle before it, receives the condyle of the jaw; and in the back-part a ſmall ſhare of the parotid gland, and a cellular fatty ſubſtance, are lodged.—At the inſide of the root of the ſtyloid apophyſe, there is a thimble-like cavity, where the beginning of the internal jugular vein, or end of the lateral ſinus is lodged.—And as the ſinuſes of the two ſides are frequently of unequal ſize, ſo one of theſe cavities is as often larger than the other (g).——Round the external meatus auditorius, ſeveral ſinuoſities are formed for receiving the cartilages and ligaments of the ear, and for their firm adheſion.

The *holes* that commonly appear on the outſide of each of theſe bones, and are proper to each of them, are five. ——The

(g) Hunauld. in Mem. de l'acad. des ſciences, 1730.

——The firſt, ſituated between the zygomatic and maſtoid proceſſes, is the orifice of a large funnel-like canal, which leads to the organ of hearing; and is therefore called *meatus auditorius externus* (*h*).—The ſecond gives paſſage to the portio dura of the ſeventh pair of nerves; and from its ſituation between the maſtoid and ſtyloid proceſſes, is called *foramen ſtylo-maſtoideum* (*i*).—Some way before, and to the inſide of the ſtyloid proceſs, is the third hole: the canal from which runs firſt upwards, then forwards, and receives into it the internal carotid artery, and the beginning of the intercoſtal nerve; where this canal is about to make the turn forwards, one, or ſometimes two, very ſmall holes go off towards the cavity of the ear, called *tympanum*: Through theſe Valſalva (*k*) affirms the proper artery or arteries of that cavity are ſent.—On the anterior edge of this bone, near the former, a fourth hole is obſervable, being the orifice of a canal which runs outwards and backwards, in a horizontal direction, till it terminates in the tympanum. This, in the recent ſubject, is continued forward and inward, from the parts which I mentioned juſt now as its orifice in the ſkeleton, to the ſide of the noſtrils; being partly cartilaginous, and partly ligamentous. The whole canal is named *Iter a palato ad aurem*, or *Euſtachian tube*.——On the external ſide of the bony part of this canal, and on the top of the chink, in the cavity that receives the condyle of the lower jaw, is the courſe of the little nerve, called *chorda tympani*, and commonly ſaid to be reflected from the lingual branch of the fifth pair, till it enters the tympanum, to run acroſs this cavity.——The fifth hole is very uncertain, appearing ſometimes behind the maſtoid proceſs; ſometimes it is common to the temporal and occipital

(*h*) Πορης της ακοης, οπη των ωτων, feneſtra aurium.

(*i*) Aquaeductus Fallopii.

(*k*) De aure humana, cap. 2. § 22. et tab. 7. fig. 1.

occipital bones; and in feveral fkulls there is no fuch hole. The ufe of it, when found, is for the tranfmiffion of a vein from the external teguments to the lateral finus: But, in fome fubjects, a branch of the occipital artery paffes through this hole, to ferve the back-part of the dura mater; in others, I have feen two or three fuch holes: but they are oftener wanting than found. And we may once for all, in general remark, that the largenefs, number, fituation, and exiftence of all fuch holes as for the moft part allow only a paffage for veins from without to the internal receptacles, are very uncertain.

The internal furface of the offa temporum is unequal; the upper circular edge of the fquamous part having numerous fmall ridges and furrows for its conjunction with the parietal bones; and the reft of it is irregularly marked with the convolutions of the middle part of the brain, and with furrows made by the branches of the arteries of the dura mater.

From the under part of this internal furface, a larger tranfverfe hard craggy protuberance runs horizontally inwards and forwards, with a fharp edge above, and two flat fides, one facing obliquely forwards and outwards, and the other as much backwards and inwards. To the ridge between thefe two fides, the large lateral procefs of the dura mater is fixed.

Sometimes a fmall bone, like the fefamoid, is found between the fmall end of this petrous procefs and the fphenoid bone (*l*).

Towards the back-part of the infide of the temporal bone, a large deep foffa is confpicuous, where the lateral finus lies; and frequently on the top of the petrous ridge, a furrow may be obferved, where a fmall finus is fituated.

The

(*l*) Riolan. Comment. de offib. cap. 32.——Winflow, Expofition anatomique de corps humain. trait. des os fecs, § 266.

The internal proper *foramina* of each of thefe bones are, firft, the internal meatus auditorius in the pofterior plain fide of the petrous procefs. This hole foon divides into two; one of which is the beginning of the aqueduct of Fallopius; the other ends in feveral very fmall canals (*m*) that allow a paffage to the branches of the portio mollis of the feventh pair of nerves, into the veftibule and cochlea. Through it alfo an artery is fent, to be diftributed to the organ of hearing.—The fecond hole, which is on the anterior plain fide of the craggy procefs, gives paffage to a reflected branch of the fecond branch of the fifth pair of nerves, which joins the portio dura of the auditory nerve, while it is in the aqueduct (*n*), fmall branches of blood-veffels accompanying the nerves, or paffing through fmaller holes near it.—The paffage of the cutaneous vein into the lateral finus, or of a branch of the occipital artery, is feen about the middle of the large foffa for that finus; and the orifice of the canal of the carotid artery is evident at the under part of the point of the petrous procefs.

Befides thefe proper holes of the temporal bones, which appear on their external and internal furfaces, there are two others in each fide that are common to this bone, and to the occipital and fphenoidal bones; which fhall be mentioned afterwards in the defcription of thefe bones.

The upper round part of the fquamous bones is thin, but equal; while the low petrous part is thick and ftrong, but irregular and unequal, having the diftinction of tables and diploë confounded, with feveral cavities, proceffes, and bones within its fubftance, which are parts of the organ of hearing. That a clear idea may be had of this beautiful, but intricate organ, anatomifts generally choofe to demonftrate all its parts together. I think the method good; and

 therefore,

(*m*) Valfalva de aure humana, cap. 3. § 11.

(*n*) Ibid. cap. 3. § 10.

therefore, ſince it would be improper to inſert a complete treatiſe on the ear here, I ſhall omit the deſcription of the parts contained within the os petroſum of the ſkeleton.

The temporal bones are joined above to the parietal bones by the ſquamous ſutures and their poſterior additamenta: Before, to the ſphenoid bone, by the ſuture of that name; to the cheek bones, by the zygomatic ſutures: Behind, to the occipital bone by the lambdoid ſuture and its additaments; and they are articulated with the lower jaw in the manner which ſhall be deſcribed when this bone is examined.

The *purpoſes* which theſe two bones ſerve, are eaſily collected, from the general uſe of the cranium, and from what has been ſaid in the deſcription of their ſeveral parts.

In an infant, a ſmall fiſſure is to be obſerved between the thin upper part and the lower craggy part of each of theſe bones; which points out the recent union of theſe parts.——Neither maſtoid nor ſtyloid proceſſes are yet to be ſeen.——Inſtead of a bony funnel-like external meatus auditorius, there is only a ſmooth bony ring, within which the membrane of the drum is faſtened.——At the entry of the Euſtachian tube, the ſide of the tympanum is not completed. ——A little more outward than the internal auditory canal, there is a deep pit, over the upper part of whoſe orifice the interior ſemicircular canal of the ear is ſtretched, and ſome way below this, the poſterior ſemicircular canal alſo manifeſtly appears.

OS OCCIPITIS.

Os OCCIPITIS (*o*), ſo called from its ſituation, is convex on the outſide, and concave internally. Its figure is an irregular ſquare, or rather rhomboid; of which the angle above

(*o*) *Inev*, Baſilare, prorae, memoriae, pyxidis, fibroſum, nervoſum, lambda.

above is generally a little rounded; the two lateral angles are more finifhed, but obtufe; and the lower one is ftretched forward in form of a wedge, and thence is called by fome the *cuneiform* procefs.—If one would, however, be very nice in obferving the feveral turns which the edges of the os occipitis make, five or feven fides, and as many angles of this bone, might be defcribed.

The external furface is convex, except at the cuneiform apophyfe, where it is flatted. At the bafe of this triangular procefs, on each fide of the great hole, but more advanced forwards than the middle of it, the large oblong protuberances named the *condyles*, appear, to ferve for the articulation of this bone with the firft vertebra of the neck. The fmooth furface of each of thefe condyloid proceffes is longeft from behind forwards, where, by their oblique fituation, they come much nearer to each other than they are at their back-part. Their inner fides are lower than the external, by which they are prevented from fliding to either fide out of the cavities of the firft vertebra (*p*). In fome fubjects, each of thefe plain fmooth furfaces feems to be divided by a fmall rifing in its middle; and the lower edge of each condyle, next the great foramen, is difcontinued about the middle, by an intervening notch: Whence fome (*q*) allege, that each of thefe apophyfes is made up of two protuberances. Round their root a fmall depreffion and fpongy roughnefs is obfervable, where the ligaments for furrounding and fecuring their articulations adhere.—Though the motion of the head is performed on the condyles, yet the centre of gravity of that globe does not fall between them, but is a good way farther forward; from which mechanifm it is evident, that the mufcles which pull the head back muft be in a conftant ftate of contraction;

(*p*) Galen. de ufu part. lib. 12. cap. 7.

(*q*) Diemerbroek, Anat. lib. 9. cap. 6.

contraction; which is ſtronger than the natural contraction of the proper flexors, elſe the head would always fall forwards, as it does when a man is aſleep, or labours under a palſy, as well as in infants, where the weight of the head far exceeds the proportional ſtrength of theſe muſcles. This ſeeming diſadvantageous ſituation of the condyles is, however, of ſingular uſe, by allowing ſufficient ſpace for the cavities of the mouth and fauces, and for lodging a ſufficient number of muſcles, which commonly ſerve for other uſes; but may at pleaſure be directed to act on the head, and then they have an advantageous lever to act with, ſo as to be able to ſuſtain a conſiderable weight, or other force applied, to pull the head back.

Somewhat more externally than the condyles, there is a ſmall riſing and ſemilunated hollow in each ſide, which make part of the holes common to the occipital and petrous bones.——Immediately behind this, on each ſide, a ſcabrous ridge is extended from the middle of the condyle towards the root of the maſtoid proceſs. Into this ridge the muſculus lateralis, commonly aſcribed to Fallopius, is inſerted.——About the middle of the external convex ſurface, a large arch runs croſs the bone; from the upper lateral parts of which the occipital muſcles have their riſe; to its middle the trapezii are attached; and half-way between this and the great hole, a leſſer arch is extended.—— In the hollows between the middle of theſe arches the complexi are inſerted; and in the depreſſions more external and further forward than theſe, the ſplenii are inſerted.—— Between the middle of the leſſer arch and the great hole, the little hollow marks of the recti minores appear; and on each ſide of theſe the fleſhy inſertions of the obliqui ſuperiores and recti majores make depreſſions.——Through the middle of the two arches a ſmall ſharp ſpine is placed, which ſerves as a kind of partition between the muſcles of different fides, or rather is owing to the action of the mufcles depreffing the bone on each fide of it, while this part is free from their compreffion. Thefe prints of the mufcles of this bone are very ftrong and plain in fome fubjects, but are not fo diftinct in others. All round the great foramen, the edges are unequal, for the firmer adhefion of the ftrong circular ligament which goes thence to the firft vertebra. One end of each lateral or moderator ligament of the head, is fixed to a rough furface at the fore-part of each condyle, and the perpendicular one is connected to a rough part of the edge of the great hole between the two condyles. Immediately before the condyles, two little depreffions are made in the external furface of the cuneiform procefs, for the infertion of the recti anteriores minores mufcles, which are unjuftly afcribed to Cowper: And ftill farther forward, near the fphenoid bone, are two other fuch depreffions, for the reception of the recti anteriores majores. When we confider the fize of the prints of mufcles on the occipital bone, before and behind its condyles, and at the fame time compare their diftances from thefe centres of motion of the head, we muft fee how much ftronger the mufcles are which pull the head backwards, than thofe which bend it forward; and how much greater force the former acquire by the long lever they act with, than the latter which are inferted fo near the condyles. This great force in the extenfor mufcles is altogether neceffary, that they might not only keep the head from falling forward in an erect pofture, but that they might fupport it when we bow forward in the moft neceffary offices of focial life, when the weight of the head comes to act at right angles on the vertebra of the neck, and obtains a long lever to act with.

On the inner furface of the os occipitis we fee two *ridges*; one ftanding perpendicularly, the other running horizontally acrofs acroſs the firſt. The upper part of the perpendicular limb of the croſs, to which the falx is fixed, is hollowed in the middle, or often on one ſide, for the reception of the ſuperior longitudinal ſinus; and the lower part of it has the ſmall or third proceſs of the dura mater faſtened to it, and is ſometimes hollowed by the occipital ſinus. Each ſide of the horizontal limb is made hollow by the lateral ſinuſes incloſed in the tranſverſe proceſs of the dura mater; the foſſa in the right ſide being generally a continuation of the one made by the longitudinal ſinus in the perpendicular limb, and therefore is larger than the left one (*r*).—Round the middle of the croſs there are four large depreſſions, ſeparated by its limbs; the two upper ones being formed by the back part of the brain, and the two lower ones by the cerebellum.—Farther forward than the laſt mentioned depreſſions, is the lower part of the foſſa for the lateral ſinus on each ſide.—The inner ſurface of the cuneiform apophyſe is made concave for the reception of the medulla oblongata, and of the baſilar artery.—A furrow is made on each ſide, near the edges of this proceſs, by a ſinus of the dura mater, which empties itſelf into the lateral ſinus (*s*).

The *holes* of this bone are commonly five proper, and two common to it and to the temporal bones.——The firſt of the proper holes, called *foramen magnum* (*t*) from its ſize, is immediately behind the wedge-like proceſs; and allows a paſſage to the medulla oblongata, nervi acceſſorii, to the vertebral arteries, and ſometimes to the vertebral veins.—At each ſide of this great hole, near its fore part, and immediately above the condyles, we always find a hole, ſometimes two, which ſoon unite again into one, that opens externally; through

(*r*) Morgagn. Adverſ. anat. 6. animad. 1.

(*s*) Albin. de oſſib. ſect. 65.

(*t*) Rachitidis, Medullæ ſpinalis.

through theſe the ninth pair of nerves go out of the ſkull. —The fourth and fifth holes pierce from behind the condyle of each ſide into the foſſæ of the lateral ſinuſes; they ſerve for the paſſage of the cervical veins to theſe ſinuſes. Often one of theſe holes is wanting, ſometimes both, when the veins paſs through the great foramen.—Beſides theſe five, we frequently meet with other holes near the edges of this bone, for the tranſmiſſion of veins; but their number and diameter are very uncertain. The two common foramina are the large irregular holes, one in each ſide, between the ſides of the cuneiform proceſs and the edges of the petrous bones. In a recent ſubject, a ſtrong membrane runs croſs from one ſide to the other of each of theſe holes: In ſome heads I have ſeen this membrane oſſified, or a bony partition dividing each hole: And in the greater number of adult ſkulls, a ſmall ſharp-pointed proceſs ſtands out from the os petroſum, and there is a more obtruſe riſing in the occipital bone, between which the partition is ſtretched. Behind this partition, where the largeſt ſpace is left, the lateral ſinus has its paſſage; and before it the eighth pair of nerves and acceſſorius make their exit out of the ſkull; and ſome authors ſay, an artery paſſes through this hole to be beſtowed on the dura mater.

The *occipital* bone is among the thickeſt of the cranium, though unequally ſo; for it is ſtronger above, where it has no other defence than the common teguments, than it is below; for being there preſſed by the lobes of the brain and cerebellum on one ſide, and by the action of the muſcles on the other, it is ſo very thin as to be diaphanous in many ſkulls: But then theſe muſcles ward of injuries; and the ridges and ſpines, which are frequent here, make it ſufficiently ſtrong to reſiſt ordinary forces.

The tables and diploë are tolerably diſtinct in this bone, except where it is ſo thin as to become diaphanous.

The

The occipital bone is *joined* above to the offa parietalia, and to the triquetra, when prefent, by the lambdoid future; —laterally to the temporal bones, by the additamenta of the lambdoid future—below to the fphenoid bone, by the end of its cuneiform procefs, in the fame way that epiphyfes and their bones are joined: For in children a ligamentous cartilage is interpofed between the occipital and fphenoid bones, which gradually turns thinner as each of the bones advances, till their fibres at laft run into each other; and, about fixteen or eighteen years of age, the union of thefe two bones becomes fo intimate, that a feparation cannot be made without violence.—The os occipitis is joined by a double articulation to the firft vertebra of the neck, each condyle being received into a fuperior oblique procefs of that vertebra. What motion is allowed here we fhall confider afterwards, where the vertebrae are defcribed.

The *ufes* of this bone appear from the preceding defcription, and therefore need not be repeated.

An infant, born at the full time, has this bone divided, by unoffified cartilages, into four parts.—The firft of thefe is larger than the other three, is of a triangular fhape, and conftitutes all the part of the bone above the great foramen. Fiffures generally appear in the upper part and fides of this triangular bone, when all the cartilage is feparated by maceration; and fometimes little diftinct bones are feen towards the edges of it.—The fecond and third pieces of this bone are exactly alike, and fituated on each fide of the great foramen, from which the whole condyles are nearly produced; and they are extended forwards almoft to the fore part of the hole for the ninth pair of nerves.—The fourth piece is the cuneiform procefs, which forms a fmall fhare of the great hole, and of thofe for the ninth pair of nerves and of the condyles; betwixt it and the fphenoid bone, a cartilage is interpofed.

Of

Of the eight bones which belong to the cranium, there are only two which are not yet defcribed, viz. the *ethmoid* and *fphenoid*. Thefe we already mentioned, in complaifance to the generality of writers on this fubject, as bones common to the cranium and face, becaufe they enter into the compofition of both; but the fame reafon might equally be ufed for calling the frontal bone a common one too. I fhall, however, pafs any idle difpute about the propriety of ranging them, and proceed to examine the ftructure of the bones themfelves.

OS ETHMOIDES.

Os Ethmoides (*u*), or the *fieve-like* bone, has got its name from the great number of fmall holes with which that part of it firft taken notice of is pierced. When this bone is entire, the figure of it is not eafily defcribed; but by a detail of its feveral parts, fome idea may be afforded of the whole; and therefore I fhall diftinguifh it into the *cribriform lamella* with its procefs, the *nafal lamella*, *cellulæ*, and *offa fpongiofa*.

The thin horizontal lamella is all (except its back-part) pierced obliquely by a great number of fmall holes, through which the filaments of the olfactory nerves pafs. In a recent fubject, thefe holes are fo clofely lined by the dura mater, that they are much lefs confpicuous than in the fkeleton. From the middle of the internal fide of this plate, a thick procefs rifes upwards; and being higheft at the forepart, gradually becomes lower as it is extended backwards. From fome refemblance which this procefs was imagined to

 have

(*u*) Cribriforme, σπογγοειδης, fpongiforme, criftatum.

have to a cock's comb, it has been called *criſta galli* (x). The falx is connected to its ridge, and to the unperforated part of the cribriform plate. When the criſta is broke, its baſe is ſometimes found to be hollow, with its cavity opening into the noſe (y). Immediately before the higheſt part of this proceſs, is the blind hole of the frontal bone, which, as was formerly remarked, is often in a good meaſure formed by a notch in the fore-part of the root of the criſta.

From the middle of the outer ſurface of the cribriform lamella, a thin ſolid plate is extended downwards and forwards, having the ſame common baſe with the criſta galli. Generally it is not exactly perpendicular, but is inclined to one ſide or other, and therefore divides the cavity of the noſe unequally. Its inclination to one ſide, and flexure in the middle, is ſometimes ſo great, that it fills up a large ſhare of one of the noſtrils, and has been miſtaken for a polypus there. It is thin at its riſe, and rather ſtill thinner in its middle; yet afterwards, towards its lower edge, it becomes thicker, that its conjunction with the bones and middle cartilage of the noſe might be firmer.

At a little diſtance from each ſide of this external proceſs, a cellular and ſpongy bony ſubſtance depends from the cribriform plate. The number and figure of the cells in this irregular proceſs of each ſide, are very uncertain, and not to be repreſented in words; only the cells open into each other, and into the cavity of the noſe: The uppermoſt, which are below the aperture of the frontal ſinuſes, are formed like funnels. The outer ſurface of theſe cells is ſmooth and plain, where this bone aſſiſts in compoſing the orbit; at which place, on each ſide, it has got the name of os planum; on the upper edge of which a ſmall notch or two may ſometimes be obſerved, which go to the formation of the internal

(x) Verruca præduta, ſeptum oſſis ſpongioſi.

(y) Palfyn. Anat. chir. tr. 4. ch. 15.

ternal orbitar holes; as was remarked in the defcription of the frontal bones.

Below the cells of each fide, a thin plate is extended inwards; and then bending down, it becomes thick and of a fpongy texture. This fpongy part is triangular, with a ftraight upper edge placed horizontally, an anterior one flanting from above, downwards and forwards, and with a pendulous convex one below. The upper and lower edges terminate in a fharp point behind. The fide of this pendulous fpongy part next to the feptum narium is convex, and its external fide is concave. Thefe two proceffes of the ethmoid bone have got the name of *offa fpongiofa*, or *turbinata fuperiora*, from their fubftance, figure, and fituation.

All the prominences, cavities, and meanders of this ethmoid bone, are covered with a continuation of the membrane of the noftrils in a recent fubject. Its horizontal cribriform is lodged between the orbitar proceffes of the frontal bone, to which it is joined by the ethmoid future, except at the back part, where it is connected with the cuneiform bone by a future common to both thefe bones, though it is generally efteemed part of the fphenoidal ——Where the offa plana are contiguous to the frontal bone within the orbit, their conjunction is reckoned part of the tranfverfe future.——Farther forward than the offa plana, the cells are covered by the offa unguis: which are not only contiuous to thefe cells, but cannot be feparated from them without breaking the bony fubftance; and therefore, in propriety, thofe bones ought to be demonftrated as part of the ethmoid bone.——Below the offa unguis and plana, thefe cells and offa fpongiofa are overlapped by the maxillary bones. The cellular part of each palate bone is contiguous to each os planum, and to the cells backwards. The lower edge of the nafal perpendicular plate is received into the furrow of the

vomer.

vomer —Its poſterior edge is joined to the fore part of the proceſſus azygos of the ſphenoid bone. Its upper edge joins the naſal proceſs of the frontal and naſal bones; and its anterior one is connected to the middle cartilage of the noſe.

From all which, the *uſes* of this bone are evident, viz. to ſuſtain the anterior lobes of the brain; to give paſſage to the olfactory nerves, and attachment to the falx; to enlarge the organ of ſmelling, by allowing the membrane of the noſe a great extent; to ſtraighten the paſſage of the air through the noſe, by leaving only a narrow winding canal, on the ſenſible membranous ſides of which the ſubſtances conveyed along with the air muſt ſtrike; to form part of the orbit of the eyes and ſeptum narium; while all its parts are ſo light as not to be in hazard of ſeparating by their weight; and they are ſo thin as to form a large ſurface, without occupying much ſpace. This brittle ſubſtance, however, is ſufficiently protected from external injuries by the firm bones which cover it.

If this bone is ſeized on by any corroding matter, we may eaſily conceive what deſtruction may enſue. Hence it is, that an ozæna is difficult to cure; and that in violent ſcurvies, or in the lues venerea, the fabric of the noſe, the eyes, and life itſelf are in danger. The ſituation of the naſal plate may ſhow us how dangerous a fracture of the bones of the noſe may be, when made by a force applied to their middle fore-part, of a perſon in whom this naſal plate is perpendicular.

The ethmoid bone of ripe children is divided into two by a perpendicular cartilage, which, when oſſified, is the criſta galli and naſal plate; but its other parts are oſſified and complete.

OS SPHENOIDES.

Os SPHENOIDES (z), or *wedge-like* bone, ſo called becauſe of its ſituation in the middle of the bones of the cranium and face, is of ſuch an irregular figure, that I know not any thing to which it may be compared, unleſs, perhaps, it bear ſome faint reſemblance to a bat with its wings extended.

When we view the external ſurface of the os ſphenoides, two or three remarkable proceſſes from each ſide of it may be obſerved, which are all of them again ſubdivided.—— The firſt pair is the two large lateral proceſſes or wings; the upper part of each of which is called the *temporal proceſs*, becauſe they join with the temporal bones in forming the temples, and the ſeat for ſome ſhare of the crotaphite muſcles. That part of the wings which juts out towards the inſide, ſomewhat lower than the temporal apophyſes, and is ſmooth and hollowed, where it makes up part of the orbit, is thence named *orbitar proceſſes*. Behind the edge ſeparating theſe two proceſſes, there is often a ſmall groove, made by a branch of the ſuperior maxillary nerve, in its paſſage to the temporal muſcle. The loweſt and back part of each wing, which runs out ſharp to meet the oſſa petroſa, has been ſtyled the *ſpinous* proceſs: from near the point of which a ſharp-pointed proceſs is frequently produced downwards, commonly called *ſtyliform*, that affords origin to the ptery-ſtaphylinus externus muſcle. From this ſtyloid proceſs a very ſmall groove is extended along the edge of the bone to the hollow at the root of the internal plate of the following proceſſes, which

(z) Cuneiforme, πολυμορφον, multiforme, paxillum, cribratum palati, colatorii, cavilla, baſilare.

which forms part of the Euſtachian tube (*a*). The ſecond pair of external proceſſes of the cuneiform bone, is the two which ſtand out almoſt perpendicular to the baſe of the ſkull. Each of them has two plates, and a middle foſſa facing backwards; and ſhould, to carry on our compariſon, be likened to the legs of a bat; but are commonly ſaid to reſemble the wings of that creature; and therefore are named *pterygoid or aliform* (*b*) proceſſes. The external plates are broadeſt, and the internal are longeſt. From each ſide of the external plates the pterygoid muſcles take their riſe. At the root of each internal plate, a ſmall hollow may be remarked, where the muſculus ptery-ſtaphilinus internus or circumflexus palati riſes, and ſome ſhare of the cartilaginous end of the Euſtachian tube reſts: and, at the lower end of the ſame plate, is a hook like riſing or proceſs, round which the tendon of the laſt-named muſcle plays, as on a pulley. From the edge of the external plates ſome ſmall ſharp ſpikes ſtand out; but their number and bulk are uncertain.——To theſe another pair may be added, to wit, the little triangular thin proceſs, which comes from each ſide of the body of the ſphenoid bone, where the pterygoid proceſſes are riſing from it, and are extended over the lower part of the aperture of the ſinus as far as to join the ethmoid bone, while their body hangs down into the nares (*c*). Beſides theſe pair of proceſſes, there is a ſharp ridge which ſtands out from the middle of its baſe: Becauſe it wants a fellow, it may be called *proceſſus azygos*. The lower part of this proceſs, where it is received into the vomer, is thick, and often not quite perpendicular, but inclining more to one ſide than the other. The fore-part of this proceſs, where it joins the naſal plate of the os ethmoides,

(*a*) Winſlow Expoſ. anatomique du corps humain, traité des os ſecs, § 233.

(*b*) Naviculares.

(*c*) Albin. Tab. Oſſ. 5. fig. 2. 6. A. A.——Bertin. Mem. de l'acad. des ſciences, 1744.—Sue, planche viii. fig. 2, 3, 4, 5, 6.

des, is thin and ſtraight. Theſe two parts have been deſcribed as two diſtinct proceſſes by ſome writers.

The depreſſions, ſinuoſities, and foſſae, on the external ſurface of this ſphenoid bone, may be reckoned up to a great number, viz. Two on the temporal apophyſes, where the crotaphite muſcles lodge—Two on the orbitar proceſſes, to make way for the globes of the eyes—Two between the temporal and ſpinous proceſſes, for receiving the temporal bones —Two between the plates of the pterygoid proceſſes, where the muſculi pterygoidei interni and ptery-ſtaphylini interni are placed—Two between the pterygoid and orbitar proceſſes, for forming the holes common to this and to the cheek and maxillary bones—Two on the lower ends of the aliform proceſſes, which the palate bones enter into.—Two at the roots of the temporal and pterygoid proceſſes, where the largeſt ſhare of the external pterygoid muſcles have their riſe—Two at the ſides of the proceſſus azygos, for forming part of the noſe, &c.

What I deſcribed under the name of *temporal* and *ſpinous proceſſes* on the outſide of the ſkull, are likewiſe ſeen on its inſide, where they are concave, for receiving part of the brain; and commonly three apophyſes on the internal ſurface of the ſphenoid bone are only mentioned.——Two riſing broad from the fore-part of its body, become ſmaller as they are extended obliquely backwards.——The third ſtanding on a long tranſverſe baſe, near the back part of the body of this bone, riſes nearly erect, and of an equal breadth, terminating often in a little knob on each ſide. The three are called *clinoid*, from ſome reſemblance which they were thought to have to the ſupporters of a bed. Sometimes one or both the anterior clinoid proceſſes are joined to the ſides of the poſterior one, or the body of the bone itſelf. From the roots of the anterior clinoid proceſſes the bone is

extended

extended on each fide outwards and forwards, till it ends in a fharp point, which may have the name of the *tranfverfe* fpinous proceffes. Between, but a little farther back than the two anterior clinoid proceffes, we fee a protuberance confiderably fmaller than the pofterior clinoid procefs, but of its fhape.——Another procefs from between the tranfverfe proceffes, often forces itfelf forwards into the os ethmoides.

Within the fkull, there are two *finuofities* in the internal part of each wing of the fphenoid bone, for receiving the middle part of the brain.——One between the tranfverfe fpinous proceffes, for lodging the part of the brain where the crura medullae oblongatae are.——Immediately before the third or middle clinoid procefs, a fingle pit may generally be remarked, from which a foffa goes out on each fide to the holes through which the optic nerves pafs. The pit is formed by the conjoined optic nerves; and in the foffa thefe nerves are lodged, as they run divided within the fkull. Between that third protuberance and the pofterior clinoid procefs, the larger pit for the glandula pituitaria may be remarked. This cavity, becaufe of its refemblance to a Turkifh faddle, is always defcribed under the name of *fella turcica*, or *ephippium*——On the fides of the pofterior clinoid procefs, a foffa may be remarked, that ftretches upwards, then is continued forwards along the fides of the fella turcica, near to the anterior clinoid proceffes, where a pit on each fide is made. Thefe foffae point out the courfe of the two internal carotid arteries, after they have entered the fkull. Befides all thefe, feveral other foffae may be obferved, leading to the feveral holes, and imprinted by the nerves and blood veffels.

The *holes* on each fide of the os fphenoides are fix proper, and three common.——The firft is the round one immediately

mediately below the anterior clinoid proceſſes, for the paſſage of the optic nerve, and of the branch of the internal carotid artery that is ſent to the eye.——The ſecond is the foramen lacerum, or large ſlit between the tranſverſe ſpinous and orbitar proceſſes: The interior end of which ſlit is large; and, as it is extended outwards, it becomes narrower. The outer end of it is formed in the os frontis; and therefore this might be reckoned among the common foramina. Through it the third, fourth, the firſt branch of the fifth, and the greater ſhare of the ſixth pair of nerves, and an artery from the internal carotid, go into the orbit. Sometimes a ſmall branch of the external carotid enters near its end, to be diſtributed to the dura mater (*d*); and a vein, ſome call it the *venous duct*, or *Nuck's aqueduct*, returns through it to the cavernous ſinus.——The third hole, ſituated a little below the one juſt now deſcribed, is called *rotundum*, from its ſhape. It allows paſſage to the ſecond branch of the fifth pair of nerves, or ſuperior maxillary nerve, into the bottom of the orbit.——The fourth is the *foramen ovale*, about half an inch behind the round hole. Through it the third branch of the fifth pair, or inferior maxillary nerve, goes out; and ſometimes a vein from the dura mater paſſes out here (*e*).——Very near the point of the ſpinous proceſs is the fifth hole of this bone; it is ſmall and round, for a paſſage to the largeſt artery of the dura mater, which is often accompanied with a vein.——The ſixth proper hole (*f*) cannot be well ſeen, till the cuneiform bone is ſeparated from all the other bones of the cranium; for one end of it is hid by a ſmall protuberance

(*d*) Winſlow, Expoſition anatomique du corps humain, traité des arteries, § 60. et de la tete, § 26.

(*e*) Ingraff. Commentar. in Galen. de oſſib. lib. 1. comment. 8.

(*f*) Veſal. Anat. lib. 1. cap. 12.——Euſtach. tab. 46. fig. 13. & 16.——Vidus Vidius, Anat. lib. 2. cap. 2. explicat. tab. 5. & tab. 6. fig. 8. 9. 10. Lit. O.

protuberance of the internal plate of the pterygoid procefs, and by the point of the proceffus petrofus of the temporal bone. Its canal is extended above the inner plate of the pterygoid procefs; and where it opens into the cavity of the nofe, it is concealed by the thin laminous part of the palate-bone. Through it a confiderable branch of the fecond branch of the fifth pair of nerves is reflected.—In the middle of the fella turcica, a fmall hole or two often pierce as far as the cellular fubftance of the bone; and fometimes at the fides of this fella, one or more fmall holes penetrate into the fphenoidal finufes. Thefe obfervations afforded fome anatomifts (*g*) an argument of weight in their days in defence of Galen (*h*), who afferted the defcent of the pituita that way into the finufes below.

The firft of the *common holes* is that unequal fiffure at the fide of the fella turcica, between the extreme point of the os petrofum and the fpinous procefs of the cuneiform bone. This hole only appears after the bones are boiled; for in a recent fubject its back-part is covered by a thin bony plate that lies over the internal carotid artery, and farther forward it is filled with a cartilaginous ligament, under which the cartilaginous part of the Euftachian tube is placed: It was by this paffage that the antients believed the flimy matter was conveyed from the emunctory of the brain, the glandula pituitaria, to the fauces.——The fecond common hole is the large difcontinuation of the external fide of the orbit, left between the orbitar proceffes of the cuneiform bone, the os maxillare, malæ, and palati. In this large hole the fat for lubricating the globe of the eye and temporal mufcles is lodged, and branches of the fuperior maxillary nerve, with fmall arteries from the carotid, and veins, pafs.——The third

(*g*) Joc. Syl. Calumniæ fecundæ amolitio.——Laurent. Hift. Anat. lib. ii. queft. 11.

(*h*) Galen. de ufu part. lib. ix. cap. 1.

third hole is formed between the baſe of this bone and the root of the orbitar proceſs of the palate-bone of each ſide. Through this a branch of the external carotid artery, and of the ſecond branch of the fifth pair of nerves, are allowed a paſſage to the noſtrils, and a returning vein accompanies them. Sometimes, however, this hole is proper to the palate-bone, being entirely formed out of its ſubſtance.

Under the ſella turcica, and ſome way farther forward, but within the ſubſtance of the ſphenoid bone, are two *ſinuſes*, ſeparated by a bony plate. Each of them is lined with a membrane, and opens into the upper and back part of each noſtril by a round hole, which is at their upper fore-part. This hole is not formed only by the os ſphenoides, which has an aperture near as large as any tranſverſe ſection of the ſinus, but alſo by the palate-bones, which are applied to the fore-part of theſe ſinuſes, and cloſe them up, that hole only excepted which was already mentioned. The two ſinuſes are frequently of unequal dimenſions, and ſometimes there is only one large cavity, with an opening into one noſtril. Theſe cavities are likewiſe ſaid (*i*) to be extended ſometimes as far back as the great foramen of the occipital bone. In other ſubjects they are not be found, when the bone is compoſed of large cells (*k*). Some (*l*) mention a cavity within the partition of the ſinuſes; but it is ſmall. The ſphenoidal ſinuſes ſerve the ſame uſes as the frontal.

As this bone is extremely ragged and unequal, ſo its ſubſtance is of very different thickneſs, being in ſome places diaphanous; in others it is a middle thickneſs, and its middle back part ſurpaſſes the greateſt ſhare of the cranium in thickneſ.

The os ſphenoides is joined by its wings to the parietal bones

(*i*) Albin. de oſſib. § 39. (*k*) Veſal. lib. I. cap. 6. (*l*) Id. ibid.

bones above, to the os frontis and offa malarum before, to the temporal bones behind;—by the fore-part of its body and fpinous proceffes, to the frontal and ethmoid bones;—by its back-part, behind the two finufes, to the occipital, where it looks like a bone with the epiphyfes taken off, and, as was formerly obferved in the defcription of the occipital bone, it cannot be feparated without violence in adults;——to the palate-bones, by the ends of the pterygoid procefs, and ftill more by the fore-part of the internal plates of the pterygoid proceffes, and of the finufes;——to the maxillary bones, by the fore-part of the external pterygoid plates;—to the vomer and nafal plate of the os ethmoides, by the proceffus azygos. All thefe conjunctions, except the laft, which is a fchindylefis, are faid to be by the future proper to this bone; though it is at firft fight evident, that feveral other futures, as the tranfverfe, ethmoidal, &c. are confounded with it.

We fee now how this bone is joined to all the bones of the cranium, and to moft of the upper jaw; and therefore obtained the name of the *wedge-like bone.*

The ufes are fo blendid with the defcription, as to leave nothing new to be added concerning them.

The fphenoidal bone is almoft complete in a foetus of nine months: only the great alae feparate after maceration from the body of the bone.——The proceffus azygos is very large and hollow;——the thin triangular proceffes are not offified; ——the internal furface of the body is unequal and porous; ——the finufes do not appear.

Whoever is acquainted with each bone of the cranium, can, without difficulty, examine them as they ftand united, fo as to know the fhapes, fizes, diftances, &c. of their feveral parts, and the forms, capacities, &c. of the cavities formed by them; which is of great ufe towards underftanding the anatomy of the parts contiguous to, contain-

ed

ed within, or connected to them. Such a review is necessary, after considering each class of bones. Thus the orbits, nostrils, mouth, face, head, spine, thorax, pelvis, trunk, extremities, and skeleton, ought likewise to be examined.

§ 2. *Bones of the* FACE.

THE face is the irregular pile of bones composing the fore and under part of the head, which is divided by authors into the *upper* and *lower maxillae* or jaws.

THE *superior maxillae* (*m*) is the common designation given to the upper immoveable share of the face; though, if we would follow Celsus (*n*), we should apply the word *maxillae* to the lower jaw only, and the name *mala* to this upper jaw. In compliance to prevailing custom, I shall, however, use the terms as they are now commonly employed. The shape of the superior jaw cannot easily be expressed; nor is it necessary, provided the shape and situation of all the bones which compose it are described.—— It is bounded above by the transverse suture, behind by the fore-part of the sphenoid bone, and below by the mouth.

The upper jaw consists of six bones on each side; of a thirteenth bone which has no fellow, placed in the middle; and of sixteen teeth. The thirteen bones are, two ossa nasi, two ossa unguis, two ossa malarum, two ossa maxillaria, two ossa palati, two ossa spongiosa inferiora, and the vomer.

The *ossa nasi* are placed at the upper part of the nose; *ossa unguis* are at the internal canthi of the orbits; *ossa malarum* form the prominence of the cheeks; *ossa maxillaria* form

(*m*) Σιαγων, γενυς, mandibula.

(*n*) Lib. 8. cap. 1.

form the ſide of the noſe, with the whole lower and fore-part of the upper jaw, and the greateſt ſhare of the roof of the mouth; *oſſa palati* are ſituated at the back part of the palate, noſtrils, and orbit; *oſſa ſpongioſa* are ſeen in the lower part of the nares; and the *vomer* helps to ſeparate theſe two cavities.

The bones of the upper jaw are joined to the bones of the ſkull by the *ſchindyleſis* and ſutures already deſcribed as common to the cranium and face, and they are connected to each other by *gomphoſis* and fifteen ſutures.

The *gomphoſis* is only where the teeth are fixed in their ſockets, and the *ſchindyleſis* is only where the edges of the vomer are joined to other bones.

The *ſutures* are generally diſtinguiſhed by numbers, which have been differently applied; and therefore I join thoſe (*o*) who prefer the giving names to each, which may be eaſily contrived from their ſituation, or from the bones which they connect.

The firſt is the anterior naſal (*p*), which is ſtraight, and placed longitudinally in the middle fore-part of the noſe.

The ſecond and third are the lateral naſal (*q*), which are at each ſide of the noſe, and almoſt parallel to the firſt ſuture.

Each of the two lacrymal is almoſt ſemicircular, and is placed round the lacrymal groove.

The ſixth and ſeventh are the internal orbitar: each of which is extended obliquely from the middle of the lower ſide of an orbit to the edge of its baſe.

The two external orbitars are continued, each from the end of the internal orbitar to the under and fore-part of the cheek.

The tenth is the myſtachial, which reaches only from the

(*o*) Vander Linden. Medicin. phyſiolog. cap. 13. art. 2. § 10.——Rolfinc. Anat. lib. 2. cap. 25.—Schenk. Schol. part. ſect. ult. par. 2. cap. 5.

(*p*) Naſalis recta.

(*q*) Naſalis obliqua.

the lower part of the feptum narium to between the two middle dentes incifores.

The longitudinal palate future (*r*) ftretches from the middle of the foremoft teeth through the middle of all the palate.

The tranfverfe palate future (*s*) runs acrofs the palate, nearer the back than the fore-part of it.

Each of the two palato-maxillary is at the back-part of the fide of each noftril.

The fifteenth is the fpinous, which is in the middle of the lower part of the noftrils. This may perhaps be rather thought a double *fchindylefis*.

The connection of the offa fpongiofa to the fide of each noftril, is fo much by a membrane in young fubjects, by a fort of hook and afterwards by concretion or union of fubftance in adults, that I did not know well how to rank it: But if any chufes to call it a future, the addition of two *tranfverfe nafal* futures may be made to thofe above named.

The futures of the face (formerly called *harmoniæ*) have not fuch confpicuous indentations as thofe of the fkull; the bones here not having fubftance enough for forming large indentations, and there being lefs neceffity for fecurity againft external injuries, or any internal protruding force, than in the cranium.—Thefe futures often difappear in old people, by the bones running into each other; which can do little prejudice, becaufe the principal ufe of the bones being fo numerous here, is to allow them to be extended into a proper form.

It is evident, from the manner of the conjunction of thefe bones, that they can have no motion, except in common with the cranium.

The purpofes which this pile of bones ferves, will be fhown in the defcription which I am going to give of each of them.

OSSA

(*r*) Laquearis, palataria recta.

(*s*) Arcuata, palatina poftica.

OSSA NASI.

Ossa nasi, fo named from their fituation at the root of the nofe, are each of an irregular oblong fquare figure, being broadeft at their lower end, narroweft a little higher than their middle, and becoming fomewhat larger at the top, where they are ragged and thickeft, and have a curvature forwards, that their connection with the frontal bone might be ftronger.—Thefe bones are convex externally, and thereby better refift any violence from without; and they are concave internally, for enlarging the cavity of the nofe.

The lower edge of thefe bones is unequal, and is ftretched outwards and backwards, to join the cartilages of the noftrils. Their anterior fide is thick, efpecially above, and unequal, that their conjunction to each other might be ftronger; and a fmall rifing may be remarked on their inner edge, where they are fuftained by the feptum narium. —Their pofterior fide, at its upper half, has externally a depreffion, where it is a little overlapped by the maxillary bones, while its lower half covers thefe bones: By which contrivance, they do not yield eafily to preffure applied to their fore-part or fides.

A fmall hole is frequently to be obferved on their external furface, into which two, three, or four holes, which appear internally, terminate for the tranfmiffion of fmall veins: Sometimes the holes go no farther than the cancelli of the bones.

The nafal bones are firm and folid, with very few cells of cancelli in them; the thin fubftance of which they confift not requiring much marrow.

They are *joined* above to the frontal bone, by the middle of the tranfverfe future;——behind, to the maxillary bones, by the lateral nafal futures;——below, to the car-

tilages

tilages of the nofe ;—before, to one another, by the anterior nafal future ;—internally, to the feptum narium.

The *ufe* of thefe bones is to cover and defend the root of the nofe.

In an infant the nafal bones are proportionally fhorter and lefs thick at their upper part, than in an adult; but are otherwife complete.

OSSA UNGUIS, or LACRYMALIA.

Ossa unguis, or lacrymalia, are fo named, becaufe their figure and magnitude are nearly like thofe of a nail of one's finger, and becaufe the tears pafs upon them into the nofe.

Their external furface is compofed of two fmooth concavities and a middle ridge.——The *depreffion* behind forms a fmall fhare of the orbit for the eye-ball to move on; and the one before is a deep perpendicular canal, or *foffa*, larger above than below, containing part of the lacrymal fac and duct. This is the part that ought to be pierced in the great operation for the fiftula lacrymalis.———This foffa of the bone is cribriform, or has a great number of fmall holes through it, that the filaments for the membrane which lines it, infinuating themfelves into thefe holes, might prevent a feparation of the membrane, and fecure the bone in its natural fituation. ——The *ridge* between thefe two cavities of the os unguis is the proper boundary of the orbit at its internal canthus; and beyond which furgeons fhould not proceed backwards in performing operations here.——The internal or pofterior furface of this bone confifts of a furrow in the middle of two convexities.

The *fubftance* of the os unguis is as thin as paper, and very brittle; which is the reafon that thofe bones are often

 wanting

wanting in ſkeletons, and need little force to pierce them in living ſubjects.

Each of thoſe bones is *joined*, above, to the frontal bone, by part of the tranſverſe ſuture;—behind to the os planum of the ethmoid bone, by the ſame ſuture;—before, and below, to the maxillary bone, by the lacrymal ſuture.——Internally, the oſſa unguis cover ſome of the ſinus ethmoidales; nay, are really continuous with the bony lamellae which make up the ſides of theſe cells; ſo that they are as much part of the ethmoid bone as the oſſa plana.

Theſe unguiform bones compoſe the interior internal parts of the orbits, lodge a ſhare of the lacrymal ſac and duct, and cover the ethmoid cells.——Their ſituation and tender ſubſtance make a raſh operator in danger of deſtroying a conſiderable ſhare of the organ of ſmelling, when he is performing the operation of the fiſtula lacrymalis: but when theſe bones are hurt, they caſt off without much difficulty, and conſequently the wound is ſoon cured, unleſs the patient labours under a general cacoethes, or there is a prediſpoſition in the bones to caries; in which caſe, a large train of bad ſymptoms follow, or at beſt the cure proves tedious.

The bones are fully formed in a new-born child.

OSSA MALARUM.

Ossa malarum (*t*) was the name given by Celſus, as was already remarked, to all the upper jaw; but is now appropriated to the prominent ſquare bones which form the cheek on each ſide.—Before, their ſurface is convex and ſmooth; backward, it is unequal and concave, for lodging part of the crotaphyte muſcles.

The four *angles* of each of theſe bones have been reckoned proceſſes

(*t*) Jugalia vel zygomatica, hypopia, ſubocularia.

proceſſes by ſome authors.—The one at the external canthus of the orbit, called the *ſuperior orbitar* proceſs, is the longeſt and thickeſt.—The ſecond terminates near the middle of the lower edge of the orbit in a ſharp point, and is named the *inferior orbitar* proceſs.—The third, placed near the lower part of the cheek, and thence called *maxillary*, is the ſhorteſt, and neareſt to a right angle.—The fourth, which is called *zygomatic*, becauſe it is extended backwards to the *zygoma* of the temporal bone, ends in a point, and has one ſide ſtraight and the other ſloping.—Between the two orbitar angles there is a concave arch, which makes about a third of the external circumference of the orbit, from which a fifth proceſs is extended backwards within the orbit, to form near one third of that cavity; and hence it may be called the *internal orbitar* proceſs.——From the lower edge of each of the oſſa malarum, which is between the maxillary and zygomatic proceſſes, the maſſeter muſcle takes its origin; and from the exterior part of the zygomatic proceſs, the muſculus diſtortor oris riſes; in both which places the ſurface of the bone is rough.

On the external ſurface of each cheek-bone, one or more ſmall *holes* are commonly found, for the tranſmiſſion of ſmall nerves or blood-veſſels from, and ſometimes into, the orbit.—On the internal ſurface are the holes for the paſſage of the nutritious veſſels of theſe bones.—A notch on the outſide of the internal orbitar proceſs of each of theſe bones aſſiſts to form the great ſlit common to this bone and to the ſphenoid, maxillary, and palate bones.

The *ſubſtance* of theſe bones is, in proportion to their bulk, thick, hard, and ſolid, with ſome cancelli.

Each of the oſſa malarum is *joined*, by its ſuperior and internal orbitar proceſſes, to the os frontis, and to the orbitar proceſs of the ſphenoid bone, by the tranſverſe future;

by

by the edge between the internal and inferior orbitar proceſſes, to the maxillary bone, by the internal orbitar ſuture; by the ſide between the maxillary and inferior orbitar proceſs, again to the maxillary bone, by the external orbitar ſuture; by the zygomatic proceſs, to the os temporum, by the zygomatic ſuture.

The cheek-bones are entire, and fully oſſified in all their parts, in infants.

OSSA MAXILLARIA SUPERIORA.

Ossa Maxillaria Superiora are the largeſt bones, and conſtitute the far greater part, of the upper jaw, which has appropriated the name of *maxillaria* to them. The figure of one of them, or of the two when joined, is ſo irregular, that words can ſcarce give an idea of it.

The *proceſſes* of each os maxillare may be reckoned ſeven. The firſt is the long naſal one at its upper and fore-part, which is broad below, and turns ſmaller as it riſes upwards, to make the ſide of the noſe. At the root of this a tranſverſe ridge may be obſerved within the noſtrils, which ſupports the fore-part of the upper edge of the os ſpongioſum inferius. The ſecond is produced backwards and outwards, from the root of the naſal proceſs, to form the lower ſide of the orbit; and therefore may be called *orbitar*. The edge of this orbitar proceſs, and the ridge of the naſal one, which is continued from it, make a conſiderable portion of the external circumference of the orbit. From the proper orbitar proceſs, a very rough triangular ſurface is extended downwards and outwards, to be connected to the cheek-bone; and therefore may be called the molar proceſs, from the loweſt protuberant part of which ſome ſhare of the maſſeter muſcle takes its riſe. Behind the orbitar proceſs, a large tuberoſity or bulge of the bone

bone appears, which is efteemed the fourth procefs. On the internal part of this we often meet with a ridge, almoft of the fame height with that in the nafal procefs, which runs tranfverfely, and is covered by a fimilar ridge of the palate-bone, on which the back-part of the upper edge of the os fpongiofum inferius refts.——The convex back-part of this tuberofity is rough for the origin of part of the external pterygoid mufcle (*u*); and more internal is fcabrous, where the palate and fphenoid bones are joined to it.—That fpongy protuberance (*x*) at the lower circumference of this bone, where the fockets for the teeth are formed, is reckoned the fifth. The fixth is the horizontal plate, which forms the greater part of the bafe of the noftrils, and roof of the mouth: its upper furface, which belongs to the noftrils, is very fmooth; but the other below is arched and rough, for the ftronger adhefion of the membrane of the mouth, which is ftretched upon it; and in chewing, fpeaking, &c. might otherwife be liable to be feparated. The feventh rifes like a fpine from the inner edge of the laft, and forms a fmall part of the partition of the noftrils.

The *depreffions* in each maxillary bone are, 1. A finuofity behind the orbitar procefs, made by the temporal mufcle. 2. A pit immediately before the fame procefs, where the origin of the mufculus elevator labiorum communis, and elevator labii fuperioris, with a branch of the fifth pair of nerves, are lodged fecurely. 3. The hollow arch of the palate. 4. The femicircular great notch, or entry to the lower part of the noftrils, between the root of the nafal procefs and fpine of the palate plate. —— Below this, the fore part of the bone is flatted, or fometimes hollowed, by the mufculus depreffor labii fuperioris. 5. Sockets for the teeth (*y*): The number of thefe fockets is uncertain; for

(*u*) Albin. de offib. § 79. (*x*) φατνια.

(*y*) Βοθρια ὁλμισκοι, Alveoli, foffulae, mortariola, fraena, locelli, cavae, loculamenta.

for the ſame number of teeth is not in all people, and the four fartheſt teeth of each ſide in each jaw vary greatly in their number of roots; and when the teeth of a living perſon fall out or are taken away, the ſockets fill up with an oſſeous net work, which becomes ſolid afterwards. 6. The lacrymal foſſa in the naſal proceſs, which aſſiſts the os unguis to form a paſſage for the lacrymal duct. The part of the bone forming this foſſa is ſo firm and ſtrong, that a ſurgeon can ſcarcely perforate it with the ordinary inſtruments for the fiſtula lacrymalis; and therefore ought to avoid it in doing this operation.——Immediately on the outſide of this, there is a ſmall depreſſion, from which the inferior or leſſer oblique muſcle of the eye has its origin (z). 7. The canal on the upper part of the great tuberoſity within the orbit, which is almoſt a complete hole; in this a branch of the ſuperior maxillary nerve paſſes. Beſides theſe, the ſuperior ſurface of the great bulge is concave, to receive the under part of the eye. Immediately above the tranſverſe ridge in the naſal proceſs, a ſmall hollow is formed by the os ſpongioſum. In ſome ſubjects, the naſal proceſs has a ſmall round pit above the lacrymal duct, where the little tendon or ligament of the orbicular muſcle of the eye-lids is inſerted. It is this tendon, and not the tendon of the larger oblique muſcle of the eye, which there is ſome hazard of cutting in the operation of the fiſtula lacrymalis.

The *holes* of this bone are two proper and two common, which are always to be found; beſides ſeveral others, whoſe magnitude, number, &c. are uncertain. The firſt of the proper is the external orbitar, immediately below the orbit, by which the infra-orbitar branch of the ſecond branch of the fifth pair of nerves, and a ſmall artery, come out, after having paſſed in the canal, at the bottom of

(z) Winſlow, Expoſition anatomique des os ſecs, § 276.

of the orbit, defcribed number 7. of the depreffions. This hole is often double, and that when the nerve has happened to fplit before it has efcaped from the bone. The fecond is the foramen incifivum, juft behind the fore teeth; which, at its under part, is one irregular hole common to both the maxillary bones when they are joined; but, as it afcends, foon divides into two, three, or fometimes more holes; fome of which open into each noftril. Through them fmall arteries and veins, and a twig of the fecond branch of the fifth pair of nerves, pafs, and make a communication between, or join the lining coats of the nofe and mouth. In fome fubjects, Steno's duct may be traced fome length on the fide of thefe paffages next to the nofe, and fmall orifices may be obferved opening into the mouth.

The firft common hole is that which appears at the inner fide of the back part of the tuberofity and of the fockets of the teeth; and is formed by a foffa in this bone, and a correfponding one in the os palati: Through it a nerve, which is a branch of the fecond branch of the fifth pair, runs to the palate. The other common hole is the great flit in the outfide of the orbit, defcribed already as the fecond common hole of the fphenoid bone.

On the nafal procefs holes may be often obferved for the paffage of veffels to the fubftance of the bones; and, at the back-part of each tuberofity, feveral foramina are placed, for the tranfmiffion of nerves to the cavity within: But thefe are uncertain.

All the *body* of the maxillary bone is hollow, and leaves a large *finus* like the frontal and fphenoid, which is commonly, but unjuftly, called *antrum Highmorianum* (*a*). When the os maxillare is fingle, or feparated from all the other bones of a fkeleton, its antrum appears to have a large aperture

(*a*) Genæ.

ture into the noftrils; but, in a recent fubject, it is fo covered at its back-part by the palate-bone, in the middle by the os fpongiofum inferius, before by a ftrong membrane, that one or fometimes two holes, fcarcely fo large as a crow-quill, are only left at the upper part; which, after a fhort winding procefs, open into the noftrils between the two offa fpongiofa.—At the bottom of this cavity, we may often obferve fome protuberances, in which the fmall points of the roots of the teeth are contained (*b*).—This cavern and the fockets of the teeth are often divided by the interpofition only of a very thin bony plate, which is liable to be eroded by acrid matter collected in the antrum, or to be broke in drawing a tooth (*c*). The fymptoms of a collection of matter here naturally led us to the practice of pulling out the teeth, and piercing through this plate into the antrum, to procure an evacuation of the collected matter; by which confiderable fervice is frequently done (*d*).

The maxillary finufes have the fame *ufes* as the frontal and fphenoidal: and the fituation of the finufes is fuch, that the liquor drilling from them, from the cells of the ethmoid and palate bones, and from the lacrymal ducts, may always moiften all the parts of the membrane of the nares in the different fituations of the head.

Though the membranes which line the frontal, fphenoidal, and maxillary finufes, are continuations of the one which covers the bones within the nofe; yet they are much thinner than it is, and have fo much fmaller veffels, that the injection which makes the membrane of the nofe red all over, fills only fome few veffels of the maxillary finufes, and is fcarcely obferved in the frontal and fphenoidal.

(*b*) Highmore, Difquif. Anat. lib. 3. part. 2. cap. 7.

(*c*) Highmore, ibid.

(*d*) Cowper in Drake's Anthropol. book 3. chap. 10.——Medical Effays and Obferv. vol. 5. art. 30.

dal. Are not the larger veſſels intended for a more plentiful ſecretion of a viſcid liquor to defend the membrane from the effects of the perflatus which is conſtantly through the noſe? Are not the membranes which have the ſmalleſt veſſels, *cæteris paribus*, the moſt ſenſible? Do not many phenomena of ſmelling, inflammations of theſe parts, megrim, polypi, &c. depend on this ſtructure of the membranes?

The *ſubſtance* of the oſſa maxillaria is compact and firm, except at the inferior proceſſes, in which the teeth are lodged, where it is very ſpongy.

The maxillary bones are joined above, by the upper ends of their naſal proceſſes to the os frontis, by the tranſverſe ſuture;—at the ſides of theſe proceſſes, to the oſſa unguis, by the lacrymal ſuture;—to the naſal bones, by the lateral naſal ſutures;—by their orbitar proceſſes, to the cheek-bones, by the external orbitar ſutures;—by the internal ſides of the internal orbitar proceſſes, to the oſſa plana, by part of the ethmoidal ſuture;—by the back-part of the tuberoſities, to the palate-bones, by the ſuturæ palato-maxillares;—by the poſterior edges of their palatine lamellæ, to the oſſa palati, by the tranſverſe palate ſuture;—by their naſal ſpines, to the vomer, by the ſpinous ſuture;—by their ſocket, to the teeth, by the gomphoſis;—by the internal edge of the palate-plate, to one another, by the longitudinal palate ſuture, on the upper and fore-part of which a furrow is left for receiving the cartilage which forms the partition of the noſtrils;—between the fore-part of the noſtrils and mouth, to each other, by the myſtachial ſuture:—Sometimes they are connected to the oſſa ſpongioſa inferiora, by a plain concretion or union of ſubſtance.

Theſe bones form the greater part of the noſe and of the roof of the mouth, and a conſiderable ſhare of the orbit.

They contain ſixteen teeth, give riſe to muſcles, tranſmiſſion to nerves, &c. as mentioned in the deſcription of their ſeveral parts.

In each of the maxillary bones of a new-born child, the external orbitar proceſs is hollow, with remarkable holes in it;—there are five ſockets for the teeth, of which the two poſterior are very large, and, when divided by a ſecond croſs partition, make the number of ſockets ſix (*e*). The palate-plate is cribriform about the middle. The great tuberoſity is not formed;—inſtead of the antrum, there is only an oblong depreſſion at the ſide of the noſtrils.

OSSA PALATI.

Ossa palati are commonly deſcribed as two ſmall ſquare bones, at the back-part of the palate or roof of the mouth, though they are of much greater extent, being continued up the back-part of the noſtrils to the orbit (*f*). Each palate-bone may therefore be divided into four parts, the palate ſquare-bone, the pterygoid proceſs, naſal lamella, and orbitar proceſs.

The *ſquare-bone* is unequally concave, for enlarging both the mouth and cavity of the noſe. The upper part of its internal edge riſes in a ſpine, after the ſame manner as the palate-plate of the maxillary bone does, to be joined with the vomer. Its anterior edge is unequally ragged, for its firmer connection with the palate-proceſs of the os maxillare. The internal edge is thicker than the reſt, and of an equal ſurface, for its conjunction with its fellow of the other ſide.

(*e*) Albin. Oſteogen, tab. 5. fig. 45.—Ungebav. de dentit. ſecund. jun. § 1.

(*f*) Euſtach. tab. 47. fig. 1. 3. 6. 7. 8.———Vidus Vidius, de nat. lib. 2. cap. 2. explicat. tab. 6. fig. 19.——Winſlow, Memoires de l'acad. des ſciences, 1720.

ſide. Behind, this bone is ſomewhat in form of a creſcent, and thick, for the firm connection of the velum pendulum palati; the internal point being produced backwards, to afford origin to the palato-ſtaphylinus or azygos muſcle This ſquare bone is well diſtinguiſhed from the pterygoid proceſs by a perpendicular foſſa, which applied to ſuch another in the maxillary bone, forms a paſſage for the palatine branch of the fifth pair of nerves; and by another ſmall hole behind this, through which a twig of the ſame nerve paſſes.

The *pterygoid proceſs* is ſomewhat triangular, having a broad baſe, and ending ſmaller above. The back-part of this proceſs has three foſſæ formed in it; the two lateral receive the ends of the two plates of the ſphenoid bone, that are commonly compared to a bat's wing; the middle foſſa makes up a part of what is commonly called the *foſſa pterygoidea;* the fore-ſide of this palatine pterygoid proceſs is an irregular concave, where it receives the back-part of the great tuberoſity of the maxillary bone. Frequently ſeveral ſmall holes may be obſerved in this triangular proceſs, particularly one near the middle of its baſe, which a little above communicates with the common and proper holes of this bone already mentioned.

The *naſal lamella* of this bone is extremely thin and brittle, and riſes upwards from the upper ſide of the external edge of the ſquare bone, and from the narrow extremity of the pterygoid proceſs; where it is ſo weak, and at the ſame time ſo firmly fixed to the maxillary bone, as to be very liable to be broken in ſeparating the bones. From the part where the plate riſes, it runs up broad on the inſide of the tuberoſity of the maxillary bone, to form a conſiderable ſhare of the ſides of the maxillary ſinus, and to cloſe up the ſpace between the ſphenoid and the great bulge of the maxillary bone, where there would otherwiſe be a large ſlit opening into the noſtrils.

noſtrils (*g*). From the middle internal ſide of this thin plate, a croſs ridge, placed on ſuch another of the maxillary bone, is extended; on it the back-part of the os ſpongioſum inferius reſts. Along the outſide of this plate, the perpendicular foſſa made by the palate-nerve is obſervable.

At the upper part of this naſal plate, the palate bone divides into *two proceſſes*, which I have already named *orbitar*; —between which and the body of the ſphenoid bone, that hole is formed which I mentioned as the laſt of the holes common to the ſphenoid bone. Sometimes this hole is wholly formed in the os palati, by a croſs plate going from the one orbitar proceſs to the other. A nerve, artery, and vein, belonging to the noſtrils, paſs here.—The anterior of the two orbitar proceſſes is the largeſt, and has its fore-part contiguous to the back-part of the maxillary ſinus, and its upper ſurface appears in the bottom of the orbit, behind the back-part of the os maxillare and planum. It has cells behind, reſembling thoſe of the ethmoid bone, to which it is contiguous; it is placed on the aperture of the ſinus ſphenoidalis, ſo as to leave only a round hole at its upper fore-part.—The other part of the orbitar proceſs is extended along the internal ſide of the upper back-part of the maxillary tuberoſity, the baſe of the ſphenoid bone, between the root of the proceſſus azygos and the pterygoid proceſs.

The palate ſquare part of this plate-bone, and its pterygoid proceſs, are firm and ſtrong, with ſome cancelli; but the naſal plate and orbitar proceſſes are very thin and brittle.

The palate-bones are *joined* to the maxillary, by the fore-edge of the palate ſquare bone, by the tranſverſe palate future:——By their thin naſal plates, and part of their orbitar proceſſes, to the ſame bones, by the palato-maxillares futures:——By their pterygoid proceſſes, and back-part of the naſal plates, to the alæ veſpertilionum, by the ſphenoid

(*g*) Albin. de oſſib. §. 88.

noid future :——By the transverfe ridges of the nafal palates, to the offa fpongiofa inferiora, by contact; hence there frequently is an intimate union of the fubftance of thefe bones in old fkulls :——By the orbitar proceffes, to the offa plana and cellulae ethmoidae, by the ethmoid future :—— To the body of the fphenoid bone, by the fphenoid future :— By the internal edge of the fquare bones, to each other by the longitudinal palate future ;—and by their nafal fpines, to the vomer, by the fpinous future.

The palate bones form part of the palate, noftrils, orbits, and foffae pterygoideae; and they cover part of the finus maxillares, fphenoidales, and ethmoidei.

Thefe bones are very complete in a new-born infant, the nafal plates being then thicker and ftronger than in adults; but the orbitar proceffes have not the cells which appear in the bones of adults.

When we are acquainted with the hiftory of thefe bones, the reafon is evident, why the eyes are fo much affected in ulcers of the palate, as to be often attended with blindnefs, which frequently happens in an ill-managed lues venerea; or why, on the other hand, the palate fuffers from an aegylops (*b*).

OSSA TURBINATA.

Ossa Turbinata, or *fpongiofa inferiora*, refemble the fuperior offa fpongiofa in fhape and fubftance, but have their anterior and upper edges contiguous to the tranfverfe ridges of the nafal proceffes of the maxillary and palate-bones.—— From their upper ftraight edge, two fmall proceffes ftand out: The pofterior, which is the broadeft, defcends to cover fome of the antrum Highmorianum; the anterior rifes up to join the os unguis, and to make part of the lacrymal duct.

Below

(*b*) Hoffman. in Ephemerid. Germ. cent. 1. and 2. obf. 135.

Below the ſpongy bones already mentioned, there are ſometimes two others, one in each noſtril, which ſeem to be a production of the ſides of the maxillary ſinus turned downwards (*i*). When this third ſort of ſpongy bones is found, the middle one of the three in each noſtril is the largeſt, and the loweſt is the ſmalleſt.——Beſides all theſe, there are often ſeveral other ſmall bones ſtanding out into the noſtrils, that, from their ſhape, might alſo deſerve the name of *turbinata:* but are uncertain in their bulk, ſituation, and number (*k*).

The names of theſe bones ſufficiently declare their ſpongy ſubſtance, which has no firm external plate covering it.

They are joined to the oſſa maxillaria, palati, and unguis, in all ſubjects, by a firm union of ſubſtance; and as this often happens in people of no great age, ſome authors (*l*) are of opinion, that they ſhould be eſteemed part of the palate-bones; others (*m*) think, that ſince their upper edge is continued by a plate to a part of the os ethmoides, they ought to be eſteemed a part of this bone.

Their uſe is, to ſtraighten the noſtrils, to afford a large ſurface for extending the organ of ſmelling, to cover part of the antra maxillaria, and to aſſiſt in forming the under part of the lacrymal ducts, the orifices of which into the noſe are concealed by theſe bones.

The oſſa turbinata are nearly complete in a new born infant.

VOMER.

VOMER, or bone reſembling a plough-ſhare, is the thirteenth of the upper jaw, and is without a fellow, forming the lower and back-parts of the partition of the noſe (*n*).

The

(*i*) Cowper in Drake's Anthropolog. book 3. chap. 10.

(*k*) Santorin. Obſervat. Anatomicae, cap. 5. ſect. 9.

(*l*) Id. ib. cap. 5. ſect. 7.

(*m*) Hunauld, in Memoires de l'acad. des ſciences, 1730.

(*n*) Columb. de re anat. lib. 1. cap. 8.——Fallop. Obſervat. Anatom.

The figure of this bone is an irregular rhomboid. Its ſides are flat and ſmooth. Its poſterior edge appears in an oblique direction at the back part of the noſtrils. The upper one is firmly united to the baſe of the ſphenoid bone, and to the naſal plate of the ethmoid; and, when it can be got ſeparated, is hollow for receiving the proceſſus azygos of the ſphenoid. The anterior edge has a long furrow in it, where the middle cartilage of the noſe enters. The lower edge is firmly united to the naſal ſpines of the maxillary and palate bone. Theſe edges of this bone are much thicker than its middle, which is as thin as the thinneſt paper; by which, and the firm union, or connection this bone has above and below, it can very ſeldom be ſeparated entire in adults: but in a child it is much more eaſily ſeparated entire, and its ſtructure is more diſtinctly ſeen; wherefore I ſhall examine all its parts in ſuch a ſubject.

Its ſituation is not always perpendicular, but often inclined and bended to one ſide, as well as the naſal plate of the ethmoid bone.

The vomer is convex at its upper part; and then is ſtraight, as it is extended downwards and forwards, where it is compoſed of two plates: the edges of which have a great number of ſmall proceſſes, diſpoſed ſomewhat like the teeth of a ſaw, but more irregularly, and ſeveral of them are reflected back. Between theſe plates a deep foſſa is left, which, as far as to the top of the curvature, is wide and has ſtrong ſides, for receiving the proceſſus azygos of the ſphenoid bone. Beyond the arch forwards, the foſſa is gradually narrower and ſhallower to the point of the bone, receiving for ſome way the naſal lamella ethmoidea; which, after the oſſification is complete, is ſo cloſely united to the vomer by the little proceſſes piercing its ſubſtance, as to prevent any ſeparation: on which account it has been eſteemed by ſome authors (*o*) a part of the ethmoid bone.

(*o*) Lieutaud, Eſſais anatomiques, ſect. I. l'os ethmoide.

bone. The middle cartilage of the nofe fills up what remains of the foffa at its fore-part. The pofterior edge of the vomer, which appears above the back-part of the palate bones, is broader above; but as it defcends forwards, becomes thinner, though it is ftill folid and firm. The lower edge of this bone, which refts on the nafal fpine of the palate and maxillary bones, has a little furrow on each fide of a fmall middle ridge, anfwering to the fpines of the bones of different fides, and the interftices between them. This and the upper edge meet in the pointed fore-end of this bone.

The body of the vomer has a fmooth and folid furface, but thin fubftance; and towards its fides, where it is thickeft, fome cancelli may be obferved when the bone is broken.

It is joined above to the fphenoid and ethmoid bones, and to the middle cartilage of the nofe by fchindylefis: below, to the maxillary and palate bones by the fpinous future.

The vomer divides the noftrils; enlarges the organ of fmelling, by allowing place for expanding the membrane of the nofe on its fides; and fuftains the palate-plates of the maxillary and palate-bones, which otherwife might be in hazard of being preffed into the noftrils: while the vomer is fecured from fhuffling to one fide or other by the double fchindylefis, by which it is joined to the bones above and below.

Thus we have now defcribed all the bones which compofe the upper jaw, except the teeth, which are fo much like thofe of the lower jaw, that I choofe to make one defcription ferve for both, in which their differences fhall be remarked, after the fecond part of the face, (*i. e.*) the lower jaw, is examined; becaufe the ftructure of the teeth

teeth cannot be well underſtood, until the caſe in which they are ſet is explained.

MAXILLA INFERIOR.

MAXILLA INFERIOR (*p*), the lower jaw, conſiſts only of one moveable bone, and ſixteen teeth incaſed in it.

This bone, which is ſomewhat of the figure of the Greek letter *υ*, is ſituated at the lower part of the face, ſo as its convex middle part is forward, and its legs are ſtretched back. It is commonly divided into the chin, ſides, and proceſſes.— The *chin* is the middle fore-part; the extent of which to each ſide is marked on the external ſurface by the holes obſervable there, and internally by the beginning of an oblique ridge. Beyond theſe the *ſides* appear; and are continued till the bone, by bending upwards, begins to form the *proceſſes*.

On the fore-part of the *chin*, a tranſverſe ridge appears in the middle; on each ſide of which the muſculi quadrati, or depreſſores, and the levatores labii inferioris, depreſs the bone: And below theſe prints a ſmall riſing may be obſerved, where the depreſſores commence. On the back-part of the chin, ſometimes three, always two, ſmall protuberances appear in the middle. To the uppermoſt, when it is ſeen, the frænum of the tongue is connected. From the middle one, the muſculi genio-gloſſi riſe; and from the loweſt, the genio-hyoidei have their origin. Below the laſt, we ſee two rough ſinuoſities formed by the digaſtric muſcles.

At the lower and fore-part of the external ſurface of each *ſide* of the lower jaw a ſmall eminence may be obſerved, where the depreſſor labiorum communis riſes. Near the upper edge of the ſide a ridge runs lengthwiſe, to which the

(*p*) Γενυς σιαγων, Mandibula, facies.

under-part of the mufculus buccinator is connected.—Internally, towards the upper edge of each fide another ridge appears, from which the mylo-hyoidei have their origin, and to which the internal membrane of the gums adheres.

In the upper edge of both *chin* and *fides*, are a great many deep pits or fockets, for receiving the roots of the teeth. The number and magnitude of thefe fockets are various, becaufe of the different number, as well of the teeth themfelves, as of their roots, in different people. Thefe fockets in this lower jaw, as well as in the upper one, are lefs deep as old age comes on: When freed from the teeth by any means, they are fome time after filled up with an offeous net-work, which at laft becomes entirely folid, and as fmooth as any other part of the bone; fo that, in a great many old jaws, we cannot obferve a veftige of the fockets: But then the jaw becomes lefs, and much narrower (*q*). Hence we may know why the chin and nofe of edentulous people are much nearer than before the teeth were loft; while their lips either fall in towards their mouth, or ftand prominent forwards.——When new teeth are protruded, new fockets are formed (*r*). The lower edge of the chin and fides is fmooth and equal, and is commonly called the bafe of the lower jaw. The ends of the bafe, where the jaw turns upwards, are called its angles; the external furface of each of which has feveral inequalities upon it, where the maffeter mufcle is inferted; as the internal furface alfo has, where the pterygoideus internus is inferted, and a ligament extended from the ftyloid procefs of the temporal bone is fixed.

The *proceffes* are two on each fide.——The anterior fharp thin coronoid ones have the crotaphite mufcles inferted into them. The pofterior proceffes or condyles (*s*) terminate in an-

(*q*) Vefal. Anat. lib. I. cap. 10.

(*r*) Fallop. Obferv. Anat.

(*s*) Articulatorii.

an oblong ſmooth head, ſupported by a cervix. The heads, whoſe greateſt length is tranſverſe, and whoſe convexity is turned forwards, are tipped with a cartilage, as the articulated parts of all other moveable bones are. The fore-part of the root and neck of theſe condyloid proceſſes are a little hollow and rough where the external pterygoid muſcles are inſerted.

The *holes* of the lower jaw are two on each ſide; one at the root of the proceſſes internally, where a large branch of the third branch of the fifth pair of nerves enters with an artery, and a vein returns. A ſmall ſharp proceſs frequently juts out backwards from the edge at the fore-part of this hole, to which a ligament extended from the temporal bone is fixed (*t*) which ſaves the nerve and veſſels from being too much preſſed by the pterygoid muſcles.—From the lower ſide of this hole, either a ſmall ſuperficial canal or furrow deſcends, where a branch of the nerve is lodged, in its way to the mylo-hyoideus muſcle and ſublingual gland (*u*). The other hole is external, at the confines of the chin, where branches of the nerve and veſſels come out. The canal between theſe two holes is formed in the middle of the ſubſtance of the bone, and is pierced by a great number of ſmall holes, by which the nerves and blood-veſſels of the cancelli and teeth paſs. This canal is continued a little farther than the external hole at the chin.—On account of the veſſels and nerves in the lower jaw, fractures of it may be attended with dangerous ſymptoms.

The *ſurface* of the lower jaw is hard and firm, except at the ſpongy ſockets, where, however, it is ſtronger than the upper jaw. Its internal *ſubſtance* is cellular, without any ſolid partition between the cancelli in its middle. At the baſe, eſpecially of the chin, where this bone is moſt expoſ-ed

(*t*) Weitbrecht. Syndeſmolog. fig. 32. I.

(*u*) Palfyn. anat. chirur. traite 5. chap. 6.

ed to injuries, the ſolid ſides of it are thick, compact, and hard.

The lower jaw generally receives the root of ſixteen teeth into its ſockets, by *gomphoſis;* and its condyloid proceſſes covered with a cartilage, are articulated with the temporal bones, in a manner that is not commonly right deſcribed: For, as was already mentioned in the deſcription of the temporal bones, not only the fore-part of the cavity between the zygomatic, auditory, and vaginal proceſſes, but alſo the adjoining tubercle at the root of the zygomatic proceſs of each os temporum, is covered with a ſmooth cartilage for this articulation. Here alſo an intermediate moveable cartilage is placed; which being thin in the middle, and thick at the edges, is concave on both ſides; and is connected ſo firmly by ligaments to each condyle, as to follow the motions of the condyle; and ſo looſely to the temporal bone, as readily to change its ſituation from the cavity to the tubercle, and to return again; while the common ligament of the articulation affords ſpace enough for ſuch a change of place backwards and forwards: But like other ligaments of the joints by ginglimus, is ſtrong and ſhort at the ſides, to confine the lateral motions.

When, therefore, the teeth of both jaws coincide, the condyles are lodged ſecurely in the temporal cavities; but their motions to either ſides muſt be confined both by the firmneſs of the ligaments and the riſing brims which are on each ſide of the cavities.—When the jaw is brought directly forwards, the condyle and intermediate cartilages deſcend and advance forwards upon the tubercles.—In this ſituation, the lateral motions are a little more free than in the former one, from the want of riſing brims to ſtop the condyles.—When the fore-teeth of the lower jaw are moved forwards and to a ſide, the condyle of the oppoſite ſide is either advanced from the cavity to the tubercle,

while

while the condyle of the ſame ſide remains in the cavity; or, if both condyles are on the tubercles, when the jaw is moved obliquely to a ſide, the condyle of the ſide to which the motion is made ſlides back from the tubercle to the cavity. —— When the mouth is opened by the deſcent of the lower jaw, the fore-part of it, where the depreſſing muſcles are fixed, is drawn backwards, as well as downwards, while reſiſtance is made to the angles moving backwards by the maſſeter and internal pterygoid muſcles, and, at the ſame time, the external pterygoid draws the condyles and their moveable cartilages forwards; and therefore, when the mouth is opened, the condyles are carried forwards upon the tubercles, and the axis of motion of the bone is a little above its angles. But in this ſituation there is leſs reſiſtance, than in any other, to the condyles luxating forwards; a diſeaſe which ſeldom happens, except when people are gaping too wide; and therefore the common practice of nurſes, who ſupport the jaw of infants when they are yawning, is reaſonable. ——In chewing, there is a ſucceſſion of the motions above deſcribed (x).

Here a general remark may be made, that wherever moveable cartilages are found in joints, either the articulated bones are of ſuch a figure, or ſo joined and fixed by their ligaments, that little motion would be allowed without ſuch cartilages; or elſe ſome motions are neceſſary to the right uſe of the member, which the form of the articulation would not otherwiſe admit of. This will more fully appear after the other joints with ſuch cartilages are deſcribed.

In a child born to the full time, the lower jaw is compoſed of two bones, connected by a thin cartilage in the middle of the chin, which gradually oſſifies, and the two bones

(x) For a more full account of this articulation, vid. Edinburgh Medical Eſſays and Obſerv. vol. I. art. II. and vol. iii. art. 13.—Memoires de l'acad. des ſciences, 1744.

bones intimately unite.——In each of theſe bones there are five or ſix ſockets for teeth, as in the upper jaw.

After I have thus deſcribed the incaſement of the teeth; the inſertion of ſo many muſcles of the tongue, and of the os hyoides; the connection of the membrane of the tongue to the maxillary bone, and the motions of this bone; it is eaſy to ſee, that the lower jaw muſt be a principal inſtrument in manducation, deglutition, and ſpeech.

THE TEETH.

The teeth are the hard white bodies placed in the ſockets of both jaws. Their number is generally ſixteen above and as many below; though ſome people have more, others have fewer.

The broad thick part of each tooth which appears without the ſocket, is the baſe or body (*y*).——The ſmaller proceſſes ſunk into the maxillae, are the roots or fangs; which become gradually ſmaller towards the end fartheſt from the baſe, or are nearly conical; by which the ſurface of their ſides divides the preſſure made on the baſes, to prevent the ſoft parts, which are at the ſmall points of the ſockets, to be hurt by ſuch preſſure. At the place where the baſe ends and the roots begin, there is generally a ſmall circular depreſſion, which ſome call the neck or collar.

Without the gums the teeth are covered with no membrane, and they are ſaid to have no proper perioſteum within the ſockets; but that is ſupplied by the reflected membrane of the gums, which after a good injection may be evidently ſeen in a young ſubject, with the veſſels from it penetrating into the ſubſtance of the teeth; and it may be diſcovered in any tooth recently pulled, by macerating it in water (*z*). The adheſion of this membrane to theſe

(*y*) Corona. (*z*) Cowper's Anat. Explic. tab. 27. fig. 9. lit. E.

theſe roots is ſtrengthened by the ſmall furrows obſervable on them.

Each tooth is compoſed of its *cortex* or enamel, and an internal bony ſubſtance. The *cortex* has no cavity or place for marrow; and is ſo ſolid and hard, that ſaws or files can with difficulty make impreſſion on it. It is thickeſt upon the baſe, and gradually, as the roots turn ſmaller, becomes thinner, but not proportionally to the difference of the ſize of the baſe and roots.——The fibres of this enamel are all perpendicular to the internal ſubſtance; and are ſtraight on the baſe, but at the ſides are arched with a convex part towards the roots (*a*); which makes the teeth reſiſt the compreſſion of any hard body between the jaws, with leſs danger of breaking theſe fibres, than if they had been ſituated tranſverſely. The ſpongy ſockets in which the teeth are placed, likewiſe ſerve better to prevent ſuch an injury than a more ſolid baſe would have done.——Notwithſtanding the great hardneſs of this cortex, it is waſted by manducation. Hence the ſharp edges of ſome teeth are blunted and made broad, while the rough ſurfaces of others are made ſmooth and flat, as people advance in life.

The bony part of the teeth has its fibres running ſtraight, according to the length of the teeth. When it is expoſed to the air, by the breaking or falling off of the hard cortex, it ſoon corrupts. And thence carious teeth are often all hollow within, when a very ſmall hole appears only externally.

The teeth have canals formed in their middle, wherein their nerves and blood-veſſels are lodged: which they certainly need, being conſtantly waſted by the attrition they are ſubjected to in manducation; and for their further growth, not only after they firſt appear, but even in adults; as is evident when a tooth is taken out: for then the oppo-
ſite

(*a*) Havers Oſteolog. Nov. diſc. 1.

ſite one becomes longer, and thoſe on each ſide of the empty ſocket turn broader; ſo that when the jaws are brought together, it is ſcarcely obſervable where the tooth is wanting (*b*).

The veſſels are eaſily traced as long as they are in the large canal, but can ſcarcely be obſerved in their diſtribution from that to the ſubſtance of the teeth of adults. Ruyſch (*c*) however affirms, that after injection he could trace the arteries into the hardeſt part of the teeth: And Leeuwenhoek (*d*) ſuſpected the fibres of the cortex to be veſſels. In children I have frequently injected the veſſels of the teeth as far as their baſe; and in ſuch as are not entirely oſſified, one can with a lucky injection fill ſo many veſſels as to make both the outſide and inſide of the cortical part appear perfectly red.—This plentiful ſupply of veſſels muſt expoſe the teeth to the ſame diſorders that attack other vaſcular parts; and ſuch teeth as have the greateſt number of veſſels muſt have the moſt numerous chances of being ſeized with theſe diſeaſes.

Every root of each tooth has a diſtinct canal, with veſſels and nerves in it. Theſe canals in the teeth with more than one root, come nearer each other as they approach the baſe of the tooth; and at laſt are only ſeparated by very thin plates, which, being generally incomplete, allow a communication of all the canals; and frequently one common cavity only appears within the baſe, in which a pulpy ſubſtance compoſed of nerves and veſſels is lodged.——The condition therefore of the nerves here bears a ſtrong analogy to that of the cutaneous nerves which ſerve for the ſenſation of touching.

The entry of the canals for theſe veſſels is a ſmall hole placed

(*b*) Ingraf. de tumor. cap. 1. p. 24. 25. 26.

(*c*) Theſaur. 10. num. 27.

(*d*) Arcan. Natur. continuat. epiſt. p. 3.

placed a little to a fide of the extreme point of each root; fometimes, efpecially in old people, this hole is entirely clofed up, and confequently the nerves and blood-veffels are deftroyed (*e*).

The teeth are feen for a confiderable time in form of mucus contained in a membrane; afterwards a thin cortical plate and fome few offeous layers appear within the membrane, with a large cavity filled with mucus in the middle; and gradually this exterior fhell turns thicker, the cavity decreafes, the quantity of mucus is leffened, and this induration proceeds till all the body is formed, from which the roots are afterwards produced.

In young fubjects, different ftamina or rudiments of teeth are to be obferved. Thofe next the gums ordinarily hinder the deeper feated ones from making their way out, while thefe prevent the former from fending out roots, or from entering deep into the bony fockets of the jaws; by which they come to be lefs fixed.

Children are feldom born with teeth; but at two years of age they have twenty; and their number does not increafe till they are about feven years old; when the teeth that firft made their way through the gums are thruft out by others that have been formed deeper in the jaw, and fome more of the teeth begin to difcover themfelves farther back in the mouth. About fourteen years of age, fome more of the firft crop are fhed, and the number is increafed. This fhedding of the teeth is of good ufe: for if the firft had remained, they would have ftood at a great diftance one from another; becaufe the teeth are too hard in their outer cruft to increafe fo faft as the jaws do. Whereas, both the fecond layer and the teeth that come out late, meeting, while they are foft, with a confiderable refiftance to their growth in length, from thofe fituated upon them, neceffarily come out

 broad,

(*e*) De la Hire, Hiftoire de l'acad. des fciences, 1699.

broad, and fit to make that cloſe guard to the mouth (*f*) which they now form.

The teeth are *joined* to the ſockets by *gomphoſis*, and the gums contribute to fix them there; as is evident by the teeth falling out when the gums are any way deſtroyed or made too ſpongy, as in the ſcurvy or ſalivation: whence ſome authors (*g*) claſs this articulation with the *ſyſſarcoſis*.

The *uſes* of the teeth are to maſticate our aliment, and to aſſiſt us in the pronunciation of ſeveral letters.

Though the teeth ſo far agree in their ſtructure, yet, becauſe of ſome things wherein they differ, they are generally divided into three claſſes, viz. *inciſores*, *canini*, and *molares*.

The INCISORES (*h*) are the four fore-teeth in each jaw, receiving their name from their office of cutting our aliment; for which they are excellently adapted, being each formed into a ſharp-cutting edge at their baſe, by their fore-ſide turning inwards there, while they are ſloped down and hollowed behind (*i*); ſo that they have the form of wedges, and therefore their power of acting muſt be conſiderably increaſed.——Seeing, in the action of the inciſores, a perpendicular compreſſion is only neceſſary, without any lateral motion, they are not ſo firmly fixed in their ſockets as the other teeth are, each having only one ſhort root; but that is broader from before backwards, than to either ſide, to have the greateſt ſtrength where it is expoſed to the ſtrongeſt force applied to it (*k*).

The inciſores of the upper jaw, eſpecially the two middle ones (*l*), are generally broader and longer than thoſe of the upper jaw.

In

(*f*) Φραγμος.

(*g*) Drake's Anthropolog. book. 4. chap. 3.

(*h*) Γελασινοι, τομικοι, διαστηρες, κτενες, τομεις, πρωσθιοι, οξεις, Riſorii, quaternii, primi, primores, anteriores, acuti.

(*i*) Ολμισκος.

(*k*) Lettre ſur l'oſteologie, aſcribed to Du Verney.

(*l*) Duales.

In a new-born infant, only the outer ſhell of the body of theſe teeth is hardened.—Afterwards, when the ſtamina of two ſets are formed, each has its own ſocket, thoſe neareſt to the edge of the gums being placed more forward, and the others are lodged farther back within the jaw-bones.

CANINI (*m*), from the reſemblance to dog tuſks, are one on each ſide of the inciſores in each jaw.——The two in the upper jaw are called *eye-teeth*, from the communication of nerves which is ſaid to be between them and the eyes.——The two in the lower jaw are named *angular* or *wike-teeth*, becauſe they ſupport the angles of the mouth.

The canini are broader, longer, and ſtronger, than the inciſores.——Their baſes are formed into a ſharp-edge, as the inciſores are; only that the edge riſes into a point at the middle. Each of them has generally but one long root, though ſometimes they have two (*n*). The roots are crooked towards the end. The canini of the upper jaw are larger, longer, and with more crooked roots, than thoſe of the under jaw. The form of their baſe is fit both for piercing and cutting, and the long crooked root of each makes it ſecure in the ſocket.

The canini of a child are in much the ſame condition as the inciſores are.

The DENTES MOLARES, or GRINDERS (*o*), which have got their name becauſe they grind our food, are generally five in each ſide of each jaw; in all twenty. Their baſes are broader, more ſcabrous, and with a thinner cortical ſubſtance, than the other teeth. They have alſo more roots; and as theſe roots generally divaricate from each other, the partitions of the

(*m*) Κυνοδοντες, Riſorii, fractorii, collaterales, columellares.

(*n*) Fauchard, Chirurgien dentiſte, chap. 1.

(*o*) Μυλιται, γομφοι, μυλοι, πλατεις, φραστηρες, Maxillares, menſales, clavales, buccarum.

the fockets between them bear a large fhare of the great pref-fure they fuffer, and hinder it from acting on their points (*p*).

The bafe of the firft grinder has an edge pointed in the middle, on its outfide, refembling the canini; from which it flopes inwards till it rifes again into a point.—It has generally but one root, which fometimes is long and crooked at its point.

The fecond dens molaris has two points on its bafe, rifing nearly equally on its out and infide.—It has two roots either feparate or run together, but fhorter than the root of the firft. Thefe two anterior grinders are much fmaller than the three that are placed farther back in the mouth.

The third and fourth are very broad in their bafes, with four or five points ftanding out; and they have three or more roots.

The fifth, commonly called *dens fapientiæ* (*q*), from its coming through the gums later than the other grinders, has four points on its bafe, which is not fo large as the bafe of the third and fourth, and its roots are lefs numerous.

The incifores of the upper jaw being broader than thofe of the lower jaw, make the fuperior grinders to be placed fo much farther back than the lower ones, that, when they are brought together, by fhutting the mouth, the points of the grinders of the one jaw enter into the depreffions of the oppofite grinders, and they are all equally applied to each other, notwithftanding the inequality of their furface.

The numerous roots of the dentes molares prevent their loofening by the lateral preffure they fuffer in grinding; and as the fockets in the upper jaw are more fpongy, and the teeth are

(*p*) Lettre fur l'ofteologie.

(*q*) Σωφρονιστηρες, ϱαντηρες, οψιγονοι, Senfus, intellectus, ferontini, ætatem complentes, genuini, moderatores.

are more liable, by their ſituation, to fall out (*r*), the grinders there have more numerous and more ſeparated roots than in the lower jaw (*s*). The number, however, of the roots of the teeth of both jaws is very uncertain; ſometimes they are more, ſometimes fewer; frequently ſeveral roots are joined together; at other times they are all diſtinct. The diſpoſition of ſuch as are diſtinct is alſo various; for in ſome the roots ſtand out ſtraight, in others they ſeparate, and in others again they are crooked inwards. When the roots are united, we can ſtill diſtinguiſh them, by remarking the number of ſmall holes at their points, which determine the number of roots each tooth ought to be reckoned to have.

At the time of birth, only two dentes molares in each jaw have begun to oſſify; and that at little more than the baſe, which has ſeveral ſharp points ſtanding out from it. The temporaneous grinders are placed more directly upon the internal ſet than the other two claſſes are: Sometimes there is a piece of the bone of the jaws between the two ſets; in other children, the two ſets have no bone interpoſed between them.

From what has been ſaid, the anſwers to the following queries may be given.

Why are children ſubject to ſalivation, fever, convulſion, vomiting, purging, &c. when their teeth are breeding or cutting the gums?

Why in children do the dentes inciſores firſt cut the gums, the canini next, and molares laſt?

Why do children ſhed their teeth?

Why have theſe temporaneous teeth generally no roots, or very ſmall ones?

Why have theſe firſt teeth ſometimes roots, and that more frequently

(*r*) Galen de oſſib. cap. 5.

(*s*) Fauchard. Chirurg. dent. chap. 1.

frequently in teeth pulled by art than in thofe which are fhed by nature (*t*)?

Why do thefe roots frequently come outwards through the gums?

Whence comes butter or buck teeth?

How do thefe teeth fometimes go into the natural row with the others, after pulling a rotten tooth near them?

How have fome people got two rows of teeth in one or both jaws (*u*)?

Why do the teeth of old people loofen, and then drop out entire?

Whence arife the new fets of teeth which feveral old people obtain (*x*)?

Why are not the gums of toothlefs old people torn by the hard fockets in chewing?

Why are the teeth infenfible when flightly filed or rafped?

How come they to be fenfible of heat or cold, to be fet on edge by acids, or to give an uneafy fenfation when gritty or fandy fubftances are rubbed between them?

Why does a perfon who has a pained tooth imagine it longer than any other?

What is the reafon of fome perfons dying convulfed, upon rafping or filing down an overgrown tooth (*y*)?

How do the teeth break and moulder away without any pain in fome people, and not in others?

What parts are affected in the toothach?

What are the caufes of the toothach?

May worms be reckoned among thefe caufes (*z*)?

Why are the dentes molares moft fubject to that difeafe?

In

(*t*) Fauchard, Chirurgien-dentifte, p. 7.

(*u*) Blaf. Comment. ad Vefling. Syntagm. cap. 1. 3.

(*x*) Hoffman. in Van. Horc. Microcofm. p. 38.

(*y*) Bartholin. Anat. reformat. lib. 4. cap. 12.

(*z*) Jacob. in Act. Hafn. vol. 5. obf. 107.—Pechlin. Obferv. Medic. lib. 2. obf. 36.—Bartholin. Hift. Medic. cent. 3. hift. 96.

In what different manners ought the ſeveral claſſes of teeth to be extracted when ſuch an operation is neceſſary?

Whence proceeds the violent obſtinate hemorrhagy which ſometimes attends the drawing of teeth (*a*)?

Why is it more difficult and dangerous to draw the eye-teeth than any other?

What makes it impoſſible frequently to draw grinders without bringing away part of the jaw-bone with them, or breaking the fangs?

Why do teeth ſoon replaced after being extracted become again fixed in the ſockets (*b*)?

According to the diviſion made of the ſkeleton, we ſhould now proceed to the deſcription of the *trunk* of the body. But we muſt firſt conſider a bone which cannot well be ſaid to belong to either the head or the trunk; nor is it immediately joined to any other, and therefore is very ſeldom preſerved with ſkeletons. However, it is generally deſcribed by authors after the bones of the face. In obedience, therefore, to the prevailing method, I ſhall next examine the ſtructure of the

OS HYOIDES.

The os hyoides (*c*), is ſituated horizontally between the root of the tongue and the larynx. It is properly enough named *hyoides*, from the reſemblance it bears to the Greek letter υ; and may, for a clearer demonſtration of its ſtructure, be diſtinguiſhed into its *body*, *cornua*, and *appendices*.

The

(*a*) Paré, livre 6. chap. 2.——Rolfine, lib. 2. cap. 27. & 30.——Moebii Fundam. Medicin. cap. 9.——Ephemerid. German. dec. 1. ann. 3. obſ. 319. ——Fauchard, Chirurg.-dentiſte, tom. 1. chap. 23. obſerv. 7.

(*b*) De la Motte Chirurgie, tom. 1. chap. 4. obſ. 2.—Fauchard, Chirurgien-dentiſte. tom. 1. chap. 29.

(*c*) Hypſyloides, lambdoides, παραστατη φαρυγγετερον, Os gutturis, os linguae, os morſus Adami, aſſeſſor, os laude, bicorne.

The *body* is the middle broad part, convex before and hollow behind.——The convex fore-part is divided into two by a ridge, into the middle of which the mylo-hyoidei, and into the ſides the ſtylo-hyoidei, muſcles are inſerted.——Above the ridge, the bone is horizontal; but pitted in the middle by the inſertion of the two genio-hyodei muſcles, and a little hollowed more laterally by the baſio-gloſſi.——Below the ridge, it is convex; but a little flatted in the middle by the ſterno-hyoidei, and pitted more externally by the coraco-hyoidei.——The concavity behind faces backwards and downwards to receive the thyroid cartilage, when the larynx and the os hyoides are pulled towards each other by the action of the ſterno-hyoidei and hyo-thyroidei muſcles; and to its upper edge, the ligamentous membranes of the epiglottis, tongue, and thyroid cartilage, are fixed.

The *cornua* of the (*d*) os hyoides are ſtretched backwards from each ſide of its body, where often a ſmall furrow points out the former ſeparation; for in young ſubjects, the body and cornua are not one continued ſubſtance, as they come afterwards to be in adults. Theſe cornua are not always ſtraight, nor of an equal length; their two plain ſurfaces ſtand obliquely ſloping from above outwards and downwards.——Into the external, the cerato-gloſſis is inſerted above, and the thyro-hoideus muſcle below; and to the one behind, the ligamentous membrane of the tongue and larynx adheres.—Each of the cornua becomes gradually ſmaller as it is extended from the baſe; but ends in a round tubercle, from which a moveable cartilage ſtands out, which is connected to the upper proceſs of the cartilago thyroidea.

Where the body of the os hyoides joins on each ſide with its cornua, a ſmall ſtyliform proceſs, called *appendix* (*e*), riſes

(*d*) Crura, latera, inferiora.

(*e*) Crura ſuperiora, latera ſuperiora, oſſa graniniformia.

rifes upwards and backwards, into which the mufculi ftylo-hyoidei alteri, and part of the hyo-gloffi mufcles, are fixed. From each of them a ligament is fometimes extended to the ftyloid proceffes of the temporal bones, to keep the os hyoides from being drawn too much forwards or downwards. The part of this ligament next to thefe proceffes fometimes forms into feveral cartilages, which afterwards offify in old people. Ruyfch *(f)* fays, that he has feen this offification continued as far up as the ftyloid proceffes, which were therefore joined to the os hyoides by anchylofis.

The *fubftance* of the os hyoides is cellular; but covered with a firm external plate, which is of fufficient ftrength to bear the actions of fo many mufcles as are inferted into it.

It is not *articulated* with any bone of the body, except by means of the mufcles and ligaments already mentioned.

The *ufe* of the os hyoides, is to ferve as a folid lever for the mufcles to act with, in raifing or depreffing the tongue and larynx, or in enlarging and diminifhing the capacity of the fauces.

At birth, this bone is in a cartilaginous ftate; excepting a fmall point of bone in the middle of its body, and in each of the cornua.—The appendices frequently remain cartilaginous many years.

SECT. II. OF THE TRUNK.

THE TRUNK confifts of the *fpine*, *pelvis*, and *thorax*.

§ 1. *The* SPINE.

THE fpine (*g*) is the long piles of bones extended from the condyles of the occiput to the end of the rump. It fome-

(*f*) Adverf. Anat. dec. 3. § 9.

(*g*) Ραχις νωτον ακανθα, ιερα συριγξ, σωλην, Tergum hominis carina.

what refembles two unequal pyramids joined in a common bafe. It is not, however, ftraight; for its upper part being drawn backwards by ftrong mufcles, it gradually advances forwards, to fupport the oefophagus, veffels of the head, &c. Then it turns backwards, to make room enough for the heart and lungs. It is next bent forwards, to fupport the vifcera of the abdomen. It afterwards turns backwards, for the enlargement of the pelvis. And, laftly, it is reflected forwards, for fuftaining the loweft great gut.

The fpine is commonly divided into *true* and *falfe vertebrae*: the former conftituting the long upper pyramid, which has its bafe below; while the falfe vertebrae make the fhorter lower pyramid, whofe bafe is above.

TRUE VERTEBRAE.

The true vertebrae (*b*) are the twenty-four upper bones of the fpine, on which the feveral motions of the trunk of our bodies are performed; from which ufe they have juftly got their name.

Each of thefe vertebrae is compofed of its body and proceffes.

The *body* is the thick fpongy fore-part, which is convex before, concave backwards, horizontal and plain in moft of them above and below.——Numerous fmall holes, efpecially on the fore and back part of their furface, give paffage to their veffels, and allow the ligaments to enter their fubftance. The edges of the body of each vertebra are covered, efpecially at the fore-part, with a ring of bone firmer and more folid than the fubftance of the body any where elfe. Thefe rings feem to be joined to the vertebrae in the form

(*b*) Στρεφοις στροφιγγος, Spondyli, offa orbiculata, offa vertebrata, verticula.

form of epiphyſes, but are alleged by ſome authors (*i*) to be the ligaments oſſified. They are of great uſe in preventing the ſpongy bodies from being broken in the motions of the trunk.

Between the bodies of each two adjoining vertebrae, a ſubſtance between the nature of ligament and cartilage is interpoſed; which ſeems to conſiſt of concentrical curved fibres, when it is cut horizontally; but when it is divided perpendicularly, the fibres appear oblique and decuſſating each other (*k*).——The outer part of the invertebral ligaments is the moſt ſolid and hard, and they gradually become ſofter till they are almoſt in the form of a glairy liquor in the centre; and therefore theſe ſubſtances were not improperly called mucous ligaments by the antients (*l*). The external fibrous part of each is capable of being greatly extended, and of being compreſſed into a very ſmall ſpace, while the middle fluid part is incompreſſible, or nearly ſo; and the parts of this ligament between the circumference and centre approach in their properties to each other, in proportion to their more ſolid or more fluid texture. The middle point is therefore a fulcrum or pivot, on which the motion of a ball and ſocket may be made, with ſuch a gradual yielding of the ſubſtance of the ligament, in whatever direction our ſpines are moved, as ſaves the body from violent ſhocks, and their dangerous conſequences (*m*).——This ligamento-cartilaginous ſubſtance is firmly fixed to the horizontal ſurfaces of the bodies of the vertebrae, to connect them; in which it is aſſiſted by a ſtrong membraneus ligament, which lines all their concave ſurface, and by a ſtill ſtronger ligament that covers all their anterior convex ſurface.

We

(*i*) Fallop. Obſervat. Anat.

(*k*) Blancardi Anat. reform. cap. 32.—Weitbrecht, Syndeſmolog. ſect. 4. § 15.

(*l*) Galen, De uſu part. lib. 12. cap. 16.

(*m*) Medical Eſſays and Obſerv. vol. 5. art. 28.

We may lay it down as a general rule, notwithſtanding ſome exceptions, That the bodies of the vertebrae are ſmaller, and more ſolid above; but, as they deſcend, they appear larger and more ſpongy; and that the cartilages between them are thick, and the ſurrounding ligaments ſtrong, in proportion to the ſize of the vertebrae, and to the quantity of motion they perform: by which diſpoſition, the greater weight is ſupported on the broadeſt beſt ſecured baſe, and the middle of our body is allowed a large and ſecure motion.

From each ſide of the body of each vertebra, a bony bridge is produced backwards, and to one ſide: from the poſterior end of which one ſlanting *proceſs* riſes, and another deſcends; the ſmooth, and what is generally the flatteſt, ſide of each of theſe four proceſſes, which are called the *oblique* (*n*), is covered with a ſmooth cartilage; and the two lower ones of each vertebra are fitted to, and articulated with, the two upper or aſcending oblique proceſſes of the vertebra below, having their articular ligaments fixed into the rough line round their edges.

From between the oblique proceſſes of each ſide, the vertebra is ſtretched out laterally into a proceſs that is named *tranſverſe*.

From the back-part of the roots of the two oblique and of the tranſverſe proceſs of each ſide, a broad oblique bony plate is extended backwards; where theſe meet, the ſeventh proceſs of the vertebrae takes its riſe, and ſtands out backwards: this being generally ſharp-pointed and narrow edged, it has therefore been called *ſpinal* proceſs; from which this whole chain of bones has got its name.

Beſides the common ligament which lines all the internal ſurface of the ſpinal proceſſes, as well as of the bodies, particular ligaments connect the bony bridges and proceſſes of the contiguous vertebrae together.

The

(*n*) Articulatorii, minimi.

The fubftance of the proceffes is confiderably ftronger and firmer, and has a thicker external plate, than the bodies of the vertebrae themfelves.

The feven *proceffes* form a concavity at their fore-part, which, joined to the one at the back-part of the bodies, makes a great hole; and the holes of all the vertebrae form a long large conduit (*o*), for continuing the fpinal marrow. —In the upper and lower edge of each lateral bridge, there is a notch. Thefe are fo adapted to each other in the contiguous vertebrae, as to form a round hole in each fide between each two vertebrae, through which the nerves that proceed from the fpinal marrow and its blood-veffels pafs.

The *articulations*, then, of thefe true vertebrae are plainly double: For their bodies are joined by the intervening cartilage above defcribed; and their oblique proceffes, being tipped with cartilages, are fo connected by their ligaments as to allow a fmall degree of motion on every fide. Hence it is evident, that their centre of motion is altered in different pofitions of the trunk: For, when we bow forwards, the upper moved part bears entirely on the bodies of the vertebrae; if we bend back, the oblique proceffes fupport the weight; if we recline to one fide, we reft upon the oblique proceffes of that fide and part of the bodies; if we ftand erect, all the bodies and oblique proceffes have their fhare in our fupport.

Hence it follows, 1. That becaufe the joints of which the fpine is compofed are fo numerons, the fpinal marrow, nerves, blood-veffels, &c. are not liable to fuch compreffion and overftretching in the motion of the trunk of the body as they would otherwife be, fince feveral vertebrae muft be concerned in every motion of the fpine; and therefore a very fmall curvature is made at the conjunction of any two verte-

brae,

(*o*) Ιερα συριγγξ, σωλην, Canalis.

brae (*p*). 2. That an erect poſture is the ſureſt and firmeſt, becauſe the ſurface of contact of the fulcra is largeſt, and the weight is moſt perpendicular to them (*q*). 3. That the muſcles which move the ſpine act with greater force in bringing the trunk into an erect poſture than in drawing it to any other: For in bending forwards, backwards, or to a ſide, the muſcles which perform any of theſe actions are nearer the centre of motion: conſequently the lever with which they act is ſhorter than when the centre of motion is on the part of the vertebra, oppoſite to that where theſe muſcles are inſerted; which is the caſe in raiſing the trunk. This is extremely neceſſary; ſince, in the deflections of the ſpine from a perpendicular bearing, the weight of the body ſoon inclines it in the direction we chooſe; whereas, in raiſing us erect, this great weight muſt be more than counteracted. 4. In calculating the force exerted by the muſcles which move the ſpine, we ſhould always make allowance for the action of the cartilages between the vertebrae, which, in every motion from an erect poſture, muſt be ſtretched on one ſide, and compreſſed on the other, to both which they reſiſt; whereas, in raiſing the trunk, theſe cartilages aſſiſt by their ſpringy force (*r*). 5. We are hence naturally led into the reaſon of our height of ſtature increaſing in the morning, and diminiſhing at night (*s*): For the intermediate cartilages of the vertebrae being preſſed all day long by the weight of our body, become more compact and thin in the evening; but, when they are relieved from this preſſure in the night, they again expand themſelves to their former thickneſs: And ſee-

ing

(*p*) Galen. de uſu part. lib. 12. cap. 12.

(*q*) Paaw de oſſib. part. 2. cap. 2.

(*r*) Borelli de motu animal. pars 1. ſchol. ad propoſ. 58. Parent, Hiſtoire de l'acad. des ſciences, 1702.

(*s*) Waſſe, Philoſoph. Tranſact. numb. 383. art. 1.

ing the bulk of any part muſt vary according to the different diſtenſion or repletion of the veſſels compoſing it, we may underſtand how we become taller after a plentiful meal, and decreaſe after faſting or evacuations (*t*). 6. From the different articulations of the bodies and oblique proceſſes of the vertebrae, and the different ſtrength of the ligaments, it is plain, that they are formed ſo as to allow much larger motion forwards than backwards; this laſt being of much leſs uſe, and might be dangerous, by over-ſtretching the large blood-veſſels that are contiguous to the bodies of the vertebrae (*u*). 7. The intervertebral cartilages ſhrivelling as they become more ſolid by age, is the cauſe why old people generally bow forwards, and cannot raiſe their bodies to ſuch an erect poſture as they had in their youth.

The *uſes* of the true vertebrae are, to give us an erect poſture; to allow ſufficient and ſecure motion to the head, neck, and trunk of the body; and to ſupport and defend the bowels and other ſoft parts.

At the ordinary time of birth, each vertebra conſiſts of three bony pieces, connected by cartilages; to wit, the body, which is not fully oſſified; and a long crooked bone on each ſide, on which we ſee a ſmall ſhare of the bony bridge, the oblique proceſſes complete, the beginning tranſverſe proceſſes, and the oblique plate, but no ſpinal proceſſes: So that the teguments are in no danger of being hurt by the ſharp ends of theſe ſpinal proceſſes, while a child is in its bended poſture in the womb, nor while it is ſqueezed in the birth.

From this general mechaniſm of the ſpine, an account is eaſily deduced of all the different preternatural curvatures of which the ſpine is capable: For if one or more vertebrae, or their cartilages, are of unequal thickneſs in oppoſite ſides, the

(*t*) Abbe Fontenu. Hiſtoire de l'acad. des ſciences, 1725.

(*u*) Galen. de uſu part. lib. 1. cap. 16.

the ſpine muſt be reclined over to the thinner ſide; which now ſuſtaining the greateſt ſhare of the weight, muſt ſtill be more compreſſed, conſequently hindered from extending itſelf in proportion to the other ſide, which, being too much freed of its burden, has liberty to enjoy a luxuriant growth. The cauſes, on which ſuch an inequality of thickneſs in different ſides of the vertebrae depends, may vary. For either it may be owing to an over-diſtenſion of the veſſels of one ſide, and from thence a preternatural increaſe of the thickneſs of that part: Or, which is more commonly the caſe, it may proceed from an obſtruction of the veſſels, by which the application of proper nouriſhment to the bony ſubſtance is hindered; whether that obſtruction depends on the faulty diſpoſition of the veſſels or fluids, or if it is produced by an unequal mechanical preſſure occaſioned by a paralytic weakneſs of the muſcles and ligaments, or by a ſpaſmodic over-action of the muſc'es on any ſide of the ſpine, or by people continuing long, or putting themſelves frequently, into any poſture declining from the erect one: In all theſe caſes one common effect follows, to wit, the vertebrae, or their cartilages, or both, turn thick on that ſide where the veſſels are free, and remain thin on the other ſide where theſe veſſels are ſtraightened or obſtructed.—Whenever any morbid curvature is thus made, a ſecond turn, but in an oppoſite direction to the former, muſt be formed; both becauſe the muſcles on the convex ſide of the ſpine being ſtretched, muſt have a ſtronger natural contraction to draw the parts to which their ends are fixed, and becauſe the patient makes efforts to keep the centre of gravity of the body perpendicular to its baſe, that the muſcles may be relieved from a conſtant violent contractile ſtate, which always creates uneaſineſs and pain.

Whence once we underſtand how theſe crooked ſpines are produced, there is little difficulty in forming a juſt prognoſis;

nofis, and a proper method of cure may be eafily contrived, which muft vary as to the internal medicines, according to the different caufes on which the difeafe depends: But one general indication muft be purfued by furgeons; which is, to counteract the bending force, by increafing the compreffion on the convex part of the curvature, and diminifhing it on the concave fide. The manner of executing which in particular cafes muft be different, and requires a very accurate examination of the circumftances both of the difeafe and patient. In many fuch cafes I have found fome fimple directions, as to poftures in which the patient's body fhould be kept, of very great advantage.

Though the true vertebrae agree in the general ftructure which I have hitherto defcribed; yet, becaufe of feveral fpecialties proper to a particular number, they are commonly divided into three claffes, viz. *cervical*, *dorfal*, and *lumbar*.

The cervical (*x*) are the feven uppermoft vertebrae; which are diftinguifhed from the reft by thefe marks.—— Their bodies are fmaller and more folid than any others; and flatted on the fore-part, to make way for the oefophagus; or rather this flat figure is owing to the preffure of that pipe, and to the action of the longi colli and anterior recti mufcles. They are alfo flat behind, where fmall proceffes rife, to which the internal ligaments are fixed. The upper furface of the body of each vertebra is made hollow, by a flanting thin procefs which is raifed on each fide:——The lower furface is alfo hollowed, but in a different manner, for here the pofterior edge is raifed a little, and the anterior one is confiderably produced.——Hence we fee how the cartilages between thofe bones are firmly connected, and their articulations are fecure.

(*x*) Τραχηλου, αυχηνς, αυχειος, Colli.

The cartilages between thefe vertebrae are thick, efpecially at their fore-part; which is one reafon why the vertebrae advance forward as they defcend, and have larger motion.

The oblique proceffes of thefe bones of the neck more juftly deferve that name than thofe of any other vertebrae. They are fituated flanting; the upper ones having their fmooth and almoft flat furfaces facing obliquely backwards and upwards, while the inferior oblique proceffes have thefe furfaces facing obliquely forwards and downwards.

The tranfverfe proceffes of thefe vertebrae are framed in a different manner from thofe of any other bones of the fpine: For, befides the common tranfverfe procefs rifing from between the oblique proceffes of each fide, there is a fecond one that comes out from the fide of the body of each vertebra; and thefe two proceffes, after leaving a circular hole for the paffage of the cervical artery and vein, unite, and are confiderably hollowed at their upper part, with rifing fides, to protect the nerves that pafs in the hollow; and at laft each fide terminates in an obtufe point, for the infertion of mufcles.

The fpinal proceffes of thefe cervical bones ftand nearly ftraight backwards, are fhorter than thofe of any other vertebrae, and are forked or double at their ends; and hence allow a more convenient infertion to mufcles.

The thick cartilages between the bodies of thefe cervical vertebrae, the obliquity of their oblique proceffes, and the fhortnefs and horizontal fituation of their fpinal proceffes, all confpire to allow them large motion.

The holes between the bony crofs bridges, for the paffage of the nerves from the fpinal marrow, have their largeft fhare formed in the loweft of the two vertebrae, to which they are common.

So far moft of the cervical vertebrae agree; but they have

have ſome particular differences, which oblige us to conſider them ſeparately.

The firſt, from its uſe of ſupporting the head, has the name of *atlas* (y); and is alſo called *epiſtrophea* from the motion it performs on the ſecond.

The atlas, contrary to all the other vertebrae of the ſpine, has no body; but, inſtead of it, there is a bony arch.——In the convex fore-part of this arch a ſmall riſing appears, where the muſculi longi colli are inſerted; and, on each ſide of this protuberance, a ſmall cavity may be obſerved, where the recti interni minores take their riſe.——The upper and lower parts of the arch are rough and unequal, where the ligaments that connect this vertebra to the os occipitis, and to the ſecond vertebra, are fixed.——The back-part of the arch is concave, ſmooth, and covered with a cartilage, in a recent ſubject, to receive the tooth like proceſs of the ſecond vertebra.——In a firſt vertebra, from which the ſecond has been ſeparated, this hollow makes the paſſage for the ſpinal marrow to ſeem much larger than it really is: On each ſide of it a ſmall rough ſinuoſity may be remarked, where the ligaments going to the ſides of the tooth-like proceſs of the following vertebra are faſtened; and on each ſide a ſmall rough protuberance and depreſſion is obſervable, where the tranſverſe ligament, which ſecures the tooth-like proceſs in the ſinuoſity, is fixed, and hinders that proceſs from injuring the medulla ſpinals in the flections of the head.

The atlas has as little ſpinal proceſs as body; but inſtead of it, there is a large bony arch, that the muſcles which paſs over this vertebra at that place might not be hurt in extending the head. On the back and upper part of this arch there are two depreſſions, where the recti poſtici minores take their riſe; and at the lower part are two other ſinuoſities,

(y) Αςραγαλος.

ſinuoſities, into which the ligaments that connect this bone to the following one are fixed.

The ſuperior oblique proceſs of this atlas are large, oblong, hollow, and more horizontal than in any other vertebra.——They riſe more in their external than internal brim; by which their articulations with the condyloid proceſſes of the os occipitis are firmer.——Under the external edge of each of theſe oblique proceſſes is the foſſa, or deep open channel, in which the vertebral arteries make the circular turn, as they are about to enter the great foramen of the occipital bone, and where the tenth pair of nerves go out.——In ſeveral bodies I have ſeen this foſſa covered with bone.——The inferior oblique proceſſes, extending from within outwards and downwards, are large, concave, and circular. So that this vertebra, contrary to the other ſix, receives the bones with which it is articulated, both above and below.

The tranſverſe proceſſes here are not much hollowed or forked; but are longer and larger than thoſe of any other vertebra of the neck, from the origin and inſertion of ſeveral muſcles; of which thoſe that ſerve to move this vertebra on the ſecond have a conſiderable lever to act with, becauſe of the diſtance of their inſertion from the axis of revolution.

The hole for the ſpinal marrow is larger in this than in any other vertebra, not only on account of the marrow being largeſt here, but alſo to prevent its being hurt by the motions of this vertebra on the ſecond one. This large hole, and the long tranſverſe proceſſes, make this the broadeſt vertebra of the neck.

The condyles of the os occipitis move forwards and backwards in the ſuperior oblique proceſſes of this vertebra; but from the figure of the bones forming theſe joints, it appears,

appears, that very little motion can here be allowed to either ſide; and there muſt be ſtill leſs circular motion.

In new born children this vertebra has only the two lateral pieces oſſified; the arch, which it has at its fore-part inſtead of a body, being cartilaginous.

The ſecond vertebra colli is called *dentata*, from the tooth-like proceſs on the upper part of its body. Some authors call it *epiſtrophea*; but improperly, ſince this deſignation is only applicable to the firſt, which moves on this as on an axis.

The body of this vertebra is ſomewhat of a pyramidal figure, being large, and produced downwards, eſpecially at its fore-ſide, to enter into a hollow of the vertebra below; while the upper part has a ſquare proceſs, with a ſmall point ſtanding out from it. This it is that is imagined to reſemble a tooth (z), and has given name to the vertebra.—The ſide of this proceſs, on which the hollow of the anterior arch of the firſt vertebra plays, is convex, ſmooth, and covered with a cartilage; and it is of the ſame form behind, for the ligament, which is extended tranſverſely from one rough protuberance of the firſt vertebra to the other, and is cartilaginous in the middle, to move on it.——A ligament likewiſe goes out in an oblique tranſverſe direction, from each ſide of the proceſſus dentatus, to be fixed at its other end to the firſt vertebra, and to the occipital bone; and another ligament riſes up from near the point of the proceſs to the os occipitis.

The ſuperior oblique proceſſes of this vertebra dentata are large, circular, very nearly in an horizontal poſition, and ſlightly convex, to be adapted to the inferior oblique proceſſes of the firſt vertebra.—A moveable cartilage is ſaid by ſome authors to be interpoſed between theſe oblique proceſſes of the firſt and ſecond vertebra; but I could never find

(z) Conoides, pyrenoides, odontoides.

find it.—The inferior oblique proceffes of this vertebra dentata anfwer exactly to the defcription given of thofe common to all the cervical vertebrae.

The tranfverfe proceffes of the vertebra dentata are fhort, very little hollowed at their upper part, and not forked at their ends; and the canals through which the cervical arteries pafs are reflected outwards about the middle fubftance of each procefs; fo that the courfe of thefe veffels may be directed towards the tranfverfe proceffes of the firft vertebra. Had this curvature of the arteries been made in a part fo moveable as the neck is, while they were not defended by a bone, and fixed to that bone, fcarce a motion could have been performed without the utmoft hazard of compreffion, and a ftop put to the courfe of the liquids, with all its train of bad confequences. Hence we obferve this fame mechanifm feveral times ufed, when there is any occafion for a fudden curvature of a large artery. This is the third remarkable inftance we have feen of it. The firft was the paffage of the carotids through the temporal bones; and the fecond was that lately defcribed in the vertebral arteries, turning round the oblique proceffes of the firft vertebra, to come at the great hole of the occipital bone.

The fpinal procefs of this vertebra dentata is thick, ftrong, and fhort, to give fufficient origin to the mufculi recti majores and obliqui inferiores, and to prevent the contufion of thefe and other mufcles in pulling the head back.

This fecond vertebra confifts, at the birth, of four bony pieces: For, befides the three which I have already mentioned as common to all the vertebrae, the tooth-like procefs of this bone is begun at this time to be offified in its middle, and is joined as an appendix to the body of the bone.——Left this appendix be bent or difplaced, nurfes ought to keep the heads of new born children from falling

too

too far backwards, by ſtay-bands, or ſome ſuch means, till the muſcles attain ſtrength ſufficient to prevent that dangerous motion.

When we are acquainted with the ſtructure and articulations of the firſt and ſecond vertebrae, and know exactly the ſtrength and connection of their ligaments, there is no difficulty in underſtanding the motions that are performed upon, or by, the firſt; though this ſubject was formerly matter of hot diſpute among ſome of the greateſt anatomiſts (*a*). It is not my purpoſe at preſent to enter into a detail of the reaſons advanced by either party; but to explain the fact, as any one may ſee it, who will remove the muſcles, which, in a recent ſubject, hinder the view of theſe two joints, and then will turn the head into all the different poſitions of which it is capable. The head may then be ſeen to move forwards and backwards on the firſt vertebra, as was already ſaid, while the atlas performs the circumgyratio upon the ſecond vertebra: The inferior oblique proceſſes of the firſt vertebra ſhuffling eaſily in a circular motion on the ſuperior oblique proceſſes of the ſecond, and its body or anterior arch having a rotation on the tooth-like proceſs, by which the perpendicular ligament that is ſent from the point of the tooth-like proceſs to the occipital bone is twiſted, while the lateral ligaments that fix the proceſſus dentatus to the ſides of the firſt vertebra, and to the os occipitis, are very differently affected; for the one upon the ſide towards which the face is turned by the circumgyratio is much ſhortened and lax, while the oppoſite one is ſtretched and made tenſe, and yielding at laſt no more, prevents the head from turning any farther round on the axis. So that theſe lateral ligaments are the proper moderators of the circumgyratio of the head here; which muſt be larger or ſmaller, as theſe ligaments are weaker

(*a*) See Euſtach. de motu capitis.

weaker or ſtronger, longer or ſhorter, and more or leſs capable of being ſtretched. Beſides the revolution on this axis, the firſt vertebra can move a ſmall way to either ſide; but is prevented from moving backwards or forwards by its anterior arch, and by the croſs ligament, which are both cloſely applied to the tooth-like proceſs. Motion forwards here would have been of very bad conſequence, as it would have brought the beginning of the ſpinal marrow upon the point of the tooth-like proceſs.

The rotatory motion of the head is of great uſe to us on many accounts, by allowing us to apply quickly the organs of the ſenſes to objects: And the axis of rotation was altogether proper to be at this place; for, if it had been at a greater diſtance from the head, the weight of the head, if it had at any time been removed from a perpendicular bearing to the ſmall very moveable joint, and thereby had acquired a long lever, would have broken the ligaments at every turn inconſiderately performed, or theſe ligaments muſt have been formed much ſtronger, and conſequently could not have been connected to ſuch ſmall bones. Neither could this circular motion be performed on the firſt vertebra without danger, becauſe the immoveable part of the medulla oblongata is ſo near, as, at each large turn, the beginning the ſpinal marrow would have been in danger of being twiſted, and of ſuffering by the compreſſion this would have made on its tender fibrils.

It is neceſſary to obſerve, that the lateral or moderator ligaments confined ſo much the motion of the firſt vertebra upon the ſecond, that though this joint may ſerve us on ſeveral occaſions, yet we are often obliged to turn our faces farther round than could be done by this joint alone, without the greateſt danger of twiſting the ſpinal marrow too much, and alſo of luxating the oblique proceſſes: Therefore, in large turns of this kind, the rotation is aſ-

ſiſted

ſiſted by all the vertebrae of the neck and loins; and if this is not ſufficient, we employ moſt of the joints of the lower extremities.——This combination of a great many joints towards the performance of one motion, is alſo to be obſerved in ſeveral other parts of the body; notwithſtanding ſuch motion being generally ſaid to be performed by ſome ſingle joint alone.

The third vertebra of the neck is by ſome called *axis*; but this name is applied to it with much leſs reaſon than to the ſecond.——This third, and the three below, have nothing particular in their ſtructure, but all their parts come under the general deſcription formerly given, each of them being larger as they deſcend.

The ſeventh (*b*) vertebra of the neck is near to the form of thoſe of the back, having the upper and lower ſurfaces of its body leſs hollow than the others: The oblique proceſſes are more perpendicular; neither ſpinal nor tranſverſe proceſſes are forked. This ſeventh and the ſixth vertebra of the neck have the hole in each of their tranſverſe proceſſes more frequently divided by a ſmall croſs bridge, that goes between the cervical vein and artery, than any of the other vertebrae.

The twelve Dorsal (*c*) may be diſtinguiſhed from the other vertebrae of the ſpine by the following marks.

Their bodies are of a middle ſize, between thoſe of the neck and loins:—they are more convex before than either of the other two ſorts; and are flatted laterally by the preſſure of the ribs, which are inſerted into ſmall cavities formed in their ſides. This flatneſs of their ſides, which makes the figure of theſe vertebrae almoſt an half oval, is of good uſe; as it affords a firm articulation to the ribs, allows the trachea arteria to divide at a ſmall angle, and

 the

(*b*) Atlas quibuſdam, maxima, magna vertebra, prominens.

(*c*) Θωρακος, μεταφρενα, νωτα, υποτραχηλια, antiſterni, pectoris, tergi.

the other large veſſels to run ſecure from the action of the vital organs.——Their bodies are more concave behind than any of the other two claſſes.——Their upper and lower ſurfaces are horizontal.

The cartilages interpoſed between the bodies of theſe vertebrae are thinner than in any other of the true vertebrae; and contribute to the concavity of the ſpine in the thorax, by being thinneſt at their fore-part.

The oblique proceſſes are placed almoſt perpendicularly; the upper ones ſlanting but a little forwards, and the lower ones ſlanting as much backwards.——Their convexity or concavity is not ſo remarkable as to require particular notice. Between the oblique proceſſes of oppoſite ſides, ſeveral ſharp proceſſes ſtand out from the upper and lower parts of the plates which join to form the ſpinal proceſſes; into theſe ſharp proceſſes, ſtrong ligaments are fixed for connecting the vertebrae.

The tranſverſe proceſſes of the dorſal vertebrae are long, thicker at their ends than in the middle, and turned obliquely backwards; which may be owing to the preſſure of the ribs, the tubercles of which are inſerted into a depreſſion near the end of theſe proceſſes.

The ſpinal proceſſes are long, ſmall-pointed, and ſloping downwards and backwards: from their upper and back-part a ridge riſes, which is received by a ſmall channel in the fore-part of the ſpinal proceſs immediately above, which is here connected to it by a ligament.

The conduit of the ſpinal marrow is here more circular, but, correſponding to the ſize of that cord, is ſmaller than in any of the other vertebrae; and a larger ſhare of the holes in the bony bridges, for the tranſmiſſion of the nerves, is formed in the vertebra above than in the one below.

The

The connection of the dorfal vertebrae to the ribs, the thinnefs of their cartilages, the erect fituation of the oblique proceffes, the length, floping, and connection of the fpinal proceffes, all contribute to reftrain thefe vertebrae from much motion, which might difturb the actions of the heart and lungs; and in confequence of the little motion allowed here, the intervertebral cartilages fooner fhrivel, by becoming more folid; and therefore the firft remarkable curvature of the fpine obferved, as people advance to old age, is in the leaft ftretched vertebrae of the back; or old people firft become round fhouldered.

The bodies of the four uppermoft dorfal vertebrae deviate from the rule of the vertebrae becoming larger as they defcend: for the firft of the four is the largeft, and the other three below gradually become fmaller, to allow the trachea and large veffels to divide at fmaller angles.

The two uppermoft vertebrae of the back, inftead of being very prominent forwards, are flatted by the action of the mufculi longi colli and recti majores.

The proportional fize of the two little depreffions in the body of each vertebra for receiving the heads of the ribs, feems to vary in the following manner; the depreffion on the udper edge of each vertebra decreafes as far down as the fourth, and after that increafes.

The tranfverfe proceffes are longer in each lower vertebra to the feventh or eighth, with their fmooth furfaces, for the tubercles of the ribs, facing gradually more downwards; but afterwards, as they defcend, they become fhorter, and the fmooth furfaces are directed more upwards.

The fpinous proceffes of the vertebrae of the back become gradually longer and more flanting, from the firft as far down as the eighth or ninth vertebra; from which they manifeftly turn fhorter and more erect.

The

The firſt (*d*) vertebra, beſides an oblong hollow in its lower edge, that aſſiſts in forming the cavity wherein the ſecond rib is received, has the whole cavity for the head of the firſt rib formed in it.

The ſecond has the name of axillary (*e*), without any thing particular in its ſtructure.

The eleventh (*f*) often has the whole cavity for the eleventh rib in its body, and wants the ſmooth ſurface on each tranſverſe proceſs.

The twelfth (*g*) always receives the whole head of the laſt rib, and has no ſmooth ſurfaces of its tranſverſe proceſſes, which are very ſhort.——The ſmooth ſurfaces of its inferior oblique proceſſes face outwards as the lumbar do.———And we may ſay in general, that the upper vertebrae of the back loſe gradually their reſemblance to thoſe of the neck, and the lower ones come nearer to the figure of the lumbar.

The articulation of the vertebrae of the back with the ribs, ſhall be more particularly conſidered after the ribs are deſcribed. Only it may be proper now to remark, that the ligaments which ſerve that articulation aſſiſt in connecting the vertebrae.

The loweſt order of the true vertebrae is the *lumbar* (*h*), which are five bones, that may be diſtinguiſhed from any others by theſe marks: 1. Their bodies, though of a circular form at their fore-part, are ſomewhat oblong from one ſide to the other; which may be occaſioned by the preſſure of the large veſſels, the aorta and cava, and of the viſcera. The epiphyſes on their edges are larger; and therefore the upper and lower ſurfaces of their bodies are more concave than in the vertebrae of the back. 2. The

cartilages

(*d*) Λοφια, Gutturalis. (*e*) Μασχαλιστηρ.

(*f*) Αρρεπης, in neutram partem inclinans.

(*g*) Διαζωστηρ, Praecingens.

(*h*) Οσπυος, ἰξυος, ψοιων, Renum, lumborum.

cartilages between thefe vertebrae are much the thickeft of any, and render the fpine convex within the abdomen, by their greateft thicknefs being at their fore-part. 3. The oblique proceffes are ftrong and deep; thofe in oppofite fides being almoft placed in parallel planes; the fuperior, which are concave, facing inwards, and the convex inferior ones facing outwards: And therefore each of thefe vertebrae receives the one above it, and is received by the one below; which is not fo evident in the other two claffes already defcribed. 4. Their tranfverfe proceffes are fmall, long, and almoft erect, for allowing large motion to each bone, and fufficient infertion to mufcles, and for fupporting and defending the internal parts. 5. Between the roots of the fuperior oblique and tranfverfe proceffes a fmall protuberance may be obferved, where fome of the mufcles that raife the trunk of the body are inferted. 6. Their fpinal proceffes are ftrong, ftraight, and horizontal, with broad flat fides, and a narrow edge above and below; this laft being depreffed on each fide by mufcles. And at the root of thefe edges, we fee rough furfaces for fixing the ligaments. 7. The canal for the numerous cords called *cauda equina*, into which the fpinal marrow divides, is rather larger in thefe bones than what contains that marrow in the vertebrae of the back. 8. The holes for the paffage of the nerves are more equally formed out of both the contiguous vertebrae than in the other claffes; the upper one furnifhes, however, the larger fhare of each hole.

The thick cartilages between thefe lumbar vertebrae, their deep oblique proceffes, and their erect fpinal proceffes, are all fit for allowing large motion: Though it is not fo great as what is performed in the neck; which appears from comparing the arches which the head defcribes when moving on the neck or the loins only.

The lumbar vertebrae, as they defcend, have their oblique

proceffes

proceffes at a greater diftance from each other, and facing more backwards and forwards.

Both tranfverfe and fpinal proceffes of the middlemoft vertebrae of the loins are longeft and thickeft; in the vertebrae above and below, they are lefs: So that thefe proceffes of the firft (*i*) and fifth (*k*) are the leaft, to prevent their ftriking on the ribs or offa ilium, or their bruifing the mufcles in the motions of the fpine.

The epiphyfes round the edges of the bodies of the lumbar vertebrae are moft raifed in the two loweft; which confequently make them appear hollower in the middle than the others are.

The body of the fifth vertebra is rather thinner than that of the fourth.—The fpinal procefs of this fifth is fmaller, and the oblique proceffes face more backwards and forwards than in any other lumbar vertebra.

After confidering the ftructure of the particular vertebrae, and their mutual connection, we may obferve a folicitous care taken that they fhall not be disjoined without great difficulty. For, befides being connected by ftrong ligaments proportioned to the forces which are to be refifted, their bodies either enter fo into each other as to prevent their being difplaced any way, as in the vertebrae of the neck; or they are propped on all fides, as thofe of the back are by the ribs; or their furfaces of contact are fo broad, as to render the feparation almoft impracticable, as in the loins: While the depth and articulation of the oblique proceffes are exactly proportioned to the quantity of motion which the other parts of the bones allow, or the mufcles can perform. Yet as thefe oblique proceffes are fmall, and therefore not capable of fo fecure a conjunction as the larger bodies, they may fooner yield

(*i*) Νεφρίτης, Renalis. (*k*) Ανοχολίτης, Fulciens.

yield to a disjoining force; but then their diflocation is not of near fo bad confequence as the feparation of the bodies would be: For by the oblique proceffes being diflocated, the mufcles, ligaments, and fpinal marrow, are indeed ftretched; but this marrow muft be compreffed, or entirely deftroyed, when the body of the vertebra is removed out of its place.

THE FALSE VERTEBRAE.

The False Vertebrae compofe the under pyramid of the fpine. They are diftinguifhed from the bones already defcribed juftly enough by this epithet of falfe; becaufe, though each bone into which they can be divided in young people refembles the true vertebrae in figure, yet none of them contribute to the motion of the trunk of the body; they being intimately united to each other in adults, except at their lower part, where they are moveable; whence they are commonly divided into two bones, *os facrum*, and *os coccygis*.

Os Sacrum (*l*), is fo called, from being offered in facrifice by the antients, or rather becaufe of its largenefs in refpect of the other vertebrae.—This bone is of an irregular triangular fhape, broad above, narrow below; convex behind, for the advantageous origin of the mufcles that move the fpine and thigh backwards; and concave before, for enlarging the cavity of the pelvis.—Four tranfverfe lines, of a colour different from the reft of the bone which are feen on its fore-part, are the marks of divifion of the five different bones of which it confifts in young perfons.

The fore-part of the os facrum, analogous to the bodies of the true vertebrae, is fmooth and flat, to allow a large fpace

(*l*) Ιερον, σπονδυλος μελας, Hippocrat. υποσπονδυλον, Oribaf. Πλατυ, Latum, os clunium, clavium.

ſpace for the contained bowels, without any danger of hurting them; or this flat figure may be owing to the equal preſſure of theſe bowels, particularly of the laſt gut.—The back-part of it is almoſt ſtraight, without ſo large a cavity as the vertebrae have; becauſe the ſpinal marrow, now ſeparated into the cauda equina, is ſmall.——The bridges between the bodies and proceſſes of this bone are much thicker, and in proportion ſhorter, than in the former claſs of bones. —The ſtrength of theſe croſs bridges is very remarkable in the three upper bones, and is well proportioned to the incumbent weight of the trunk of the body, which theſe bridges ſuſtain in a tranſverſe, conſequently an unfavourable, ſituation, when the body is erect.

There are only two oblique proceſſes of the os ſacrum; one ſtanding out on each ſide from the upper part of the firſt bone.—Their plain erect ſurfaces face backwards, and are articulated with the inferior oblique proceſſes of the laſt vertebra of the loins, to which each of theſe proceſſes is connected by a ſtrong ligament, which riſes from a ſcabrous cavity round their roots, where mucilaginous glands are alſo lodged.—Inſtead of the other oblique proceſſes of this bone, four rough tubercles are to be ſeen on each ſide of its ſurface behind, from which the muſculus ſacer has its origin.

The tranſverſe proceſſes here are all grown together into one large ſtrong oblong proceſs on each ſide; which, ſo far as it anſwers to the firſt three bones, is very thick, and divided into two irregular cavities by a long perpendicular ridge——The foremoſt of the two cavities has commonly a thin cartilaginous ſkin covering it in the recent ſubject, and is adapted to the unequal protuberance of the os ilium; and a ſtrong ligament connects the circumference of theſe ſurfaces of the two bones.——The cavity behind is divided by a tranſverſe ridge into two, where ſtrong

ligamentous

ligamentous ſtrings that go from this bone to the os ilium, with a cellular ſubſtance containing mucus, are lodged.

The tranſverſe proceſſes of the two laſt bones of the os ſacrum are much ſmaller than the former.—At their back-part near their edge, a knob and oblong flat ſurface give riſe to two ſtrong ligaments which are extended to the os iſchium; and are therefore called *ſacroſciatic.*

The ſpinal proceſſes of the three uppermoſt bones of the os ſacrum appear ſhort, ſharp, and almoſt erect, while the two lower ones are open behind; and ſometimes a little knob is to be ſeen on the fourth, though generally it is bifurcated, without the two legs meeting into a ſpine; in which condition alſo the firſt is often to be ſeen; and ſometimes none of them meet, but leave a ſinus, or rather foſſa, inſtead of a canal (*m*).—The muſculus latiſſimus and longiſſimus dorſi, ſacro-lumbalis, and glutaeus maximus, have part of their origins from theſe ſpinal proceſſes.

The canal between the bodies and proceſſes of this bone, for the cauda equina, is triangular; and becomes ſmaller, as the cauda alſo does, as it deſcends.—Below the third bone, this paſſage is no more a complete bony canal, but is open behind; and is only there defended by a ſtrong ligamentous membrane ſtretched over it, which, with the muſcles that cover it, and that are very prominent on each ſide, is a ſufficient defence for the bundle of nerves within.

At the root of each oblique proceſs of this bone, the notch is conſpicuous; by which, and another ſimilar one in the laſt vertebra of the loins, a paſſage is left for the twenty-fourth ſpinal nerve; and in viewing the os ſacrum, either before or behind, four large holes appear in each ſide, in much the ſame height as where the marks of the union of its ſeveral bones remain. Some of the largeſt nerves of the body paſs through the anterior holes; and ſuperficial

 grooves,

(*m*) Verheyen, Anat. tract. 5. cap. 9.—Sue Trad. d'oſteol. p. 127.

grooves, running outwards from them in different directions, ſhew the courſe of theſe nerves.——From the intervals of theſe grooves, the pyriformis muſcle chiefly riſes.——The holes in the back-part of the bone are covered by membranes which allow ſmall nerves to paſs through them.——The two uppermoſt of theſe holes, eſpecially on the fore-ſide, are the largeſt; and as the bone deſcends, the holes turn ſmaller. Sometimes a notch is only formed at the lower part in each ſide of this bone; and in other ſubjects there is a hole common to it and the os coccygis, through which the twenty-ninth pair of ſpinal nerves paſſes; and frequently a bony bridge is formed on the back-part of each ſide by a proceſs ſent up from the back-part of the os coccygis, and joined to the little knobs which the laſt bone of the os ſacrum has inſtead of a ſpinal proceſs. Under this bridge or jugum, the twenty-ninth pair of ſpinal nerves runs in its courſe to the common holes juſt now deſcribed.

The upper part of the body of the firſt bone reſembles the vertebrae of the loins; but the ſmall fifth bone is oblong tranſverſely, and hollow in the middle of its lower ſurface.

The ſubſtance of the os ſacrum is very ſpongy, without any conſiderable ſolid external plates, and is lighter proportionally to its bulk than any other bone in the body; but it is ſecured from injuries by the thick muſcles that cover it behind, and by the ſtrong ligamentous membranes that cloſely adhere to it.—As this is one of the moſt remarkable inſtances of this ſort of defence afforded a ſoft weak bone, we may make the general obſervation: That wherever we meet with ſuch a bone, one or other, or both theſe defences, are uſed; the firſt to ward off injuries; and the ſecond to keep the ſubſtance of the bone from yielding too eaſily.

This

This bone is *articulated* above to the laſt vertebra of the loins, in the manner that the lumbar vertebrae are joined; and therefore the ſame motions may be performed here.—The articulation of the lower-part of the os ſacrum to the os coccygis, ſeems well enough adapted for allowing conſiderable motion to this laſt bone, were it not much confined by ligaments. Laterally, the os ſacrum is joined to the oſſa ilium by an immoveable ſynchondroſis, or what almoſt deſerves the name of a ſuture: For the cartilaginous cruſt on the ſurface of the bones is very thin; and both their ſurfaces are ſo ſcabrous and unequal, as to be indented into each other; which makes ſuch a ſtrong connection, that great force is required to ſeparate them, after all the muſcles and ligaments are cut.—Frequently the two bones grow together in old ſubjects.

The *uſes* of the os ſacrum are, to ſerve as the common baſe and ſupport of the trunk of the body, to guard the nerves proceeding from the end of the ſpinal marrow, to defend the back-part of the pelvis, and to afford ſufficient origin to the muſcles which move the trunk and thigh.

The bones that compoſe the os ſacrum of infants, have their bodies ſeparated from each other by a thick cartilage; and, in the ſame manner as the true vertebrae, each of them conſiſts of a body and two lateral plates, connected together by cartilages; the ends of the plates ſeldom being contiguous behind.

Os Coccygis (*n*), or *rump-bone*, is that triangular chain of bones depending from the os ſacrum; each bone becoming ſmaller as they deſcend, till the laſt ends almoſt in a point. The os coccygis is convex behind, and concave before; from which crooked pyramidal figure, which was thought to reſemble a cuckow's beak, it has got its name.

This

(*n*) Ὀῤῥοπύγιον, ὄῤῥος, Caudae os, ſpondylium os cuculi.

This bone confifts of four pieces in people of middle age: —In children, almoft the whole of it is cartilage: In old fubjects, all the bones are united, and become frequently one continued bone with the os facrum.

The higheft of the four bones is the largeft, with fhoulders extended farther to each fide than the end of the os facrum; which enlargement fhould, in my opinion, ferve as a diftinguifhing mark to fix the limits of either bone; and therefore fhould take away all difpute about reckoning the number of bones, of which one or other of thefe two parts of the falfe vertebrae is compofed; which difpute muft ftill be kept up, as long as the numbering five or fix bones in the os facrum depends upon the uncertain accident of this broad fhouldered little bone being united to or feparated from it.—The upper furface of this bone is a little hollow.—From the back of that bulbous part, called its fhoulders, a procefs often rifes up on each fide, to join with the bifurcated fpine of the fourth and fifth bones of the os facrum, to form the bony bridge mentioned in the defcription of the os facrum.——Sometimes thefe fhoulders are joined to the fides of the fifth bone of the os facrum, to form the hole in each fide common to thefe two bones, for the paffage of the twenty-ninth pair of fpinal nerves.—Immediately below the fhoulders of the os coccygis, a notch may be remarked on each fide, where the thirtieth pair of the fpinal nerves paffes.——The lower end of this bone is formed into a fmall head, which very often is hollow in the middle.

The three lower bones gradually become fmaller, and are fpongy; but are ftrengthened by a ftrong ligament which covers and connects them.—Their ends, by which they are articulated, are formed in the fame manner as thofe of the firft bone are.

Between each of thefe four bones of young fubjects a cartilage

cartilage is interpofed; therefore their articulation is analogous to that of the bodies of the vertebrae of the neck: For, as has been above remarked, the lower end of the os facrum, and of each of the three fuperior bones of the os coccygis, has a fmall depreffion in the middle; and the upper part of all the bones of the os coccygis is a little concave, and confequently the interpofed cartilages are thickeft in the middle, to fill up both cavities; by which they connect the bones more firmly.—When the cartilages offify, the upper end of each bone is formed into a cavity, exactly adapted to the protuberant lower end of the bone immediately above.—From this fort of articulation, it is evident, that, unlefs when thefe bones grow together, all of them are capable of motion; of which the firft and fecond, efpecially this laft, enjoys the largeft fhare.

The lower end of the fourth bone terminates in a rough point, to which a cartilage is appended.

To the fides of thefe bones of the os coccygis, the coccygaei mufcles (*o*), and part of the levatores ani, and of the glutaei maximi, are fixed.

The fubftance of thefe bones is very fpongy, and in children cartilaginous; there being only a part of the firft bone offified in a new born infant.——Since therefore the inteftinum rectum of children is not fo firmly fupported as it is in adults, this may be one reafon why they are more fubject to a procidentia ani than old people (*p*).

From the defcription of this bone, we fee how little it refembles the vertebrae; fince it feldom has proceffes, never has any cavity for the fpinal marrow, nor holes for the paffage of nerves. Its connection hinders it from being moved to either fide: and its motion backwards and forwards is much

(*o*) Douglas, Myograph. chap. 40.—Euftach. tab. 36. N°. 45. 20.

(*p*) Spigel. de humani corp. fabric. lib. 2. cap. 22.—Paaw de offib. par. 2. cap. 3.

much confined: Yet, as its ligaments can be ftretched by a confiderable force, it is of great advantage in the excretion of the faeces alvinae, and much more in child-bearing, that this bone fhould remain moveable; and the right management of it, in delivering women, may be of great benefit to them (*q*). The mobility of the os coccygis diminifhing as people advance in age, efpecially when its ligaments and cartilages have not been kept flexible by being ftretched, is probably one reafon why the women, who are old maids before they marry, have generally difficult parturition.

The os coccygis ferves to fuftain the inteftinum rectum; and, in order to perform this office more effectually, it is made to turn with a curve forwards; by which alfo the bone itfelf, as well as the mufcles and teguments, is preferved from any injury when we fit with our body reclined back.

§ 2. *Of the* Pelvis.

The fecond part of the trunk of the fkeleton, viz. the pelvis, is the cylindrical cavity at the lower part of the abdomen formed by the os facrum, os coccygis, and offa innominata; which laft therefore fall now in courfe to be examined.

OSSA INNOMINATA.

Though the name of *offa innominata* (*r*) contributes nothing to the knowledge of their fituation, ftructure, or office; yet they have been fo long univerfally known by it, that there is no occafion for changing it. They are two large broad bones, which form the fore-part and fides of the

(*q*) Paaw, ibid.—Deventer, Operat. chirurg. cap. 27.

(*r*) Σκελιων προσφυσεις, Sacro conjuncta.

the pelvis, and the lower part of the ſides of the abdomen.— In children, each of theſe bones is evidently divided into three; which are afterwards ſo intimately united, that ſcarce the leaſt mark of their former ſeparation remains: They are nevertheleſs deſcribed as conſiſting each of three bones, to wit, the os ilium, iſchium, and pubis; which I ſhall firſt deſcribe ſeparately, and then ſhall conſider what is common to any two of them, or to all the three.

Os ILIUM (*s*), or *haunch-bone*, is ſituated higheſt of the three, and reaches as far down as one third of the great cavity into which the head of the thigh-bone is received.

The external ſide of this bone is unequally convex, and is called its *dorſum*;—the internal concave ſurface is by ſome authors (but improperly) named its *coſta*.——The ſemicircular edge at the higheſt part of this bone, which is tipped with a cartilage in the recent ſubject, is named the *ſpine*, into which the external or deſcending oblique muſcle of the abdomen is inſerted; and from it the internal aſcending oblique, and the tranſverſe muſcles of the belly, with the glutaeus maximus, quadratus lumborum, and latiſſimus dorſi, have their origin. Some writers (*t*) are of opinion, that it is only the tendinous cruſt of all theſe muſcles, and not a cartilage, as is commonly alleged, that covers this bony edge.——The ends of the ſpine being more prominent than the ſurface of the bone below them, are therefore reckoned proceſſes.———From the anterior ſpinal proceſs, the ſartorius and faſcialis muſcles have their riſe, and the outer end of the doubled tendon of the external oblique muſcle of the abdomen, commonly called *Fallopius's* or *Paupart's* ligament, is fixed to it. The inſide of the poſterior ſpinal proceſs, and of part of the ſpine forward

(*s*) Λαγονιον κενεων, Scaphium, lumbare, clunium, clavium, anchas.

(*t*) Winſlow, Expoſition anatomique du corps humain, traité des os frais, § 96.

ward from that, is made flat and rough where the ſacro-lumbalis and longiſſimus dorſi riſe; and to its outſide are fixed ligaments extended to the os ſacrum and tranſverſe proceſſes of the fifth and fourth vertebrae of the loins (*u*).——Below the anterior ſpinal proceſs another protuberance ſtands out, which by its ſituation may be diſtinguiſhed from the former, by adding the epithet of *inferior*, where the muſculus rectus tibiae has its origin (*x*).——Between theſe two anterior proceſſes the bone is hollowed where the beginning of the ſartorius muſcle is lodged.——Below the poſterior ſpinal proceſs, a ſecond protuberance of the edge of this bone is in like manner obſervable, which is cloſely applied to the os ſacrum.——Under this laſt proceſs a conſiderable large niche is obſervable in the os ilium; between the ſides of which and the ſtrong ligament that is ſtretched over from the os ſacrum to the ſharp pointed proceſs of the os iſchium of the recent ſubject, a large hole is formed, through which the muſculus pyriformis, the great ſciatic nerve, and the poſterior crural veſſels, paſs, and are protected from compreſſion.

The external broad ſide, or dorſum of the os ilium, is a little hollow towards the fore-part; farther back, it is as much raiſed; then is conſiderably concave; and, laſtly, it is convex.——Theſe inequalities are occaſioned by the actions of the muſcles that are ſituated on this ſurface.——From behind the uppermoſt of the two anterior ſpinal proceſſes, in ſuch bones as are ſtrongly marked by the muſcles, a ſemicircular ridge is extended to the hollow paſſage of the ſciatic nerve. Between the ſpine and this ridge, the gluteus medius takes its riſe. Immediately from above the loweſt of the anterior ſpinal proceſſes, a ſecond ridge is ſtretched to the niche. Between this and the former ridge,

(*u*) Weitbrecht, Syndeſmolog. ſect. 4. § 39. 40. 46. 47.

(*x*) Baker, Curſ. Oſteolog. demonſtr. 3.

ridge, the glutaeus minimus has its origin.——On the outſide of the poſterior ſpinal proceſſes, the dorſum of the os ilium is flat and rough, where part of the muſculus glutaeus maximus and pyriformis riſes. The loweſt part of this bone is the thickeſt, and is formed into a large cavity with high brims, to aſſiſt in compoſing the great acetabulum; which ſhall be conſidered, after all the three bones that conſtitute the os innominatum are deſcribed.

The internal ſurface of the os ilium is concave in its broadeſt fore-part, where the internal iliac muſcle has its origin, and where ſome ſhare of the inteſtinum ilium and colon is lodged. From this large hollow, a ſmall ſinuoſity is continued obliquely forwards, at the inſide of the anterior inferior ſpinal proceſs, where part of the pſoas and iliacus muſcles, with the crural veſſels and nerves, paſs.—The large concavity is bounded below by a ſharp ridge, which runs from behind forwards; and, being continued with ſuch another ridge of the os pubis, forms a line of partition between the abdomen and pelvis.—Into this ridge the broad tendon of the pſoas parvus is inſerted.

All the internal ſurface of the os ilium, behind this ridge, is very unequal: For the upper part is flat, but ſpongy, where the ſacro-lumbalis and longiſſimus dorſi riſe.———Lower down, there is a tranſverſe ridge from which ligaments go out to the os ſacrum.——Immediately below this ridge, the rough unequal cavities and prominences are placed, which are exactly adapted to thoſe deſcribed on the ſide of the os ſacrum. In the ſame manner, the upper part of this rough ſurface is porous, for the firmer adheſion of the ligamentous cellular ſubſtance; while the lower part is more ſolid, and covered with a thin cartilaginous ſkin, for its immoveable articulation with the os ſacrum.———From all the circumference of this large unequal ſurface, ligaments are extended to the os ſacrum, to ſecure more firmly the conjunction of theſe bones.

The paſſages of the medullary veſſels are very conſpicuous, both in the dorſum and coſta of many oſſa ilium; but in others they are inconſiderable.

The poſterior and lower parts of theſe bones are thick; but they are generally exceedingly thin and compact at their middle, where they are expoſed to the actions of the muſculi glutaei and iliacus internus, and to the preſſure of the bowels contained in the belly.—The ſubſtance of the oſſa ilium is moſtly cellular, except a thin external table.

In a ripe child, the ſpine of the os ilium is cartilaginous; and is afterwards joined to the bone, in form of an epiphyſe. ——The large lower end of this bone is not completely oſſified.

Os Ischium (y), or hip-bone, is of a middle bulk between the two other parts of the os innominatum, is ſituated loweſt of the three, and is of a very irregular figure. Its extent might be marked by a horizontal line drawn near through the middle of the acetabulum; for the upper bulbous part of this bone forms rather leſs than the lower half of that great cavity, and the ſmall leg of it riſes to much the ſame height on the other ſide of the great hole common to this bone and the os pubis.

From the upper thick part of the os iſchium, a ſharp proceſs, called by ſome authors ſpinous, ſtands out backwards, from which chiefly the muſculus coccygaeus and ſuperior gemellus, and part of the levator ani, riſe; and the anterior or internal ſacroſciatic ligament is fixed to it. Between the upper part of this ligament and the bones, it was formerly obſerved that the pyriform muſcle, the poſterior crural veſſels, and the ſciatic nerve, paſs out of the pelvis. —Im-

(y) Coxae, coxendicis, pyxis.

—Immediately below this proceſs, a ſinuoſity is formed for the tendon of the muſculus obturator internus.———In a recent ſubject this part of the bone, which ſerves as a pulley on which the obturator muſcle plays, is covered with a ligamentous cartilage, that, by two or three ſmall ridges, points out the interſtices of the fibres in the tendon of this muſcle. ——The outer ſurface of the bone at the root of this ſpinous proceſs is made hollow by the pyriformis or iliacus externus muſcle.

Below the ſinuoſity for the obturator muſcle, is the great knob or tuberoſity, covered with cartilage or tendon (z). ——The upper part of the tuberoſity gives riſe to the inferior gemellus muſcle.——To a ridge at the inſide of this the external or poſterior ſacroſciatic ligament is ſo fixed, that between it, the internal ligament, and the ſinuoſity of the os iſchium, a paſſage is left for the internal obturator muſcle. ——The upper thick ſmooth part of the *tuber*, called by ſome its *dorſum*, has two oblique impreſſions on it. The inner one gives origin to the long head of the biceps flexor tibiae, and ſeminervoſus muſcles; and the ſemimembranoſus riſes from the exterior one, which reaches higher and nearer the acetabulum than the other.——The lower, thinner, more ſcabrous part of the knob which bends forwards, is alſo marked with two flat ſurfaces; whereof the internal is what we lean upon in ſitting, and the external gives riſe to the largeſt head of the triceps adductor femoris. Between the external margin of the tuberoſity and the great hole of the os innominatum, there is frequently an obtuſe ridge extended down from the acetabulum, which gives origin to the quadratus femoris.———As the tuber advances forwards, it becomes ſmaller, and is rough, for the origin of the muſculus tranſverſalis and erector penis.—The ſmall leg of it, which mounts upwards to join the os pubis, is rough and prominent at

(z) Winſlow, Expoſit. Anat. des os frais, § 96.

at its edge, where the two lower heads of the triceps or quadriceps adductor femoris take their rise.

The upper and back-part of the os ischium is broad and thick; but its lower and fore-part is narrower and thinner. ——Its substance is of the structure common to broad bones.

The os ilium and pubis of the same side are the only bones which are contiguous to the os ischium.

The part of the os ischium, which forms the acetabulum, the spinous process, the great tuber, and the recurved leg, are all cartilaginous at birth.—The tuber, with part of the leg or process above it, becomes an epiphyse before this bone is fully formed.

The Os Pubis (*a*), *share-bone*, is the least of the three parts of the os innominatum, and is placed at the upper fore-part of it.———The thick largest part of this bone is employed in forming the acetabulum; from which becoming much smaller, it is stretched inwards to its fellow of the other side, where it again grows larger, and sends a small branch downwards to join the end of the small leg of the os ischium.——————The upper fore part of each os pubis is tuberous and rough where the musculus rectus and pyramidalis are inserted.—From this a ridge is extended along the upper edge of the bone, in a continued line with such another of the os ilium, which divides the abdomen and pelvis. The ligament of Fallopius is fixed to the internal end of this ridge, and the smooth hollow below it is made by the psoas and iliacus internus muscles passing with the anterior crural vessels and nerves behind the ligament.——Some way below the former ridge, another is extended from the tuberous part of the os pubis downwards and outwards

(*a*) ἥβης, Pectinis, penis, pudibundum, fenestratum.

outwards towards the acetabulum; between these two ridges the bone is hollow and smooth, for lodging the head of the pectineus muscle.—Immediately below, where the lower ridge is to take the turn downwards, a winding niche is made, which is comprehended in the great foramen of a skeleton; but is formed into a hole by a subtended ligament in the recent subject, for the passage of the posterior crural nerve, an artery, and a vein.——The internal end of the os pubis is rough and unequal, for the firmer adhesion of the thick ligamentous cartilage that connects it to its fellow of the other side:——The process which goes down from that to the os ischium is broad and rough before, where the gracilis and upper heads of the triceps, or rather *quadriceps*, adductor femoris have their origin.

The substance of the os pubis is the same as of other broad bones.

Only a part of the large end of this bone is ossified, and the whole leg is cartilaginous, in a child born at the full time.

Between the os ischium and pubis a very large irregular hole is left, which, from its resemblance to a door or shield, has been called *thyroides*. This hole is all, except the niche for the posterior crural nerve, filled up, in a recent subject, with a strong ligamentous membrane, that adheres very firmly to its circumference. From this membrane chiefly the two obturator muscles, external and internal, take their rise. —The great design of this hole, besides rendering the bone lighter, is to allow a strong enough origin to the obturator muscles, and sufficient space for lodging their bellies, that there may be no danger of disturbing the functions of the contained viscera of the pelvis by the actions of the internal, nor of the external being bruised by the thigh bone, especially by its lesser trochanter, in the motions of the thigh inwards:

wards: Both which inconveniencies muft have happened, had the offa innominata been complete here, and of fufficient thicknefs and ftrength to ferve as the fixed point of thefe mufcles.—The bowels fometimes make their way through the niche for the veffels, at the upper part of this thyroid hole; and this caufes a hernia in this place (*b*).

In the external furface of the offa innominata, near the outfide of the great hole, a large deep cavity is formed by all the three bones conjunctly: For the os pubis conftitutes about one fifth, the os ilium makes fomething lefs than two fifths, and the os ifchium as much more than two fifths. The brims of this cavity are very high, and are ftill much more enlarged by the ligamentous cartilage, with which they are tipped in a recent fubject. From this form of the cavity it has been called *acetabulum;* and for a diftinguifhing character the name of the bone that conftitutes the largeft fhare of it is added; therefore *acetabulum offis ifchii* (*c*) is the name this cavity commonly bears. Round the bafe of the fupercilia the bone is rough and unequal, where the capfular ligament of the articulation is fixed.——The brims at the upper and back part of the acetabulum are much larger and higher than any where elfe; which is very neceffary to prevent the head of the femur from flipping out of its cavity at this place, where the whole weight of the body bears upon it, and confequently would otherwife be in perpetual danger of thrufting it out. As thefe brims are extended downwards and forwards, they become lefs; and at their internal lower part a breach is made in them; from the one fide of which to the other, a ligament is placed in the recent fubject; under which a large hole is left, which contains a fatty cellular fubftance and veffels. The reafon of which appearance has

(*b*) Memoires de l'acad. de chirurgie, tom. I. p. 709. &c.

(*c*) Coxæ, coxendicis.

has afforded matter of debate. To me it feems evidently contrived for allowing a large motion to the thigh inwards: For if the bony brims had been here continued, the neck of the thigh-bone muft have ftruck upon them when the thighs were brought acrofs each other; which, in a large ftrong motion this way, would have endangered the neck of the one bone, or brim of the other. Then the veffels which are diftributed to the joint may fafely enter at the finuofity in the bottom of the breach; which being, however, larger than is neceffary for that purpofe, allows the larger mucilaginous gland of the joint to efcape below the ligament, when the head of the thigh-bone is in hazard of preffing too much upon it in the motions of the thigh outwards (*d*). Befides this difference in the height of the brims, the acetabulum is otherwife unequal; for the lower internal part of it is depreffed below the cartilaginous furface of the upper part, and is not covered with cartilage; into the upper part of this particular depreffion, where it is deepeft and of a femilunar form, the ligament of the thigh-bone, commonly, though improperly, called the *round* one is inferted; while, in its more fuperficial lower part, the large mucilaginous gland of this joint is lodged. The greateft part of this feparate depreffion is formed in the os ifchium.

From what has been faid of the condition of the three bones compofing this acetabulum in new-born children, it muft be evident that a confiderable part of this cavity is cartilaginous in them.

THE *offa innominata* are *joined* at their back-part to each fide of the os facrum by a fort of future, with a very thin intervening cartilage, which ferves as fo much glue to cement thofe bones together; and ftrong ligaments go from the

(*d*) Petit. Memoires de l'acad. des fciences, 1722.

the circumference of this unequal ſurface, to connect them more firmly. The oſſa innominata are connected together at their fore-part by the ligamentous cartilage interpoſed between the two oſſa pubis. Theſe bones can therefore have no motion in a natural ſtate, except what is common to the trunk of the body, or to the os ſacrum. But it has been diſputed, whether or not they looſen ſo much from each other, and from the os ſacrum, in child-birth, by the flow of mucus to the pelvis, and by the throes of labour, as that the oſſa pubis recede from each other, and thereby allow the paſſage between the bones to be enlarged. Several obſervations (*e*) ſhew that this relaxation ſometimes happens: But thoſe who had frequently opportunities of diſſecting the bodies of women who died immediately after being delivered of children, teach us to beware of regarding this as the common effect of child-birth; for they found ſuch a relaxation in very few of the bodies which they examined (*f*).

Conſidering the great weight that is ſupported in our erect poſture, by the articulation of the oſſa innominata with the os ſacrum, there is great reaſon to think, that if the conglutinated ſurfaces of theſe bones were once ſeparated (without which the oſſa pubis cannot ſhuffle on each other), the ligaments would be violently ſtretched, if not torn: From whence many diſorders would ariſe (*g*).

Each os innominatum affords a ſocket (the acetabulum) for the thigh-bones to move in; and the trunk of the body rolls here ſo much on the heads of the thigh-bones, as to allow the moſt conſpicuous motions of the trunk, which are commonly thought to be performed by the bones of the

(*e*) Bauchin. Theat. anat. lib. I. cap. 49.—Spigel. Anat. lib. 2. c. 24.—Riclan. Anthropog. lib. 6. cap. 12.—Diemerbroek, Anat. lib 9 cap. 16.

(*f*) Hildan. epiſt. cent. obſ. 46.—Dionis Sixieme demonſtrat. des os.—Morgagn. Adverſ. 3. animad. 15.

(*g*) Ludov. in Ephem. German. dec. I. ann. 3. obſ. 255.

the ſpine. This articulation is to be more fully deſcribed after the oſſa femoris are examined.

The pelvis, then, has a large open above where it is continued with the abdomen; is ſtrongly fenced by bones on the ſides, back and fore-part; and appears with a wide opening below, in the ſkeleton; but, in a recent ſubject, a conſiderable part of the opening is filled by the ſacroſciatic ligaments, pyriform, internal obturator, levatores ani, gemini, and coccygaei muſcles, which ſupport and protect the contained parts better than bones could have done; ſo that ſpace is only left at the loweſt part of it, for the large excretories, the veſica urinaria, inteſtinum rectum, and in females, the uterus, to diſcharge themſelves.

§ 3. *Bones of the* THORAX.

THE THORAX, (*h*), or *cheſt*, which is the only part of the trunk of the body that we have not yet deſcribed, reaches from below the neck to the belly; and, by means of the bones that guard it, is formed into a large cavity: The figure of it is ſomewhat conoidal: but its upper ſmaller end is not finiſhed, being left open for the paſſage of the windpipe, gullet, and large blood-veſſels; and its lower part or baſe, has no bones, and is ſhorter before than behind; ſo that, to carry on our compariſon, it appears like an oblique ſection of the conoid. Beſides which, we ought alſo to remark, that the lower part of this cavity is narrower than ſome way above (*i*); and that the middle of its back-part is conſiderably diminiſhed by the bones ſtanding forwards into it.

The bones which form the thorax are the twelve dorſal vertebrae behind, the ribs on the ſides, and the ſternum before.

 The

(*h*) Pectus caſſum. (*i*) Albin. de oſſib. § 169.

The vertebrae have already been deſcribed as part of the ſpine; and therefore are now to be paſſed.

THE RIBS.

The Ribs, or *coſtae* (*k*), (as if they were *cuſtodes*, or guards, to thoſe principal organs of the animal machine, the heart and lungs), are the long crooked bones placed at the ſide of the cheſt, in an oblique direction downwards in reſpect of the back-bone.——Their number is generally twelve on each ſide; though frequently eleven or thirteen have been found (*l*).——Sometimes the ribs are found preternaturally conjoined or divided (*m*).

The ribs are all concave internally; where they are alſo made ſmooth by the action of the contained parts, which, on this account, are in no danger of being hurt by them; and they are convex externally, that they might reſiſt that part of the preſſure of the atmoſphere which is not balanced by the air within the lungs during *inſpiration*.———The ends of the ribs next the vertebrae are rounder than they are after theſe bones have advanced forwards, when they become flatter and broader, and have an upper and lower edge; each of which is made rough by the action of the intercoſtal muſcles inſerted into them. Theſe muſcles, being all of nearly equal force, and equally ſtretched in the interſtices of the ribs, prevent the broken ends of theſe bones, in a fracture, from being removed far out of their natural place, to interrupt the motion of the vital organs.——The upper edge of the ribs is more obtuſe and rounder than the lower, which is depreſſed on its internal ſide by

ar

(*k*) Πλευραι, περιστερνα, σπαθαι.

(*l*) Riolan. Comment. de oſſibus, cap. 19.——Marchetti, cap. 9. Cowper. Explicat. tab. 93. and 94.——Morgagn. Adverſ. Anat.

(*m*) Sue, Trad. d'oſteolog. p. 142.

a long foſſa, for lodging the intercoſtal veſſels and nerves; on each ſide of which there is a ridge, to which the intercoſtal muſcles are fixed. The foſſa is not obſervable, however, at either end of the ribs; for, at the poſterior or root, the veſſels have not yet reached the ribs; and, at the fore-end, they are ſplit away into branches, to ſerve the parts between the ribs: Which plainly teaches ſurgeons one reaſon of the greater ſafety of performing the operation of the empyema towards the ſides of the thorax, than either near the back or the breaſt.

At the poſterior end (*n*) of each rib, a little head is formed, which is divided by a middle ridge into two plain or hollow ſurfaces; the loweſt of which is the broadeſt and deepeſt in moſt of them. The two plains are joined to the bodies of two different vertebrae, and the ridge forces itſelf into the intervening cartilage.——A little way from this head, we find on the external ſurface, a ſmall cavity, where mucilaginous glands are lodged; and round the head, the bone appears ſpongy, where the capſular ligament of the articulation is fixed.——Immediately beyond this a flatted tubercle riſes, with a ſmall cavity at, and roughneſs about, its root, for the articulation of the rib with the tranſverſe proceſs of the loweſt of the two vertebrae, with the bodies of which the head of the rib is joined.——Advancing farther on this external ſurface, we obſerve in moſt of the ribs another ſmaller tubercle, into which ligaments connecting the ribs to each other, and to the tranſverſe proceſſes of the vertebrae and portions of the longiſſimus dorſi, are inſerted.——Beyond this the ribs are made flat by the ſacro-lumbalis muſcle, which is inſerted into the part of this flat ſurface fartheſt from the ſpine, where each rib makes a conſiderable curve, called by ſome its angle.——Then the rib begins

(*n*) Κωπίον, Remulus.

begins to turn broad, and continues ſo to its anterior end (*o*), which is hollow and ſpongy, for the reception of, and firm coalition with, the cartilage that runs thence to be inſerted into the ſternum, or to be joined with ſome other cartilage. ——In adults, the cavity at this end of the ribs is generally ſmooth and poliſhed on its ſurface; by which the articulation of the cartilage with it has the appearance of being deſigned for motion, but it has none.

The *ſubſtance* of the ribs is ſpongy, cellular, and only covered with a very thin external lamellated ſurface, which increaſes in thickneſs and ſtrength as it approaches the vertebrae.

To the fore-end of each rib a long, broad, and ſtrong cartilage is fixed, and reaches thence to the ſternum, or is joined to the cartilage of the next rib. This courſe, however, is not in a ſtraight line with the rib: for the cartilages generally make a conſiderable curve, the concave part of which is upwards; therefore, at their inſertion into the ſternum, they make an obtuſe angle above, and an acute one below.—— Theſe cartilages are of ſuch a length as never to allow the ribs to come to a right angle with the ſpine; but they keep them ſituated ſo obliquely as to make the angle very conſiderably obtuſe, above, till a force exceeding the elaſticity of the cartilage is applied.——Theſe cartilages, as all others, are firmer and harder internally than they are on their external ſurface; and ſometimes in old people, all their middle ſubſtance becomes bony, while a thin cartilaginous lamella appears externally (*p*). The oſſification, however, begins frequently at the external ſurface.——The greateſt alternate motions of the cartilages being made at their great curvature, that part remains frequently cartilaginous after all the reſt is oſſified (*q*).

The

(*o*) Πλατη, Palmul.

(*p*) Veſal. lib. 2. cap. 19.

(*q*) Havers, Oſteolog. Nov. diſc. 5. p. 289.

The ribs then are *articulated* at each end, of which the one behind is doubly joined to the vertebrae; for the head is received into the cavities of two bodies of the vertebrae, and the larger tubercle is received into the depreffion in the tranfverfe procefs of the lower vertebra.—When we examine the double articulation, we muft immediately fee that no other motion can be allowed here than upwards and downwards; fince the tranfverfe procefs hinders the rib to be thruft back; the refiftance on the other fide of the fternum prevents the ribs coming forward; and each of the two joints, with the other parts attached, oppofe its turning round. But then it is likewife as evident, that even the motion upwards and downwards can be but fmall in any one rib at the articulation itfelf. But as the ribs advance forwards, the diftance from their centre of motion increafing, the motion muft be larger; and it would be very confpicuous at their anterior ends, were they not refifted there by the cartilages, which yield fo little, that the principal motion is performed by the middle part of the ribs, which turns outwards and upwards, and occafions the twift remarkable in the long ribs at the place near their fore-end where they are moft refifted (*r*).

Hitherto I have laid down the ftructure and connection which moft of the ribs enjoy, as belonging to all of them; but muft now confider the fpecialities wherein any of them differ from the general defcription given, or from each other.

In viewing the ribs from above downwards, their figure is ftill ftraighter; the uppermoft being the moft crooked of any.——Their obliquity in refpect of the fpine increafes as they defcend; fo that though their diftances from each other is very little different at their back-part, yet at their fore-ends the diftances between the lower ones muft increafe.—

In

(*r*) Winflow, Memoires de l'acad. des fciences, 1720.

In consequence, too, of this increased obliquity of the lower ribs, each of their cartilages makes a greater curve in its progress from the rib towards the sternum; and the tubercles, that are articulated to the transverse processes of the vertebrae, have their smooth surfaces gradually facing more upwards.—The ribs becoming thus more oblique, while the sternum advances forwards in its descent, makes the distance between the sternum and the anterior end of the lower ribs greater than between the sternum and the ribs above; consequently the cartilages of those ribs that are joined to the breast-bone are longer in the lower than in the higher ones. —These cartilages are placed nearer to each other as the ribs descend, which occasions the curvature of the cartilages to be greater.

The length of the ribs increases from the first and uppermost rib, as far down as the seventh; and from that to the twelfth, it gradually diminishes.—The superior of the two plain, or rather hollow surfaces, by which the ribs are articulated to the bodies of the vertebrae, gradually increase from the first to the fourth rib, and is diminished after that in each lower rib.—The distance of their angles from the heads always increases as they descend to the ninth, because of the greater breadth of the sacrolumbalis muscle (*s*).

The ribs are commonly divided into *true* and *false*.

The *true* (*t*) costae are the seven upper ones of each side, whose cartilages are all gradually longer as the ribs descend, and are joined to the breast-bone: So that, being pressed constantly between two bones, they are flatted at both ends; and are thicker, harder, and more liable to ossify, than the other cartilages that are not subject to so much pressure. These ribs include the heart and lungs: and therefore are the proper or true *custodes* of life.

The

(*s*) Winslow, Exposition anatomique des os secs, § 643.

(*t*) Γνησιαι, Germanæ, legitimæ.

The five inferior ribs of each ſide are the *falſe* or *baſtard* (*u*), whoſe cartilages do not reach to the ſternum; and therefore, wanting the reſiſtance at their fore-part, they are there pointed; and on this account, having leſs preſſure, their ſubſtance is ſofter.—The cartilages of theſe falſe ribs are ſhorter as the ribs deſcend.—To all theſe five ribs the circular edge of the diaphragm is connected: And its fibres, inſtead of being ſtretched immediately tranſverſely, and ſo running perpendicular to the ribs, are preſſed ſo as to be often, eſpecially in exſpiration, parallel to the plane in which the ribs lie: Nay, one may judge by the attachments which theſe fibres have ſo frequently to the ſides of the thorax a conſiderable way above where their extremities are inſerted into the ribs, and by the ſituation of the viſcera always to be obſerved in a dead ſubject laid ſupine, that there is conſtantly a large concavity formed on each ſide by the diaphragm within theſe baſtard ribs, in which the ſtomach, liver, ſpleen, &c. are contained; which being only reckoned among the viſcera naturalia, have occaſioned the name of *baſtard cuſtodes* to theſe bones.

Hence, in ſimple fractures of the falſe-ribs, without fever, the ſtomach ought to be kept moderately filled with food, leſt the pendulous ribs falling inwards, ſhould thereby increaſe the pain, cough, &c. (*x*).——Hence likewiſe we may learn how to judge better of the ſeat of ſeveral diſeaſes, and to do the operation of the empyema, and ſome others, with more ſafety than we can do if we follow the common directions.

The eight upper ribs were formerly (*y*) claſſed into pairs, with particular names to each two; to wit, the *crooked*, the *ſolid*,

(*u*) Μαλθακαι, χονδροιδεις, ακανθαι, κλενες, ροαι, Adultrinae, ſpuriae, illegitimae.

(*x*) Hippocrat. de articulo, § 51.—Paré, lib. 15. cap. 11.

(*y*) Laurent. Hiſt. Anat. lib. 2. cap. 29.—Paaw, de oſſibus, pars 3. cap 2.

ſolid, the *pectoral*, the *twiſted*: But theſe names are of ſo little uſe, that they are now generally neglected.

The firſt rib of each ſide is ſo ſituated, that the flat ſides are above and below, while one edge is placed inwards and the other outwards, or nearly ſo: Therefore ſufficient ſpace is left above it for the ſubclavian veſſels and muſcles; and the broad concave ſurface is oppoſed to the lungs. But then, in conſequence of this ſituation, the channel for the intercoſtal veſſels is not to be found; and the edges are differently formed from all the other, except the ſecond; the lower one being rounded, and the other ſharp.—The head of this rib is not divided into two plain ſurfaces by a middle ridge, becauſe it is only articulated with the firſt vertebra of the thorax.—Its cartilage is oſſified in adults, and is united to the ſternum at right angles.—This firſt rib frequently has a ridge riſing near the middle of its poſterior edge, where one of the heads of the ſcalenus muſcles riſes.—Farther forward it is flatted, or ſometimes depreſſed by the clavicle.

The fifth, ſixth, and ſeventh, or rather the ſixth, ſeventh, eighth, and ſometimes the fifth, ſixth, ſeventh, eighth, and ninth ribs, have their cartilages at leaſt contiguous: And they are frequently joined to each other by croſs cartilages; and moſt commonly the cartilages of the eighth, ninth, and tenth, are connected to the former and to each other by firm ligaments.

The eleventh, and ſometimes the tenth rib, has no tubercle for its articulation with the tranſverſe proceſs of the vertebra, to which it is only looſely fixed by ligaments.—— The foſſa in its lower edge is not ſo deep as in the upper ribs, becauſe the veſſels run more towards the interſtice between the ribs.—Its fore-end is ſmaller than its body, and its ſhort ſmall cartilage is but looſely connected to the cartilage of the rib above.

The

The twelfth rib is the ſhorteſt and ſtraighteſt.—Its head is only articulated with the laſt vertebra of the thorax; therefore is not divided into two ſurfaces.—This rib is not joined to the tranſverſe proceſs of the vertebra; and therefore has no tubercle, being often pulled neceſſarily inwards by the diaphragm, which an articulation with the tranſverſe proceſs would not have allowed.—The foſſa is not found at its under edge, becauſe the veſſels run below it.—The fore-part of this rib is ſmaller than its middle, and has only a very ſmall pointed cartilage fixed to it.—To its whole internal ſide the diaphragm is connected.

The motions and uſes of the ribs ſhall be more particularly treated of after the deſcription of the ſternum.

The heads and tubercles of the ribs of a new-born child have cartilages on them; part of which becomes afterwards thin epiphyſes.——The bodies of the ribs encroach gradually after birth upon the cartilages; ſo that the latter are proportionally ſhorter, when compared to the ribs, in adults than in children.

Here I cannot help remarking the wiſe Providence of our Creator, in preſerving us from periſhing as ſoon as we come into the world. The end of the bones of the limbs remain in a cartilaginous ſtate after birth, and are many years before they are entirely united to the main body of their ſeveral bones; whereas the condyles of the occipital bone, and of the lower jaw, are true original proceſſes, and oſſified before birth; and the heads and tubercles of the ribs are nearly in the ſame condition: And therefore the weight of the large head is firmly ſupported; the actions of ſucking, ſwallowing, reſpiration, &c. which are indiſpenſably neceſſary for us as ſoon as we come into the world, are performed without danger of ſeparating the parts of the bones that are moſt preſſed on in theſe motions: Whereas, had theſe proceſſes of the head, jaw, and ribs, been epiphyſes at birth, children muſt have been expofed to danger of dying by fuch a feparation; the immediate confequences of which would be the compreffion of the beginning of the fpinal marrow, or want of food, or a ftop put to refpiration.

THE STERNUM.

The fternum (z), or breaft-bone, is the broad flat bone, or pile of bones, at the fore-part of the thorax. The number of bones into which this fhould be divided, has occafioned debates among anatomifts, who have confidered it in fubjects of different ages.—In adults of a middle age, it is compofed of three bones, which eafily feparate after the cartilages connecting them are deftroyed. The two lower bones are frequently found intimately united; and very often, in old people, the fternum is a continued bony fubftance from one end to the other; though we ftill obferve two, fometimes three, tranfverfe lines on its furface; which are marks of the former divifions.

When we confider the fternum as one bone, we find it broadeft and thickeft above, and becoming fmaller as it defcends. The internal furface of this bone is fomewhat hollowed for enlarging the thorax: But the convexity on the external furface is not fo confpicuous, becaufe the fides are preffed outwards by the true ribs; the round heads of whofe cartilages are received into feven fmooth pits formed in each fide of the fternum, and are kept firm there by ftrong ligaments, which, on the external furface, have a particular radiated texture (a). The cartilaginous fibres frequently thruft themfelves into the bony fubftance of the fternum, and are joined by a fort of future.—The pits at the upper-part of the fternum are at the greateft diftance one from another, and,

as

(z) Στηθος, Os pectoris, enfiforme, fcutum cordis.

(a) Ruyfch, Catalog, Rar. fig. 9.

as they defcend, are nearer; fo that the two loweft are contiguous.

The *fubftance* of the breaft-bone is cellular, with a very thin external plate, efpecially on its internal furface, where we may frequently obferve a cartilaginous cruft fpread over it (*b*).—On both furfaces, however, a ftrong ligamentous membrane is clofely braced; and the cells of this bone are fo fmall, that a confiderable quantity of offeous fibres muft be employed in the compofition of it. Whence, with the defence which the mufcles give it, and the moveable fupport it has from the cartilages, it is fufficiently fecured from being broken: For it is ftrong by its quantity of bone; its parts are kept together by ligaments; and it yields enough to elude confiderably any violence offered (*c*).

So far may be faid of this bone in *general*; but the *three* bones, of which, according to the common account, it is compofed in adults, are each to be examined.

The *firft*, all agree, is fomewhat of the figure of a heart, as it is commonly painted; only it does not terminate in a fharp point.—This is the uppermoft thickeft part of the fternum.

The upper middle part of this firft bone, where it is thickeft, is hollowed, to make place for the trachea arteria, though this cavity (*d*) is principally formed by the bone being raifed on each fide of it, partly by the clavicles thrufting it inwards, and partly by the fterno-maftoidei mufcles pulling it upwards.—On the outfide of each tubercle there is an oblong cavity, that, in viewing it tranfverfely from before backwards, appears a little convex. Into thefe glenae, the ends of the clavicle are received.—Immediately below thefe, the fides of this bone begin to turn thinner; and in each a fuperficial cavity

(*b*) Jac. Sylv. in Galen de offibus, cap. 12.

(*c*) Senac, in Memoires de l'acad. des fciences, 1724.

(*d*) Σφαγη, Jugulum, furcula fuperior.

cavity or a rough ſurface is to be ſeen, where the firſt ribs are received or joined to the ſternum.—In the ſide of the under end of this firſt bone, the half of the pit for the ſecond rib on each ſide is formed.——The upper part of the ſurface behind is covered with a ſtrong ligament, which ſecures the clavicles; and is afterwards to be more particularly taken notice of.

The *ſecond* or middle diviſion of this bone is much longer, narrower, and thinner, than the firſt; but excepting that it is a little narrower above than below, it is nearly equal all over in its dimenſions of breadth or thickneſs.—In the ſides of it are complete pits for the third, fourth, fifth, and ſixth ribs, and an half of the pits for the ſecond and ſeventh; the lines, which are marks of the former diviſion of this bone, being extended from the middle of the pits of one ſide to the middle of the correſponding pits of the other ſide.—Near its middle an unoſſified part of the bone is ſometimes found; which, freed of the ligamentous membrane or cartilage that fills it, is deſcribed as a hole: And in this place, for the moſt part, we may obſerve a tranſverſe line, which has made authors divide this bone into two.—When the cartilage between this and the firſt bone is not oſſified, a manifeſt motion of this upon the firſt may be obſerved in reſpiration, or in raiſing the ſternum, by pulling the ribs upwards, or diſtending the lungs with air in a recent ſubject.

The *third* bone is much leſs than the other two, and has only one half of the pit for the ſeventh rib formed in it; wherefore it might be reckoned only an appendix of the ſternum.——In young ſubjects it is always cartilaginous, and is better known by the name of *cartilago xiphoides* or *enſiformis* (*e*) than any other; though the antients often called

(*e*) Clypealis, gladialis, mucronata, malum granatum, ſcutum ſtomachi, epiglottalis, cultralis, medium furculae inferioris, ſcutiformis, enſiculata.

called the whole ſternum *enſiforme;* comparing the two firſt bones to the handle, and this appendix to the blade of a ſword.———This third bone is ſeldom of the ſame figure, magnitude, or ſituation, in any two ſubjects; for ſometimes it is a plain triangular bone, with one of the angles below, and perpendicular to the middle of the upper ſide, by which it is connected to the ſecond bone.———In other people the point is turned to one ſide, or obliquely forwards or backwards. Frequently it is all nearly of an equal breadth, and in ſeveral ſubjects it is bifurcated; whence ſome writers give it the name of *furcella or furcula inferior;* or elſe it is unoſſified in the middle.———In the greateſt number of adults it is oſſified, and tipped with a cartilage; in ſome, one half of it is cartilaginous; and in others, it is all in a cartilaginous ſtate.———Generally ſeveral oblique ligaments, fixed at one end to the cartilages of the ribs, and by the other to the outer ſurface of the xiphoid bone, connect it firmly to thoſe cartilages *(f)*.

So many different ways this ſmall bone may be formed without any inconvenience: But then ſome of theſe poſitions may be ſo directed, as to bring on a great train of ill conſequences; particularly when the lower end is oſſified, and is too much turned outwards or inwards (*g*), or when the conjunction of this *appendix* with the ſecond bone is too weak (*h*).

The ſternum is *joined* by cartilages to the ſeven upper ribs unleſs when the firſt coaleſces with it in an intimate union of ſubſtance; and its unequal cavity on each ſide of its upper end is fitted for the ends of the clavicles.

The

(f) Weitbrecht, Syndeſmolog. p. 121.

(g) Rolfinc. Diſſert. Anat. lib. 2. cap. 41.——Paaw de oſſib. pars 1. cap. 3. & pars 3. cap. 3.———Codronchi de prolapſu cartilagin. mucronat.

(*h*) Paaw de oſſib. pars 1. cap. 3. & pars 3. cap. 3.—Borrich. Act. Haſn. vol. 5. ob. 79.---Donet. Sepulchret. Anat. tom. 2. lib. 3. § 5. Append. ad. obſ. 8. et ibid. § 7. obſ. 19.

The ſternum moſt frequently has four ſmall round bones, ſurrounded with cartilage, in children born at the full time; the uppermoſt of theſe, which is the firſt bone, being the largeſt.——Two or three other very ſmall bony points are likewiſe to be ſeen in ſeveral children.——The number of bones increaſes for ſome years, and then diminiſhes, but uncertainly, till they are at laſt united into thoſe above deſcribed of an adult.

The *uſes* of this bone are, to afford origin and inſertion to ſeveral muſcles; to ſuſtain the mediaſtinum; to defend the vital organs, the heart and lungs, at the fore part; and, laſtly, by ſerving as a moveable fulcrum of the ribs, to aſſiſt conſiderably in reſpiration: which action, ſo far as it depends on the motion of the bones, we are now at liberty to explain.

When the ribs that are connected by their cartilages to the ſternum, or to the cartilages of the true ribs, are acted upon by the intercoſtal muſcles, they muſt all be pulled from the oblique poſition which their cartilages kept them in, nearer to right angles with the vertebrae and ſternum, becauſe the firſt or uppermoſt rib is by much the moſt fixed of any; and the cartilages making a greater reſiſtance to raiſing the anterior ends of the ribs, their large arched middle parts turn outwards as well as upwards.——The ſternum, preſſed ſtrongly on both ſides by the cartilages of the ribs, is puſhed forwards, and that at its ſeveral parts, in proportion to the length and motion of its ſupporters the ribs; that is, moſt at its lower end.——The ſternum and the cartilages, thus raiſed forwards, muſt draw the diaphragm connected to them: conſequently ſo far ſtretch it, and bring it nearer to a plane. The power that raiſes this bone and the cartilages, fixes them ſufficiently to make them reſiſt the action of the diaphragm, whoſe fibres contract at the ſame time, and thruſt the viſcera of the abdomen

men downwards.——The arched part of the ribs being thus moved outwards, their anterior ends and the ſternum being advanced forwards, and the diaphragm being brought nearer to a plain ſurface, inſtead of being greatly convex on each ſide within each cavity of the thorax, it is evident how conſiderably the cavity, of which the nine or ten upper ribs are the ſides, muſt be widened, and made deeper and longer. While this is doing in the upper ribs, the lower ones, whoſe cartilages are not joined to the ſternum or to other cartilages, move very differently, though they conſpire to the ſame intention, the enlargement of the thorax: for having no fixed point to which their anterior ends are faſtened, and the diaphragm being inſerted into them at the place where it runs nearly ſtraight upwards from its origin at the vertebrae, theſe ribs are drawn downwards by this ſtrong muſcle, and by the muſcles of the abdomen, which at this time reſiſt the ſtretching force of the bowels; while the intercoſtal muſcles are pulling them in the contrary direction, to wit, upwards. The effect, therefore, of either of theſe powers, which are antagoniſts to each other, is very little, as to moving the ribs either up or down; but the muſcles of the abdomen, puſhed at this time outwards by the viſcera, carry theſe ribs along with them.——Thus the thorax is not only not allowed to be ſhortened, but is really widened at its lower part, to aſſiſt in making ſufficient ſpace for the due diſtention of the lungs.

As ſoon as the action of theſe ſeveral muſcles ceaſes, the elaſtic cartilages, extending themſelves to their natural ſituations, depreſs the upper ribs, and the ſternum ſubſides; the diaphragm is thruſt up by the viſcera abdominalia, and the oblique and tranſverſe muſcles of the belly ſerve to draw the inferior ribs inwards at the ſame time.——By theſe cauſes, the cavity of the breaſt is diminiſhed in all its dimenſions.

Though

Though the motions above defcribed of the ribs and fternum, efpecially of the latter bone, are fo fmall in the mild refpiration of a healthy perfon, that we can fcarce obferve them; yet they are manifeft whenever we defignedly increafe our refpiration, or are obliged to do it after exercife, and in feveral difeafes.

SECT. III.

OF THE SUPERIOR EXTREMITIES.

AUTHORS are much divided in their opinions about the number of bones of which each fuperior extremity (*i*) fhould be faid to confift; fome defcribing the clavicle and fcapula as part of it, others claffing thefe two bones with thofe of the thorax: But fince moft quadrupeds have no clavicles, and the human thorax can perform its functions right when the fcapula is taken away (*k*), while it is impoffible for us to have the right ufe of our arms without thefe bones, I muft think that they belong to the fuperior extremities. Each of the fuperior extremities may be divided into the fhoulder, arm, fore-arm, and hand.

§ 1. *Bones of the* SHOULDER.

The SHOULDER confifts of the *clavicle* and *fcapula.*

CLAVICULA.

CLAVICULA, or *collar bone* (*l*), is the long crooked bone, in figure like an Italic *f*, placed almoft horizontally between

(*i*) Κωλα, γυια, εκφυαδες, Enata, adnata, explanata membra, artus.

(*k*) Philofoph. Tranfact. numb. 449. § 5.

(*l*) Os jugulare, jugulum, furcula, ligula, clavis, humerus quibufdam.

between the upper lateral part of the ſternum and what is commonly called the top of the ſhoulder; which, as a clavis or beam, it bears off from the trunk of the body.

The clavicle, as well as other long round bones, is larger at its two ends than in the middle. The end next to the ſternum (*m*) is triangular: The angle behind is conſiderably protruded, to form a ſharp ridge, to which the tranſverſe ligament, extended from one clavicle to the other, is fixed (*n*). The ſide oppoſite to this is ſomewhat rounded. The middle of this protuberant end is as irregularly hollowed as the cavity in the ſternum for receiving it is raiſed: But, in a recent ſubject, the irregular concavities of both are ſupplied by a moveable cartilage; which is not only much more cloſely connected every where by ligaments to the circumference of the articulation than thoſe of the lower jaw are, but it grows to the two bones at both its internal and external end; its ſubſtance at the external end being ſoft, but very ſtrong, and reſembling the intervertebral cartilages (*o*).

From this internal end, the clavicle, for about two fifths of its length, is bended obliquely forwards and downwards. On the upper and fore-part of this curvature a ſmall ridge is ſeen, with a plain rough ſurface before it; whence the muſculus ſterno-hyoideus and ſterno-maſtoideus have in part their origin. Near the lower angle a ſmall plain ſurface is often to be remarked, where the firſt rib and this bone are contiguous (*p*), and are connected by a firm ligament (*q*). From this a rough plain ſurface is extended outwards, where

(*m*) Παρασφαγις.

(*n*) Riolan. Encheirid. anat. lib. 6. cap. 13.——Winſlow, Expoſ. Anat. des os frais, § 248.——Weitbrecht. Act. Petropolit. tom. 4. p. 255. et Syndeſmolog. ſect. 2. I. §. 3.

(*o*) Weitbrecht. Syndeſmolog. ſect. 2. I. § 6.

(*p*) Dionis, Sixieme demonſt. des os.

(*q*) Weitbrecht. Syndeſmolog. ſect. 2. I. § 7.

the pectoral mufcle has part of its origin. Behind, the bone is made flat and rough by the infertion of the larger fhare of the fubclavian mufcle. After the clavicle begins to be bent backwards, it is round: But it foon after becomes broad and thin; which fhape it retains to its external end. Along the external concavity, a rough finuofity runs, from which fome part of the deltoid mufcle takes its rife; oppofite to this, on the convex edge, a fcabrous ridge gives infertion to a fhare of the cucullaris mufcle. The upper furface of the clavicle is here flat; but the lower is hollow, for lodging the beginning of the mufculus fubclavius; and towards its back part a tubercle rifes; to which, and to a roughnefs near it, the ftrong fhort thick ligament, connecting this bone to the coracoid procefs of the fcapula, is fixed.

The external end (*r*) of this bone is horizontally oblong, fmooth, floping at the pofterior fide, and tipped in a recent fubject with a cartilage, for its articulation with the acromion fcapulae. Round this the bone is fpongy, for the firmer connection of the ligaments.

The medullary arteries having their direction obliquely outwards, enter the clavicles by one or more fmall paffages in the middle of their back-part.

The *fubftance* of this bone is the fame as of the other round long bones.

The triangular unequal interior end of each clavicle has the cartilage above defcribed interpofed betwen it and the irregular cavity of the fternum —The ligaments which furround this articulation to fecure it, are fo fhort and ftrong, that little motion can be allowed any way; and the ftrong ligament that is ftretched acrofs the upper furcula of the fternum, from the pofterior prominent angle of the one clavicle to

(*r*) Σπωμις.

to the ſame place of the other clavicle, ſerves to keep each of theſe bones more firmly in their place.——By the affiſtance, however, of the moveable intervening cartilage, the clavicle can, at this joint, be raiſed or depreſſed, and moved backwards and forwards ſo much as that the external end, which is at a great diſtance from that axis, enjoys very conſpicuous motions. The articulation of the exterior end of the clavicle ſhall be conſidered after the deſcription of the ſcapula.

The clavicles of infants are not deficient in any of their parts; nor have they any epiphyſes at their extremities joined afterwards to their bodies, as moſt other ſuch long bones have, which preſerve them from being bent too much, and from the danger of any unoſſified parts being ſeparated by the force which pulls the arms forwards.

The *uſes* of the clavicles are, to keep the ſcapulae, and conſequently all the ſuperior extremities, from falling in and forward upon the thorax; by which, as in moſt quadrupeds, the motions of the arms would be much confined, and the breaſt made too narrow. The clavicles likewiſe afford origin to ſeveral muſcles, and a defence to large veſſels.

From the ſituation, figure, and uſe of the clavicles, it is evident that they are much expoſed to fractures; and their broken parts muſt generally paſs each other; and that they are difficultly kept in their place afterwards.

SCAPULA.

Scapula, or *ſhoulder-blade* (s), is the triangular bone ſituated on the outſide of the ribs: with its longeſt ſide, called its *baſe*, towards the ſpinal proceſſes of the vertebrae; and with

(s) Ωμοπλατης, επινωτιον. Latitudo humeri, ſceptulum vel ſcutulum opertum, ſpatula, ala, humerus, clypeus, ſcutum thoracis.

with the angle at the upper part of this ſide about three inches, and the lower angle at a greater diſtance, from theſe proceſſes. The back-part of the ſcapula has nothing but the thin ends of the ſerratus anticus major and ſubſcapularis muſcles between it and the ribs: But as this bone advances forwards, its diſtance from the ribs increaſes. The upper or ſhorter ſide, called the *ſuperior coſta*, of the ſcapula, is nearly horizontal, and parallel with the ſecond rib. The lower ſide, which is named the *inferior coſta*, is extended obliquely from the third to the eighth rib. The ſituation of this bone, here deſcribed, is when people are ſitting or ſtanding in a ſtate of inactivity, and allowing the members to remain in the moſt natural eaſy poſture. The inferior angle of the ſcapula is very acute; the upper one is near to a right angle; and what is called the anterior does not deſerve the name, for the two ſides do not meet to form an angle. The body of this bone is concave towards the ribs, and convex behind, where it has the name of *dorſum* (*t*). Three proceſſes are generally reckoned to proceed from the ſcapula. The firſt is the large ſpine that riſes from its convex ſurface behind, and divides it unequally. The ſecond proceſs ſtands out from the fore part of the upper ſide: And, from its imaginary reſemblance to a crow's beak, is named *coracoides* (*u*). The third proceſs is the whole thick bulbous fore-part of the bone.

After thus naming the ſeveral conſtituent parts of the ſcapula, the particular deſcription will be more eaſily underſtood.

The baſe, which is tipped with cartilage in a young ſubject, is not all ſtraight: For above the ſpine it runs obliquely forwards to the ſuperior angle, that here it might not be too protuberant backwards, and ſo bruiſe the muſcles

(*t*) Χελωνιον.

(*u*) Anchoroides, ſigmoides, digitalis, anciſtroides.

cles and teguments. Into the oblique ſpace the muſculus patientiae is inſerted. At the root of the ſpine, on the back-part of the baſe, a triangular plain ſurface is formed by the preſſure of the lower fibres of the trapezius. Below this the edge of the ſcapula is ſcabrous and rough, for the inſertion of the ſerratus major anticus and rhomboid muſcles.

The back-part of the inferior angle is made ſmooth by the latiſſimus dorſi paſſing over it. This muſcle alſo alters the direction of the inferior coſta ſome way forwards from this angle: and ſo far it is flatted behind by the origin of the teres major. As the inferior coſta advances forward, it is of conſiderable thickneſs, it is ſlightly hollowed and made ſmooth behind by the teres minor, while it has a foſſa formed into it below by part of the ſubſcapularis; and between the two a ridge with a ſmall depreſſion appears, where the longus extenſor cubiti has its origin.

The ſuperior coſta is very thin: and near its fore-part there is a ſemilunar niche, from one end of which to the other a ligament is ſtretched; and ſometimes the bone is continued to form one, or ſometimes two, holes for the paſſage of the ſcapular blood-veſſels and nerves. Immediately behind this ſemilunar cavity the coraco-hyoid muſcle has its riſe. From the niche to the termination of the foſſa for the teres minor, the ſcapula is narrower than any where elſe, and ſupports the third proceſs. This part has the name of *cervix*.

The whole dorſum of the ſcapula is always ſaid to be convex; but, by reaſon of the raiſed edges that ſurround it, it is divided into two cavities by the ſpine, which is ſtretched from behind forwards, much nearer to the ſuperior than to the inferior coſta. The cavity above the ſpine is really concave where the ſupra-ſpinatus muſcle is lodged; while the ſurface of this bone below the ſpine, on which the infra-ſpi-

natus

natus muſcle is placed, is convex, except a foſſa that runs at the ſide of the inferior coſta.

The internal or anterior ſurface of this bone is hollow, except in the part above the ſpine, which is convex.——The ſubſcapularis muſcle is extended over this ſurface, where it forms ſeveral ridges and intermediate depreſſions, commonly miſtaken for prints of the ribs; they point out the interſtices of the bundles of fibres of which the ſubſcapularis muſcle is compoſed (*x*).

The ſpine (*y*) riſes ſmall at the baſe of the ſcapula, and becomes higher and broader as it advances forwards.——On the ſides it is unequally hollowed and crooked, by the actions of the adjacent muſcles.——Its ridge (*z*) is divided into two rough flat ſurfaces: Into the upper one, the trapezius muſcle is inſerted; and the lower one has part of the deltoid fixed to it.——The end of the ſpine, called *acromion* (*a*), or top of the ſhoulder, is broad and flat, and is ſometimes only joined to the ſpine by a cartilage (*b*).——The anterior edge of the acromion is flat, ſmooth, and covered with a cartilage, for its articulation with the external end of the clavicle; and it is hollowed below, to allow a paſſage to the infra and ſupra ſpinati muſcles, and free motion to the os humeri.

The coracoid (*c*) proceſs is crooked, with its point inclining forwards; ſo that a hollow is left at the lower ſide of its root, for the paſſage of the infra ſcapularis muſcle.——The end of this proceſs is marked with three plain ſurfaces. Into the internal, the ſerratus minor anticus is inſerted;

(*x*) Winſlow, in Memoires de l'acad. des ſciences, 1722.

(*y*) Ραχις, υπεροχη αμοπλατων, Eminentia ſcapularum.

(*z*) Ptergium, criſta.

(*a*) Επωμις, αγκυροειδης, κοραχοειδης, κατακλεις, Acromii os, ſummus armus, roſtrum porcinum, proceſ. digitalis.

(*b*) Sue, Trad. d'oſteol. p. 160.

(*c*) Ἀγκυροειδης, σιγμοειδης, Roſtriformis.

inferted: from the external, one head of the biceps flexor cubiti rifes; and from the lower one, the coraco-brachialis has its origin. At the upper part of the root of this procefs, immediately before the femilunar cavity, a fmooth tubercle appears, where a ligament from the clavicle is fixed. From all the external fide of this coracoid apophyfe, a broad ligament goes out, which becomes narrower where it is fixed to the acromion. The fharp pain, violent inflammation, and tedious cure of contufions in this part, are probably owing to thefe tendons and ligaments being hurt.

From the cervix fcapulae the third procefs is produced. The fore-part of this is formed into a glenoid cavity (*d*), which is of the fhape of the longitudinal fection of an egg, being broad below and narrow above. Between the brims of this hollow and the fore-part of the root of the fpine, a large finuofity is left for the tranfmiffion of the fupra and infra fpinati mufcles; and on the upper part of thefe brims we may remark a fmooth furface, where the fecond head of the biceps flexor cubiti has its origin. The root of the fupercilia is rough all round, for the firmer adhefion of the capfular ligament of the articulation, and of the cartilage which is placed on thefe brims, where it is thick, but becomes very thin as it is continued towards the middle of the cavity, which it lines all over.

The medullary veffels enter the fcapula near the bafe of the fpine.

The *fubftance* of the fcapula, as in all other broad flat bones, is cellular, but of an unequal thicknefs: for the neck and third procefs are thick and ftrong; the inferior cofta, and fpine, and coracoid procefs, are of a middle thicknefs; and the body is fo preffed by the mufcles, as to become thin and diaphanous.

(*d*) Ὠμοκοτύλη.

The ſcapula and clavicle are *joined* by plain ſurfaces, tipped with cartilage (*e*); by which neither bone is allowed any conſiderable motion, being tightly tied down by the common capſular ligament, and by a very ſtrong one which proceeds from the coracoid proceſs; but divides into two before it is fixed into the clavicle, with ſuch a direction, as can either allow this bone to have a ſmall rotation, in which its poſterior edge turns more backwards, while the anterior one riſes farther forwards; or it can yield to the fore-part of the ſcapula moving downwards, while the back-part of it is drawn upwards; in both which caſes, the oblong ſmooth articulated ſurfaces of the clavicle and ſcapula are not in the ſame plane, but ſtand a little tranſverſely, or acroſs each other, and thereby preſerve this joint from luxations, to which it would be ſubject if either of the bones was to move on the other perpendicularly up and down without any rotation.——Sometimes a moveable ligamentous cartilage is found in this joint; and ſometimes ſuch a cartilage is only interpoſed at the anterior half of it: and in ſome old ſubjects I have found a ſeſamoid bone here (*f*). The ſcapula is connected to the head, os hyoides, vertebrae, ribs, and arm-bone, by muſcles, that have one end faſtened to theſe bones, and the other to the ſcapula, which can move it upwards, downwards, backwards, or forwards; by the quick ſucceſſion of theſe motions, its whole body is carried in a circle. But being alſo often moved as upon an axis perpendicular to its plane, its circumference turns in a circle whoſe centre this axis is (*g*). Whichever of theſe motions it performs, it always carries the outer end of the clavicle and the arm along with it.——The glenoid cavity of this bone receives the os humeri,

(*e*) Acromion, κατακλεις, Clauſurae.

(*f*) Jac. Sylv. Iſagog. Anat. lib. 1. cap. 2.

(*g*) See Winſlow, Memoires de l'acad. des ſciences, 1726.

humeri, which plays in it as a ball in a ſocket, as will be more fully explained hereafter.

The *uſe* of the ſcapula is, to ſerve as a fulcrum to the arm; and, by altering its poſition on different occaſions, to allow always the head of the os humeri a right ſituated ſocket to move in: And thereby to aſſiſt and to enlarge greatly the motions of the ſuperior extremity, and to afford the muſcles which riſe from it more advantageous actions, by altering their direction to the bone which they are to move.——This bone alſo ſerves to defend the back-part of the thorax, and is often employed to ſuſtain weights, or to reſiſt forces, too great for the arm to bear.

The baſe, acromion, coracoid proceſs, and head of the ſcapula, are all in a cartilaginous ſtate at birth; and the three firſt are joined as epiphyſes; while the head, with the glenoid cavity, is not formed into a diſtinct ſeparate bone, but is gradually produced by the oſſification of the body of this bone being continued forwards.

§ 2. *The* Arm.

The *Arm* has only one bone, beſt known by the Latin name of *os humeri* (*b*); which is long, round, and nearly ſtraight.

The upper end of this bone (*i*) is formed in a large round ſmooth head, whoſe middle point is not in a ſtraight line with the axis of the bone, but ſtands obliquely backwards from it.—The extent of the head is diſtinguiſhed by a circular foſſa ſurrounding its baſe, where the head is united to the bone, and the capſular ligament of the joint is fixed.—Below the fore-part of its baſe, two tubercles ſtand out: The

(*b*) Αγκάλια, ωλενη, Os brachii, armi, adjutorium, parvum, brachium, canna brachii.

(*i*) Acrocolium.

ſmalleſt one, which is ſituated moſt to the inſide, has the tendon of the ſubſcapularis muſcle inſerted into it.—The larger more external protuberance is divided, at its upper part, into three ſmooth plain ſurfaces; into the anterior of which, the muſculus ſupra-ſpinatus; into the middle or largeſt, the infra-ſpinatus; and into the one behind, the teres minor, is inſerted.—Between theſe two tubercles, exactly in the fore-part of the bone, a deep long foſſa is formed, for lodging the tendinous head of the biceps flexor cubiti; which, after paſſing, in a manner peculiar to itſelf, through the cavity of the articulation, is tied down by a tendinous ſheath extended acroſs the foſſa; in which, and in the neighbouring tubercles, are ſeveral remarkable holes, which are penetrated by the tendinous and ligamentous fibres, and by veſſels —— On each ſide of this foſſa, as it deſcends in the os humeri, a rough ridge, gently flatted in the middle, runs from the roots of the tubercles. The tendon of the pectoral muſcle is fixed into the anterior of theſe ridges, and the latiſſimus dorſi and teres major are inſerted into the internal one. A little behind the lower end of this laſt, another rough ridge may be obſerved, where the coraco-brachialis is inſerted. From the back-part of the root of the largeſt tubercle a ridge alſo is continued, from which the brevis extenſor cubiti riſes. This bone is flatted on the inſide, about its middle, by the belly of the biceps flexor cubiti. In the middle of this plain ſurface, the entry of the medullary artery is ſeen ſlanting obliquely downwards. At the fore-ſide of this plane the bone riſes in a ſort of a ridge, which is rough, and often has a great many ſmall holes in it, where the tendon of the ſtrong deltoid muſcle is inſerted; on each ſide of which the bone is ſmooth and flat, where the brachius internus riſes. The exterior of theſe two flat ſurfaces is the largeſt; behind it a ſuperficial ſpiral channel, formed by the muſcular nerve and the veſſels that accompany it, runs from behind

behind forwards and downwards. The body of the os humeri is flatted behind by the extenſors of the fore-arm.

Near the lower end of this bone, a large ſharp ridge is extended on its outſide, from which the muſculus ſpinator radii longus, and the longeſt head of the extenſor carpi radialis, riſe. Oppoſite to this, there is another ſmall ridge to which the aponeurotic tendon, that gives origin to the fibres of the internal and external brachial muſcles, is fixed; and from a little depreſſion on the fore-ſide of it, the pronator radii teres riſes.

The body of the os humeri becomes gradually broader towards the lower end, where it has ſeveral proceſſes; at the roots of which there is a cavity before and another behind (*k*). The anterior is divided by a ridge into two; the external, which is the leaſt, receives the end of the radius; and the internal receives the coronoid proceſs of the ulna in the flexions of the fore arm, while the poſterior deep triangular cavity lodges the olecranon in the extenſions of that limb. The bone between theſe two cavities is preſſed ſo thin by the proceſſes of the ulna, as to appear diaphanous in ſeveral ſubjects. The ſides of the poſterior cavity are ſtretched out into two proceſſes, one on each ſide: Theſe are called *condyles*; from each of which a ſtrong ligament goes out to the bones of the fore-arm. The external condyle, which has an oblique direction alſo forwards in reſpect of the internal, when the arm is in the moſt natural poſture (*l*), is equally broad, and has an obtuſe ſmooth head riſing from it forwards. From the rough part of the condyle, the inferior heads of the bicornis, the extenſor digitorum communis, extenſor carpi ulnaris, anconaeus, and ſome part of the ſpinator radii brevis, take their riſe; and on the ſmooth head the upper end of the radius plays. Immediately on the out-ſide of this, a ſinuoſity

(*k*) Βαθμίδες.

(*l*) Winſlow, Memoires de l'acad. des ſciences, 1722.

ſinuoſity is made by the ſhorter head of the bicornis muſcle, upon which the muſcular nerve is placed. The internal condyle is more pointed and protuberant than the external, to give origin to ſome part of the flexor carpi radialis, pronator radii teres, palmaris longus, flexor digitorum ſublimis, and flexor carpi ulnaris. Between the two condyles, is the trochlea or pulley; which conſiſts of two lateral protuberances, and a middle cavity, that are ſmooth and covered with cartilage. When the fore-arm is extended, the tendon of the internal brachiaeus muſcle is lodged in the fore part of the cavity of this pulley. The external protuberance, which is leſs than the other, has a ſharp edge behind; but forwards, this ridge is obtuſe, and only ſeparated from the little head, already deſcribed, by a ſmall foſſa, in which the joined edges of the ulna and radius move. The internal protuberance of the pulley is largeſt and higheſt; and therefore, in the motions of the ulna upon it, that bone would be inclined outwards, were it not ſupported by the radius on that ſide.——Between this internal protuberance and condyle, a ſinuoſity may be remarked, where the ulnar nerve paſſes.

The *ſubſtance* and the internal ſtructure of the os humeri is the ſame, and diſpoſed in the ſame way, as in other long bones.

The round head at the upper end of this bone is *articulated* with the glenoid cavity of the ſcapula; which being ſuperficial, and having long ligaments, allows the arm a free and extenſive motion.———Theſe ligaments are, however, conſiderably ſtrong. For beſides the common capſular one, the tendons of the muſcles perform the office, and have been deſcribed under the name of *ligaments*.——— Then the acromion and coracoid proceſs, with the ſtrong broad ligaments ſtretched between them, ſecure the articu-

lation

lation above, where the greateſt and moſt frequent force is applied to thruſt the head of the bone out of its place. It is true, that there is not near ſo ſtrong a defence at the lower part of the articulation; but, in the ordinary poſtures of the arm, that is, ſo long as it is at an acute angle with the trunk of the body, there cannot be any force applied at this place to occaſion a luxation, ſince the joint is protected ſo well above.

The motions which the arm enjoys by this articulation are to every ſide; and by the ſucceſſion of theſe different motions, a circle may be deſcribed. Beſides which, the bone performs a ſmall rotation round its own axis. But though this can be performed with the round head in all poſitions; yet as theſe vary, the effects upon the body of the bone are very different: For if the middle of the head is the centre of rotation, as it is when the arm hangs down by the ſide, the body of the bone is only moved forwards and backwards; becauſe the axis of motion of the head it nearly at right angles with the length of the bone (*m*); whereas, when the arm is raiſed to right angles with the trunk of the body, the centre of motion, and the axis of the bone, come to be of the ſame ſtraight line: and therefore the body of the os humeri performs the ſame motion with its head. Though the motions of the arm ſeem to be extenſive, yet the larger ſhare of them depends on the motions of the ſcapula. The lower end of the os humeri is articulated with the bone of the fore-arm, and carries them with it in all its motions, but ſerves as a baſe on which they perform the motions peculiar to themſelves; as ſhall be deſcribed afterwards.

Both the ends of this bone are cartilaginous in a new-born infant; and the large head with the two tubercles, and

(*m*) Hippocrat. de articul. § 1.

and the trochlea with the two condyles, become epiphyfes before they are united to the body of the bone.

§ 3. *The* Fore-Arm.

The fore-arm (*n*) confifts of two long bones, the *ulna* and *radius*; whofe fituation, in refpect of each other, is oblique in the leaft ftraining or moft natural pofture; that is, the ulna is not directly behind, nor on the outfide of the radius, but in a middle fituation between thefe two, and the radius croffes it. The fituation, however, of thefe bones, and of all the other bones of the fuperior extremity that are not yet defcribed, is frequently altered: and therefore, to fhun repetitions, I defire it may now be remarked, that, in the remaining account of the fuperior extremity, I underftand by the term of *pofterior*, that part which is in the fame direction with the back of the hand: by *anterior*, that anfwering to the palm; by *internal*, that on the fame fide with the thumb; by *external*, the fide neareft to the little finger; fuppofing the hand always to be in a middle pofition between the pronation and fupination.

ULNA.

Ulna (*o*), fo named from its being ufed as a meafure, is the longeft of the two bones of the fore arm, and fituated on the outfide of the radius.

At the upper end of the ulna are two proceffes.——The pofterior is the largeft, and formed like a hook, whofe concave furface moves upon the pulley of the os humeri, and is called *olecranon* (*p*), or top of the cubit. The convex

(*n*) Cubitus, πηχύς. ωλενη, πυγων, Ulna, lacertus.

(*o*) Cubitus, πηχυς, προπηχιον, Focile majus, canna, vel arundo major, et inferior brachii

(*p*) Αγκων, Gibber cubitus, additamentum necatum.

vex back part of it is rough and ſcabrous, where the longus, brevis, and brachiaeus externus, are inſerted. The olecranon makes it unneceſſary that the tendons of the extenſor muſcles ſhould paſs over the end of the os humeri; which would have been of ill conſequence in the great flexions of this joint, or when any conſiderable force is applied to this part (*q*). The anterior proceſs is not ſo large, nor does it reach ſo high, as the one behind; but is ſharper at its end, and therefore is named *coronoid*.——Between theſe two proceſſes, a large ſemicircular or ſigmoid concavity is left; the ſurface of which on each ſide of a middle riſing, is ſlanting, and exactly adapted to the pulley of the bone of the arm.——Acroſs the middle of it, there is a ſmall ſinuoſity for lodging mucilaginous glands; where, as well as in a ſmall hollow on the internal ſide of it, the cartilage that lines the reſt of its ſurface is wanting.——Round the brims of this concavity the bone is rough, where the capſular ligament of the joint is implanted.——Immediately below the olecranon, on the back-part of the ulna, a flat triangular ſpongy ſurface appears, on which we commonly lean.——At the internal ſide of this, there is a larger hollow ſurface, where the muſculus anconaeus is lodged; and the ridge at the inſide of this gives riſe to the muſculus ſupinator radii brevis. Between the top of the ridge and the coronoid proceſs is the ſemilunated ſmooth cavity, lined with cartilage; in which, and in a ligament extended from the one to the other end of this cavity, the round head of the radius plays.——Immediately below it, a rough hollow gives lodging to mucilaginous glands.——Below the root of the coronoid proceſs, this bone is ſcabrous and unequal, where the brachiaeus internus is inſerted.——On the outſide of that, we obſerve a ſmooth concavity, where

(*q*) Winſlow, Expoſition anatomique du corps humain, traité des os ſecs, § 979.

where the beginning of the flexor digitorum profundus ſprouts out.

The body of the ulna is triangular.——The internal angle is very ſharp where the ligament that connects the two bones is fixed: The ſides which make this angle are flat and rough, by the action and adheſion of the many muſcles which are ſituated here. At the diſtance of one-third of the length of the ulna from the top, in its fore-part, the paſſage of the medullary veſſels may be ſeen ſlanting upwards. The external ſide of this bone is ſmooth, ſomewhat convex, and the angles at each edge of it are blunted by the preſſure of the muſcles equally diſpoſed about them.

As this bone deſcends, it becomes gradually ſmaller; ſo that its lower end terminates in a little head, ſtanding on a ſmall neck. Towards the fore but outer part of which laſt, an oblique ridge runs, that gives riſe to the pronator radii quadratus. The head is round, ſmooth, and covered with a cartilage on its internal ſide, to be received into the ſemilunar cavity of the radius; while a ſtyloid proceſs (*r*) riſes from its outſide, to which is fixed a ſtrong ligament that is extended to the os cuneiforme and piſiforme of the wriſt. Between the back-part of that internal ſmooth ſide and this proceſs, a ſinuoſity is left for the tendon of the extenſor carpi ulnaris. On the fore-part of the root of the proceſs, ſuch another depreſſion may be remarked for the paſſage of the ulnar artery and nerve. The end of the bone is ſmooth, and covered with a cartilage. Between it and the bones of the wriſt, a doubly concave moveable cartilage is interpoſed; which is a continuation of the cartilage that covers the lower end of the radius, and is connected looſely to the root of the ſtyloid proceſs, and to the rough cavity there; in which mucilaginous glands are lodged.

The

(*r*) Γραφοειδη, Malleolus externus.

The ulna is articulated above with the lower end of the os humeri, where theſe bones have depreſſions and protuberances correſponding to each other, ſo as to allow an eaſy and ſecure extenſion of the fore-arm to almoſt a ſtraight line with the arm, and flexion to a very acute angle; but, by the ſlanting poſition of the pulley, the lower part of the fore-arm is turned outwards in the extenſion, and inwards in the flexion (s); and a very ſmall kind of rotation is likewiſe allowed in all poſitions, eſpecially when the ligaments are moſt relaxed by the fore-arm being in a middle degree of flexion. The ulna is alſo articulated with the radius and carpus, in a manner to be related afterwards.

RADIUS.

Radius (t), ſo called from its imagined reſemblance to a ſpoke of a wheel or to a weaver's beam, is the bone placed at the inſide of the fore-arm. Its upper end is formed into a circular little head, which is hollowed for an articulation with the tubercle at the ſide of the pulley of the os humeri; and the half of the round circumference of the head next to the ulna is ſmooth, and covered with a cartilage, in order to be received into the ſemilunated cavity of that bone.——Below the head, the radius is much ſmaller; therefore this part, which is made round by the action of the ſupinator radii brevis, is named its *cervix*.——At the external root of this neck, a tuberous proceſs riſes; into the outer part of which the biceps flexor cubiti is inſerted.———From this a ridge runs downwards and inwards, where the ſupinator radii brevis is inſerted; and a little below, and behind this ridge, there is a rough ſcabrous ſurface, where the pronator radii teres is fixed.

The body of the radius is not ſtraight, but convex on its

(s) Winſlow, Memoires de l'acad. des ſciences, 1722.

(t) Κερκις, παραπηχιον, Focile minus, canna minor, arundo minor.

its internal and pofterior furfaces; where it is alfo made round by the equal preffure of the circumjacent mufcles, particularly of the extenfors of the thumb; but the furfaces next to the ulna are flatted and rough, for the origin of the mufcles of the hand; and both terminate in a common fharp fpine, to which the ftrong ligament extended between the two bones of the fore-arm is fixed. A little below the beginning of the plain furface, on its fore-part, where the flexor mufcle of the laft joint of the thumb takes its origin, the paffage of the medullary veffels is feen flanting upwards. The radius becomes broader and flatter towards the lower end, efpecially on its fore-part, where its pronator quadratus mufcle is fituated.

The lower end of the radius is larger than the fuperior; though not in fuch a difproportion as the upper end of the ulna is larger than its lower end.——Its back-part has a flat ftrong ridge in the middle, and foffae on each fide.———In a fmall groove, immediately on the outfide of the ridge, the tendon of the extenfor tertii internodii pollicis plays. In a large one behind this, the tendons of the indicator and of the common extenfor mufcles of the fingers pafs.——Contiguous to the ulna there is a fmall depreffion made by the extenfor minimi digiti.——On the infide of the ridge there is a broad depreffion, which feems again fubdivided, where the two tendons of the bicornis, or extenfor carpi radialis, are lodged.—the internal fide of this end of the radius is alfo hollowed by the extenfors of the firft and fecond joint of the thumb; immediately above which a little rough furface fhews where the fupinator radii longus is inferted.——The ridges at the fides of the grooves, in which the tendons play, have an angular ligament fixed to them, by which the feveral fheaths for the tendons are formed. The fore-part of this end of the radius is alfo depreffed, where the flexors of the fingers and flexor carpi radialis pafs.——The external fide is formed into

into a femilunated fmooth cavity, lined with a cartilage, for receiving the lower end of the ulna.——The loweft part of the radius is formed into an oblong cavity: in the middle of which is a fmall tranfverfe rifing, gently hollowed, for lodging mucilaginous glands; while the rifing itfelf is infinuated into the conjunction of the two bones of the wrift that are received into the cavity.——The internal fide of this articulation is fenced by a remarkable procefs (*u*) of the radius, from which a ligament going out to the wrift, as the ftyloid procefs of the ulna with its ligament, guard it on the outfide.

The ends of both the bones of the fore-arm being thicker than the middle, there is a confiderable diftance between the bodies of thefe bones; in the larger part of which a ftrong tendinous, but thin ligament, is extended, to give a large enough furface for the origin of the numerous fibres of the mufcles fituated here, that are fo much funk between the bones as to be protected from injuries, to which they would otherwife be expofed. But this ligament is wanting near the upper end of the fore-arm, where the fupinator radii brevis, and flexor digitorum profundus, are immediately connected (*x*).

Both ends of the bones of the fore-arm are firft cartilages, and then epiphyfes, in children.

As the head of the radius receives the tubercle of the os humeri, it is not only bended and extended along with the ulna, but may be moved round its axis in any pofition; and, that this motion round its axis may be fufficiently large, the ligament of the articulation is extended, further down than ordinary, on the neck of this bone, before it is connected to it: and it is very thin at its upper and lower

part,

(*u*) Malleolus internus, proceffus ftyloides.

(*x*) Weitbrecht, Syndefmolog. fig. 10, 11.

part, but makes a firm ring in the middle. This bone is alſo joined to the ulna by a double articulation: for above, a tubercle of the radius plays in a ſocket of the ulna; whilſt below, the radius gives the ſocket, and the ulna the tubercle. But then the motion performed in theſe two is very different: for, at the upper end, the radius does no more than turn round its axis; while, at the lower end, it moves in a ſort of cycloid upon the round part of the ulna; and as the hand is articulated and firmly connected here with the radius, they muſt move together.——When the palm is turned uppermoſt, the radius is ſaid to perform the *ſupination*: when the back of the hand is above, it is ſaid to be *prone*. But then the quickneſs and large extent of theſe two motions are aſſiſted by the ulna, which, as was before obſerved, can move with a kind of ſmall rotation on the ſloping ſides of the pulley. This lateral motion, though very inconſiderable in the joint itſelf, is conſpicuous at the lower end of ſuch a long bone; and the ſtrong ligament connecting this lower end to the carpus, makes the hand more readily obey theſe motions. When we deſign a large circular turn of our hand, we increaſe it by the rotation of the os humeri, and ſometimes employ the ſpine and inferior extremities to make theſe motions of pronation or ſupination of the hand large enough.

§ 4. *The* HAND.

THE hand *(y)* comprehends all from the joint of the wriſt to the points of the fingers. Its back-part is convex, for greater firmneſs and ſtrength; and it is concave before, for containing more ſurely and conveniently ſuch bodies as we take hold of. One half of the hand has an obſcure motion

(y) Ακροχειρ, Summa manus.

motion in comparifon of what the other has, and ferves as a bafe to the moveable half; which can be extended back very little farther than to a ftraight line with the fore-arm, but can be confiderably bent forwards.

As the bones that compofe the hand are of different fhapes and ufes, while feveral of them that are contiguous agree in fome general characters; the hand is, on this account, commonly divided into carpus, metacarpus, and fingers; among which laft the thumb is reckoned.

CARPUS.

The carpus (z) is compofed of eight fmall fpongy bones, fituated at the upper part of the hand. I fhall defcribe each of thefe bones, under a proper name taken from their figure (*a*); becaufe the method of ranging them by numbers leaves anatomifts too much at liberty to debate very idly, which ought to be preferred to the firft number; or, what is worfe, feveral, without explaining the order they obferve, apply the fame numbers differently, and fo confound their readers. But, that the defcription of thefe bones may be in the fame order as they are found in the generality of anatomical books, I fhall begin with the range of bones that are concerned in the moveable joint of the wrift, or are connected to the fore-arm, and fhall afterwards confider the four that fupport the thumb and offa metacarpi of the fingers.

The eight bones of the carpus are, Os fcaphoides, lunare, cuneiforme, pififorme, trapezium, trapezoides, magnum, unciforme.

The *fcaphoides* is fituated moft internally of thofe that are articulated with the fore-arm.——The *lunare* immediately on

(*z*) Καρπὸς, Brachiale, prima palmae pars, rafetta.

(*a*) Lyfer, Cult. Anat. lib. 5. cap. 2.

on the outſide of the former.——The *cuneiforme* is placed ſtill more externally, but does not reach ſo high as the other two.——The *piſiforme* ſtands forwards in the palm from the *cuneiforme*.——The *trapezium* is the firſt of the ſecond row, and is ſituated between the ſcaphoides and firſt joint of the thumb.——The *trapezoides* is immediately on the outſide of the trapezium.——The *os magnum* is ſtill more external.——The *unciforme* is farther to the ſide of the little finger.

Os ſcaphoides (*b*) is the largeſt of the eight, excepting one. It is convex above, concave and oblong below: From which ſmall reſemblance to a boat, it has got its name. Its ſmooth convex ſurface is divided by a rough middle foſſa, which runs obliquely croſs it. The upper largeſt diviſion is articulated with the radius. The common ligament of the joint of the wriſt is fixed into the foſſa; and the lower diviſion is joined to the trapezium and trapezoides. The concavity receives more than an half of the round head of the os magnum. The external ſide of this hollow is formed into a ſemilunar plane, to be articulated with the following bone.———The internal, poſterior, and anterior edges are rough, for fixing the ligaments that connect it to the ſurrounding bones.

Os lunare (*c*) has a ſmooth convex upper ſurface, by which it is articulated with the radius. The internal ſide, which gives name to the bone, is in the form of a creſcent, and is joined with the ſcaphoid;———the lower ſurface is hollow, for receiving part of the head of the os magnum. On the outſide of this cavity is another ſmooth, but narrow, oblong ſinuoſity, for receiving the upper end of the os unciforme:———On the outſide of which a ſmall convexity is found, for its connection with the os cuneiforme. Between the great convexity above, and the firſt deep inferior cavity, there

(*b*) Κοτυλοειδὴς. Naviculare. (*c*) Lunatum.

there is a rough foſſa, in which the circular ligament of the joint of the wriſt is fixed.

Os cuneiforme (*d*) is broader above, and towards the back of the hand, than it is below and forwards; which gives it the reſemblance of a wedge. The ſuperior ſlightly convex ſurface is included in the joint of the wriſt, being oppoſed to the lower end of the ulna.—Below this the cuneiform bone has a rough foſſa, wherein the ligament of the articulation of the wriſt is fixed. On the internal ſide of this bone, where it is contiguous to the os lunare, it is ſmooth and ſlightly concave. Its lower ſurface, where it is contiguous to the os unciforme, is oblong, ſomewhat ſpiral, and concave. Near the middle of its anterior ſurface a circular plane appears, where the os piſiforme is ſuſtained.

Os piſiforme (*e*) is almoſt ſpherical, except one circular plane, or ſlightly hollow ſurface, which is covered with cartilage for its motion on the cuneiform bone, from which its whole rough body is prominent forwards into the palm; having the tendon of the flexor carpi ulnaris, and a ligament from the ſtyloid proceſs of the ulna, fixed to its upper part; the tranſverſe ligament of the wriſt is connected to its internal ſide; ligaments extended to the unciform bone, and to the os metacarpi of the little finger, are attached to its lower part; the abductor minimi digiti has its origin from its fore-part; and, at the internal ſide of it, a ſmall depreſſion is formed, for the paſſage of the ulnar nerve.

Trapezium (*f*) has four unequal ſides and angles in its back-part, from which it has got its name.———Above, its ſurface is ſmooth, ſlightly hollowed, and ſemicircular, for its conjunction with the os ſcaphoides.——Its external ſide is

(*d*) Triquetrum.

(*e*) Cartilaginoſum, ſubrotundum, rectum.

(*f*) Os cubiforme, trapezoides, multangulum, majus.

is an oblong concave ſquare for receiving the following bone. The inferior ſurface is formed into a pulley; the two protuberant ſides of which are external and internal. On this pulley the firſt bone of the thumb is moved.—At the external ſide of the external protuberance, a ſmall oblong ſmooth ſurface is formed by the os metacarpi indicis. The fore-part of the trapezium is prominent in the palm, and near to the external ſide has a ſinuoſity in it, where the tendon of the flexor carpi radialis is lodged; on the ligamentous ſheath of which the tendon of the flexor tertii internodii pollicis plays: And ſtill more externally the bone is ſcabrous, where the tranſverſe ligament of the wriſt is connected, the abductor and flexor primi internodii pollicis have their origin, and ligaments go out to the firſt bone of the thumb.

Os trapezoides (*g*), ſo called from the irregular quadrangular figure of its back-part, is the ſmalleſt bone of the wriſt except the piſiforme. The figure of it is an irregular cube. It has a ſmall hollow ſurface above, by which it joins the ſcaphoides; a long convex one internally, where it is contiguous to the trepezium; a ſmall external one, for its conjunction with the os magnum; and an inferior convex ſurface, the edges of which are, however, ſo raiſed before and behind, that a ſort of pulley is formed, where it ſuſtains the os metacarpi indicis.

Os magnum (*h*), ſo called becauſe it is the largeſt bone of the carpus, is oblong, having four quadrangular ſides, with a round upper end, and a triangular plain one below. The round head is divided by a ſmall riſing, oppoſite to the connection of the os ſcaphoides and lunare, which together form the cavity for receiving it. On the inſide a ſhort plain ſurface joins the os magnum to the trapezoides. On the outſide is a long narrow concave ſurface, where it is

(*g*) Trapezium, multangulum minus.

(*h*) Maximum, capitatum.

is contiguous to the os unciforme. The lower end, which ſuſtains the metacarpal bone of the middle finger, is triangular, ſlightly hollowed, and farther advanced on the internal ſide than on the external, having a conſiderable oblong depreſſion made on the advanced inſide by the metacarpal bone of the fore-finger; and generally there is a ſmall mark of the os metacarpi digiti annularis on its external ſide.

Os unciforme (i) has got its name from a thin broad proceſs that ſtands out from it forwards into the palm, and is hollow on its inſide, for affording paſſage to the tendons of the flexors of the fingers. To this proceſs alſo the tranſverſe ligament is fixed that binds down and defends theſe tendons; and the flexor and abductor muſcles of the little finger have part of their origin from it. The upper plain ſurface is ſmall, convex, and joined with the os lunare: The internal ſide is long, and ſlightly convex, adapted to the contiguous os magnum. The external ſurface is oblique, and irregularly convex, to be articulated with the cuneiform bone. The lower end is divided into two concave ſurfaces; the external is joined with the metacarpal bone of the little finger; and the internal one is fitted to the metacarpal bone of the ring-finger.

In the deſcription of the preceding eight bones, I have only mentioned thoſe plain ſurfaces covered with cartilage, by which they are articulated to each other, or to ſome other bones, except in ſome few caſes, where ſomething extraordinary was to be obſerved; and I have deſignedly omitted the other rough ſurfaces, leſt, by crowding too many words in the deſcription of ſuch ſmall bones, the whole ſhould be unintelligible. But theſe ſcabrous parts of the bones may eaſily be underſtood after mentioning their figure, if it is obſerved, that they are generally found only towards the back or palm

(i) Cuneiforme.

of the hand; that they are all plain, larger behind than before; and that they receive the different ligaments, by which they are either connected to neighbouring bones or to one another; for these ligaments cover all the bones, and are so accurately applied to them, that at first view the whole carpus of a recent subject, appears one smooth bone (*k*).

As the surfaces of these bones are largest behind, the figure of the whole conjoined must be convex there, and concave before; which concavity is still more increased by the os pisiforme, and process of the os unciforme, standing forwards on one side, as the trapezium does on the other: And the bones are securely kept in this form by the broad strong transverse ligament connected to those parts of them that stand prominent into the palm of the hand. The convexity behind renders the whole fabric stronger, where it is most exposed to injuries; and the large anterior hollow is necessary for a safe passage to the numerous vessels, nerves, and tendons of the fingers.

The *substance* of these bones is spongy and cellular, but strong in respect of their bulk.

The three first bones of the carpus make an oblong head, by which they are *articulated* with the cavity at the lower ends of the bones of the fore-arm, so as to allow motion on all sides; and by a quick succession of these motions, they may be moved in a circle. But as the joint is oblong, and therefore the two dimensions are unequal, no motion is allowed to the carpus round its axis, except what it has in the pronation and supination along with the radius.—— The articulation of the first three bones of the superior row, with the bones of the inferior, is such as allows of motion, especially backwards and forwards; to the security and easiness of

(*k*) Galen. De usu part. lib. 2. cap. 8. For a particular description of these ligaments, see Weitbrecht. Syndesmolog. p. 5.——68.

of which, the reception of the os magnum into the cavity formed by the fcaphoides and lunare confiderably contributes: And the greateft number of the mufcles that ferve for the motion of the wrift on the radius, being inferted beyond the conjunction of the firft row of bones with the fecond, act equally on this articulation as they do on the former; but the joint formed with the radius being the moft eafily moved, the firft effect of thefe mufcles is on it; and the fecond row of the carpus is only moved afterwards. By this means a larger motion of the wrift is allowed than otherwife it could have had fafely: for if as large motion had been given to one joint, the angle of flexion would have been very acute, and the ligaments muft have been longer than was confiftent with the firmnefs and fecurity of the joint. The other articulations of the bones here being by nearly plain furfaces, fcarcely allow of any more motion, becaufe of the ftrong connecting ligaments, than to yield a little, and fo elude the force of any external power; and to render the back of the wrift a little more flat, or the palm more hollow, on proper occafions. The articulations of the thumb and metacarpal bones fhall be examined afterwards.

The *ufes* of the carpus are to ferve as a bafe to the hand, to protect its tendons, and to afford it a free large motion.

All the bones of the carpus are in a cartilaginous ftate at the time of birth.

On account of the many tendons that pafs upon the lower end of the fore-arm and the carpus, and of the numerous ligaments of thefe tendons and of the bones, which have lubricating liquors fupplied to them, the pain of fprains here is acute, the parts take a long time to recover their tone, and their fwellings are very obftinate.

ME-

METACARPUS.

METACARPUS (*l*) confifts of four bones which fuftain the fingers. Each bone is long and round, with its ends larger than its body.——The upper end, which fome call the bafe, is flat and oblong, without any confiderable head or cavity; but it is, however, fomewhat hollowed, for the articulation with the carpus: It is made flat and fmooth on the fides where thefe bones are contiguous to each other. Their bodies are flatted on their back-part by the tendons of the extenfors of the fingers. The anterior furface of thefe bodies is a little concave, efpecially in their middle; along which a fharp ridge ftands out, feparating the mufculi interoffei placed on each fide of thefe bones, which are there made flat and plain by thefe mufcles.

Their lower ends are raifed into large oblong fmooth heads, whofe greateft extent is forwards from the axis of the bone. At the fore-part of each fide of the root of each of thefe heads, one or two tubercles ftand out, for fixing the ligaments that go from one metacarpal bone to another, to preferve them from being drawn afunder: Round the heads a rough ring may be remarked, for the capfular ligaments of the firft joints of the fingers to be fixed to; and both fides of thefe heads are flat, by preffing on each other.

The *fubftance* of the metacarpal bones is the fame with that of all long bones.

At the time of birth, thefe bones are cartilaginous at both ends, which afterwards become epiphyfes.

The metacarpal bones are *joined* above to the offa carpi and to each other by nearly plain furfaces. Thefe connections

(*l*) Κτεις, προκαρπιον, στηθος, ανδηρον, κτενιον, Poftbrachiale, pectus, palma, pecten.

tions are not fit for large motions. The articulation of their round heads at the lower ends with the cavities of the firſt bones of the fingers, is to be taken notice of hereafter.

The concavity on the fore-part of theſe metacarpal bones, and the placing their baſes on the arched carpus, cauſe them to form a hollow in the palm of the hand, which is often uſeful to us. The ſpaces between them lodge muſcles, and their ſmall motion makes them fit ſupporters for the fingers to play on.

Though the oſſa metacarpi ſo far agree, yet they may be diſtinguiſhed from each other by the following marks.

The *os metacarpi indicis* is generally the longeſt.—Its baſe, which is articulated with the os trapezoides, is hollow in the middle. The ſmall ridge on the internal ſide of this oblong cavity is ſmaller than the one oppoſite to it, and is made flat on the ſide by the trapezium. The exterior ridge is alſo ſmooth, and flat on its outſide, for its conjunction with the os magnum; immediately below which a ſemicircular ſmooth flat ſurface ſhews the articulation of this to the ſecond metacarpal bone. The back part of this baſe is flatted where the long head of the extenſor carpi radialis is inſerted, and its fore-part is prominent where the tendon of the flexor carpi radialis is fixed. The external ſide of the body of this bone is more hollowed by the action of muſcles than the internal. The tubercle at the internal root of its head is larger than the external. Its baſe is ſo firmly fixed to the bone it is connected with, that it has no motion.

Os metacarpi medii digiti is generally the ſecond in length but often it is as long as the former; ſometimes it is longer; and it frequently appears only to equal the firſt by the os magnum being farther advanced downwards than any other bone of the wriſt. Its baſe is a broad ſuperficial cavity,

vity, ſlanting outwards: The internal poſterior angle of which is ſo prominent, as to have the appearance of a proceſs. The internal ſide of this baſe is made plain in the ſame way as the external ſide of the former bone, while its external ſide has two hollow circular ſurfaces, for joining the third metacarpal bone; and between theſe ſurfaces there is a rough foſſa, for the adheſion of a ligament, and lodging mucilaginous glands. The ſhorter head of the bicornis is inſerted into the back part of this baſe. The two ſides of this bone are almoſt equally flatted; only the ridge on the fore-part of the body inclines outwards. The tubercles at the fore-part of the root of the head are equal. The motion of this bone is very little more than that of the former; and therefore theſe two firmly reſiſt bodies preſſed againſt them by the thumb or fingers, or both.

Os metacarpi digiti annularis is ſhorter than the ſecond metacarpal bone. Its baſe is ſemicircular and convex, for its conjunction with the os unciforme. On its internal ſide are two ſmooth convexities, and a middle foſſa, adapted to the ſecond metacarpal bone. The external ſide has a triangular ſmooth concave ſurface to join it with the fourth one. The anterior ridge of its body is ſituated more to the out than to the inſide.—The tubercles near the head are equal.—The motion of this third metacarpal bone is greater than the motion of the ſecond.

Os metacarpi minimi digiti is the ſmalleſt and ſharpeſt. Its baſe is irregularly convex, and riſes ſlanting outwards.——Its internal ſide is exactly adapted to the third metacarpal bone. ——The external has no ſmooth ſurface, becauſe it is not contiguous to any other bone; but it is prominent where the extenſor carpi ulnaris is inſerted.——As this metacarpal bone is furniſhed with a proper moving muſcle, has the plaineſt articulation, is moſt looſely connected and leaſt confined, it

not

not only enjoys a much larger motion than any of the reſt, but draws the third bone with it, when the palm of the hand is to be made hollow by its advancement forwards, and by the prominence of the thumb oppoſite to it.

THUMB AND FINGERS.

The thumb and four fingers are each compoſed of three long bones.

The Thumb (*m*) is ſituated obliquely in reſpect of the fingers, neither oppoſite directly to them, nor in the ſame plane with them.——All its bones are much thicker and ſtronger in proportion to their length, than the bone of the fingers are: Which are extremely neceſſary, ſince the thumb counteracts all the fingers.

The firſt bone of the thumb has its baſe adapted to the double pulley of the trapezium: For, in viewing it from one ſide to the other, it appears convex in the middle; but when conſidered from behind forwards, it is concave there. ——The edge at the fore-part of this baſe is produced farther than any other part; and round the back-part of the baſe a rough foſſa may be ſeen, for the connection of the ligaments of this joint. The body and head of this bone are of the ſame ſhape as the oſſa metacarpi; only that the body is ſhorter, the head flatter, and the tubercles at the fore-part of its root larger.

The articulation of the upper end of this bone is uncommon: For, though it has protuberances and depreſſions adapted to the double pulley of the trapezium; yet it enjoys a circular motion, as the joints do where a round head of the one

(*m*) Αντιχειρ, δικονδυλος, Magnus digitus, promanus.

one plays in the orbicular ſocket of another; only it is ſomewhat more confined, and leſs expeditious, but ſtronger and more ſecure than ſuch joints generally are.

This bone in children is in the ſame ſtate with the metacarpal bones.

The ſecond bone of the thumb has a large baſe formed into an oblong cavity, whoſe greateſt length is from one ſide to the other.——Round it ſeveral tubercles may be remarked, for the inſertion of ligaments.——Its body is convex, or a half round behind; but flat before, for lodging the tendon of the long flexor of the thumb, which is tied down by ligamentous ſheaths that are fixed on each ſide to the angle at the edge of this flat ſurface.——The lower end of this ſecond bone has two lateral round protuberances, and a middle cavity, whoſe greateſt extent of ſmooth ſurface is forwards.

The articulation and motion of the upper end of this ſecond bone is as ſingular as that of the former.——For its cavity being joined to the round head of the firſt bone, it would ſeem to enjoy motion in all directions; yet, becauſe of the ſtrength of its lateral ligaments, oblong figure of the joint itſelf, and mobility of the firſt joint, it only allows flexion and extenſion; and theſe are generally much confined.

The third bone of the thumb is the ſmalleſt, with a large baſe, whoſe greateſt extent is from one ſide to the other.——This baſe is formed into two cavities and a middle protuberance, to be adapted to the pulley of the former bone.—Its body is rounded behind; but is flatter than in the former bone for ſuſtaining the nail.—It is flat and rough before, by the inſertion of the flexor tertii internodii.—This bone becomes gradually ſmaller, till near the lower end, where it is a little enlarged, and has an oval ſcabrous edge.

The

The motion of this third bone is confined to flexion and extenſion.

The orderly diſpoſition of the bones of the FINGERS into three rows, has made them generally obtain the name of three *phalanges* (*n*).—All of them have half-round convex ſurfaces, covered with an aponeuroſis, formed by the tendons of the extenſors, lumbricales, and interoſſei, and placed directly backwards, for their greater ſtrength; and their flat concave part is forwards, for taking hold more ſurely, and for lodging the tendons of the flexor muſcles.—The ligaments for keeping down theſe tendons are fixed to the angles that are between the convex and concave ſides.

The bones of the firſt phalanx (*o*) of the fingers anſwer to the deſcription of the ſecond bone of the thumb; only that the cavity in their baſe is not ſo oblong; nor is their motion on the metacarpal bones ſo much confined: For they can be moved laterally or circularly; but have no rotation, or a very ſmall degree of it, round their axis.

Both the ends of this firſt phalanx are in a cartilaginous ſtate at the birth; and the upper one is afterwards affixed in form of an epiphyſe.

The ſecond bone (*p*) of the fingers has its baſe formed into two lateral cavities, and a middle protuberance; while the lower end has two lateral protuberances and a middle cavity; therefore it is joined at both ends in the ſame manner, which none of the bones of the thumb are.

This bone is in the ſame condition with the former in children.

The third bone (*q*) differs nothing from the deſcription of the third bone of the thumb, excepting in the general dif-

(*n*) Scytalidae, internodia, ſcuticula, agmina, acies, condyli articuli.

(*o*) Προκονδυλοι. (*p*) Κονδυλοι. (*q*) Μετακονδυλοι, ριζωνυχια.

diſtinguiſhing marks; and therefore the ſecond and third phalanx of the fingers enjoy only flexion and extenſion.

The upper end of this third phalanx is a cartilage in a ripe child; and is only an epiphyſe after, till the full growth of the body.

All the difference of the *phalanges* of the ſeveral fingers conſiſts in their magnitude ——The bones of the *middle finger* (r) being the longeſt and largeſt,——thoſe of the *fore-finger* (s) come next to that in thickneſs, but not in length, for thoſe of the *ring-finger* (t) are a little longer. The *little finger* (u) has the ſmalleſt bones. Which diſpoſition is the beſt contrivance for holding the largeſt bodies; becauſe the longeſt fingers are applied to the middle largeſt periphery of ſuch ſubſtances as are of a ſpherical figure (x).

The uſes of all the parts of our *ſuperior extremities* are ſo evident in the common actions of life, that it is needleſs to enumerate them here; and therefore I ſhall proceed to the laſt part of the ſkeleton. Only, leſt I ſhould ſeem to have forgot the ſmall bones at the joints of the hand, I deſire now to refer to the deſcription of them, under the common title of *ſeſamoid bones*, which I have placed after the bones of the feet.

SECT. IV.

OF THE INFERIOR EXTREMITIES.

THE INFERIOR EXTREMITIES depend from the acetabula of the oſſa innominata: and are commonly divided into three parts, viz. the thigh, leg, and foot.

§ 1.

(r) Καταπυγων, σφακελος, Infamis, impudicus, verpus, famoſus, obſcœnus.

(s) Δεικτικος, Indicator, λιχανος, demonſtrativus, ſalutaris.

(t) Ἰατρικος, παραμεσος, δακτυλιωτης, επιβατης, Annularis, medicus, cordis digitus.

(u) Μυωψ, ωτικης, Auricularis, minimus.

(x) Galen. de uſu part. lib. 1. cap. 24.

§ 1. *The* THIGH.

THE thigh (*y*) has only one bone; which is the longeſt in the whole body, and the largeſt and ſtrongeſt of any of the cylindrical bones. The ſituation of it is not perpendicular; for the lower end is inclined conſiderably inwards; ſo that the knees are almoſt contiguous, while there is a conſiderable diſtance between the thigh-bones above; which is of great uſe, ſince ſufficient ſpace is thereby left for the external parts of generation, the two great cloacae of urine and faeces, and for the large thick muſcles that move the thigh inwards. At the ſame time this ſituation of the thigh-bones renders our progreſſion quicker, ſurer, ſtraighter, and in leſs room: For, had the knees been at a greater diſtance from each other, we muſt have been obliged to deſcribe ſome part of a circle with the trunk of our body in making a long ſtep; and when one leg was raiſed from the ground, our centre of gravity would have been too far from the baſe of the other, and we ſhould conſequently have been in danger of falling; ſo that our ſteps would neither have been ſtraight nor firm, nor would it have been poſſible to walk in a narrow path, had our thigh-bones been otherwiſe placed. In conſequence, however, of the weight of the body bearing ſo obliquely on the joint of the knee by this ſituation of the thigh-bones, weak ricketty children become inn-knee'd.

The upper end of the thigh-bone is not continued in a ſtraight line with the body of it, but is ſet off obliquely inwards and upwards, whereby the diſtance here between theſe two bones at their upper part is conſiderably increaſed.——This end is formed into a large ſmooth round head (*z*), which is the greater portion of a ſphere unequally divided.——Towards its lower internal part a round rough

(*y*) Μηρος, Femen, coxa, agis, anchae os, crus, femur.

(*z*) Vertebrum.

rough ſpongy pit is obſervable, where the ſtrong ligament, commonly, but unjuſtly, called the *round one*, is fixed, to be extended from thence to the lower internal part of the receiving cavity, where it is conſiderably broader than near to the head of the thigh-bone.——The ſmall part below the head, called the *cervix*, of the os femoris, has a great many large holes, into which the fibres of the ſtrong ligament continued from the capſular, enter, and are thereby firmly united to it; and round the root of the neck, where it riſes from the bones, a rough ridge is found, where the capſular ligament of the articulation itſelf is connected.——Below the back-part of this root, the large unequal protuberance, called *trochanter major* (*a*), ſtands out; the external convex part of which is diſtinguiſhed into three different ſurfaces: Whereof the one on the fore-part is ſcabrous and rough, for the inſertion of the glutaeus minimus; the ſuperior one is ſmooth, and has the glutaeus medius inſerted into it; and the one behind is made flat and ſmooth, by the tendon of the glutaeus maximus paſſing over it.——The upper edge of this proceſs is ſharp and pointed at its back-part, where the glutaeus medius is fixed; but forwards it is more obtuſe, and has two ſuperficial pits formed in it; Into the ſuperior of theſe the pyriformis is implanted; and the obturator internus and gemini are fixed into the lower one.——From the hindmoſt prominent part of this great trochanter, a rough ridge runs backwards and downwards, into which the quadratus is inſerted.——In the deep hollow, at the internal upper ſide of this ridge, the obturator externus is implanted.——More internally, a conoid proceſs, called *trochanter minor* (*b*), riſes for the inſertion of the muſculus pſoas and iliacus internus; and the pectineus is implanted into a rough hollow below its internal

(*a*) Γλϐτος, Rotator natis, malum granatum teſticulorum.

(*b*) Rotator minor.

nal root. The mufcles inferted into thofe two proceffes being the principal inftruments of the rotatory motion of the thigh, have occafioned the name of *trochanters* to be given to thofe proceffes.——The tendons that are fixed into or pafs over the great *trochanter*, caufe bruifes, by falls on this part, to be attended with great pain and weaknefs of the limb, which generally remain long.

The body of the os femoris is convex on the fore-part, and made hollow behind, by the action of the mufcles that move it and the leg, and for the conveniency of fitting, without bearing too much on thefe mufcles; and probably the weight of the legs depending from the thighs in that pofture contributes to this curvature. The fore-part of the thigh-bone is a little flatted above by the beginning of the cruraeus mufcle, as it is alfo below by the fame mufcle and the rectus. ——Its external furface is likewife made flat below by the vaftus externus, where it is feparated from the former by an obtufe ridge. The vaftus internus depreffes a little the lower part of the internal furface.——The pofterior concave furface has a ridge rifing in its middle, commonly called *linea afpera*, into which the triceps is inferted, and the fhort head of the biceps flexor tibiae rifes from it.——At the upper part of it the medullary veffels enter by a fmall hole that runs obliquely upwards. A little above which there is a rough foffa or two, where the tendon of the glutaeus maximus is fixed. ——The lower end of the linea afpera divides into two, which defcend towards each fide.——The two vafti mufcles have part of their origin from thefe ridges; and the long tendon of the triceps is fixed to the internal, by a part of the fafcia aponeurotica of the thigh.——Near the beginning of the internal ridge, there is a difcontinuation of the ridge, where the crural artery paffes through the aponeurofis.—— Between thefe two rough lines, the bone is made flat by the large blood-veffels and nerves which pafs upon it; and near the

the end of each of thefe ridges, a fmall fmooth protuberance may often be remarked, where the two heads of the external gaftrocnemius mufcle take their rife, and where fefamoid bones are fometimes found (*c*); and from the fore-part of the internal tubercle a ftrong ligament is extended to the infide of the tibia.

The lower end of the os femoris is larger than any other part of it, and is formed into a great protuberance on each fides, called its *condyles;* between which a confiderable cavity is found, efpecially at the back-part, in which the crural veffels and nerves lie immerfed in fat.——The internal condyle is longer than the external, which muft happen from the oblique pofition of this bone, to give lefs obliquity to the leg. Each of thefe proceffes feem to be divided into its plain fmooth furface. The mark of divifion on the external is a notch, and on the internal a fmall protuberance. The fore-part of this divifion, on which the rotula moves, is formed like a pulley, the external fide of which is higheft. Behind, there are two oblong large heads, whofe greateft extent is backwards, for the motion of the tibia: and from the rough cavity between them, but near to the bafe of the internal condyle, the ftrong ligament, commonly called the *crofs one*, has its rife.——A little above which a protuberance gives infertion to the tendon of the triceps. The condyles, both on the outer and inner fide of the knee, are made flat by the mufcles paffing along them. On the back-part of the internal, a flight depreffion is made by the tendons of the gracilis and fartorius; and on the external fuch another is formed by the biceps flexor cruris; behind which a deep foffa is to be obferved, where the poplitaeus mufcle has its origin. From the tubercle immediately before this cavity, a ftrong ligament goes out to the upper part of the fibula.——Round this lower end

(*c*) Vefal. lib. I. cap. 28. & 30.

end of the thigh-bone, large holes are found, into which the ligaments for the ſecurity of the joint are fixed, and blood-veſſels paſs to the internal ſubſtance of the bone.

All the proceſſes of the femur are cartilaginous in new-born children; and afterwards become ſmall apophyſes, with large epiphyſes.

The thigh-bone being articulated above with the acetabulum of the oſſa innominata, which affords its round head a ſecure and extenſive play, can be moved to every ſide; but is reſtrained in its motion outwards by the high brims of the cavity, and by the round ligament; for otherwiſe the head of the bone would have been frequently thruſt out at the breach of the brims on the inſide, which allows the thigh to move conſiderably inwards.——The body of this bone enjoys little or no rotatory motion, though the head moſt commonly moves round its own axis; becauſe the oblique progreſs of the neck and head from the bone is ſuch, that the rotatory motion of the head can only bring the body of the bone forwards and backwards. Nor is the head, as in the arm, ever capable of being brought to a ſtraight direction with its body; ſo far, however, as the head can move within the cavity backwards and forwards, the reſt of the bone may have a partial rotation.——When the thigh-bone reſiſts the actions of its muſcles more than the trunk of the body can then do, as in ſtanding, theſe muſcles have their effect on the trunk, cauſing it to bend forward, raiſing it up, inclining it to the one or the other ſide, twiſting it obliquely, &c. for which the rolling of the acetabula of the oſſa innominata on the round heads of the thigh-bones is well fitted.——The os femoris is articulated below to the tibia and rotula in the manner afterwards to be deſcribed.

The nearneſs of the ſmall neck to the round head of the

the thigh-bone, and its upper end being covered with very thick mufcles, make greater difficulty in diftinguifhing between a luxation and fracture here, than in any other part of the body.

§ 2. *The* LEG.

THE leg (*d*) is compofed, according to the common account, of two bones, *tibia* and *fibula*, though it feems to have a very good title to a third, the *rotula*; which bears a ftrong analogy to the olecranon of the ulna, and moves always with the other two.

TIBIA.

TIBIA (*e*), fo called from its refemblance to an old mufical pipe or flute, is the long thick triangular bone, fituated at the internal part of the leg, and continued in almoft a ftraight line from the thigh-bone.

The upper end of the tibia is large, bulbous, and fpongy, and is divided into two cavities by a rough irregular protuberance (*f*), which is hollow at its moft prominent part, as well as before and behind. The anterior of the two ligaments that compofe the great crofs one is inferted into the middle cavity, and the depreffion behind receives the pofterior ligament.——The two broad cavities at the fides of this protuberance are not equal: for the internal is oblong and deep, to receive the internal condyle of the thigh-bone; while the external is more fuperficial and rounder, for the external condyle.——In each of thefe two cavities of a recent fubject, a femilunar cartilage is placed,

(*d*) Κνημη Crus, tibia.

(*e*) Προκνημιον, αντικνημιον, Focile majus, arundo major, canna major, canna domeftica cruris.

(*f*) Διαφυσις, εξοχη νευροχονδρωδης, Tuber, tuberculum.

placed, which is thick at its convex edge, and becomes gradually thinner towards the concave or interior edge. The middle of each of thefe cartilages is broad, and the ends of them turn narrower and thinner as they approach the middle protuberance of the tibia. The thick convex edge of each cartilage is connected to the capfular and other ligaments of the articulation: but fo near to their rife from the tibia, that the cartilages are not allowed to change place far; while the narrow ends of the cartilages becoming almoft ligaments, are fixed at the infertion of the ftrong crofs ligament into the tibia; and feem to have their fubftance united with it; therefore a circular hole is left between each cartilage and the ligament, in which the moft prominent convex part of each condyle of the thigh-bone moves. The circumference of thefe cavities is rough and unequal, for the firm connection of the ligaments of the joint. Immediately below the edge at its back-part, two rough flatted protuberances ftand out; into the internal, the tendon of the femimembranofus mufcle is inferted; and a part of the crofs ligament is fixed to the external.——On the outfide of this laft tubercle, a fmooth flightly-hollowed furface is formed by the action of the poplitaeus mufcle.

Below the fore-part of the upper end of the tibia, a confiderable rough protuberance (*g*) rifes, to which the ftrong tendinous ligament of the rotula is fixed.——On the internal fide of this, there is a broad fcabrous flightly-hollowed furface, to which the internal long ligament of the joint, the aponeurofis of the vaftus internus, and the tendons of the feminervofus, gracilis, and fartorius, are fixed. The loweft part of this furface is therefore the place where the tibia ought to be fawn through in an amputation, fo as not to have too long and troublefome a ftump,

and

(*g*) Αντικνήμιον, Anterior tuber.

and at the ſame time to preſerve its motions, by ſaving the proper muſcles. Below the external edge of the upper end of the tibia, there is a flat circular ſurface, covered in a recent ſubject with cartilage, for the articulation of the fibula; between which and the anterior knob, a rough hollow affords origins to the tibialis anticus, and extenſor digitorum longus. From this ſmooth flat ſurface, a ridge runs obliquely downwards and inwards, to give riſe to part of the ſolaeus, tibialis poſticus, and flexor digitorum longus, and inſertion to the aponeuroſis of the ſemimembranoſus which covers the poplitaeus, and to ſome of the external fibres of this laſt-named muſcle. At the inſide of this ridge an oblique plain ſurface is left, where the greateſt part of the muſculus poplitaeus is inſerted. The remaining body of the tibia is triangular. The anterior angle is very ſharp, and is commonly called the *ſpine* or *ſhin (h)*. This ridge is not ſtraight; but turns firſt inwards, then outwards, and laſtly inwards again. The plain internal ſide is ſmooth and equal, being little ſubjected to the actions of muſcles; but the external ſide is hollowed above by the tibialis anticus, and below by the extenſor digitorum longus and extenſor pollicis longus. The two angles behind theſe ſides are rounded by the action of the muſcles; the poſterior ſide comprehended between them is not ſo broad as thoſe already mentioned, but is more oblique and flatted by the action of the tibialis poſticus and flexor digitorum longus.——A little above the middle of the bone, the internal angle terminates, and the bone is made round by the preſſure of the muſculus ſolaeus. Near to this the paſſage of the medullary veſſels is ſeen ſlanting obliquely downwards.

The lower end of the tibia is hollowed, ſo as to occaſion a ſmall protuberance to riſe in the middle. The internal ſide

(*h*) Ακανθα, Spina, cerea, linea prima tibiae, angulus acutus.

ſide of this cavity, which is ſmooth, and in a recent ſubject is covered with cartilage, is produced into a conſiderable proceſs, commonly named *malleolus internus (i)*; the point of which is divided by a notch, and from it ligaments are ſent out to the foot. We ought to obſerve here, that this internal malleolus is ſituated more forwards than the internal condyle of the upper end of this bone; which is neceſſary to be remembered in reducing a fracture of the leg (*k*). The external ſide of this end of the tibia has a rough irregular ſemilunar cavity formed in it for receiving the lower end of the fibula. The poſterior ſide has two lateral grooves, and a ſmall middle protuberance. In the internal depreſſion, the tendons of the muſculus tibialis poſticus and flexor digitorum longus are lodged; and in the external, the tendon of the flexor longus pollicis plays. From the middle protuberance, ligamentous ſheaths go out, for tying down theſe tendons.

The articulations and motions of the tibia ſhall be explained, after all the three bones of the leg are deſcribed.

Both the ends of the tibia are cartilages at birth, and become afterwards epiphyſes.

FIBULA.

Fibula (*l*), is the ſmall long bone, placed on the outſide of the leg, oppoſite to the external angle of the tibia; the ſhape of it is irregularly triangular.

The head of the fibula has a ſuperficial circular cavity formed on its inſide, which, in a recent ſubject, is covered with a cartilage, and it is ſo cloſely connected to the tibia by ligaments, as to allow only a ſmall motion backwards and

(*i*) Σφυρον, πεσσος, Talus, clavicula, clavilla interior, clavilla domeſtica.

(*k*) Winſlow, Expoſition anatomique des os ſecs, § 865.

(*l*) Παρακνημιον, Perone, focile minus, arundo minor, canna minor cruris, ſura, radius.

and forwards. This head is protuberant and rough on its outſide, where a ſtrong round ligament and the muſculus biceps are inſerted; and, below the back-part of its internal ſide, a tubercle may be remarked, that gives riſe to the ſtrong tendinous part of the ſolaeus muſcle.

The body of this bone is a little crooked inwards and backwards: which figure is owing to the actions of the muſcles; but is ſtill farther increaſed by nurſes, who often hold children careleſsly by the legs. The ſharpeſt angle of the fibula is forwards; on each ſide of which the bone is conſiderably, but unequally, depreſſed by the bellies of the ſeveral muſcles that riſe from or act upon it; and in old people, theſe muſcles make diſtinct ſinuoſities for themſelves.—— The external ſurface of the fibula is depreſſed obliquely from above downwards and backwards by the two peronaei. Its internal ſurface is unequally divided into two narrow longitudinal planes, by an oblique ridge extended from the upper part of the anterior angle, to join with the lower end of the internal angle. To this ridge the ligament ſtretched between the two bones of the leg is connected. The anterior of the two two planes is very narrow above, where the extenſor longus digitorum and extenſor longus pollicis ariſe from it; but is broader below, where it has the print of the nonus Veſalii. The poſterior plane is broad and hollow, giving origin to the larger ſhare of the tibialis poſticus. The internal angle of this bone has a tendinous membrane fixed to it, from which ſome fibres of the flexor digitorum longus take their riſe. The poſterior ſurface of the fibula is the plaineſt and ſmootheſt: but is made flat above by the ſolaeus, and is hollowed below by the flexor pollicis longus. In the middle of this ſurface, the canal for the medullary veſſels may be ſeen ſlanting downwards.

I have taken particular notice of the entry and direction of of the medullary veſſels of the large bones of the extremities (*m*); becauſe in ſeveral chirurgical caſes, a ſurgeon who is ignorant of their ſituation and courſe, may do miſchief to his patient. Thus, for example, if theſe veſſels are opened very near their entry into the bone, or while they are in the oblique paſſage through it, an obſtinate haemorrhagy may enſue: For the arteries being connected to the bony paſſage, ſtyptics, and other like corrugators, are applied in vain; compreſſing inſtruments can do no ſervice, and ligatures cannot be employed. There ſeems to be a particular deſign in the contrivance of theſe canals; thoſe in the os humeri, tibia, and fibula running obliquely downwards from their external entry; whereas in the radius, ulna, and os femoris, they ſlant upwards, whereby the arteries and nerves which are ſent into theſe three laſt bones muſt ſuffer a conſiderable reflexion before they come at the cancelli. The reaſon of this diverſity may perhaps be, that the arteries, which are ſo ſmall within the bones as to have no ſtrong contractile propelling force in their coats, and where they are not aſſiſted by the action of any moving neighbouring organ, ſhould have, at leaſt in their paſſage through the bone, a favourable deſcent for their liquids: Which, it is evident, they have in the deſcending oblique paſſages formed for them in the firſt claſs of bones, to wit, the os humeri, tibia, and fibula, which are generally depending; and they alſo moſt frequently acquire the like advantage in the radius, ulna, and os femoris; becauſe the hand, in the moſt natural poſture, is higher than the elbow: And when we ſit or lie, the lower end of the thigh-bone comes to be at leaſt raiſed as high as the upper end. In ſtanding and walking, or when the arms are moved, the blood muſt indeed aſcend as it paſſes through the bones of the fore-arm and thigh; but the

pressure

(*m*) Havers, Oſteolog. Nov. diſ. 1. p. 59.

preſſure of the muſcles, then in action on the veſſels, before they enter the bones, is ſufficient to compenſate the diſadvantage of their courſe. This reaſoning ſeems to be ſtill enforced, by obſerving, that this paſſage is always nearer the upper than the lower ends of theſe bones.

The lower end of the fibula is extended into a ſpongy oblong head; on the inſide of which is a convex, irregular, and frequently a ſcabrous, ſurface, that is received by the external hollow of the tibia, and ſo firmly joined to it by a very thin intermediate cartilage and ſtrong-ligaments, that it ſcarce can move.——Below this the fibula is ſtretched out into a ſmooth coronoid proceſs, covered with cartilage on its internal ſide, and is there contiguous to the outſide of the firſt bone of the foot, the aſtragalus, to ſecure the articulation. This proceſs, named *malleolus externus*, being ſituated farther back than the internal malleolus, and in an oblique direction, obliges us naturally to turn the fore-part of the foot outwards (*n*). At the lower internal part of this proceſs, a ſpongy cavity for mucilaginous glands may be remarked; from its point ligaments are extended to the aſtragalus, os calcis, and os naviculare, bones of the foot; and from its inſide ſhort ſtrong ones go out to the aſtragalus. On the back part of it a ſinuoſity is made by the tendons of the peronaei muſcles. When the ligament extended over theſe tendons from the one ſide of the depreſſion to the other is broken, ſtretched too much, or made weak by a ſprain, the tendons frequently ſtart forwards to the outſide of the fibula.

The conjunction of the upper end of the fibula with the tibia, is by plain ſurfaces tipped with cartilage; and at its lower end the cartilage ſeems to glue the two bones together; not, however, ſo firmly in young people, but that the motion at the other end of ſuch a long radius is very obſervable;

(*n*) Winſlow, Mem. de l'acad. des ſciences, 1722.

obfervable.—In old fubjects I have often feen the two bones of the leg grown together at their lower ends.

The principal ufe of this bone is to afford origin and infertion to mufcles; the direction of which may be a little altered on proper occafions, by its upper part fhuffling backwards and forwards.——It likewife helps to make the articulation of the foot more fecure and firm.——The ends of the tibia and fibula being larger than their middle, a fpace is here left, which is filled up with fuch another ligament as I have defcribed extended between the bones of the fore-arm; and which is alfo difcontinued at its upper-part, where the tibialis anticus immediately adheres to the foleaus and tibialis pofticus; but every where elfe it gives origin to mufcular fibres (*o*).

Both the ends of this bone are cartilaginous in a ripe child, and affume the form of appendices before they are united to its body.

ROTULA.

Rotula (*p*) is the fmall flat bone fituated at the fore-part of the joint of the knee.—Its fhape refembles the common figure of the heart with its point downwards.—The anterior convex furface of the rotula is pierced by a great number of holes, into which fibres of the ftrong ligament, that is fpread over it, enter.—Behind, its furface is fmooth, covered with cartilage, and divided by a middle convex ridge into two cavities, of which the external is largeft; and both are exactly adapted to the pulley of the os femoris, on which they are placed in the moft ordinary unftraining poftures of the leg: But when the leg is much bent, the rotula defcends far down

(*o*) Weitbrecht, Syndefmolog. p. 156.

(*p*) Επιμυλις, μυλακρις, κογχος, επιγονατις, πλακηνσισδρον, Patella, mola, genu, fcutiforme os, cartilaginofum, difciforme, oculus genu.

down on the condyles; and when the leg is fully extended, the rotula rifes higher in its upper-part than the pulley of the thigh-bone.——The plain fmooth furface is furrounded by a rough prominent edge, to which the capfular ligament adheres: Below, the point of the bone is fcabrous, where the ftrong tendinous ligament from the tubercle of the tibia is fixed. The upper horizontal part of this bone is flatted and unequal, where the tendons of the extenfors of the leg are inferted.

The fubftance of the rotula is cellular, with very thin external firm plates; but then thefe cells are fo fmall, and fuch a quantity of bone is employed in their formation, that fcarce any bone of its bulk is fo ftrong. Befides, it is covered all over with a thick ligament, (as it was obferved that this fort of bones generally is), to connect its fubftance, and is moveable to one fide or other: Therefore it is fufficiently ftrong to refift the ordinary actions of the large mufcles that are inferted into it, or any common external force applied to it; while a fixed procefs, fuch as the olecranon, would not have been fufficient to bear the whole weight of our bodies, which frequently falls on it, and would have hindered the rotatory motion of the leg. Notwithftanding thefe precautions to preferve this bone from fuch injuries, yet I have feen a tranfverfe fracture in it, when, by the report of the patient, and of the people about him, and by the want of fwelling, difcolouring, or other mark of bruife or contufion, it was plain the bone was broken by the violent ftraining effort of the mufcles (*q*). Though my patient recovered the ufe of the joint of the knee, yet I think it reafonable to believe, that this fort of fracture is commonly attended with difficulty of motion after the broken parts of the rotula are reunited; becaufe the callous matter probably extends itfelf into the cavity of the joint, where it either grows to fome of the parts, or makes fuch

(*q*) See Rufych. Obferv. anat. chirurg. obf. 3.

fuch an inequality on the furface of this bone, as does not allow it to perform the neceffary motions on the condyles of the femur (*r*).

At the ordinary time of birth, the rotula is entirely cartilaginous, and fcarcely affumes a bony nature fo foon as moft epiphyfes do.

The parts which conftitute the joint of the knee being now defcribed, let us examine what are its motions, and how they are performed.—The two principal motions are flexion and extenfion. In the former of thefe, the leg may be brought to a very acute angle with the thigh, by the condyles of the thigh-bones being round and made fmooth far backwards. In performing this, the rotula is pulled down by the tibia. When the leg is to be extended, the rotula is drawn upwards, confequently the tibia forwards, by the extenfor mufcles; which, by means of the protuberant joint, and of this thick bone with its ligament, have the chord, with which they act, fixed to the tibia at a confiderable angle, act, on that account, with advantage; but they are reftrained from pulling the leg farther than to a ftraight line with the thigh, by the pofterior part of the crofs ligament, that the body might be fupported by a firm perpendicular column: For at this time the thigh and leg are as little moveable in a rotatory way, or to either fide, as if they were one continued bone.—But when the joint is a little bent, the rotula is not tightly braced, and the pofterior ligament is relaxed; therefore this bone may be moved a little to either fide, or with a fmall rotation in the fuperficial cavities of the tibia; which is done by the motion of the external cavity backwards and forwards, the internal ferving as a fort of axis (*s*). Seeing, then, one part of the crofs ligament is fituated perpendicularly, and the pof-

(*r*) Pare, liv. 15. cap. 22.

(*s*) Winflow, Expofition anatomique du corps humain, traite des os fecs, § 976.

terior part is ſtretched obliquely from the internal condyle of the thigh outwards, that poſterior part of the croſs ligament prevents the leg from being turned at all inwards; but it could not hinder it from turning outwards almoſt round, was not that motion confined by the lateral ligaments of this joint, which can yield little. This rotation of the leg outwards is of good advantage to us in croſſing our legs, and turning our feet outwards, on ſeveral neceſſary occaſions; though it is altogether fit this motion ſhould not be very large, to prevent frequent luxations here.—While all theſe motions are performing, the part of the tibia that moves immediately on the condyles is only ſo much of it as is within the cartilaginous ring, which by the thickneſs on their outſides make the cavities of the tibia more horizontal; by raiſing their external ſide where the ſurface of the tibia ſlants downwards. By this means the motions of this joint are more equal and ſteady than otherwiſe they would have been. The cartilages being capable of changing a little their ſituation, are fit for doing this good office in the different motions and poſtures of the limb, and likewiſe contribute to make the motions larger and quicker.

On account of the very large ſurface of the bones forming the joint of the knee, and the many ſtrong ligaments connecting them, luxations ſeldom happen here. But theſe very ligaments, the aponeuroſis paſſing over this joint, and the quantity of fat and mucilaginous glands neceſſary for lubricating it, make it more ſubject to white ſwellings, dropſies, and ſuch other diſorders, than any other joint of the body.

§ 3. *The* FOOT.

The foot is divided, as well as the hand, into three parts, viz. *tarſus*, *metatarſus*, and *toes*: In the deſcription of of which, the ſeveral ſurfaces ſhall be named, according to their natural ſituation, viz. the broad upper part of the foot ſhall be called *ſuperior*; the ſole, *inferior*; the ſide on which the great toe is, *internal*; and the other *external*.

TARSUS.

The tarſus (*t*) conſiſts of ſeven ſpongy bones; to wit, the aſtragalus, os calcis, naviculare, cuboides, cuneiforme externum, cuneiforme medium, and cuneiforme internum.

The *aſtragalus* is the uppermoſt of theſe bones.———The *os calcis* is below the aſtralagus, and is conſiderably prominent backwards beyond the other bones, to form the heel.——— The *os naviculare* is in the middle of the internal ſide of the tarſus.——The *os cuboides* is the moſt external of the row of four bones at its fore-part.——The *os cuneiforme externum* is placed at the inſide of the cuboid.——The *cuneiforme medium* is between the external and internal cuneiform bones; and the *internal cuneiforme* is put at the internal ſide of the foot.

That the deſcription of theſe bones may not be immoderately ſwelled with repetition, I deſire, once for all, to obſerve, That wherever a ridge is mentioned, without a particular uſe aſſigned, a ligament is underſtood to be fixed to it; or where a ſpongy rough cavity, depreſſion, or foſſa, is remarked, without naming its uſe, a ligament is inſerted, and mucilaginous glands are lodged: for ſuch will occur in the detail of each of theſe bones.

Aſtragalus. The upper part of the aſtragalus (*u*) is formed into a large ſmooth head (*x*), which is ſlightly hollowed in the middle; and therefore reſembles a ſuperficial pulley, by which it is fitted to the lower end of the tibia. ———The internal ſide of this head is flat and ſmooth, to play

(*t*) Raſſetta.

(*u*) Ἀστρις, Talus, balliſtae os, malleolus, chaib, quatrio, os teſſarae, claviculae, unciforme.

(*x*) Τρωριτος.

play on the internal malleolus.——The external ſide has alſo ſuch a ſurface, but larger, for its articulation with the external malleolus. Round the baſe of this head there is a rough foſſa; and immediately before the head, as alſo below its internal ſmooth ſurface, we find a conſiderable rough cavity.

The lower ſurface of the aſtralagus is divided by an irregular deep rough foſſa; which at its internal end is narrow, but gradually widens as it ſtretches obliquely outwards and forwards. The ſmooth ſurface, covered with cartilage, behind this foſſa, is large, oblong, extended in the ſame oblique ſituation with the foſſa, and concave for its conjunction with the os calcis. The back-part of the edge of this cavity is produced into two ſharp-pointed rough proceſſes; between which is a depreſſion made by the tendon of the flexor pollicis longus.——The lower ſurface before the foſſa is convex, and compoſed of three diſtinct ſmooth planes.——The long one behind, and the exterior or ſhorteſt, are articulated with the heel-bone; while the internal, which is the moſt convex of the three, reſts and moves upon a cartilaginous ligament, that is continued from the calcaneum to the os ſcaphoides. Without which ligament the aſtralagus could not be ſuſtained; but would be preſſed out of its place by the great weight it ſupports, and the other bones of the tarſus would be ſeparated. Nor would a bone be fit here, becauſe it muſt have been thicker than could conveniently be allowed; otherwiſe it would break, and would not prove ſuch an eaſy bending baſe, to leſſon the ſhock which is given to the body in leaping, running, &c.

The fore-part of this bone is formed into a convex oblong ſmooth head, called by ſome its *proceſs*, which is received by the os naviculare. Round the root of this head, eſpecially efpecially on the upper furface, a rough foffa may be remarked.

The aftragalus is articulated above to the tibia and fibula, which together form one cavity. Though in this articulation the bones have prominences and cavities, fo fmall as might allow motions in all directions, yet the flexion and extenfion are the moft confiderable, the other motions being confined by the malleoli, and, by the ftrong ligaments which go out from the points of thefe proceffes, to the aftragalus and os calcis.——When the foot is bent, fo far as it commonly is when we ftand, no lateral or rotatory motion is allowed in this joint; for then the head of the aftragalus is funk deep between the malleoli, and the ligaments are tenfe: but when the foot is extended, the aftragalus can move a little to either fide, and with a fmall rotation. By this contrivance the foot is firm, when the weight of the body is to be fupported on it; and when a foot is raifed, we are at liberty to direct it more exactly to the place we intend next to ftep upon.—The aftragalus is joined below to the os calcis; and before to the os naviculare, in the manner to be explained when thefe bones are defcribed.

A confiderable fhare of this bone is offified in a new-born infant.

Calcaneum (*w*) is the largeft bone of the feven.———Behind, it is formed into a large knob, commonly called the *heel*: the furface of which is rough behind, where the tendo Achillis is inferted; and above that part it is hollow and fpongy. Farther forwards, on the upper furface of the calcaneum, there is an irregular oblong fmooth convexity, adapted to the concavity at the back part of the aftragalus: and beyond this a narrow foffa is feen, which divides it from two fmall concave fmooth furfaces, that are joined to

(*w*) Os calcis, πτέρνα, calcar pedis.

to the fore-part of the aſtragalus.——Behind the poſterior of theſe ſmooth ſurfaces, which is the largeſt, a ſmall ſinuoſity is made by the tendon of the flexor digitorum longus; at the fore-part of which a ſmall rough protuberance appears, that gives riſe to the muſculus extenſor digitorum brevis.

The external ſide of this bone is flat, with a ſuperficial foſſa running horizontally, in which the tendon of the muſculus peronaeus longus is lodged. The internal ſide of the heel-bone is hollowed, for lodging the origin of the maſſa cornea Jac. Sylvii, and for the ſafe paſſage of tendons, nerves, and arteries. Under the ſide of the internal ſmooth concavity, a particular groove is made by the tendon of the flexor pollicis longus; and from the thin protuberance of this internal ſide the cartilaginous ligament that ſupports the aſtragalus, goes out to the os naviculare; on which ligament, and on the edge of this bone to which it is fixed, the groove is formed for the tendon of the flexor digitorum profundus.

The lower ſurface of this bone is preſſed flat at the back-part, by the weight of our bodies; and immediately before this plane, there are two tubercles, from the internal of which the muſculus abductor pollicis, flexor digitorum ſublimis, as alſo part of the aponeuroſis plantaris, and of the abductor minimi digiti, have their origin; and the other part of the abductor minini digiti and aponeuroſis plantaris riſes from the external. Before theſe protuberances this bone is concave, for lodging the flexor muſcles; and at its fore-part we may obſerve a rough depreſſion, from which, and a tubercle behind it, the ligament goes out that prevents this bone from being ſeparated from the os cuboides.

The fore-part of the os calcis is formed into an oblong pulley-like ſmooth ſurface, which is circular at its upper external

external end, but is pointed below. The ſmooth ſurface is fitted to the os cuboides.

Though the ſurfaces by which the aſtragalus and os calcis are articulated, ſeem fit enough for motion; yet the very ſtrong ligaments by which theſe bones are connected, prevent much motion, and render this principal part of our baſe, which reſts on the ground, firm.

A large ſhare of the heel-bone is oſſified at the ordinary time of birth, and the large knob appears afterwards in form of an epiphyſe.

Os naviculare (y), is ſomewhat circular.——It is formed into an oblong concavity behind, for receiving the anterior head of the aſtragalus.——On the upper ſurface there is a rough foſſa.——Below, the os naviculare is very unequal and rough; but hollow for the ſafety of the muſcles.——On its inſide a large knob riſes out, from which the abductor pollicis takes in part its origin, the tendon of the tibialis poſticus is inſerted into it, and to it two remarkable ligaments are fixed; the firſt is the ſtrong one, formerly mentioned, which ſupports the aſtragalus; the ſecond is ſtretched from this bone obliquely croſs the foot, to the metatarſal bones of the middle toe, and of the toe next to the little one.——On the outſide of the os naviculare there is a ſemicircular ſmooth ſurface, where it is joined to the os cuboides. The fore-part of this bone is all covered with cartilage, and is divided into three ſmooth planes, fitted to the three oſſa cuneiformia.

The os naviculare and aſtragalus are joined as a ball and ſocket; and the naviculare moves in all directions in turning the toes inwards, or in raiſing or depreſſing either ſide of the foot, though the motions are greatly reſtrained by the ligaments which connect this to the other bones of the tarſus.

(y) Σκαφοειδης, Os cymbae.

tarſus. A weakneſs of theſe ligaments cauſes ſometimes an unnatural turn of the fore-part of the foot inwards.

The os naviculare is wholly cartilaginous in a new-born infant.

Os cuboides (z) is a very irregular cube.——Behind, it is formed into an oblong unequal concavity, adapted to the fore-part of the os calcis. On its internal ſide, there is a ſmall ſemicircular ſmooth cavity, to join the os naviculare.—Immediately before which, an oblong ſmooth plane is made by the os cuneiforme externum. Below this the bone is hollow and rough.—On the internal ſide of the lower ſurface a round protuberance and foſſa are found, where the muſculus adductor pollicis has its origin.—On the external ſide of this ſame ſurface, there is a round knob, covered with cartilage; immediately before which a ſmooth foſſa may be obſerved, in which the tendon of the peronaeus primus runs obliquely croſs the foot; and on the knob the thin flat cartilage proper to this muſcle plays; in place of which ſometimes a bone is found: More externally than the knob, a rough hollow is made, for the ſtrong ligaments ſtretched between this bone and the os calcis.—Before, the ſurface of the os cuboides is flat, ſmooth, and ſlightly divided into two planes, for ſuſtaining the os metatarſi of the little toe, and of the toe next to it.

The form of the back-part of the os cuboides, and the ligaments connecting the joint with os calcis, both concur in allowing little motion in this part.

The oſſification of this bone is ſcarcely begun at the birth.

Os cuneiforme externum (*a*), if we regard its ſituation or medium by its bulk, is much of the ſhape of a wedge, being

(z) Πολυμορφον, Cubiforme, quadratum, grandinoſum varium teſſarae, multiforme.

(a) Chalcoideum externum.

ing broad and flat above, with long ſides running obliquely downwards, and terminating in a ſharp edge. The upper ſurface of this bone is an oblong ſquare. The one behind is nearly a triangle, but not complete at the inferior angle, and is joined to the os naviculare. The external ſide is an oblong ſquare divided as it were by a diagonal; the upper half of it is ſmooth, for its conjunction with the os cuboides: The other is a ſcabrous hollow, and in its ſuperior anterior angle a ſmall ſmooth impreſſion is made by the os metatarſi of the toe next to the little one. The internal ſide of this bone is alſo quadrangular, with the fore-part of its edge made flat and ſmooth by the os metatarſi of the toe next to the great one, and the back-part is alſo flat and ſmooth where the os cuneiforme medium is contiguous to it. The fore-part of this bone is an oblong triangle, for ſuſtaining the os metatarſi of the middle toe.

Os cuneiforme medium, or *minimum*, is ſtill more exactly the ſhape of a wedge than the former. Its upper part is ſquare;——its internal ſide has a flat ſmooth ſurface above and behind, for its conjunction with the following bone; with a ſmall rough foſſa below; and a conſiderable ſhare of it is rough and hollow. The external ſide is ſmooth and a little hollowed, where it is contiguous to the laſt deſcribed bone.——Behind, this bone is triangular, where it is articulated with the os naviculare; and it is alſo triangular at its fore-part, where it is contiguous to the os metatarſi of the toe next to the great one.

Os cuneiforme maximum, or *internum*, differs from the two former in its ſituation, which is more oblique than theirs.—Beſides, its broad thick part is placed below, and the ſmall thin point is above and outwards; while its under broad ſurface is concave, for allowing a ſafe paſſage to the flexor of the great toe.——The ſurface of this os cuneiforme behind, where it is joined to the os naviculare, is hollow, ſmooth, and of a circular figure below, but pointed above. The external ſide conſiſts of two ſmooth and flat ſurfaces, whoſe direction is nearly at right angles with each other. With the poſterior, that runs obliquely from below forwards and upwards, the os cuneiforme minimum is joined; and with the anterior, whoſe direction is longitudinal, the os metatarſi of the toe next to the great one is connected. The fore-part of this bone is ſemilunar, but flat and ſmooth, for ſuſtaining the os metatarſi of the great toe. The internal ſide is ſcabrous, with two remarkable tubercles below, from which the muſculus abductor pollicis riſes, and the tibialis anticus is inſerted into its upper part.

The three cuneiform bones are all ſo ſecured by ligaments, that very little motion is allowed in any of them, and they are cartilaginous in a foetus of nine months.

The ſeven bones of the *tarſus*, when joined, are convex above, and leave a concavity below, for lodging ſafely the ſeveral muſcles, tendons, veſſels, and nerves, that lie in the ſole of the foot. In the recent ſubject, their upper and lower ſurfaces are covered with ſtrong ligaments, which adhere firmly to them; and all the bones are ſo tightly connected by theſe and the other ligaments, which are fixed to the rough ridges and foſſae mentioned in the preceding deſcription of the particular bones, that notwithſtanding the many ſurfaces covered with cartilage, ſome of which are of the form of the very moveable articulations, no more motion is here allowed, than only to prevent too great a ſhock of the fabric of the body in walking, leaping, &c. by falling on too ſolid a baſe; which, if it was one continued bone, would likewiſe be much more liable to be broken; and, in order to make our foot accommodate itſelf to the ſurfaces we tread on, by becoming more or leſs hollow, or by raiſing or

depreſſing

depreffing either fide of it, as might be judged by what was faid of the particular bones.

Sprains occafion here, as in the wrift, great pain and obftinate tumours, which too often caufe carious bones.

METATARSUS.

Metatarsus (*a*) is compofed of five bones, which, in their general characters, agree with the metacarpal bones; but may be diftinguifhed from them by the following marks: 1. They are longer, thicker, and ftronger. 2. Their anterior round ends are not fo broad, and are lefs in proportion to their bafes. 3. Their bodies are fharper above and flatter on their fides, with their inferior ridge inclined more to the outfide. 4. The tubercles at the lower part of the round head are larger.

The firft or internal metatarfal bone is eafily diftinguifhed from the reft by its thicknefs. The one next to it is the longeft, and with its fharp edge almoft perpendicular. The others are fhorter and more oblique, as their fituation is more external. Which general remarks, with the defcription I am now to give of each, may teach us to diftinguifh them from each other.

Os metatarfi pollicis is by far the thickeft and ftrongeft, as having much the greateft weight to fuftain. Its bafe is oblong, irregularly concave, and of a femilunar figure, to be adapted to the os cuneiforme maximum. The inferior edge of this bafe is a little prominent and rough, where the tendon of the peronaeus primus mufcle is inferted. On its outfide an oblique circular depreffion is made by the fecond metatarfal bone. Its round head has generally on

(*a*) Στηθος, πεδιον, Planta; planum, veftigium, folium, pectus, precordium, pectufculum.

on its fore-part a middle ridge, and two oblong cavities, for the offa fefamoidea; and on the external fide a depreffion is made by the following bone.

Os metatarfi of the *fecond toe*, is the longeft of the five, with a triangular bafe fupported by the os cuneiforme medium and the external fide produced into a procefs; the end of which is an oblique fmooth plane, joined to the os cuneiforme externum.—Near the internal edge of the bafe, this bone has two fmall depreffions, made by the os cuneiforme maximum, between which is a rough cavity.—Farther forwards we may obferve a fmooth protuberance, which is joined to the foregoing bone.——On the outfide of the bafe are two oblong fmooth furfaces, for its articulation with the following bone; the fuperior fmooth furface being extended longitudinally, and the inferior perpendicularly; between which there is a rough foffa.

Os metatarfi of the *middle toe*, is the fecond in length.—— Its bafe, fupported by the os cuneiforme externum, is triangular, but flanting outwards, where it ends in a fharp-pointed little procefs; and the angle below is not completed.

The internal fide of this bafe is adapted to the preceding bone; and the external fide has alfo two fmooth furfaces covered with cartilage, but of a different figure; for the upper one is concave, and being round behind, turns fmaller as it advances forwards; and the lower furface is little, fmooth, convex, and very near the edge of the bafe.

Os metatarfi of the *fourth* toe, is near as long as the former, with a triangular flanting bafe joined to the os cuboides, and made round at its external angle; having one hollow fmooth furface on the outfide, where it is preffed upon by the following bone; and two on the internal fide, correfponding to the former bone; behind which is a long narrow furface impreffed by the os cuneiforme externum.

Os

Os metatarsi of the *little toe*, is the shortest, situated with its two flat sides above and below, and with the ridges laterally. ——The base of it, part of which rests on the os cuboides, is very large, tuberous, and produced into a long-pointed process externally, where part of the abductor minimi digiti is fixed; and into its upper part the peronaeus secundus is inserted. Its inside has a flat conoidal surface, where it is contiguous to the preceding bone.

When we stand, the fore-ends of these metatarsal bones, and the os calcis, are our only supporters; and therefore it is necessary that they should be strong, and should have a confined motion.

TOES.

THE bones of the toes are nearly similar to those of the thumb and fingers; particularly the two of the great toe are precisely formed as the two last of the thumb; only their position, in respect of the other toes, is not oblique; and they are proportionally much stronger, because they are subjected to a greater force; for they sustain the force with which our bodies are pushed forwards by the foot behind at every step we make; and on them principally the weight of the body is supported, when we are raised on our tip-toes.

The three bones in each of the other four toes, compared to those of the fingers, differ from them in these particulars. They are less and smaller in proportion to their lengths: Their bases are much larger than their anterior ends: Their bodies are more narrow above than below, and flatter on the sides. The first phalanx is proportionally much longer than the bones of the second and third, which are very short.

Of the four, the toe next to the great one has the largest bones in all dimensions, and more externally the toes are

less,

lefs.——The little toe, and frequently that next to it, have the fecond and third bones intimately united into one; which may be owing to their little motion, and the great preffure they are fubject to.

The toes are of great ufe to us in walking; for, when the fole is raifed, they bring our body, with its centre of gravity, perpendicular to the advanced foot.

The bones of the METATARSUS and TOES, are in the fame condition in children as thofe of the metacarpus and fingers.

THE only bones now remaining to complete the defcription of the fkeleton, are the fmall ones which are found at the joints of the fingers and toes, and in fome other parts, called

OSSA SESAMOIDEA.

Thefe are of very different figures and fizes, though they are generally faid to refemble the feed of the fefamum.———They feem to me nothing elfe than the ligaments of the articulations, or the firm tendons of ftrong mufcles, or both, become bony by the compreffion which they fuffer. Thus the fefamoid bones at the beginning of the gaftrocnemii mufcles, are evidently compofed of the tendinous fibres only. Thefe, at the firft joint of the great toe, are as plainly the fame continued fubftance with the ligaments and the tendons of the adductor, flexor, brevis, and abductor.——That which is fometimes double at the fecond joint of that toe is part of the capfular ligament; and if we enumerate the other fefamoid bones that are at any time found, we may obferve all of them formed in this manner. Their number, figure, fituation, and magnitude, are fo uncertain, that it were in vain to infift on the

the difference of each; and therefore I ſhall only in general remark,

1. That wherever the tendons and ligaments are firmeſt, the actions of the muſcles ſtrongeſt, and the compreſſion greateſt, there ſuch bones are moſt commonly found.

2. That, *caeteris paribus*, the older the ſubject is in which they are ſought, their number is greater, and their ſize larger.

3. The more labour any perſon is inured to, he has, *caeteris paribus*, the moſt numerous and largeſt oſſa ſeſamoidea.

However, as the two at the firſt joint of the great toe are much larger than any other, are early formed, and are ſeldom wanting in an adult, we may judge, that beſides the more forcible cauſe of their formation, there ſhould alſo be ſome particular advantage neceſſary at this place, rather than elſewhere; which may poſſibly be, to allow the flexor muſcles to ſend their tendons along this joint, ſecure from compreſſion in the hollow between the two oblong ſeſamoid bones; while by removing theſe tendons from the centre of motion, and giving them the advantage of an angle at their inſertion, the force of the muſcle is increaſed; and therefore the great ſuperincumbent weight of our body in progreſſion is more eaſily raiſed.

APPENDIX.

MARKS OF A FEMALE SKELETON.

TO finifh the defcription of the bones, is generally to conclude the ofteology: But, that no part of the fubject may be left untouched, I think it neceffary to fubjoin the diftinguifhing marks of the Male and Female fkeletons; and I have chofen to illuftrate them principally in the latter; becaufe women having a more delicate conftitution, and affording lodging and nourifhment to their tender fœtufes till they have fufficient ftrength and firmnefs to bear the injuries of the atmofphere, and contact of other more folid fubftances, their bones are frequently incomplete, and always of a make in fome parts of the body different from thofe of the robuft male; which agree to the defcription already given, unlefs where the proper fpecialities of the female were particularly remarked; which could not be done in all places where they occur, without perplexing the order of this treatife: Therefore I choofe rather to fum them up here by way of appendix.

The caufes of the following fpecialities of the female bones may be reduced to thefe three: 1. A weak lax conftitution. 2. A fedentary unactive life, increafing that conftitution. 3. A proper frame for being mothers.

The bones of women are fmaller in proportion to their length than thofe of men; becaufe the force of their mufcles is not fo great, nor is fuch ftrong external force applied to them to prevent their ftretching out in length.

The

The *depreſſions*, *ridges*, *ſcabrous ſurfaces*, and other inequalities made by the *muſcles*, are not ſo conſpicuous in them; becauſe their *muſcles* are neither ſo thick nor ſtrong, nor ſo much employed, as to make ſo ſtrong prints on their bones.

The *os frontis* is more frequently divided by a continuation of the ſagittal ſuture; which depends on the firſt and ſecond general cauſes aſſigned above for the ſpecialties in their bones, as will appear after reflecting on the account given formerly of the middle internal ſpine of this bone.

Their *clavicles* are leſs crooked; becauſe their arms have been leſs forcibly pulled forwards; which, in our European women, eſpecially thoſe of diſtinction, is more hindered by their garb.

Their *ſternum* is more raiſed by long cartilages below, that the thorax might be there widened in ſome proportion to what it is ſhortened by the preſſure upon the diaphragm when they are with child.

The defect of bone, or the hole, in the middle of the *ſternum*, is ofteneſt found in them; to allow the paſſage of the mammary veſſels, ſay ſome. But, in my opinion, this is owing to a lax conſtitution, by which the oſſification is not ſo ſoon completed as in men, where the action of the ſolids is vigorous, and the circulation of the fluids is briſk; for a much ſmaller hole might have ſerved this purpoſe; and the branches of the internal mammary veſſels which are ſent to the external parts of the thorax, do not paſs here, but between the cartilages of the ribs, before theſe are joined to the ſternum.

The *cartilago xiphoides* is oftener bifurcated in women than in men, for the reaſon aſſigned in the preceding paragraph, viz. a leſs forcible power of oſſification.

The

The ſuperior cartilages of the ribs ſooner oſſify, to ſupport the weight of the mammae.

The middle cartilages are more flat and broad by the weight of the breaſts.

The inferior cartilages are longer, for enlarging the cheſt.

Weak women, who have borne many children when young, often have the *vertebræ* of their back bent forwards, and their *ſternum* depreſſed, or become round-ſhouldered and flat-breaſted (*b*), by the preſſure and weight of the impregnated uterus, and by the ſtrong action of the abdominal muſcles.

The *os ſacrum* is broader, and turned much more backwards, for enlarging the pelvis.

The *os coccygis* is more moveable, and much leſs bent forwards, to facilitate the birth.

The *oſſa ilium* are more hollow, and more reflected outwards, and conſequently further removed from each other, in order to widen the lower part of their abdomen, and for the better ſupport of the impregnated uterus.

The *ridge* on the upper part of the *os pubis* is larger in ſuch women as have borne children, being extended by the ſtrong action of the muſculi recti abdominis.

The *cartilage* between the two oſſa pubis, eſpecially in women who have borne children, is thicker than in men, by which the pelvis is more capacious in females.

The *conjoined ſurfaces* of the *oſſa pubis*, and of the *oſſa innominata* and *ſacrum*, are leſs, the angle under the *ſymphyſis* of the *oſſa pubis* is much larger, and the arches formed below and behind by the *oſſa ilium* and *iſchium* are wider, which, with the ſtraighter *os ſacrum*, and more diſtant *tubera iſchii*, leave a larger paſſage for the excluſion of the child in birth.

The great *tuberoſity* of the *oſſa iſchium* is flatter in women than in men, becauſe it is more preſſed upon in the ſedentary life which females enjoy.

In

(*b*) Cheſelden, Anatomy, book I. chap. 1.

In confequence of the *pelvis* of women being wider, the articulations of their thigh-bones muft be farther removed from each other; and therefore a larger fpace is left for the procreation and birth of children (*c*); which diftance of the thighs may be one reafon why women in running fhuffle more from one fide to the other than men, to preferve the centre of gravity of their bodies from falling too far to a fide of the joint of the thigh that fupports them when the other is raifed, which would endanger their tumbling to the ground.

(*c*) Albin, De offib. § 339.

A

SYSTEM OF ANATOMY.

PART II.

CONTAINING A DESCRIPTION OF THE

HUMAN MUSCLES,

Chiefly as they appear on Diſſection.

Together with their ſeveral Uſes, and the Synonyma of the beſt Authors.

By JOHN INNES.

TO

ALEXANDER MONRO, M. D.

Profeſſor of Anatomy and Medicine, in the Univerſity of Edinburgh.

SIR,

HAVING been repeatedly ſolicited, for ſeveral years paſt, by many of your Pupils, to publiſh a ſhort Deſcription of the Muſcles as they appear upon Diſſection of the Human Body, I have at laſt ventured to comply with their requeſt. Your anxiety to promote the Science of Anatomy, and to encourage every thing that may be uſeful to the gentlemen who attend your Theatre, was the principal motive which induced me to undertake this taſk. I have no knowledge of the ſubject but what I derived from you. If, therefore, this Treatiſe, which you have never ſeen till I now preſent it to you, ſhould communicate any advantage to the gentlemen under your care, it is to you alone they are indebted for the obligation. I am, Sir, with reſpect, gratitude, and eſteem, your much obliged and very humble ſervant,

EDINBURGH, 1776.

JOHN INNES.

PREFACE.

SEVERAL full and accurate deſcriptions of the muſcles have already been publiſhed. But their ſize and prolixity have rendered them of leſs value to the diſſector than the ſmall treatiſe of Dr Douglas, which was firſt publiſhed about the beginning of this century; and ſince that time has undergone various impreſſions, without receiving any improvement, excepting the addition of the ſynonyma from Albinus. It is, therefore, preſumed, that a ſimple and conciſe deſcription of the muſcles, which ſhould contain all the improvements of the moderns, is ſtill wanting.

To claſs the muſcles according to their uſes, may do very well in a large work, or in deſcribing their compound actions; but this method can never anſwer the purpoſes of diſſection. To remedy this inconvenience, the muſcles, in the following Treatiſe, are deſcribed chiefly as they appear in diſſecting the human body.

The deſcribing of the muſcles according to their origins and inſertions prevents much circumlocution. This is the method purſued by Dr Douglas; and wherever his deſcriptions ſeemed tolerably accurate, they have been followed with little alteration. But Dr Douglas's book is peculiarly defective with regard to the muſcles of the abdomen, back, and neck: In deſcribing theſe, therefore, the method of Albinus has been preferred.

Thoſe who have not opportunity, or are averſe from undergoing the labour of diſſecting, may derive conſiderable advantages from comparing the deſcriptions now given with the beautiful and correct tables of Albinus; and, to facilitate ſtill more the ſtudy of theſe intricate organs, I have cauſed eight of Albinus's tables to be publiſhed, with conciſe explanations, on a ſmall ſcale adapted for the pocket.

For the benefit of thoſe who wiſh to examine the hiſtory of the muſcles more minutely, the ſynonyma of the beſt authors are added; and, for the ſake of brevity, the compound action of the muſcles, and the origin and inſertion of ſeveral inconſiderable fibres, are omitted.

The reader will obſerve, that, in general, the muſcles of one ſide only are deſcribed; becauſe all the muſcles of the body, with very few exceptions, have correſpondent ones on the oppoſite ſide.

A

SHORT ACCOUNT

OF THE

AUTHOR,

AND

OF HIS WRITINGS.

MR John Innes, author of the following Treatife, was born at Callart, an obfcure village in the Highlands of Scotland. He came to Edinburgh at an early period of life, where he obtained the patronage and protection of Dr Alexander Monro, Profeffor of Anatomy; who inftructed him in the knowledge of the human body, and in the art of diffection. When he was about the age of eighteen years, Dr Monro appointed him diffector to the Anatomical Theatre. The functions of this important and difficult office, he continued to perform with much reputation for near twenty years.

But his abilities were not confined to the dexterity of diffecting the moft minute parts of the human frame. He defcribed the various organs with eafe and with perfpicuity. This happy talent attracted the notice of the ftudents; and, at their folicitation, and by the approbation of Dr Monro, he opened an evening courfe of anatomical demonftrations.

The number of pupils who annually attended thefe demonftrations afforded the beft evidence of his abilities, and of the advantages derived from his labours. During his laft courfe, he was attended by near two hundred ftudents.

For fome time before his death, he was troubled with an affection of the lungs, which terminated in a phthifis pulmonalis, and proved fatal to him on the 12th of January 1777.

On the 15th of the fame month, the following account of him appeared in the public papers:

" Mr John Innes, at an early period of life, had been educated in the diffecting art: He made a rapid progrefs in his profeffion; and his genius and induftry were rewarded with the privilege of giving private lectures for his own emolument. The utility of his leffons was foon perceived. Numbers

of

of ſtudents reſorted to him for inſtruction; and all of them acknowledged the advantages they had received. At that ſtage of life when men are moſt capable of benefiting themſelves, and of being uſeful to the public, death hurried him out of the world He has given two ſmall ſpecimens of what was to be expected from his anatomical ſkill In the courſe of laſt year, he publiſhed a ſhort deſcription of the Human Muſcles as they appear on diſſection, together with their ſeveral uſes, and the ſynonyma of the beſt authors. The merit of this work was univerſally acknowledged. Some months after, he publiſhed, as a *vade mecum* for ſtudents, eight anatomical tables, containing the principal parts of the ſkeleton and muſcles repreſented in the large tables of Albinus, with accurate explanations. Theſe are all the monuments he has left, by which the public are to judge of his ability. To his numerous friends and acquaintance, it is unneceſſary to mention the warmth of his heart, or the integrity of his diſpoſition."

ADVERTISEMENT.

DURING the illneſs of which Mr INNES died, he put into my hands the firſt edition of his Deſcription of the Muſcles, with a few, chiefly verbal, corrections of it.

ON peruſing that work lately, at the requeſt of the Bookſeller, I have found it neceſſary to make a very conſiderable number of alterations in what relates to the deſcription, as well as to the uſes, of the Muſcles.

EDIN. Sept. 5. 1777.

ALEX. MONRO.

CHAP.

C H A P. I.

Muscles *of the* Teguments *of the* Cranium.

THE ſkin that covers the cranium is moved by a ſingle broad digaſtric muſcle, and one ſmall pair.

1. Occipito Frontalis,

Ariſes fleſhy from the tranſverſe protuberant ridge near the middle of the os occipitis laterally, where it joins with the temporal bone; and tendinous from the reſt of that ridge backwards, oppoſite to the lateral ſinus; it ariſes after the ſame manner on the other ſide: From thence it comes ſtraight forwards, by a broad thin tendon, which covers the upper part of the cranium at each ſide, as low down as the attollens aurem, to which it is connected, as alſo to the zygoma, and covers a part of the aponeuroſis of the temporal muſcles; when it comes as far forwards as near the hair of the front, it becomes fleſhy, and deſcends with ſtraight fibres.

Inſerted into the orbicularis palpebrarum of each ſide, and into the ſkin of the eye-brows, ſending down a fleſhy ſlip between them, as far as the compreſſor naris and levator labii ſuperioris alæque naſi.

Uſe. Pulls the ſkin of the head backwards; raiſes the eye-brows upwards; and, at the ſame time, it draws up and wrinkles the ſkin of the forehead.

Epicranius, Albinus.

Frontalis et occipitalis, Winſlow.

2. Cor.

2. Corrugator Supercilii,

Arifes flefhy from the internal angular procefs of the os frontis, above the joining of the os nafi, and nafal procefs of the fuperior maxillary bone; from thence it runs outwards, and a little upwards.

Inferted into the inner and inferior flefhy part of the occipito-frontalis mufcle, where it joins with the orbicularis palpebrarum, and extends outwards as far as the middle of the fuperciliary ridge.

Ufe. To draw the eye-brow of that fide towards the other, and make it project over the inner canthus of the eye: When both act, they pull down the fkin of the forehead, and make it wrinkle, particularly between the eye-brows.

Mufculus Supercilii, Winflow.

Mufculus Frontalis verus, feu Corrugator, Douglas.

CHAP. II.

Of the Muscles *of the* Ear.

THE mufcles of the ear may be divided into three claffes, viz. the common, proper, and internal. The common move the whole ear; the proper only affect the particular parts to which they are connected; and the internal, the fmall bones within the tympanum.

The common mufcles are,

1. Attollens Aurem,

Arifes thin, broad, and tendinous, from the tendon of the occipito-frontalis, from which it is almoſt inſeparable, where it covers the aponeuroſis of the temporal muſcle.

Inſerted into the upper part of the ear, oppoſite to the antihelix.

Uſe. To draw the ear upwards, and make the parts into which it is inſerted tenſe.

Superior auris, Winſlow.

2. ANTERIOR AURIS,

Ariſes thin and membranous near the poſterior part of the zygoma.

Inſerted into a ſmall eminence on the back of the helix, oppoſite to the concha.

Uſe. To draw this eminence a little forwards and upwards.

3. RETRAHENTES AURIS,

Ariſes, ſometimes by three, but always by two diſtinct ſmall muſcles, from the external and poſterior part of the root of the maſtoid proceſs, immediately above the inſertion of the ſterno-cleido-maſtoid muſcle.

Inſerted into that part of the back of the ear which is oppoſite to the ſeptum that divides the ſcapha and concha.

Uſe. To draw the ear back, and ſtretch the concha.

Poſterior auris, Winſlow.

The proper muſcles are,

1. HELICIS MAJOR,

Ariſes from the upper and acute part of the helix anteriorly.

Inſerted into its cartilage a little above the tragus.

Uſe.

Use. To depress that part from which it arises a little downwards and forwards.

2. Helicis Minor,

Arises from the inferior and anterior part of the helix.

Inserted into the crus of the helix, near the fissure in the cartilage opposite to the concha.

Use. To contract the fissure.

3. Tragicus,

Arises from the middle and outer part of the concha, at the root of the tragus, along which it runs.

Inserted into the point of the tragus.

Use. Pulls the point of the tragus a little forwards.

4. Antitragicus,

Arises from the internal part of the cartilage that supports the antitragus; and, running upwards, is

Inserted into the tip of the antitragus, as far as the inferior part of the antihelix, where there is a fissure in the cartilage.

Use. Turns the tip of the antitragus a little outwards, and depresses the extremity of the antihelix towards it.

5. Transversus Auris,

Arises from the prominent part of the concha on the dorsum of the ear; the fibres not so fleshy as in the former.

Inserted opposite to the outer side of the antihelix.

Use. Draws the parts to which it is connected towards each other, and stretches the scapha and concha.

The muscles of the internal ear are three:

1. Laxator Tympani,

Arises by a small beginning from the extremity of the spinous

ſpinous proceſs of the ſphenoid bone, behind the entry of the artery of the dura mater; then runs backwards, and a little upwards, along with the nerve called *chorda tympani*, in a fiſſure of the os temporis near the foſſa that lodges the condyle of the lower jaw.

Inſerted into the long proceſs of the malleus, within the tympanum, where it reſts upon the edge of the fiſſure between the pars ſquamoſa and petroſa.

Uſe. To draw the malleus obliquely forwards towards its origin, and conſequently the membrana tympani; by which means that membrane is made leſs concave, or is relaxed.

Externus mallei, Albinus. *Anterior mallei*, Winſlow.
Obliquus auris, Douglas.

2. Tensor Tympani,

Ariſes by a very ſmall beginning, from the cartilaginous extremity of the Euſtachian tube, juſt where it begins to be covered by the pars petroſa, and ſpinous proceſs of the ſphenoid bone, near the entry of the artery of the dura mater; from thence running backwards near the oſſeous part of the Euſtachian tube, it forms a very diſtinct fleſhy belly, below a thin oſſeous plate, between the pars ſquamoſa and labyrinth; and ſends off a ſlender tendon, which makes a turn into the tympanum along with the nerve called *chorda tympani*.

Inſerted into the poſterior part of the handle of the malleus, a little lower than the root of its long proceſs.

Uſe. To pull the malleus and membrana tympani inwards towards the pars petroſa, by which the membrane is made more concave and tenſe.

Internus mallei, Winſlow. *Internus auris*, Douglas.

3. Stapedius,

Ariſes, by a ſmall fleſhy belly, from a little cavern in the

the pars petrofa, near the cells of the maftoid procefs, before the inferior part of the paffage for the portio dura of the auditory nerve; its tendon paffes ftraight through a fmall round hole in the fame cavern, enters the anterior part of the tympanum, and is

Inferted into the pofterior part of the head of the ftapes.

Ufe. To draw the ftapes obliquely upwards towards the cavern, by which the pofterior part of its bafe is moved inwards, and the anterior part outwards.

Mufculus ftapedis, Winflow. *Stapidaeus*, Douglas.

CHAP. III.

Of the Muscles *of the* Eye-lids.

THE palpebrae or eye-lids, have one mufcle common to both, and the upper eye-lid one proper to itfelf.

1. Orbicularis Palpebrarum.

Arifes, by a number of flefhy fibres, from the outer edge of the orbitar procefs of the fuperior maxillary bone, and from a tendon near the inner angle of the eye: thefe run a little downwards, then outwards, over the upper part of the cheek, below the orbit, covering the under eye-lid, and furround the external angle, being loofely connected only to the fkin and fat: run over the fuperciliary ridge of the os frontis, towards the inner canthus, where they intermix with thofe of the occipito frontalis and corrugator fupercilii; then covering the upper eye-lid, they defcend to the inner angle oppofite to the inferior origin of this mufcle, firmly adhering to the internal angular procefs of the os frontis, and to the fhort ſhort round tendon which ſerves to fix the palpebrae and muſcular fibres ariſing from it.

Inſerted, by the ſhort round tendon, into the naſal proceſs of the ſuperior maxillary bone, covering the anterior and upper part of the lachrymal ſac; which tendon can be eaſily felt at the inner canthus of the eye.

Uſe. To ſhut the eye, by drawing both lids cloſe together, the fibres contracting from the outer angle towards the inner, preſs the eye-ball, ſqueeze the lachrymal gland, and convey the tears towards the puncta lachrymalia.

The *ciliaris* of ſome authors is only a part of this muſcle covering the cartilages of the eye-lids, called *cilia* or *tarſi*.

There is often a ſmall fleſhy ſlip which runs down from the outer and inferior part of this muſcle above the zygomaticus minor, and joins with the levator labii ſuperioris alaeque naſi.

2. Levator Palpebrae Superioris,

Ariſes from the upper part of the foramen opticum of the ſphenoid bone, through which the optic nerve paſſes, above the levator oculi, near the trochlearis muſcle.

Inſerted, by a broad thin tendon, into the cartilage that ſupports the upper eye-lid, named *tarſus*.

Uſe. To open the eye, by drawing the eye-lid upwards; which it does completely, by being fixed to the tarſus, pulling it below the eye-brow, and within the orbit.

Aperiens palpebram rectus, Douglas.

CHAP.

CHAP. IV.

MUSCLES *of the* EYE-BALL.

THE mufcles which move the globe of the eye are fix, viz.

Four *ftraight* and two *oblique*.

The four ftraight mufcles very much refemble each other: all

Arifing by a narrow beginning, a little tendinous and flefhy, from the bottom of the orbit around the foramen opticum of the fphenoid bone, where the optic nerve enters, fo that they may be taken out adhering to this nerve; and all having ftrong flefhy bellies.

Inferted at the fore-part of the globe of the eye into the anterior part of the tunica fclerotica, and under the tunica adnata, at oppofite fides, which indicates both their names and *Ufe*; fo that they fcarcely require any further defcription, but to name them fingly.

1. LEVATOR OCULI,

Arifes from the upper part of the foramen opticum of the fphenoid bone, below the levator palpebrae fuperioris; and runs forwards to be

Inferted into the fuperior and fore-part of the tunica fclerotica, by a broad thin tendon.

Ufe. To raife up the globe of the eye.

Attolens, Albinus. *Elevator*, Douglas.

2. DE-

2. Depressor Oculi,

Arifes from the inferior part of the foramen opticum.

Inferted oppofite to the former.

Ufe. To pull the globe of the eye down.

Deprimens, Albinus.

3. Adductor Oculi,

Arifes, as the former, between the obliquus fuperior and depreffor, being, from its fituation, the fhorteft.

Inferted oppofite to the inner angle.

Ufe. To turn the eye towards the nofe.

4. Abductor Oculi,

Arifes from the bony partition between the foramen opticum and lacerum, being the longeft from its fituation; and is

Inferted into the globe oppofite to the outer canthus.

Ufe. To move the globe outwards.

The oblique mufcles are two:

Obliquus Superior, *feu* Trochlearis,

Arifes, like the ftraight mufcles, from the edge of the foramen opticum at the bottom of the orbit, between the levator and adductor oculi; from thence runs ftraight along the pars plana of the ethmoid bone to the upper part of the orbit, where a cartilaginous trochlea is fixed to the infide of the internal angular procefs of the os frontis, through which its tendon paffes, and runs a little downwards and outwards, inclofed in a loofe membranous fheath.

Inferted, by a broad thin tendon, into the tunica fclerotica, about half way between the infertion of the attolens oculi and optic nerve.

Ufe.

Use. To roll the globe of the eye, and turn the pupil downwards and outwards, ſo that the upper ſide of the globe is turned inwards, and the inferior part to the outſide of the orbit, and the whole globe drawn forwards towards the inner canthus.

Obliquus major, Winſlow.

2. Obliquus Inferior,

Ariſes, by a narrow beginning, from the outer edge of the orbitar proceſs of the ſuperior maxillary bone, near its juncture with the os unguis; and running obliquely outwards, is

Inſerted into the ſclerotica, in the ſpace between the abductor and optic nerve, by a broad thin tendon.

Uſe. To draw the globe of the eye forwards, inwards, and downwards; and, contrary to the ſuperior, to turn the pupil upwards, towards the inner extremity of the eye-brow; at the ſame time, the external part of the globe is turned towards the inferior ſide, and the internal rolls towards the upper part.

Obliquus minor, Winſlow.

CHAP. V.

Of the Muscles *of the* Nose.

THERE is only one muſcle on each ſide that can be called proper to the noſe, though it is affected by ſeveral muſcles of the face.

Compressor Naris,

Ariſes, by a narrow beginning, from the root of the ala naſi externally, where part of the levator labii ſuperioris alaeque nafi is connected to it; it fpreads into a number of thin feparate fibres, which run up along the cartilage in an oblique manner towards the dorfum of the nofe, where it joins with its fellow, and is

Inferted flightly into the anterior extremity of the os nafi and nafal procefs of the fuperior maxillary bone, where it meets with fome of the fibres defcending from the occipito-frontalis mufcle.

Ufe. To comprefs the ala towards the feptum nafi, particularly when we want to fmell acutely; but, if the fibres of the frontal mufcle, which adhere to it, act, the upper part of this thin mufcle affifts to pull the ala outwards. It alfo corrugates the fkin of the nofe, and affifts in expreffing certain paffions.

Rinaeus, vel nafalis, Douglas.

CHAP. VI.

Muscles *of the* Mouth *and* Lips.

THE mouth has nine pair of mufcles, which are inferted into the lips, and a common one formed by the termination of thefe, viz. three *above*, three *below*, three *outwards*, and the common mufcle furrounds the mouth.

The three above are,

1. Levator Anguli Oris,

Arifes, thin and flefhy, from the hollow of the fuperior

maxillary

maxillary bone, between the root of the ſocket of the firſt dens molaris and the foramen infra-orbitarium.

Inſerted into the angle of the mouth and under lip, where it joins with its antagoniſt.

Uſe. To draw the corner of the mouth upwards, and make that part of the cheek oppoſite to the chin prominent, as in ſmiling.

Elevator labiorum communis, Douglas.

Caninus, Winſlow.

2. Levator Labii Superioris Alaeque Nasi,

Ariſes by two diſtinct origins; the firſt broad and fleſhy, from the external part of the orbitar proceſs of the ſuperior maxillary bone which forms the lower part of the orbit, immediately above the foramen infra orbitarium; the ſecond portion ariſes from the naſal proceſs of the ſuperior maxillary bone, where it joins the os frontis at the inner canthus, deſcending along the edge of the groove for the lacrymal ſac. The firſt and ſhorteſt portion is

Inſerted into the upper lip and orbicularis labiorum; the ſecond and longeſt, into the upper lip and outer part of the ala naſi.

Uſe. To raiſe the upper lip towards the orbit, and a little outwards; the ſecond portion ſerves to draw the ſkin of the noſe upwards and outwards, by which the noſtril is dilated.

Elevator labii ſuperioris proprius, Douglas.

Inciſivus lateralis, Firſt portion; *Pyramidalis*, Second portion; Winſlow.

3. Depressor Labii Superioris Alaeque Nasi.

Ariſes, thin and fleſhy, from the os maxillare ſuperius, immediately above the joining of the gums with the two

dentes

dentes incisivi, and the dens caninus: from thence it runs up under part of the levator labii superioris alaeque nasi.

Inserted into the upper lip and root of the ala nasi.

Use. To draw the upper lip and ala nasi downwards and backwards.

Depressor alae nasi, Albinus.

Incisivus medius, Winslow.

Depressor labii superioris proprius, Douglas.

The three below are,

1. Depressor Anguli Oris,

Arises, broad and fleshy, from the lower edge of the maxilla inferior, at the side of the chin, being firmly connected to that part of the platysma myoides, which runs over the maxilla to the angle of the mouth, to the depressor labii inferioris within, and to the skin and fat without, gradually turning narrower; and is

Inserted into the angle of the mouth, joining with the zygomaticus major and levator anguli oris.

Use. To pull down the corner of the mouth.

Triangularis, Winslow.

Depressor labiorum communis, Douglas.

2. Depressor Labii Inferioris,

Arises, broad and fleshy, intermixed with fat, from the inferior part of the lower jaw next the chin; runs obliquely upwards; and is

Inserted into the edge of the under lip, extends along one half of the lip, and is lost in its red part.

Use. To pull the under lip and the skin of the side of the chin downwards, and a little outwards.

Quadratus, Winslow.

Depressor labii inferioris proprius, Douglas.

3. Le-

3. LEVATOR LABII INFERIORIS,

Arifes, from the lower jaw, at the roots of the alveoli of two dentes incifivi and of the caninus; is

Inferted into the under lip and fkin of the chin.

Ufe. To pull the parts into which it is inferted upwards.

Levator menti, Albinus.

Incifivus inferior, Winflow.

Elevator labii inferioris proprius, Douglas.

The three outward are,

1. BUCCINATOR,

Arifes, tendinous and flefhy, from the lower jaw, as far back as the laft dens molaris and fore-part of the root of the coronoid procefs; flefhy from the upper jaw, between the laft dens molaris and pterygoid procefs of the fphenoid bone; from the extremity of which it arifes tendinous, being continued between both jaws to the conftrictor pharyngis fuperior, with which it joins; from thence proceeding with ftraight fibres, and adhering clofe to the membrane that lines the mouth, it is

Inferted into the angle of the mouth within the orbicularis oris.

Ufe. To draw the angle of the mouth backwards and outwards, and to contract its cavity, by preffing the cheek inwards, by which the food is thruft between the teeth.

Retractor anguli oris, Albinus.

2. ZYGOMATICUS MAJOR,

Arifes, flefhy, from the os malae, near the zygomatic future.

Inferted into the angle of the mouth, appearing to be loft in the depreffor anguli oris and orbicularis oris.

Ufe.

Uſe. To draw the corner of the mouth and under lip towards the origin of the muſcle, and make the cheek prominent as in laughing.

Zygomaticus, Douglas.

3. ZYGOMATICUS MINOR,

Ariſes from the upper prominent part of the os malæ above the origin of the former muſcle; and, deſcending obliquely downwards and forwards, is

Inſerted into the upper lip, near the corner of the mouth, along with the levator anguli oris.

Uſe. To draw the corner of the mouth obliquely outwards, and upwards, towards the external canthus of the eye.

The common muſcle is the

ORBICULARIS ORIS.

This muſcle is, in a great meaſure, formed by the muſcles that move the lips; the fibres of the ſuperior deſcending, thoſe of the inferior aſcending, and, decuſſating each other about the corner of the mouth, run along the lip to join thoſe of the oppoſite ſide, ſo that the fleſhy fibres appear to ſurround the mouth like a ſphincter.

Uſe. To ſhut the mouth, by contracting and drawing both lips together, and to counteract all the muſcles that aſſiſt in forming it.

Sphincter labiorum, Douglas.

Semi orbicularis, Winſlow.

Conſtrictor oris, Cowper.

There is another ſmall muſcle deſcribed by Albinus, which he calls *Naſalis labii ſuperioris;* but it ſeems to be only ſome fibres of the former connected to the ſeptum naſi.

CHAP.

CHAP. VII.

Muscles *of the* Lower Jaw.

THE lower jaw has four pair of mufcles for its elevation or lateral motions, viz. two, which are feen on the fide of the face, and two concealed by the angle of the jaw.

1. Temporalis,

Arifes, flefhy, from a femicircular ridge of the lower and lateral part of the parietal bone, from all the pars fquamofa of the temporal bone, from the external angular procefs of the os frontis, from the temporal procefs of the fphenoid bone, and from an aponeurofis which covers it; from thefe different origins the fibres defcend like radii towards the jugum, under which they pafs; and are

Inferted, by a ftrong tendon, into the upper part of the coronoid procefs of the lower jaw; in the duplicature of which tendon this procefs is inclofed as in a fheath, being continued down all its fore-part to near the laft dens molaris.

Ufe. To pull the lower jaw upwards, and prefs it againft the upper, at the fame time drawing it a little backwards.

N. B. This mufcle is covered by a tendinous membrane, called its *aponeurofis*, which arifes from the bones that give origin to the upper and femicircular part of the mufcle; and defcending

defcending over it, is inferted into all the jugum, and the adjoining part of the os frontis.

The ufe of this membrane is to give room for the origin of a greater number of flefhy fibres, to fortify the mufcle in its action, and to ferve as a defence to it.

Crotaphite mufcle, Winflow.

2. Masseter,

Arifes, by ftrong, tendinous, and flefhy fibres, which run in different directions, from the fuperior maxillary bone, where it joins the os malae, and from the inferior and anterior part of the zygoma, its whole length, as far back as the tubercle before the focket for the condyle of the lower jaw; the external fibres flanting backwards, and the internal forwards.

Inferted into the angle of the lower jaw, and from that upwards to near the top of its coronoid procefs.

Ufe. To pull the lower to the upper jaw, and by means of its oblique decuffation, a little forwards and backwards.

3. Pterygoideus Internus,

Arifes, tendinous and flefhy, from the inner and upper part of the internal plate of the pterygoid procefs, filling all the fpace between the two plates; and from the pterygoid procefs of the os palati between thefe plates.

Inferted into the angle of the lower jaw internally.

Ufe. To draw the jaw upwards, and obliquely towards the oppofite fide.

Pterygoideus major, Winflow.

4. Pterygoideus Externus,

Arifes, from the outer fide of the external plate of the pterygoid procefs of the fphenoid bone, from part of the

tuberofity

tuberofity of the os maxillare adjoining to it, and from the root of the temporal procefs of the fphenoid bone.

Inferted into a cavity in the neck of the condyloid procefs of the lower jaw; fome of its fibres are inferted into the ligament that connects the moveable cartilage and that procefs to each other.

Ufe. To pull the lower jaw forwards, and to the oppofite fide; and to pull the ligament from the joint, that it may not be pinched during thefe motions: When both external pterygoid mufcles act, the fore-teeth of the under jaw are pufhed forwards beyond thofe of the upper jaw.

Pterygoideus minor, Winflow.

CHAP. VIII.

The MUSCLES *which appear about the anterior part of the* NECK.

ON the fide of the neck are two mufcles or layers.

1. MUSCULUS CUTANEUS, VULGO PLATYSMA MYOIDES,

Arifes, by a number of flender feparate flefhy fibres, from the cellular fubftance that covers the upper parts of the deltoid and pectoral mufcles; in their afcent, they all unite to form a thin mufcle, which runs obliquely upwards along the fide of the neck, adhering to the fkin.

Inferted into the lower jaw, between its angle and the origin of the depreffor anguli oris, to which it is firmly connected, and but ſlightly to the ſkin that covers the inferior part of the maſſeter muſcle and parotid glands.

Uſe. To aſſiſt the depreſſor anguli oris in drawing the ſkin of the cheek downwards; and when the mouth is ſhut, it draws all that part of the ſkin, to which it is connected, below the lower jaw, upwards.

Platyſma myoides, Galen.

Muſculus cutaneus, Winſlow.

Quadratus genæ, vel Latiſſimus colli, Douglas.

Latiſſimus colli, Albinus.

2. Sterno-Cleido-Mastoideus,

Ariſes, by two diſtinct origins; the anterior, tendinous and a little fleſhy, from the top of the ſternum near its junction with the clavicle; the poſterior, fleſhy, from the upper and anterior part of the clavicle; both unite a little above the anterior articulation of the clavicle, to form one muſcle, which runs obliquely upwards and outwards, to be

Inſerted, by a thick ſtrong tendon, into the maſtoid proceſs, which it ſurrounds; and, gradually turning thinner, is inſerted as far back as the lambdoid ſuture.

Uſe. To turn the head to one ſide, and bend it forwards.

Sterno-maſtoideus and *Cleido-maſtoideus*, Albinus.

Maſtoideus, Douglas.

CHAP.

CHAP. IX.

MUSCLES *situated between the* LOWER JAW *and* OS HYOIDES.

THERE are four layers before, and two mufcles at the fide.

The four layers are,

1. DIGASTRICUS,

Arifes, by a flefhy belly, intermixed with tendinous fibres, from the foffa at the root of the maftoid procefs of the temporal bone, and foon becomes tendinous; runs downwards and forwards: The tendon paffes generally through the ftylo-hyoideus mufcle; then it is fixed by a ligament to the os hyoides: And having received from that bone an addition of tendinous and mufcular fibres, runs obliquely forwards, turns flefhy again, and is

Inferted, by its anterior belly, into a rough finuofity at the inferior and anterior edge of that part of the lower jaw called the *chin*.

Ufe. To open the mouth, by pulling the lower jaw downwards, and backwards; and, when the jaws are fhut, to raife the larynx, and confequently the pharynx, upwards, as in deglutition.

Biventer maxillae inferioris, Albinus.

2. MYLO-HYOIDEUS,

Arifes, flefhy, from all the infide of the lower jaw, between

tween the laſt dens molaris and the middle of the chin, where it joins with its fellow.

Inſerted into the lower edge of the baſis of the os hyoides, and joins with its fellow.

Uſe. To pull the os hyoides forwards, upwards, and to a ſide.

3. Genio-Hyoideus,

Ariſes, tendinous, from a rough protuberance in the middle of the lower jaw internally, or on the inſide of the chin.

Inſerted into the baſis of the os hyoides.

Uſe. To draw this bone forwards to the chin.

4. Genio-Hyo-Glossus,

Ariſes, tendinous, from a rough protuberance in the ſide of the middle of the lower jaw; its fibres run, like a fan, forwards, upwards, and backwards; and are

Inſerted into the tip, middle, and root of the tongue, and baſe of the os hyoides, near its cornu.

Uſe. According to the direction of its fibres, to draw the tip of the tongue backwards into the mouth, the middle downwards, and to render its dorſum concave; to draw its root and os hyoides forwards, and to thruſt the tongue out of the mouth.

The two muſcles at the ſide are,

1. Hyo-Glossus,

Ariſes, broad and fleſhy, from the baſe, cornu, and appendix of the os hyoides; the fibres run upwards and outwards, to be

Inſerted into the ſide of the tongue, near the ſtylo-gloſſus.

Uſe. To pull the tongue inwards and downwards.

Baſio-cerato-chondro-gloſſus, Albinus.

Cerato-gloſſus, Douglas.

2. Lin-

2. Lingualis,

Arifes, from the root of the tongue laterally; runs forwards between the hyo-gloffus and genio-gloffus, to be

Inferted into the tip of the tongue, along with part of the ftylo-gloffus.

Ufe. To contract the fubftance of the tongue, and bring it backwards.

CHAP. X.

Muscles *fituated between the* Os Hyoides *and* Trunk.

THESE may be divided into two layers.

The firft layer confifts of two mufcles.

1. Sterno-Hyoideus,

Arifes, thin and flefhy, from the cartilaginous extremity of the firft rib, the upper and inner part of the fternum, and from the clavicle where it joins with the fternum.

Inferted into the bafe of the os hyoides.

Ufe. To pull the os hyoides downwards.

2. Omo-Hyoideus,

Arifes, broad, thin, and flefhy, from the fuperior cofta of the fcapula, near the femilunar nitch, and from the ligament that runs acrofs it; thence afcending obliquely, it becomes tendinous below the fterno-cleido-maftoid mufcle; and growing flefhy again, is

Inferted into the bafe of the os hyoides, between its cornu and the infertion of the fterno-hyoides.

Ufe.

Use. To pull the os hyoides obliquely downwards.

Coraco-hyoideus, Albinus and Douglas.

The ſecond layer conſiſts of three muſcles.

1. Sterno-thyroideus,

Ariſes, fleſhy, from the whole edge of the uppermoſt bone of the ſternum internally, oppoſite to the cartilage of the firſt rib, from which it receives a ſmall part of its origin.

Inſerted into the ſurface of the rough line at the external part of the inferior edge of the thyroid cartilage.

Uſe. To draw the larynx downwards.

2. Thyreo-Hyoideus,

Ariſes from the rough line, oppoſite to the former.

Inſerted into part of the baſes, and almoſt all the cornu of the os hyoides.

Uſe. To pull the os hyoides downwards, or the thyroid cartilage upwards.

Thyro-hyoideus vel Hyo-thyroideus, Winſlow.

3. Crico-Thyroideus,

Ariſes from the ſide and fore-part of the cricoid cartilage, running obliquely upwards.

Inſerted by two portions; the firſt, into the lower part of the thyroid cartilage; the ſecond into its inferior cornu.

Uſe. To pull forwards and depreſs the thyroid, or to elevate and draw backwards the cricoid cartilage.

CHAP.

CHAP. XI.

MUSCLES *ſituated between the* LOWER JAW *and* OS HYOIDES *laterally.*

THEY are five in number. Three proceed from the ſtyloid proceſs of the temporal bone, from which they have half of their names; and two from the pterygoid proceſs of the ſphenoid bone.

The three from the ſtyloid proceſs are,

1. STYLO-GLOSSUS,

Ariſes, tendinous and fleſhy, from the ſtyloid proceſs, and from a ligament that connects that proceſs to the angle of the lower jaw.

Inſerted into the root of the tongue, runs along its ſide, and is inſenſibly loſt near its tip.

Uſe. To draw the tongue laterally and backwards.

2. STYLO-HYOIDEUS,

Ariſes by a round tendon, from the middle and inferior part of the ſtyloid proceſs.

Inſerted into the os hyoides at the junction of the baſe and cornu.

Uſe. To pull the os hyoides to one ſide, and a little upwards.

N. B. Its fleſhy belly is generally perforated by the tendon of the digaſtric muſcle, on one or both ſides.——

There

There is often another accompanying it, called *ſtylo-hyoideus alter*; and has the ſame origin, inſertion, and uſe.

3. Stylo-Pharyngeus,

Ariſes, fleſhy, from the root of the ſtyloid proceſs.

Inſerted into the ſide of the pharynx and back-part of the thyroid cartilage.

Uſe. To dilate and raiſe the pharynx and thyroid cartilage upwards.

The two from the pterygoid proceſs are,

1. Circumflexus, or Tensor Palati,

Ariſes from the ſpinous proceſs of the ſphenoid bone, behind the foramen ovale, which tranſmits the third branch of the fifth pair of nerves; from the Euſtachian tube, not far from its oſſeous part: it then runs down along the pterygoideus internus, paſſes over the hook of the internal plate of the pterygoid proceſs by a round tendon, which ſoon ſpreads into a broad membrane.

Inſerted into the velum pendulum palati, and the ſemilunar edge of the os palati, and extends as far as the ſuture which joins the two bones. Generally ſome of its poſterior fibres join with the conſtrictor pharyngis ſuperior, and palato-pharyngeus.

Uſe. To ſtretch the velum, to draw it downwards, and to a ſide towards the hook. It has little effect upon the tube, being chiefly connected to its oſſeous part.

Circumflexus palati, Albinus.

Spheno-ſalpingo ſtaphylinus, ſeu *Staphylinus externus*, Winſlow.

Muſculus tubae novus, Valſalva; vel *Palato-ſalpingeus*, Douglas.

2. Levator

2. Levator Palati,

Ariſes, tendinous and fleſhy, from the extremity of the pars petroſa of the temporal bone, where it is perforated by the Euſtachian tube, and alſo from the membranous part of the ſame tube.

Inſerted into the whole length of the velum pendulum palati, as far as the root of the uvula, and unites with its fellow.

Uſe. To draw the velum upwards and backwards, ſo as to ſhut the paſſage from the fauces into the mouth and noſe.

Levator palati mollis, Albinus.

Petro-ſalpingo-ſtaphylinus, vel *Salpingo ſtaphylinus internus*, *vulgo*, Winſlow.

Salpingo-ſtaphylinus, Valſalva. *Pterigo-ſtaphylinus externus*, *vulgo*, Douglas.

Spheno-ſtaphylinus, Cowper.

Previous to the deſcription of the muſcles ſituated about the paſſage into the throat, it will be neceſſary to mention the principal parts to which they are connected.

Upon looking into any perſon's mouth, when wide opened, we ſee a ſoft curtain hanging from the palate bones, named *velum pendulum palati*. In the middle of which we likewiſe obſerve a papilla projecting from the velum, named *uvula*, or *pap of the throat*. From each ſide of the uvula, at its root, two arches, or columns are ſent down; the anterior to the root of the tongue, the poſterior to the pharynx. Between theſe arches, on each ſide, the cellular glands, called *amygdalae*, or *almonds of the ears*, are ſituated.

The common opening behind the anterior arch may be named *fauces*, or *top of the throat*; from which there are ſix paſſages, viz. two upwards, being one to each noſtril; two at the ſides, or one to each ear, called the *Euſtachian tubes:* two downwards; the anterior is the paſſage through the *glottis* and *larynx,* into the *trachea,* which terminates in the lungs; the poſterior is the largeſt, named *pharynx,* or *top of the oeſophagus,* which leads to the ſtomach.

CHAP. XII.

MUSCLES *ſituated about the entry to the* FAUCES.

THERE are two on each ſide, and a ſingle one in the middle.

The two on each ſide are,

1. CONSTRICTOR ISTHMI FAUCIUM,

Ariſes, by a ſlender beginning, from the ſide of the tongue, near its root; from thence running upwards within the anterior arch, before the amygdala; it is

Inſerted into the middle of the velum pendulum palati, at the root of the uvula anteriorly, being connected with its fellow, and with the beginning of the palato pharyngeus.

Uſe. Draws the velum toward the root of the tongue, which it raiſes at the ſame time, and, with its fellow, contracts the paſſage between the two arches, by which it ſhuts the opening into the fauces.

Gloſſo ſtaphylinus, Winſlow and Douglas.

2. PALATO-PHARYNGEUS,

Ariſes, by a broad beginning, from the middle of the velum

velum pendulum palati, at the root of the uvula posteriorly, and from the tendinous expansion of the circumflexus palati. The fibres are collected within the posterior arch behind the amygdalae, and run backwards to the top and lateral part of the pharynx, where the fibres are scattered, and mix with those of the stylo-pharyngeus.

Inserted into the edge of the upper and back-part of the thyroid cartilage; some of its fibres being lost between the membrane of the pharynx, and the two inferior constrictors.

Use. Draws the uvula and velum downwards and backwards; and at the same time pulls the thyroid cartilage and pharynx upwards, and shortens it; with the constrictor superior and tongue, it assists in shutting the passage into the nostrils; and, in swallowing, it thrusts the food from the fauces into the pharynx.

Thyro staphylinus, Douglas.

Thyro pharyngo-staphylinus, Winslow.

SALPINGO PHARYNGEUS of Albinus is composed of a few fibres of this muscle, which

Arise from the anterior and lower part of the cartilaginous extremity of the Eustachian tube; and are

Inserted into the inner part of the last-mentioned muscle.

Use. To assist the former, and to dilate the mouth of the tube.

The one in the middle is the

AZYGOS UVULAE,

Arises, fleshy, from the extremity of the suture which joins the palate-bones; runs down the whole length of the

velum

velum and uvula, reſembling a ſmall earth-worm, and adhering to the tendons of the circumflexi.

Inſerted into the tip of the uvula.

Uſe. Raiſes the uvula upwards and forwards, and ſhortens it.

Palato-ſtaphylinus, Douglas.

Staphylinus, or *Epiſtaphylinus*, Winſlow.

CHAP. XIII.

MUSCLES *ſituated on the poſterior part of the* PHARYNX.

OF theſe there are three pair.

1. CONSTRICTOR PHARYNGIS INFERIOR,

Ariſes from the ſide of the thyroid cartilage, near the attachment of the ſterno-hyoideus and thyreo-hyoideus muſcles; and from the cricoid cartilage, near the crico-thyroideus. This muſcle is the largeſt of the three; and is

Inſerted into the white line, where it joins with its fellow; the ſuperior fibres running obliquely upwards, covering nearly one half of the middle conſtrictor, and terminating in a point; the inferior fibres run more tranſverſely, and cover the beginning of the oeſophagus.

Uſe. To compreſs that part of the pharynx which it covers, and to raiſe it with the larynx a little upwards.

Thyro-pharyngeus, *Crico-pharyngeus*, Douglas.

2. CON-

2. Constrictor Pharyngis Medius,

Arifes from the appendix of the os hyoides, from the cornu of that bone, and from the ligament which connects it to the thyroid cartilage; the fibres of the fuperior part running obliquely upwards, and, covering a confiderable part of the fuperior conftrictor, terminate in a point.

Inferted into the middle of the cuneiform procefs of the os occipitis, before the foramen magnum, and joined to its fellow at a white line in the middle back-part of the pharynx. The fibres at the middle part run more tranfverfely than thofe above or below.

Ufe. To comprefs that part of the pharynx which it covers, and to draw it and the os hyoides upwards.

Hyo pharyngeus, *Syndefmo pharyngeus*, Douglas.

3. Constrictor Pharyngis Superior,

Arifes, above, from the cuneiform procefs of the os occipitis, before the foramen magnum, near the holes where the ninth pair of nerves paffes out; lower down, from the pterygoid procefs of the fphenoid bone; from the upper and under jaw, near the roots of the laft dentes molares; and between the jaws, it is continued with the buccinator mufcle; and with fome fibres from the root of the tongue, and from the palate.

Inferted into a white line in the middle of the pharynx, where it joins with its fellow, and is covered by the conftrictor medius.

Ufe. To comprefs the upper part of the pharynx, and draw it forwards and upwards.

Cephalo-pharyngeus, *Pterygo-pharyngeus*, *Mylo-pharyngeus*, *Gloffo-pharyngeus*, Douglas.

CHAP.

CHAP. XIV.

MUSCLES *ſituated about the* GLOTTIS.

THEY conſiſt generally of four pair of ſmall muſcles, and a ſingle one.

1. CRICO-ARYTAENOIDEUS POSTICUS,

Ariſes, fleſhy, from the back-part of the cricoid cartilage, and is

Inſerted into the poſterior part of the baſe of the arytenoid cartilage.

Uſe. To open the rima glottidis a little, and, by pulling back the arytenoid cartilage, to ſtretch the ligament ſo as to make it tenſe.

2. CRICO-ARYTAENOIDEUS LATERALIS,

Ariſes, fleſhy, from the cricoid cartilage, laterally, where it is covered by part of the thyroid, and is

Inſerted into the ſide of the baſe of the arytenoid cartilage near the former.

Uſe. To open the rima glottidis, by pulling the ligaments from each other.

3. THYREO-ARYTAENOIDEUS,

Ariſes from the under and back-part of the middle of the thyroid cartilage; and, running backwards and a little upwards, along the ſide of the glottis, is

Inſerted into the arytenoid cartilage, higher up and farther forwards than the crico-arytaenoideus lateralis.

Uſe.

Use. To pull the arytenoid cartilage forwards nearer to the middle of the thyroid, and consequently to shorten and relax the ligament of the larynx or glottis vera.

4. ARYTÆNOIDEUS OBLIQUUS,

Arises from the base of one arytenoid cartilage; and, crossing its fellow, is

Inserted near the tip of the other arytenoid cartilage.

Use. When both act, they pull the arytenoid cartilages towards each other.

N. B. One of these is very often wanting.

Arytaenoideus minor, Douglas.

The single muscle is the

ARYTÆNOIDEUS TRANSVERSUS,

Arises from the side of one arytenoid cartilage, from near its articulation with the cricoid to near its tip. The fibres run straight across, and are

Inserted, in the same manner, into the other arytenoid cartilage.

Use. To shut the rima glottidis, by bringing these two cartilages, with the ligaments, nearer one another.

Arytaenoideus major, Douglas.

Besides these, there are a few separate muscular fibres on each side; which, from their general direction, are named,

1. THYREO-EPIGLOTTIDEUS.

Arises, by a few pale separated fibres, from the thyroid cartilage; and is

Inserted into the epiglottis laterally.

Use. To draw the epiglottis obliquely downwards, or, when

when both act, directly downwards; and, at the same time, it expands that soft cartilage.

2. Arytæno-Epiglottideus,

Arises, by a number of small fibres, from the lateral and upper part of the arytenoid cartilage; and, running along the outer side of the external rima, is

Inserted into the epiglottis along with the former.

Use. To pull that side of the epiglottis towards the external rima; or, when both act, to pull it close upon the glottis. It is counteracted by the elasticity of the epiglottis.

CHAP. XV.

Muscles *situated on the anterior part of the* Abdomen.

THEY consist of three broad layers on each side of the belly; always a long one, and generally also a short one, on each side of the linea alba.

The three layers are,

1. Obliquus Descendens Externus,

Arises, by eight heads, from the lower edges of an equal number of inferior ribs, at a little distance from their cartilages: It always intermixes, in a serrated manner, with portions of the serratus major anticus; and generally coheres to the pectoralis major, intercostals, and latissimus dorsi: Which last covers the edge of a portion of it extend-

ed

ed from the laſt rib to the ſpine of the os ilium. From theſe origins the fibres run down obliquely forwards, and terminate in a thin broad tendon, whoſe fibres are continued in the ſame direction.

Inſerted into the whole length of the *linea alba* *; becomes thicker towards the lower part of the abdomen, and is perforated in the middle by the umbilicus †. On the outſide of the rectus muſcle, the tendon of the external oblique appears whiter than elſewhere, by its being there connected with the tendons of the internal oblique and tranſverſe muſcles; ſo that this part has been called *linea ſemilunaris*, from its curved ſhape. The under part of the tendon divides into two columns, which leaves an oval ſpace between them, named the *ring* ‡ of the external oblique muſcle, for the paſſage of the ſpermatic cord in the male, or round ligament of the womb: The anterior ſuperior column paſſes over the cartilage between the oſſa pubis, and is fixed to the oppoſite os pubis; the other is fixed to the os pubis of the ſame ſide. It is alſo inſerted, tendinous and fleſhy, into the middle of the ſpine of the ilium.

From that part, which is named its *anterior ſuperior ſpinous proceſs*, it is ſtretched tendinous to the os pubis, and is named

* The *linea alba* is formed by the tendinous fibres of the two oblique and tranſverſe muſcles, interlaced with thoſe of the oppoſite ſide, the whole way from the cartilago enſiformis to the os pubis; ſo that ſome anatomiſts think they ſhould be called three digaſtric muſcles, with a broad middle tendon and two fleſhy bellies.

† The *umbilicus* was originally the paſſage for the veſſels that connected the foetus to the ſecundines; and is really a hole through the teguments and tendons, filled up only by a cellular ſubſtance, and covered within by the peritoneum.

‡ The *ring* of the external oblique muſcle is made ſomewhat circular by a thin tendinous or rough cellular ſubſtance, which helps to fill it up; and though a few muſcular fibres of the internal are ſeparated, yet the ſtricture in herniae only happens in the tendon of the external.

named *Poupart's* or *Fallopius's* ligament *. From this ligament it ſends a tendinous layer, which is loſt in the membranous faſcia of the thigh.

Uſe. Supports and compreſſes the peritonaeum and abdomen; aſſiſts the evacuations of faeces and urine, and likewiſe in the excluſion of the foetus; thruſts the diaphragm upwards, and draws down the ribs in expiration; bends the body obliquely when the ribs are fixed, and raiſes the pelvis obliquely.

Obliquus externus abdominis, Albinus.

Obliquus deſcendens, Douglas.

2. Obliquus Ascendens Internus,

Ariſes from the ſpine of the ilium, the whole length between the poſterior and ſuperior anterior ſpinous proceſs; from the os ſacrum and the three undermoſt lumbar vertebrae, by a tendon common to it and to the ſerratus poſticus inferior muſcle; from Poupart's ligament, at the middle of which it ſends off the beginning of the cremaſter muſcle; and the ſpermatic cord in the male, or round ligament of the womb in the female, paſſes under its thin edge, except a few detached fibres.

Inſerted into the cartilago enſiformis, into the cartilages of the ſeventh, and thoſe of all the falſe ribs; but, at the upper part, it is extremely thin, reſembling a cellular membrane,

* *Poupart's* or *Fallopius's ligament* is the inferior part of the tendon of the externus obliquus, extending from the anterior ſuperior ſpinous proceſs of the ilium to the os pubis, where it is thickeſt in order to ſtrengthen the inferior part of the abdomen: Here it is not inſerted into any bone, but paſſes over the blood veſſels of the inferior extremity; and in women, from the greater ſize of the pelvis, it is longer and looſer, by which they are more ſubject to crural herniae; but, by the ſize of the ſpermatic cord, men are more liable to the inguinal.

brane, and only becomes fleſhy at the cartilage of the tenth rib. Here its tendon divides into two layers *; the anterior layer, with a great portion of the inferior part of the poſterior layer, joins the tendon of the external oblique, and runs over the rectus to be inſerted into the whole length of the linea alba. The poſterior layer joins the tendon of the tranſverſalis muſcle as low as half-way between the umbilicus and os pubis; but, below this place, only a few fibres of the poſterior layer are ſeen, and the reſt of it paſſes before the rectus muſcle, and is inſerted into the linea alba; ſo that the whole tendon of the external oblique muſcle, with the anterior layer of the internal oblique, paſſes before the rectus muſcle; and the whole poſterior layer of the internal oblique, together with the whole tendon of the tranſverſalis muſcle, excepting at the inferior part, paſs behind the rectus, and are inſerted into the linea alba. At its undermoſt part it is inſerted into the fore-part of the os pubis.

Uſe. To aſſiſt the former; but it bends the trunk in the reverſe direction.

Obliquus internus abdominis, Albinus and Winſlow.

Obliquus aſcendens, Douglas.

3. TRANSVERSALIS,

Ariſes tendinous, but ſoon becoming fleſhy, from the inner or back part of the cartilages of the ſeven lower ribs, where

* To obtain a proper view of the two layers of the tendon of the internal oblique muſcles, both the oblique muſcles ſhould be raiſed as far forwards as their joining near the linea ſemilunaris: then the tendon before the rectus muſt be cut parallel to the linea alba, and turned outwards as far as the outer edge of the rectus; by which the whole of the rectus is brought into view, and the tendons are preſerved. But Douglas directs to cut the poſterior layer of the internal oblique, where it joins with the tranſverſalis; by this method the rectus is laid bare; but the ſtructure of the tendinous ſheath, which incloſes it, is deſtroyed.

where ſome of its fibres are continued with thoſe of the diaphragm and the intercoſtal muſcles; by a broad thin tendon, connected to the tranſverſe proceſſes of the laſt vertebra of the back and the four ſuperior vertebra of the loins: fleſhy, from the whole ſpine of the os ilium internally, and from the tendon of the external oblique muſcle, where it intermixes with ſome fibres of the internal oblique.

Inſerted into the cartilago enſiformis, and into the whole length of the linea alba, excepting its lowermoſt part.

Uſe. To ſupport and compreſs the abdominal bowels; and it is ſo particularly well adapted for the latter purpoſe, that it might be called the *proper conſtrictor* of the abdomen.

Tranſverſus abdominis, Albinus.

The long muſcle in the middle is named,

Rectus Abdominis.

Ariſes, by two heads, from the ligament of the cartilage which joins the two oſſa pubis to each other; runs upwards the whole length of, and parallel to, the linea alba, growing broader and thinner as it aſcends.

Inſerted into the cartilages of the three inferior true ribs, and often intermixed with ſome fibres of the pectoral muſcle.

It is generally divided by three tendinous interſections; the firſt is at the umbilicus, the ſecond where it runs over the cartilage of the ſeventh rib, and the third in the middle between theſe; and there is commonly a half interſection below the umbilicus: Theſe interſections ſeldom penetrate through the whole thickneſs of the muſcle; they adhere firmly to the anterior part of the ſheath, but very ſlightly to the poſterior layer.

Uſe. To compreſs the fore-part, but more particularly the

the lower part of the belly; to bend the trunk forwards, or to raiſe the pelvis. By its tendinous interſections, it is enabled to contract at any of the intermediate ſpaces; and, by its connection with the tendons of the other muſcles, it is prevented from changing place, and from riſing into a prominent form when in action.

The ſhort muſcle in the middle is named

PYRAMIDALIS.

Ariſes along with the rectus; and, running upwards, within the ſame ſheath, is

Inſerted, by an acute termination, near half-way between the os pubis and umbilicus, into the linea alba and inner edge of the rectus muſcle.

As it is frequently wanting in both ſides, without any inconveniency, its

Uſe ſeems to be, to aſſiſt the inferior part of the rectus.

CHAP. XVI.

MUSCLES *about the Male Organs of* GENERATION.

THE *teſticles* are ſaid to have a thin muſcle common to both, and one proper to each.

The ſuppoſed common muſcle is called the

DARTOS.

This appears to be no more than a condenſation of the cellular membrane lining the ſcrotum; yet the ſkin here is is capable of being corrugated and relaxed in a greater degree than in other places.

The muſcle proper to each teſticle is the

Cremaster.

Ariſes from the internal oblique, where a few fibres of that muſcle intermix with the tranſverſalis, near the junction of the os ilium and pubis, over which part it paſſes, after having pierced the ring of the externus obliquus; and then it deſcends upon the ſpermatic cord.

Inſerted into the tunica vaginalis of the teſticle, upon which it ſpreads, and is inſenſibly loſt.

Uſe. To ſuſpend and draw up the teſticle, and to compreſs it in the act of coition.

The penis has three pair of muſcles,

1. Erector Penis,

Ariſes, tendinous and fleſhy, from the tuberoſity of the os iſchium, and runs upwards, embracing the whole crus of the penis.

Inſerted into the ſtrong tendinous membrane that covers the corpora cavernoſa penis, near as far up as the union of theſe bodies.

Uſe. To compreſs the crura penis, by which the blood is puſhed from it into the fore-part of the corpora cavernoſa; and the penis is by that means more completely diſtended. The erectores ſeem likewiſe to keep the penis in its proper direction.

Iſchio-cavernoſus, Winſlow.

2. Accelerator Urinae, *ſeu* Ejaculator Seminis,

Ariſes, fleſhy, from the ſphincter ani and membranous part of the urethra; and tendinous from the crus, nearly as

far

far forwards as the beginning of the corpus cavernofum penis; the inferior fibres run more tranfverfely, and the fuperior defcend in an oblique direction.

Inferted into a line in the middle of the bulb, where it joins with its fellow, by which the bulb is completely inclofed.

Ufe. To drive the urine or femen forwards; and, by grafping the bulb of the urethra, to pufh the blood towards its corpus cavernofum and the glans, by which they are diftended.

Bulbo-cavernofus, Winflow.

3. TRANSVERSUS PERINEI,

Arifes from the tough fatty membrane that covers the tuberofity of the os ifchium; from thence it runs tranfverfely inwards, and is

Inferted into the accelerator urinae, and into that part of the fphincter ani which covers the bulb.

Ufe. To dilate the bulb, and draw the perineum and verge of the anus a little outwards and backwards.

Tranfverfalis urethrae, Winflow.

Tranfverfus perinei, Albinus.

Levator parvus, feu *externus*, Douglas.

There is often a fourth mufcle, named

TRANSVERSUS PERINEI ALTER.

Arifes behind the former, runs more obliquely forwards, and is

Inferted into that part of the accelerator urinae which covers the anterior part of the bulb of the urethra.

Ufe. To affift the former.

Inferior proftate, Winflow.

Tranfverfus perinei alter, Albinus.

CHAP.

CHAP. XVII.

Muscles *of the* Anus.

THE *anus* has a ſingle muſcle, and one pair.

The ſingle muſcle is

Sphincter Ani.

Ariſes from the ſkin and fat that ſurround the verge of the anus on both ſides, near as far out as the tuber of the os iſchium; the fibres are gradually collected into an oval form, and ſurround the extremity of the rectum.

Inſerted, before, by a narrow point, into the perineum, accelerators urinae, and tranſverſi perinei; behind, by an acute termination, into the extremity of the os coccygis.

Uſe. Shuts the paſſage through the anus into the rectum: pulls down the bulb of the urethra, by which it aſſiſts in ejecting the urine and ſemen.

Sphincter externus, Albinus and Douglas.

Sphincter cutaneus, Winſlow.

N. B. The ſphincter internus of Albinus and Douglas is only that part of the circular fibres of the muſcular coat of the rectum, which ſurrounds its extremity.

Levator Ani,

Ariſes from the os pubis within the pelvis, as far up as the upper edge of the foramen thyroideum, and joining of the

the os pubis with the os iſchium; from the thin tendinous membrane that covers the obturator internus and coccygeus muſcles; from the ſpinous proceſs of the os iſchium; and its fibres run down like rays from a circumference to a centre.

Inſerted into the ſphincter ani, acceleratores urinae, and anterior part of the two laſt bones of the coccygis; ſurrounds the extremity of the rectum, neck of the bladder, proſtate gland, and part of the veſiculae ſeminales; ſo that its fibres behind and below the os coccygis joining it with its fellow, they together very much reſemble the ſhape of a funnel.

Uſe. To draw the rectum upwards after the evacuation of the faeces, and to aſſiſt in ſhutting it; to ſuſtain the contents of the pelvis, and to help in ejecting the ſemen, urine, and contents of the rectum; and, perhaps, by preſſing upon the veins, to contribute greatly to the erection of the penis.

C H A P. XVIII.

Muscles *of the Female Organs of* Generation.

THE *clitoris* has one pair,

Erector Clitoridis,

Ariſes from the crus of the os iſchium internally, and in its aſcent covers the crus of the clitoris as far up as the os pubis.

Inſerted into the upper part of the crus and body of the clitoris.

Uſe. Draws the clitoris downwards and backwards; and may ſerve to make the body of the clitoris more tenſe, by ſqueezing the blood into it from its crus.

Firſt muſcle of the clitoris, Douglas.

The vagina has one pair,

SPHINCTER VAGINÆ,

Ariſes from the ſphincter ani, and from the poſterior ſide of the vagina, near the perineum: From thence it runs up the ſide of the vagina, near its external orifice, oppoſite to the nymphae, and covers the corpus cavernoſum vaginae.

Inſerted into the crus and body, or union of the crura clitoridis.

Uſe. Contracts the mouth of the vagina, and compreſſes its corpus cavernoſum.

Conſtrictor cunni, Albinus.

Second muſcle of the clitoris, Douglas.

The perineum has one pair,

TRANSVERSUS PERINEI,

Ariſes, as in the male, from the fatty cellular membrane which covers the tuberoſity of the os iſchium.

Inſerted into the upper part of the ſphincter ani, and into a white hardiſh tough ſubſtance in the perineum, between the lower part of the pudendum and anus.

Uſe. To ſuſtain and keep the perineum in its proper place.

The anus, as in the male, has a ſingle muſcle, and one pair.

SPHINCTER

Sphincter Ani,

Arifes, as in the male, from the ſkin and fat ſurrounding the extremity of the rectum.

Inſerted, above, into the white tough ſubſtance of the perineum; and below, into the point of the os coccygis.

Uſe. To ſhut the paſſage into the rectum; and, by pulling down the perineum, to aſſiſt in contracting the mouth of the vagina.

Levator Ani,

Ariſes, as in the male, within the pelvis, and deſcends along the inferior part of the vagina and rectum.

Inſerted into the perineum, ſphincter ani, extremity of the vagina, and rectum.

Uſe. To raiſe the extremity of the rectum upwards, to contract the inferior part of the rectum, and to aſſiſt in contracting and ſupporting the vagina; and, perhaps, by preſſing on the veins, to contribute to the diſtention of the cells of the clitoris and corpus cavernoſum of the vagina.

CHAP. XIX.

Muscles *ſituated within the* Pelvis.

OF theſe there are two pair.

1. Obturator Internus,

Ariſes from more than one half of the internal circumference of the foramen thyroideum, formed by the os pubis and iſchium: Its inſide is covered by a portion of the levator

tor ani; and appears to be divided into a number of fafciculi, which unite and form a roundifh tendon, that paffes out of the pelvis, between the pofterior facro ifchiatic ligament and tuberofity of the os ifchium; where it paffes over the capfular ligament of the thigh-bone, it is inclofed as in a fheath, by the gemini mufcles.

Inferted, by a round tendon, into the large pit at the root of the trochanter major.

Ufe. To roll the os femoris obliquely outwards.

Marfupialis, feu *Obturator internus*, Douglas,

N. B. The infertion of this mufcle fhould not be profecuted, until the mufcles of the thigh, to which it belongs, are diffected. *Vid.* Chap. xxix.

2. Coccygeus,

Arifes, tendinous and flefhy, from the fpinous procefs of the os ifchium, and covers the infide of the pofterior facro-ifchiatic ligament; from this narrow beginning, it gradually increafes, to form a thin flefhy belly, interfperfed with tendinous fibres.

Inferted into the extremity of the os facrum, and near the whole length of the os coccygis laterally.

Ufe. To fupport and move the os coccygis forwards, and to tie it more firmly to the facrum.

CHAP. XX.

Muscles *fituated within the Cavity of the* Abdomen.

THESE confift of a fingle mufcle, and four pair.

Diaphragma.

This broad thin mufcle, which makes a complete feptum between the thorax and abdomen, is concave below and convex

convex above; the middle of it on each ſide reaching as high within the thorax of the ſkeleton as the fourth rib; it is commonly divided into two portions.

1. The ſuperior or Greater Muſcle of the DIAPHRAGM,

Ariſes, by diſtinct fleſhy fibres, from the cartilago enſiformis, from the cartilages of the ſeventh, and of all the inferior ribs on both ſides. The fibres from the cartilago enſiformis, and from the ſeventh and eighth ribs, run obliquely upwards and backwards; from the ninth and tenth, tranſverſely inwards and upwards; and from the eleventh and twelfth, obliquely upwards. From theſe different origins the fibres run, like radii from the circumference to the centre of a circle; and are

Inſerted into a cordiform tendon, of a conſiderable breadth, which is ſituated in the middle of the diaphragm, and in which, therefore, the fibres from oppoſite ſides are interlaced. Towards the right ſide the tendon is perforated, by a triangular hole for the paſſage of the vena cava inferior; and to the upper convex part of it the pericardium and mediaſtinum are connected.

2. The inferior, Leſſer Muſcle, or Appendix of the DIAPHRAGM,

Ariſes from the ſecond, third, and fourth lumbar vertebrae, by eight heads; of which two in the middle, commonly called its *crura*, are the longeſt, and begin tendinous. Between the crura, the aorta and thoracic duct paſs; and, on the outſide of theſe, the great ſympathetic nerves and branches of the vena azygos perforate the ſhorter heads. The muſcular fibres run obliquely upwards and forwards, and form in the middle two fleſhy columns, which decuſſate and leave an oval ſpace between them for the paſſage of the oeſophagus and eighth pair of nerves.

Inſerted,

Inserted, by ſtrong fleſhy fibres, into the poſterior part of the middle tendon.

Uſe. The diaphragm is the principal agent in reſpiration, particularly in inſpiration: for when it is in action, the fibres, from their different attachments, endeavour to bring themſelves into a plane towards the middle tendon, by which the cavity of the thorax is enlarged, particularly at the ſides, where the lungs are chiefly ſituated; and as the lungs muſt always be contiguous to the inſide of the thorax and upper ſide of the diaphragm, the air ruſhes into them, in order to fill up the increaſed ſpace. This muſcle is aſſiſted by the two rows of intercoſtals, which elevate the ribs, and the cavity of the thorax is more enlarged. In time of violent exerciſe, or whatever cauſe drives the blood with unuſual celerity towards the lungs, the pectoral muſcles, the ſerrati antici majores, the ſerrati poſtici ſuperiores, and ſcaleni muſcles, are brought into action. And in laborious inſpiration, the muſcles which ariſe from the upper part of the thorax, when the parts into which they are inſerted, are fixed, likewiſe aſſiſt. In exſpiration, the diaphragm is relaxed and puſhed up by the preſſure of the abdominal muſcles upon the viſcera of the abdomen; and at the ſame time that they preſs it upwards, they alſo, together with the ſterno-coſtales and ſerrati poſtici inferiores, pull down the ribs, and are aſſiſted in a powerful manner by the elaſticity of the cartilages that join the ribs to the ſternum; by which the cavity of the thorax is diminiſhed, and the air ſuddenly puſhed out of the lungs: and, in laborious exſpiration, the quadrati lumborum, ſacro-lumbales, and longiſſimi dorſi, concur in pulling down the ribs.

The four pair are,

1. Quadratus Lumborum,

Arifes, fomewhat broad, tendinous, and flefhy from the pofterior part of the fpine of the os ilium.

Inferted into the tranfverfe proceffes of all the vertebrae of the loins, into the laft rib near the fpine, and by a fmall tendon into the fide of the laft vertebra of the back.

Ufe. To move the loins to one fide, pull down the laft rib, and, when both act, to bend the loins forwards.

Quadratus, feu *Lumbaris externus*, Winflow.

2. Psoas Parvus,

Arifes, flefhy, from the fides of the two upper vertebrae of the loins, and fends off a fmall long tendon, which ends thin and flat, and is

Inferted into the brim of the pelvis, at the junction of the os ilium and pubis.

Ufe. To affift the pfoas magnus in bending the loins forwards; and, in certain pofitions, to affift in raifing the pelvis.

N. B. This mufcle is very often wanting.

3. Psoas Magnus,

Arifes, flefhy, from the fide of the body, and tranfverfe procefs of the laft vertebra of the back; and, in the fame manner, from all thofe of the loins, by as many diftinct flips.

Inferted, tendinous, into the trochanter minor of the os femoris; and flefhy into that bone, a little below the fame trochanter.

Ufe. To bend the thigh forwards; or, when the inferior extremity is fixed, to affift in bending the body.

Pfoas, feu *Lumbaris internus*, Winflow.

4. Iliacus

4. Iliacus Internus,

Arifes, flefhy, from the tranfverfe procefs of the laft vertebra of the loins, from all the inner lip of the fpine of the os ilium, from the edge of that bone between its anterior fuperior fpinous procefs and the acetabulum, and from moft of the hollow part of the ilium. It joins with the pfoas magnus, where it begins to become tendinous; and is

Inferted along with it.

Ufe. To affift the pfoas in bending the thigh, and to bring it directly forwards.

N. B. The infertion of the two laft mufcles fhould not be profecuted till the mufcles of the thigh are diffected.

CHAP. XXI.

Muscles *fituated on the Anterior Part of the* Thorax.

THESE may be divided into two layers. The firft layer confifts of one mufcle, named

Pectoralis Major,

Arifes, from the cartilaginous extremities of the fifth and fixth ribs, where it always intermixes with the external oblique mufcle of the abdomen; from almoft the whole length of the fternum, and from near half of the anterior part of the clavicle: the fibres run towards the axilla in a folding manner.

Inferted, by two broad tendons, which crofs each other

at

at the upper and inner part of the os humeri, above the infertion of the deltoid mufcle, and outer fide of the groove for lodging the tendon of the long head of the biceps.

Ufe. To move the arm forwards, and obliquely upwards, towards the fternum.

Pectoralis, Albinus.

The fecond layer confifts of three mufcles:

1. Subclavius,

Arifes tendinous from the cartilage that joins the firft rib to the fternum.

Inferted, after becoming flefhy, into the inferior part of the clavicle, which it occupies from within an inch or fo of the fternum, as far outwards as to its connection, by ligament, with the coracoid procefs of the fcapula.

Ufe. To pull the clavicle downwards and forwards.

2. Pectoralis Minor,

Arifes, tendinous and flefhy, from the upper edge of the third, fourth, and fifth ribs, near where they join with their cartilages.

Inferted, tendinous, into the coracoid procefs of the fcapula; but foon grows flefhy and broad.

Ufe. To bring the fcapula forwards and downwards, or to raife the ribs upwards.

Serratus anticus, Albinus.

Serratus minor anticus, Douglas.

3. Serratus Magnus,

Arifes from the nine fuperior ribs, by an equal number of flefhy digitations, refembling the teeth of a faw.

Inferted, flefhy, into the whole bafe of the fcapula internally, between the infertion of the rhomboid and the origin of the ſubſcapularis muſcles, being folded about the two angles of the ſcapula.

Uſe. To move the ſcapula forwards; and, when the ſcapula is forcibly raiſed, to draw upwards the ribs.

Serratus major anticus, Douglas.

CHAP. XXII.

MUSCLES *ſituated between the Ribs, and within the* THORAX.

BETWEEN the ribs, on each ſide, there are eleven double rows of muſcles, which are therefore named *intercoſtals*. Theſe decuſſate each other like the ſtrokes of the letter X.

1. INTERCOSTALES EXTERNI,

Ariſes from the inferior acute edge of each ſuperior rib, and run obliquely forwards, the whole length from the ſpine to near the joining of the ribs with their cartilages; from which, to the ſternum, there is only a thin membrane covering the internal intercoſtals.

Inſerted into the upper obtuſe edge of each inferior rib, as far back as the ſpine, into which the poſterior portion is fixed.

2. INTERCOSTALES INTERNI,

Ariſes in the ſame manner as the external: But they begin at the ſternum, and run obliquely backwards, as far as the angle of the rib; and from that to the ſpine they are wanting.

Inſerted in the ſame manner as the external.

Uſe. By means of theſe muſcles, the ribs are equally raiſed upwards during inſpiration. Their fibres being oblique, give them a greater power of bringing the ribs near each other, than could be performed by ſtraight ones. But, by the obliquity of the fibres, they are almoſt brought contiguous: And as the fixed points of the ribs are before and behind, if the external had been continued forwards to the ſternum, and the internal backwards to the ſpine, it would have hindered their motion, which is greateſt in the middle, though the obliquity of the ribs renders it leſs perceptible; and, inſtead of raiſing the fibres fixed to the ſternum and ſpine, would have depreſſed the ribs.

N. B. The portions of the external intercoſtals which ariſe from the tranſverſe proceſſes of the vertebrae where the ribs are fixed to them, and other portions that paſs over one rib and terminate in the next below it, Albinus calls *Levatores coſtarum longiores et breviores.*

The portions of the internal that paſs over one rib, and are inſerted into the next below it, are by Douglas called, *Coſtarum depreſſores proprii Cowperii.*

Theſe portions of both rows aſſiſt in raiſing the ribs in the ſame manner as the reſt of the intercoſtals.

Supra coſtales, and *Infra coſtales*, Winſlow.

The muſcles within the thorax are one pair, viz.

TRIANGULARIS, *or* STERNOCOSTALIS,

Ariſes, fleſhy, and a little tendinous, from all the length of the cartilago enſiformis laterally, and from the edge of the lower half of the middle bone of the ſternum, from whence its fibres aſcend obliquely upwards and outwards.

Inſerted, generally by three triangular terminations, into the lower edge of the cartilages of the third, fourth, and fifth ribs, near where theſe join with the ribs.

Uſe.

Uſe. To depreſs theſe cartilages, and the extremities of the ribs; and conſequently to aſſiſt in contracting the cavity of the thorax.

This muſcle often varies; and is ſometimes inſerted into the cartilage of the ſecond rib, ſometimes into the cartilage of the ſixth rib.

CHAP. XXIII.

MUSCLES *ſituated on the Anterior Part of the* NECK *cloſe to the* VERTEBRÆ.

THESE conſiſt of one layer formed by four muſcles.

1. LONGUS COLLI,

Ariſes, tendinous and fleſhy, from the bodies of the three vertebrae of the back laterally; and from the tranſverſe proceſs of the third, fourth, fifth, and ſixth vertebrae of the neck, near their roots.

Inſerted into the fore-part of the bodies of all the vertebrae of the neck, by as many ſmall tendons, which are covered with fleſh.

Uſe. To bend the neck gradually forwards, and to one ſide.

2. RECTUS CAPITIS INTERNUS MAJOR,

Ariſes from the anterior points of the tranſverſe proceſſes of the third, fourth, fifth, and ſixth vertebrae of the neck, by four diſtinct beginnings.

Inſerted into the cuneiform proceſs of the os occipitis, a little before the condyloid proceſs.

Uſe.

Use. To bend the head forwards.

Rectus anterior longus, Winflow.

3. Rectus Capitis Internus Minor,

Arifes, flefhy, from the fore-part of the body of the firft vertebra of the neck, oppofite to the fuperior oblique procefs.

Inferted near the root of the condyloid procefs of the os occipitis, under, and a little farther outwards than the former mufcle.

Use. To bend the head forwards.

Rectus anterior brevis, Winflow.

4. Rectus Capitis Lateralis,

Arifes, flefhy, from the anterior part of the point of the tranfverfe procefs of the firft vertebra of the neck.

Inferted into the os occipitis, oppofite to the foramen ftylo-maftoideum of the temporal bone.

Use. To bend the head a little to one fide.

Tranfverfalis anticus primus, Winflow.

CHAP. XXIV.

Muscles *fituated on the Pofterior Part of the* Trunk.

THESE may be divided into four layers, and a fingle pair.

The firft layer confifts of two mufcles, which cover almoft the whole pofterior part of the trunk.

1. Tra-

1. Trapezius *seu* Cucularis,

Arises, by a ſtrong round tendon, from the lower part of the protuberance in the middle of the os occipitis behind; and, by a thin membranous tendon, which covers part of the ſplenius and complexus muſcles, from the rough curved line that extends from the protuberance towards the maſtoid proceſs of the temporal bone; runs down along the nape of the neck; where it ſeems to ariſe from its fellow, and covers the ſpinous proceſſes of the ſuperior vertebrae of the neck; but riſes from the ſpinous proceſſes of the two inferior, and from the ſpinous proceſſes of all the vertebrae of the back; adhering, tendinous, to its fellow, the whole length of its origin.

Inſerted, fleſhy, into the poſterior half of the clavicle; tendinous and fleſhy, into the acromion, and into almoſt all the ſpine of the ſcapula.

Uſe. Moves the ſcapula according to the three different directions of its fibres; for the upper deſcending fibres draw it obliquely upwards, the middle tranſverſe ſtraight fibres draw it directly backwards, and the inferior aſcending fibres draw it obliquely downwards and backwards.

N. B. Where it is inſeparably united to its fellow in the nape of the neck, it is named *Ligamentum Nuchae* or *Colli.*

2. Latissimus Dorsi,

Ariſes, by a broad thin tendon, from the poſterior part of the ſpine of the os ilium, from all the ſpinous proceſſes of the os ſacrum and vertebrae of the loins, and from the ſeven inferior ones of the vertebrae of the back; alſo, tendinous and fleſhy, from the extremities of the three or four inferior ribs, a little beyond their cartilages, by as many diſtinct ſlips. The inferior fibres aſcend obliquely, and the ſuperior run tranſverſely, over the inferior angle of of the fcapula, towards the axilla, where they are all collected, twifted, and folded.

Inferted, by a ftrong thin tendon, into the inner edge of the groove for lodging the tendon of the long head of the biceps.

Ufe. To pull the arm backwards and downwards, and to roll the os humeri.

N. B. The infertion of this mufcle fhould not be profecuted till the mufcles of the os humeri, to which it belongs, are diffected.

The fecond layer confifts of three pair, two on the back, and one on the neck.

On the back,

1. Serratus Posticus Inferior,

Arifes, by a broad thin tendon, in common with that of the latiffimus dorfi, from the fpinal proceffes of the two inferior vertebrae of the back, and from the three fuperior vertebrae of the loins.

Inferted into the lower edges of the four inferior ribs, at a little diftance from their cartilages, by as many diftinct flefhy lips.

Ufe. To deprefs the ribs into which it is inferted.

2. Rhomboideus.

This mufcle is divided into two portions.

1. *Rhomboideus major, arifes*, tendinous, from the fpinous proceffes of the five fuperior vertebrae of the back.

Inferted into all the bafis of the fcapula below its fpine.

Ufe. To draw the fcapula obliquely upwards, and directly inwards.

2. *Rhomboideus minor, arifes*, tendinous, from the fpinous

nous proceſſes of the three inferior vertebrae of the neck, and from the ligamentum nuchae.

Inſerted into the baſe of the ſcapula, oppoſite to its ſpine.

Uſe. To aſſiſt the former.

On the neck,

3. Splenius,

Ariſes, tendinous, from the four ſuperior ſpinous proceſſes of the vertebrae of the back; tendinous and fleſhy, from the five inferior of the neck, and adheres firmly to the ligamentum nuchae. At the third vertebra of the neck, the ſplenii recede from each other, ſo that part of the complexus muſcle is ſeen.

Inſerted, by as many tendons, into the five ſuperior tranſverſe proceſſes of the vertebrae of the neck; and tendinous and fleſhy, into the poſterior part of the maſtoid proceſs, and into the os occipitis, where it joins with the root of that proceſs.

Uſe. To bring the head and upper vertebrae of the neck backwards laterally; and, when both act, to pull the head directly backwards.

N. B. Albinus divides this muſcle into two; viz. That portion which ariſes from the five inferior ſpinous proceſſes of the neck, and is inſerted into the maſtoid proceſs and os occipitis, he calls *Splenius Capitis:* and that portion which ariſes from the third, and fourth of the back, and is inſerted into the five ſuperior tranſverſe proceſſes of the neck, is called by him *Splenius Colli.*

The ſingle pair,

Serratus Superior Posticus,

Ariſes, by a broad thin tendon, from the ſpinous proceſſes

ceſſes of the three laſt vertebrae of the neck, and the two uppermoſt of the back.

Inſerted into the ſecond, third, fourth, and fifth ribs, by as many fleſhy ſlips.

Uſe. To elevate the ribs, and dilate the thorax.

The third layer conſiſts of three pair on the back, and three on the neck.

Thoſe on the back are,

1. Spinalis Dorsi,

Ariſes from the ſpinous proceſſes of the two uppermoſt vertebrae of the loins, and the three inferior of the back by as many tendons.

Inſerted into the ſpinous proceſſes of the nine uppermoſt vertebrae of the back, except the firſt, by as many tendons.

Uſe. To erect and fix the vertebrae, and to aſſiſt in raiſing the ſpine.

2. Longissimus Dorsi,

Ariſes, tendinous without, and fleſhy within, from the ſide, and all the ſpinous proceſſes of the os ſacrum: From the poſterior ſpine of the os ilium: from all the ſpinous proceſſes; and from the roots of the tranſverſe proceſſes of the vertebrae of the loins.

Inſerted into all the tranſverſe proceſſes of the vertebrae of the back, chiefly by ſmall double tendons; alſo by a tendinous and fleſhy ſlip, into the lower edge of all the ribs, except the two inferior, at a little diſtance from their tubercles.

Uſe. To extend the vertebrae, and to raiſe and keep the trunk of the body erect.

N. B. From the upper part of this muſcle there runs up a round fleſhy portion which joins with the cervicalis deſcendens.

3. Sacro-Lumbalis,

Ariſes in common with the longiſſimus dorſi.

Inſerted into all the ribs, where they begin to be curved forwards, by as many long and thin tendons; and,

From the upper part of the ſix or eight lower ribs, ariſe as many bundles of thin fleſhy fibres, which ſoon terminate in the inner ſide of this muſcle, and are named *Muſculi ad Sacro-lumbalem Acceſſorii.*

Uſe. To pull the ribs down, and aſſiſt to erect the trunk of the body.

N. B. There is a fleſhy ſlip which runs from the upper part of this muſcle into the fourth, fifth, and ſixth tranſverſe proceſſes of the vertebrae of the neck, by three diſtinct tendons: It is named *Cervicalis Deſcendens;* and *its* uſe is to turn the neck obliquely backwards, and to one ſide.

On the neck are,

1. Complexus,

Ariſes from the tranſverſe proceſſes of the ſeven ſuperior vertebrae of the back, and four inferior of the neck, by as many diſtinct tendinous origins; in its aſcent it receives a fleſhy ſlip from the ſpinous proceſs of the firſt vertebra of the back: From theſe different origins it runs upwards, and is every where intermixed with tendinous fibres.

Inſerted, tendinous and fleſhy, into the inferior edge of the protuberance in the middle of the os occipitis, and into a part of the curved line that runs forwards from that protuberance.

Uſe. To draw the head backwards, and to one ſide; and, when both act, to draw the head directly backwards.

N. B.

N. B. The long portion of this mufcle that is fituated next the fpinous proceffes, lies more loofe, and has a roundifh tendon in the middle of it; for which reafon Albinus calls it *Bivrenter cervicis.*

2. Trachelo-Mastoideus,

Arifes from the tranfverfe proceffes of the three uppermoft vertebrae of the back, and from the five lowermoft of the neck, where it is connected to the tranfverfalis cervicis, by as many thin tendons, which unite into a belly, and run up under the fplenius.

Inferted into the middle of the pofterior fide of the maftoid procefs, by a thin tendon.

Ufe. To affift the complexus; but it pulls the head more to a fide.

Complexus minor, feu *Maftoideus lateralis*, Winflow.

Trachelo maftoideus, feu *Capitis par tertium Fallopii*, Douglas.

3. Levator Scapulae,

Arifes, tendinous and flefhy, from the tranfverfe proceffes of the five fuperior vertebrae of the neck, by as many diftinct flips, which foon unite to form a mufcle that runs downwards and outwards.

Inferted, flefhy, into the fuperior angle of the fcapula.

Ufe. To pull the fcapula upwards, and a little forwards.

Angularis, vel *Levator proprius*, Winflow.

Elevator feu *Mufculus patientiae*, Douglas.

The fourth layer confifts of two pair on the back, two on the pofterior part of the neck, four fmall pair fituated immediately below the pofterior part of the occiput, and three on the fide of the neck.

On

On the back are;

1. Semi-spinalis Dorsi,

Arifes, from the tranfverfe proceffes of the feventh, eighth, ninth, and tenth vertebrae of the back, by as many diftinct tendons, which foon grow flefhy, and then become tendinous again ; and are

Inferted, into the fpinous proceffes of all the vertebrae of the back above the eighth, and into the two lowermoft of the neck, by as many tendons.

Ufe. To extend the fpine obliquely backwards.

Semi-fpinalis externus, feu *Tranfverfo-fpinalis dorfi*, Winflow.

2. Multifidus Spinae,

Arifes from the fide and fpinous proceffes of the os facrum, and from the pofterior part of the os ilium, where it joins with the facrum ; from all the oblique and tranfverfe proceffes of the vertebrae of the loins ; from all the tranfverfe proceffes of the vertebrae of the back, and from thofe of the neck, except the three firft, by as many diftinct tendons, which foon grow flefhy, run in an oblique direction ; and are

Inferted, by diftinct tendons, into all the fpinous proceffes of the vertebrae of the loins, of the back, and of the neck, except the firft.

Ufe. When the different portions of this mufcle act on one fide, they extend the back obliquely, or move it laterally ; but if they act together on both fides, they extend the vertebrae backwards.

Tranfverfo-fpinalis lumborum, veterib.. Sacer.

Semi fpinalis internus, five *Tranfverfo-fpinalis dorfi.*

Semi-

Semi-ſpinalis, five *Tranſverſo-ſpinalis colli, Pars interna*, Winſlow.
Tranſverſalis lumborum, vulgo Sacer.
Tranſverſalis dorſi.
Tranſverſalis colli, Douglas.

On the poſterior part of the neck are,

1. Semi-Spinalis Colli,

Ariſes, from the tranſverſe proceſſes of the uppermoſt ſix vertebrae of the back, by as many diſtinct tendons, aſcending obliquely under the complexus.

Inſerted into the ſpinous proceſſes of all the vertebrae of the neck, except the firſt and the laſt.

Uſe. To extend the neck obliquely backwards.

Semi-ſpinalis, five *Tranſverſo-ſpinalis colli*, Winſlow.
Spinalis cervicis, Albinus.
Spinalis, Douglas.

2. Transversalis Colli,

Ariſes from the tranſverſe proceſſes of the five uppermoſt vertebrae of the back, by as many tendinous and fleſhy origins; runs between the trachelo-maſtoideus, and ſplenius colli and cervicalis deſcendens.

Inſerted into the tranſverſe proceſſes of all the cervical vertebrae, except the firſt and the laſt.

Uſe. To turn the neck obliquely backward, and a little to one ſide.

Below the poſterior part of the occiput are,

1. Rectus Capitis Posticus Major,

Ariſes, fleſhy, from the external part of the ſpinous proceſs of the ſecond vertebra of the neck; and grows broader

broader in its afcent, which is not ftraight, but obliquely outwards.

Inferted, tendinous and flefhy, into the os occipitis, near the rectus capitis lateralis, and the infertion of the obliquus capitis fuperior.

Ufe. To pull the head backwards, and to affift a little in its rotation.

Rectus major, Winflow and Douglas.

2. Rectus Capitis Posticus Minor,

Arifes, by a narrow beginning, clofe to its fellow, from a little protuberance in the middle of the back part of the firft vertebra of the neck, its outer edge being covered by the rectus major.

Inferted, fomewhat broad, into the fides of a dimple in the os occipitis, near its foramen magnum.

Ufe. To affift the rectus major in moving the head backwards.

Obliquus minor, Winflow and Douglas.

3. Obliquus Capitis Superior,

Arifes from the tranfverfe procefs of the firft vertebra of the neck.

Inferted, tendinous and flefhy, into the os occipitis behind the back part of the maftoid procefs of the temporal bone, and under the infertion of the complexus mufcle.

Ufe. To draw the head backwards.

Obliquus major, Winflow.

Obliquus fuperior, Douglas.

4. Obliquus Capitis Inferior,

Arifes, flefhy, from the fpinous procefs of the fecond vertebra of the neck, its whole length; and, forming a thick flefhy belly, is

Inferted

Inserted into the transverse process of the first vertebra of the neck.

Use. To give a rotatory motion to the head.

On the side of the neck are,

1. Scalenus Anticus,

Arises, from the fourth, fifth, and sixth transverse processes of the first vertebra of the neck, by as many tendons.

Inserted, tendinous and fleshy, into the upper side of the first rib, near its cartilage.

Scalenus prior, Albinus.

Anterior portion of the first scalenus, Winslow.

First scalenus, Douglas.

2. Scalenus Medius,

Arises, from all the transverse processes of the vertebrae of the neck, by as many strong tendons; the nerves to the superior extremity pass between it and the former.

Inserted into the upper and outer part of the first rib, from its root, to within the distance of an inch from its cartilage.

Posterior portion of the first scalenus, Winslow.

Second scalenus, Douglas.

3. Scalenus Posticus,

Arises from the fifth and sixth transverse processes of the vertebrae of the neck.

Inserted into the upper edge of the second rib, not far from the spine.

Posterior portion of the second scalenus, Winslow.

Third scalenus, Douglas.

Use of the three scaleni: To bend the neck to one side;

or,

or, when the neck is fixed, to elevate the ribs, and to dilate the thorax.

There are a number of ſmall muſcles ſituated between the ſpinous and tranſverſe proceſſes of contiguous vertebrae; which are accordingly named,

1. Interspinales Colli,

The ſpace between the ſpinous proceſſes of the vertebrae of the neck, moſt of which are bifurcated, is filled up with fleſhy portions; which

Ariſe, double, from the ſpinous proceſs of the inferior vertebrae of the neck; and aſcend to be

Inſerted, in the ſame manner, into the ſpinous proceſs of the ſuperior vertebra. They are five in number.

Uſe. To draw theſe proceſſes nearer to each other.

2. Intertransversales Colli.

They begin from the tranſverſe proceſs of the firſt vertebra of the back, and fill up the ſpaces between the tranſverſe proceſſes of the vertebrae of the neck, which are likewiſe bifurcated; and, conſequently, there are ſix diſtinct double muſcles, which

Ariſe from the inferior tranſverſe proceſs of each vertebra of the neck, and firſt of the back, and are

Inſerted into the ſuperior tranſverſe proceſſes.

Uſe. To draw theſe proceſſes towards each other, and turn the neck a little to one ſide.

3, 4, 5. Interspinales Dorsi et Lumborum, and the Intertransversales Dorsi,

Are rather ſmall tendons than muſcles, ſerving to connect the ſpinal and tranſverſe proceſſes.

6. Inter-

6. Intertransversales Lumborum,

Are four diftinct fmall bundles of flefh, which fill up the fpaces between the tranfverfe proceffes of the vertebrae of the loins, and ferve to draw them towards each other.

CHAP. XXV.

Muscles *of the* Superior Extremities.

THESE may be divided into the mufcles that are fituated on the fcapula, on the os humeri, on the cubit or fore-arm, and on the hand.

Mufcles fituated on the fcapula.

Thefe are called *mufcles* of the *os humeri;* and are three behind, one along its inferior cofta, two before, and one beneath it.

Behind are,

1. Supraspinatus,

Arifes, flefhy, from all that part of the bafe of the fcapula that is above its fpine; alfo from the fpine and fuperior cofta; paffes under the acromion, and adheres to the capfular ligament of the os humeri.

Inferted, tendinous, into that part of the large protuberance on the head of the os humeri that is next the groove for lodging the tendon of the long head of the biceps.

Ufe. To raife the arm upwards; and, at the fame time, to pull the capfular ligament from between the bones, that it may not be pinched.

2. INFRASPINATUS,

Arifes, flefhy, from all that part of the bafe of the fcapula that is between its fpine and inferior angle; from the fpine as far as the cervix of the fcapula. The fibres afcend and defcend obliquely towards a tendon in the middle of the mufcle, which runs forwards, and adheres to the capfular ligament.

Inferted, by a thick and fhort tendon, into the upper and middle part of the large protuberance on the head of the os humeri.

Ufe. To roll the humerus outwards; to affift in raifing, and in fupporting it when raifed; and to pull the ligament from between the bones.

N. B. Thefe two mufcles are covered with a tendinous membrane, from which a number of their flefhy fibres arife. It ferves befides to ftrengthen their actions, and keeps them from fwelling too much outwardly when in action.

3. TERES MINOR,

Arifes, flefhy, from all the round edge of the inferior cofta of the fcapula, and runs forwards along the inferior edge of the infrafpinatus mufcle, and adheres to the ligament.

Inferted, tendinous, into the back-part of the large protuberance on the head of the os humeri, a little behind and below the termination of the laft named mufcles.

Ufe. To roll the humerus outwards; to draw the humerus backwards; and to prevent the ligament from being pinched between the bones.

Along the inferior cofta of the fcapula is,

TERES

TERES MAJOR,

Arifes, flefhy, from the inferior angle of the fcapula, and from all that portion of its inferior cofta that is rough and thicker than the reft; its flefhy fibres are continued over part of the infrafpinatus mufcle, to which they firmly adhere.

Inferted, by a broad, fhort, and thin tendon, into the ridge at the inner fide of the groove for lodging the tendon of the long head of the biceps, along with the latiffimus dorfi.

Ufe. To roll the humerus inwards, and to draw it backwards and downwards.

The two before the fcapula are,

1. DELTOIDES,

Arifes, flefhy, from all the pofterior part of the clavicle that the pectoralis major does not poffefs; tendinous and flefhy, from the acromion, and lower margin of almoft the whole fpine of the fcapula oppofite to the infertion of the cucullaris mufcle: From thefe origins it runs in three different directions, i. e. from the clavicle outwards and downwards; from the fpine of the fcapula outwards, forwards, and downwards; and from the acromion ftraight downwards; and is compofed of a number of fafciculi, which form a ftrong flefhy mufcle that covers the anterior part of the joint of the os humeri.

Inferted, tendinous, into a rough protuberance in the outer fide of the os humeri, near its middle, where the fibres of this mufcle intermix with fome part of the brachialis externus.

Ufe. To pull the arm directly outwards and upwards, and a little forwards or backwards, according to the different directions of its fibres.

2. Co-

2. Coraco-Brachialis,

Arifes, tendinous and flefhy, from the fore-part of the coracoid procefs of the fcapula; adhering, in its defcent, to the fhort head of the biceps.

Inferted, tendinous and flefhy, about the middle of the internal part of the os humeri, near the origin of the third head of the triceps, called *brachialis externus*, where it fends down a thin tendinous expanfion to the internal condyle of the os humeri.

Ufe. To raife the arm upwards and forwards.

N. B. There paffes a nerve through this mufcle, called *Mufculo cutaneus*.

The one beneath the fcapula is,

Subscapularis,

Arifes, flefhy, from all the bafe of the fcapula internally, and from its fuperior and inferior coftae, being compofed of a number of tendinous and flefhy fafciculi, which make prints on the bone; they all join together, fill up the hollow of the fcapula, and pafs over the joint adhering to the capfular ligament.

Inferted, tendinous, into the upper part of the internal protuberance at the head of the os humeri.

Ufe. To roll the humerus inwards, and to draw it to the fide of the body; and to prevent the capfular ligament from being pinched.

CHAP.

CHAP. XXVI.

MUSCLES *ſituated on the* OS HUMERI.

THESE are called

Muſcles of the *Cubit* or *Fore-arm.*

They conſiſt of two before, and two behind.

Before are,

1. BICEPS FLEXOR CUBITI,

Ariſes, by two heads. The firſt and outermoſt, called *longus*, begins tendinous from the upper edge of the glenoid cavity of the ſcapula; paſſes over the head of the os humeri within the joint; and, in its deſcent without the joint, is incloſed in a groove near the head of the os humeri, by a membranous ligament that proceeds from the capſular ligament and adjacent tendons. The ſecond, or innermoſt head, called *brevis*, ariſes, tendinous and fleſhy, from the coracoid proceſs of the ſcapula, in common with the coraco-brachialis muſcle. A little below the middle of the fore part of the os humeri, theſe heads unite.

Inſerted, by a ſtrong roundiſh tendon, into the tubercle of the upper end of the radius internally.

Uſe. To turn the hand ſupine, and to bend the fore-arm.

N. B. At the bending of the elbow, where it begins to grow tendinous, it ſends off an aponeuroſis, which covers all

all the mufcles on the infide of the fore-arm, and joins with another tendinous membrane, which is fent off from the triceps extenfor cubiti, and covers all the mufcles on the outfide of the fore-arm, and a number of the fibres, from oppofite fibres, decuffate each other. It ferves to ftrengthen the mufcles, by keeping them from fwelling too much outwardly, when in action; and a number of their flefhy fibres take their origin from it.

Biceps brachii, Albinus.

Coraco-radialis, feu *biceps*, Winflow.

Biceps-internus, Douglas.

2. Brachialis Internus,

Arifes, flefhy, from the middle of the os humeri, at each fide of the infertion of the deltoid mufcle, covering all the inferior and fore-part of this bone, runs over the joint, and adheres firmly to the ligament.

Inferted, by a ftrong fhort tendon, into the coronoid procefs of the ulna.

Ufe. To bend the fore-arm, and to prevent the capfular ligament of the joint from being pinched.

Brachialis, Winflow.

Behind are,

1. Triceps Extensor Cubiti,

Arifes, by three heads; the firft, called *longus*, fomewhat broad and tendinous, from the inferior cofta of the fcapula, near its cervix. The fecond head called *brevis*, arifes by an acute, tendinous, and flefhy beginning, from the back-part of the os humeri, and a little below its head, outwardly. The third, called *brachialis externus*, arifes by an acute beginning, from the back-part of the os humeri. Thefe three heads unite lower than the infertion of the teres

res major, and cover the whole pofterior part of the humerus, from which they receive addition in their defcent.

Inferted into the upper and external part of the procefs of the ulna, called *olecranon*, and partly into the condyles of the os humeri, adhering firmly to the ligament.

Ufe. To extend the fore-arm.

Anconeus major, *Anconeus externus*, and *Anconeus internus*, Winflow.

Biceps externus, and *Brachialis externus*, Douglas.

3. ANCONEUS,

Arifes, tendinous, from the pofterior part of the external condyle of the os humeri; it foon grows flefhy, and is continued from the third head of the triceps.

Inferted, flefhy, and thin, into a ridge on the outer and pofterior edge of the ulna, being continued fome way below the olecranon, and covered with a tendinous membrane.

Ufe. To affift in extending the fore-arm.

Anconeus minor, Winflow.

Anconeus, vel *Cubitalis Riolani*, Douglas.

CHAP. XXVII.

MUSCLES *fituated on the* CUBIT *or* FORE-ARM *.

THESE may be divided into three claffes; *firft*, flexors and extenfors of the whole *hand*; *fecond*, flexors and extenfors

* In the following defcription, the arm is fuppofed to hang by the fide with the palm turned forwards; fo that the radius and thumb are upon its outer fide, and the ulna and little finger upon its inner fide; whereas, when the mufcles are defcribed in the lefs ftraining pofture of pronation, as has been generally done by authors, the utmoft confufion is neceffarily introduced in the application of the terms *outer* and *inner*, from the decuffation of the radius and ulna.

extenſors of the *fingers;* and *third,* ſupinators and pronators, or thoſe that roll the *radius on the ulna.*

Firſt claſs conſiſts of three flexors, and three extenſors.

Flexors:

1. Palmaris Longus,

Ariſes, tendinous, from the internal condyle of the os humeri, ſoon grows fleſhy, and after a ſhort progreſs, ſends off a long ſlender tendon.

Inſerted into the ligamentum carpi annulare, and into a tendinous membrane that is expanded on the palm of the hand, named *aponeuroſis palmaris;* which, above, begins at the tranſverſe or annular ligament of the wriſt, and, below, is fixed to the roots of the fingers.

Uſe. To bend the hand, and to ſtretch the membrane that is expanded on the palm.

Ulnaris gracilis, Winſlow.

N. B. This muſcle is ſometimes wanting; but the aponeuroſis palmaris is always to be found, and a ſmall muſcle named

Palmaris Brevis,

Ariſes from the ligamentum carpi annulare, and tendinous membrane that is expanded on the palm of the hand.

Inſerted, by ſmall bundles of fleſhy fibres, into the ſkin and fat that covers the abductor minimi digiti, and into the os piſiforme.

Uſe. To aſſiſt in contracting the palm of the hand.

Palmaris cutaneus, Winſlow.

2. Flexor

2. Flexor Carpi Radialis,

Arifes, tendinous and flefhy, from the internal condyle of the os humeri, and from the anterior part of the upper end of the ulna, where it firmly adheres to the pronator radii teres.

Inferted, by a flat tendon, into the fore and upper part of the metacarpal bone that fuftains the fore finger, after running through a foffa in the os trapezium.

Ufe. To bend the hand, and to affift in its pronation.

Radialis internus, Albinus and Winflow.

3. Flexor Carpi Ulnaris,

Arifes, tendinous, from the internal condyle of the os humeri. It has likewife a fmall flefhy beginning from the outer fide of the olecranon; between which and the condyle the ulnar nerve paffes to the fore-arm; and a number of its flefhy fibres arife from the tendinous membrane which covers the fore-arm.

Inferted, by a fhort ftrong tendon, into the os pififorme; at a little diftance from its infertion, a fmall ligament is fent off to the metacarpal bone that fuftains the little finger.

Ufe. To affift the former in bending the arm.

Ulnaris internus, Albinus and Winflow.

Extenfors are,

1. Extensor Carpi Radialis Longior,

Arifes, broad, thin, and flefhy, immediately below the fupinator radii longus, from the lower part of the external ridge of the os humeri, above its external condyle.

Inferted, by a round tendon, into the pofterior and upper part of the metacarpal bone that fuftains the fore-finger.

Use. To extend and bring the hand backwards.

Radialis externus longior, Albinus.

Radialis externus primus, Winslow.

2. Extensor Carpi Radialis Brevior,

Arises, tendinous, from the external condyle of the os humeri, and from the ligament that connects the radius to it, and runs along the outside of the radius.

Inserted, by a round tendon, into the upper and back part of the metacarpal bone that sustains the middle finger.

Use. To assist the last-mentioned muscle.

Radialis externus brevior, Albinus.

Radialis secundus, Winslow.

3. Extensor Carpi Ulnaris,

Arises, tendinous, from the external condyle of the os humeri; and, in its progress, fleshy from the middle of the ulna, where it passes over the ulna. Its round tendon is inclosed by a membranous sheath, in a groove which is situated at the extremity of the ulna.

Inserted, by its round tendon, into the posterior and upper part of the metacarpal bone that sustains the little-finger.

Use. To assist the former in extending the hand.

Ulnaris externus, Albinus and Winslow.

Second Class.

The flexors and extensors of the four fingers are two long, and one small flexor to each finger, and one extensor.

1. Flexor Sublimis Perforatus,

Arises, tendinous and fleshy, from the internal condyle of the os humeri; tendinous from the coronoid process of the

the ulna, near the edge of the cavity that receives the head of the radius; flefhy from the tubercle of the radius; and membranous and flefhy from the middle of the fore-part of the radius, where the flexor pollicis longus arifes. Its flefhy belly fends off four round tendons before it paffes under the ligament of the wrift.

Inferted into the anterior and upper part of the fecond bone of each finger, being, near the extremity of the firft bone, divided for the paffage of the perforans.

Ufe. To bend the fecond joint or phalanx of the fingers.

Sublimus, Albinus.

Perforatus, Douglas.

2. Flexor Profundus Perforans,

Arifes, flefhy, from the external fide, and upper part of the ulna, for fome way downwards, and from a large fhare of the interoffeous ligament. It fplits into four tendons, a little before it paffes under the ligamentum carpi annulare; and thefe pafs through the flits in the tendons of the flexor fublimis.

Inferted into the fore and upper part of the third or laft bone of all the four fingers.

Ufe. To bend the laft joint of the fingers.

Profundus, Albinus.

Perforans, Douglas.

The four fmall flexors are named

Lumbricales.

Arifes, thin and flefhy, from the outfide of the tendons of the flexor profundus, a little above the lower edge of the ligamentum carpi annulare.

Inferted, by long flender tendons, into the outer fides of the

the broad tendons of the interoſſei muſcles, about the middle of the firſt joint.

Uſe. To increaſe the flexion of the fingers while the long flexors are in full action.

Extenſors are,

EXTENSOR DIGITORUM COMMUNIS,

Ariſes, by an acute, tendinous, and fleſhy beginning, from the external condyle of the os humeri, where it adheres to the ſupinator radii brevis. Before it paſſes under the ligamentum carpi annulare externum, it ſplits into four tendons; ſome of which may be divided into ſeveral ſmaller: and about the fore-part of the metacarpal bones they remit tendinous filaments to each other.

Inſerted into the poſterior part of all the bones of the four fingers by a tendinous expanſion.

Uſe. To extend all the joints of the fingers.

Third Claſs,

Conſiſts of four muſcles, viz, two *ſupinators*, and two *pronators*.

Supinators are,

1. SUPINATOR RADII LONGUS,

Ariſes, by an acute and fleſhy origin, from the external ridge of the os humeri, above the external condyle, near as far up as the middle of that bone.

Inſerted into the outer-ſide of the inferior extremity of the radius.

Uſe. To roll the radius outwards, and conſequently the palm of the hand upwards.

Supinator longus, Albinus, Winſlow, and Douglas.

2. Su-

2. Supinator Radii Brevis,

Arifes, tendinous, from the external condyle of the os humeri; tendinous and flefhy, from the external and upper part of the ulna, and adheres firmly to the ligament that joins thefe two bones.

Inferted into the head, neck, and tubercle of the radius, near the infertion of the biceps, and ridge running from that downwards and outwards.

Ufe. To roll the radius outwards, and fo bring the hand fupine.

Pronators are,

1. Pronator Radii Teres,

Arifes, flefhy, from the internal condyle of the os humeri, and tendinous from the coronoid procefs of the ulna.

Inferted, thin, tendinous, and flefhy, into the middle of the pofterior part of the radius.

Ufe. To roll the radius, together with the hand, inwards.

2. Pronator Radii Quadratus,

Arifes, broad, tendinous, and flefhy, from the lower and inner part of the ulna; the fibres run tranfverfely, to be

Inferted into the lower and anterior part of the radius, oppofite to its origin.

Ufe. To turn the radius, together with the hand, inwards.

CHAP.

CHAP. XXVIII.

MUSCLES *ſituated on the* HAND *chiefly.*

THESE may be divided into four claſſes, viz. muſcles of the *thumb*, *fore-finger*, *little-finger*, and *metacarpal bones.*

Muſcles of the Thumb.

Theſe conſiſt of *three flexors*, *three extenſors*, *one abductor*, and *one adductor.*

Flexors are,

1. FLEXOR LONGUS POLLICIS MANUS,

Ariſes, by an acute fleſhy beginning, from the upper part of the radius, immediately below its tubercle, and is continued down for ſome ſpace on the fore-part of this bone. It has likewiſe generally another origin from the internal condyle of the os humeri, which forms a diſtinct fleſhy ſlip that terminates near the upper part of the origin from the radius.

Inſerted into the laſt joint of the thumb, after having paſſed its tendon under the ligament of the wriſt.

Uſe. To bend the laſt joint of the thumb.

Flexor tertii internodii, Douglas.

2. FLEXOR BREVIS POLLICIS MANUS,

Ariſes from the os trapezoides, magnum, and unciforme

of

of the carpus, and is divided into two portions by the tendon of the flexor pollicis longus.

Inserted into the ossa sesamoidea and first bone of the thumb.

Use. To bend the first joint of the thumb.

Flexor secundi internodii, Douglas.

3. Flexor Ossis Metacarpi Pollicis, *or* Opponens Pollicis,

Arises, fleshy, from the os trapezium and ligamentum carpi annulare, lying under the abductor pollicis.

Inserted, tendinous and fleshy, into the under and anterior part of the metacarpal bone of the thumb.

Use. To bring the thumb inwards, opposite to the other fingers.

Flexor primi internodii, Douglas.

Extensors are,

1. Extensor Ossis Metacarpi Pollicis Manus,

Arises, fleshy, from the middle and posterior part of the ulna, immediately below the insertion of the anconaeus muscle, from the posterior part of the middle of the radius, and from the interosseous ligament.

Inserted, generally by two tendons, into the os trapezium, and upper back-part of the metacarpal bone of the thumb, and often joins with the abductor pollicis.

Use. To extend the metacarpal bone of the thumb outwardly.

Abductor longus pollicis manus, Albinus.

Extensor primi internodii, Douglas.

2. Ex-

2. Extensor Primi Internodii,

Arises, flefhy, from the pofterior part of the ulna near the former mufcle, and from the interoffeous ligament.

Inserted, tendinous, into the pofterior part of the firft bone of the thumb; and part of it may be traced as far as the fecond bone.

Use. To extend the firft bone of the thumb obliquely outwards.

Extensor minor pollicis manus, Albinus.

This and the preceding mufcle is called

Extensor pollicis primus, Winflow.

Extensor secundi internodii, Douglas.

3. Extensor Secundi Internodii,

Arises, by an acute, tendinous, and flefhy beginning, from the middle back-part of the ulna, and from the interoffeous ligament; its tendon runs through a fmall groove at the inner and back part of the lower end of the radius.

Inserted into the laft bone of the thumb.

Use. To extend the laft joint of the thumb obliquely backwards.

Extensor major pollicis manus, Albinus.

Extensor pollicis secundus, Winflow.

Extensor tertii internodii, Douglas.

Abductor Pollicis Manus,

Arises, by a broad tendinous and flefhy beginning, from the ligamentum carpi annulare, and from the os trapezium.

Inserted, tendinous, into the outer fide of the root of the firft bone of the thumb.

Use. To draw the thumb from the fingers.

N. B.

N. B. Albinus names the inner portion of this mufcle *Abductor brevis alter.*

Abductor, Thenar Riolani, Douglas.

Adductor Pollicis Manus,

Arifes, flefhy, from almoft the whole length of the metacarpal bone that fuftains the middle finger; from thence its fibres are collected together.

Inferted, tendinous, into the inner part of the root of the firft bone.

Ufe. To pull the thumb towards the fingers.

Adductor ad minimum digitum, Douglas.

Fore-finger:

Indicator,

Arifes, by an acute flefhy beginning, from the middle of the pofterior part of the ulna; its tendon paffes under the fame ligament with the extenfor digitorum communis, with part of which it is

Inferted into the pofterior part of the fore-finger.

Extenfor fecundi internodii indicis proprius, vulgo indicator, Douglas.

Abductor Indicis Manus,

Arifes, from the os trapezium, and from the fuperior part and inner fide of the metacarpal bone of the thumb.

Inferted, by a fhort tendon, into the outer and back-part of the firft bone of the fore-finger.

Ufe. To bring the fore-finger towards the thumb.

Semi-interoffeus, Winflow.

Little finger:

ABDUCTOR MINIMI DIGITI MANUS,

Arifes, flefhy, from the os pififorme, and from that part of the ligamentum carpi annulare next it.

Inferted, tendinous, into the inner fide of the upper end of the firft bone of the little finger.

Ufe. To draw this finger from the reft.

Hypothenar minor, Winflow.

Extenfor tertii internodii minimi digiti, Douglas.

ADDUCTOR METACARPI MINIMI DIGITI MANUS,

Arifes, flefhy, from the thin edge of the os unciforme, and from that part of the ligament of the wrift next it.

Inferted, tendinous, into the inner fide and anterior part of the metacarpal bone of this finger.

Ufe. To bend and bring the metacarpal bone of this finger towards the reft.

Metacarpus, Winflow.

Flexor primi internodii minimi digiti, Douglas.

FLEXOR PARVUS MINIMI DIGITI,

Arifes, flefhy, from the outer fide of the os unciforme, and from the ligament of the wrift which joins with that bone.

Inferted, by a roundifh tendon, into the inner and anterior part of the upper end of the firft bone of this finger.

Ufe. To bend the little finger, and affift the adductor.

Abductor minimi digiti, Hypothenar Riolani, Douglas.

Between the metacarpal bones, there are *four internal* and *three external* mufcles named *interoffei*.

Interoffei

Interoſſei interni:

1. Prior Indicis,

Ariſes, tendinous and fleſhy, from the upper and outer part of the metacarpal bone that ſuſtains the fore-finger.

Inſerted into the outſide of that part of the tendinous expanſion from the extenſor digitorum communis, which covers the poſterior part of the fore-finger.

Uſe. To draw the fore-finger inwards towards the thumb, and extend it obliquely.

Extenſor tertii internodii indicis, Douglas.

2. Posterior Indicis,

Ariſes, tendinous and fleſhy, from the root and inner part of the metacarpal bone that ſuſtains the fore-finger.

Inſerted into the inner ſide of the tendinous expanſion which is ſent off from the extenſor digitorum communis along the poſterior part of the fore-finger.

Uſe. To extend the fore-finger obliquely, and to draw it outwards.

Firſt interoſſeus, Douglas.

3. Prior Annularis,

Ariſes, from the root of the outſide of the metacarpal bone that ſuſtains the ring-finger.

Inſerted into the outſide of the tendinous expanſion of the extenſor digitorum communis which covers the ring-finger.

Uſe. To extend and pull the ring-finger towards the thumb.

Fourth interoſſeus, Douglas.

4. Interosseus Auricularis,

Ariſes from the root and outer ſide of the metacarpal bone of the little finger; and is

Inſerted

Inserted into the outside of the tendinous expansion of the extensor digitorum communis, which covers the posterior part of the little finger.

Use. To extend and draw the little finger outwards.

Sixth interosseus, Douglas.

Interossei externi, seu bicipites:

1. Prior Medii,

Arises, by two origins, from the roots of the metacarpal bones that sustain the fore and middle fingers externally, and next each other: Runs along the outside of the middle finger; and, being conspicuous on both sides of the hand, is

Inserted into the outside of the tendinous expansion from the extensor digitorum communis, which covers the posterior part of the middle finger.

Use. To extend, and to draw the middle finger inwards.

Second interosseus, Douglas.

2. Posterior Medii,

Arises, by two origins, from the roots of the metacarpal bones, next each other, that sustain the middle and ring-fingers.

Inserted into the inside of the tendinous expansion from the extensor digitorum communis, which runs along the posterior part of the middle finger.

Use. To extend and draw the middle-finger outwards.

Third interosseus, Douglas.

3. Posterior Annularis,

Arises, by two origins, from the roots of the metacarpal bones that sustain the ring and little fingers next each other.

Inserted

Inserted into the infide of the tendinous expanfion of the extenfor digitorum communis, which runs along the pofterior part of the ring-finger.

Ufe. To extend and draw the ring-finger inwards.

Fifth interoffeus, Douglas.

N. B. The internal interoffei are only confpicuous on the palm of the hand; but the external are apparent on both the palm and back of the hand.

CHAP. XXIX.

MUSCLES *of the* INFERIOR EXTREMITIES.

THESE may be divided into the mufcles *fituated* on the *outfide* of the *pelvis*, on the *thigh*, on the *leg*, and on the *foot*.

Mufcles on the outfide of the *pelvis*, which are called *mufcles of the thigh*.

Thefe are compofed of *one layer before* and *three layers behind*.

The layer before confifts of five mufcles:

1. PSOAS MAGNUS.
2. ILIACUS INTERNUS.

} Thefe were defcribed, p. 311 & 312.

3. PECTINALIS.

Arifes, broad and flefhy, from the upper and anterior part of the os pubis or pectinis, immediately above the foramen thyroideum.

Inferted into the anterior and upper-part of the linea af-

pera

pera of the os femoris, a little below the trochanter minor, by a flat and ſhort tendon.

Uſe. To bring the thigh upwards, and inwards, and to give it a degree of rotation outwards.

Pectineus, Albinus.

4. Triceps Adductor Femoris,

Under this appellation are comprehended three diſtinct muſcles:

1. Adductor Longus Femoris,

Ariſes, by a ſtrong roundiſh tendon, from the upper and interior part of the os pubis, and ligament of its ſynchondroſis, on the inner ſide of the pectinalis.

Inſerted, tendinous, near the middle of the poſterior part of the linea aſpera, being continued for ſome way down.

Adductor femoris primus, Douglas.

Triceps minus, Winſlow.

2. Adductor Brevis Femoris,

Ariſes, tendinous, from the os pubis near its joining with the oppoſite os pubis below and behind the former.

Inſerted, tendinous and fleſhy, into the inner and upper part of the linea aſpera, from a little below the trochanter minor, to the beginning of the inſertion of the adductor longus.

Adductor femoris ſecundus, Douglas.

Triceps ſecundus, Winſlow.

3. Adductor Magnus Femoris,

Ariſes, a little lower down than the former, near the ſymphaſis of the oſſa pubis; tendinous and fleſhy, from the tuberoſity of the os iſchium; the fibres run outwards and downwards.

Inſerted

Inserted into almoſt the whole length of the linea aſpera; into a ridge above the internal condyle of the os femoris; and, by a roundiſh long tendon, into the upper part of that condyle, a little above which the femoral artery takes a ſpinal turn towards the ham, paſſing between this muſcle and the bone.

Uſe of theſe three muſcles or triceps. To bring the thigh inwards and upwards, according to the different directions of their fibres; and, in ſome degree, to roll the thigh outwards

Adductor femoris tertius, and

Adductor femoris quartus, Douglas.

Triceps tertius, Winſlow.

5. OBTURATOR EXTERNUS,

Ariſes, fleſhy, from the lower fore-part of the os pubis, and fore-part of the inner crus of the iſchium; ſurrounds the foramen thyroideum; a number of its fibres, ariſing from the membrane which fills up that foramen, are collected like rays towards a centre, and paſs outwards around the root of the back-part of the cervix of the os femoris.

Inſerted, by a ſtrong tendon, into the cavity at the inner and back-part of the root of the trochanter major, adhering in its courſe to the capſular ligament of the thigh-bone.

Uſe. To roll the thigh-bone obliquely outwards, and to prevent the capſular ligament from being pinched.

Behind are,

Firſt Layer.

GLUTEUS MAXIMUS,

Ariſes, fleſhy, from the poſterior part of the ſpine of the os os ilium, a little higher up than the joining of the ilium with the os facrum, from the whole external fide of the os facrum, below the pofterior fpinous procefs of the os ilium; from the pofterior facro-ifchiatic ligament, over which part of the inferior edge of this mufcle hangs in a folded manner; from the os coccygis. All the flefhy fibres run obliquely forwards, and a little downwards, to form a thick broad mufcle, which is divided into a number of ftrong fafciculi. The upper part of it covers almoft the whole of the trochanter major, between which and the tendon of this mufcle there is a large burfa mucofa, and where it is infeparably joined to the broad tendon of the *tenfor vaginae femoris.*

Inferted, by a ftrong, thick, and broad tendon, into the upper and outer part of the linea afpera, which is continued from the trochanter major, for fome way downwards.

Ufe. To extend the thigh, by pulling it directly backwards, and a little outwards.

Gluteus magnus, Albinus.

Gluteus major, Cowper.

Second Layer.

GLUTEUS MEDIUS,

Arifes, flefhy, from the anterior fuperior fpinous procefs of the os ilium, and from all the outer edge of the fpine of the ilium, except its pofterior part, where it arifes from the dorfum of that bone.

Inferted, by a broad tendon, into the outer and pofterior part of the trochanter major.

Ufe. To draw the thigh-bone outwards, and a little backwards; to roll the thigh-bone outwards, efpecially when it is bended.

N. B.

N. B. The anterior and upper part of this muſcle is covered by a tendinous membrane, from which a number of its fleſhy fibres ariſe, and which joins with the broad tendons of the gluteus maximus, tenſor vaginae femoris, and latiſſimus dorſi.

Third Layer conſiſts of four Muſcles.

1. Gluteus Minimus,

Ariſes, fleſhy, from a ridge that is continued from the ſuperior anterior ſpinous proceſs of the os ilium, and from the middle of the dorſum of that bone as far back as its great niche.

Inſerted, by a ſtrong tendon, into the fore and upper part of the trochanter major.

Uſe. To aſſiſt the former in pulling the thigh outwards and backwards, and in rolling it.

Gluteus minor, Albinus.

2. Pyriformis,

Ariſes, within the pelvis, by three tendinous and fleſhy origins, from the ſecond, third, and fourth pieces of the os ſacrum; from thence growing gradually narrower, it paſſes out of the pelvis along with the poſterior crural nerve, below the niche in the poſterior part of the os ilium, where it receives a few fleſhy fibres.

Inſerted, by a roundiſh tendon, into the upper part of the cavity at the inner ſide of the root of the trochanter major.

Uſe. To move the thigh a little upwards, and roll it outwards.

Pyriformis, ſeu *iliacus externus*, Douglas.

3. Gemini,

Ariſes by two diſtinct origins; the ſuperior from the ſpinous

nous procefs, and the inferior from the tuberofity of the os ifchium; alfo, from the pofterior facro-ifchiatic ligament. They are both united by a tendinous and flefhy membrane, and form a purfe for the tendon of the obturator internus mufcle, which was formerly defcribed.

Inferted, tendinous and flefhy, into the cavity at the inner fide of the root of the trochanter major, on each fide of the tendon of the obturator internus, to which they firmly adhere.

Ufe. To roll the thigh outwards, and to preferve the tendon of the obturator internus from being hurt by the hardnefs of that part of the ifchium over which it paffes; alfo, to hinder it from ftarting out of its place, while the mufcle is in action.

Gemelli, Winflow.

4. Quadratus Femoris,

Arifes, tendinous and flefhy, from the outfide of the tuberofity of the os ifchium; and, running tranfverfely, is

Inferted, flefhy, into a rough ridge, continued from the root of the large trochanter to the root of the fmall one.

Ufe. To roll the thigh outwards.

CHAP. XXX.

Muscles *fituated on the* Thigh.

THESE are called *mufcles* of the *leg*; and confift of *one*, on the *outfide*; *two*, on the *infide*; *four*, *before*; and *four*, *behind*.

Previous

Previous to the defcription of the mufcles that are fituated on the thigh and leg, it is neceffary to take notice of a broad tendinous fafcia or fheath, which is fent off from the back and from the tendons of the glutei and adjacent mufcles.

It is a ftrong thick membrane on the outfide of the thigh and leg; but, towards the infide of both, it gradually turns thinner, and has rather the appearance of cellular fubftance, than a tendinous membrane. A little below the trochanter major, it is firmly fixed to the linea afpera; and, farther down, to that part of the head of the tibia that is next the fibula; where it fends off the tendinous expanfion along the outfide of the leg.

It ferves to ftrengthen the action of the mufcles, by keeping them firm in their proper places while in action, particularly the tendons that pafs over the joints, where this membrane is thickeft; and it gives origin to a number of the flefhy fibres of the mufcles.

On the outfide is,

TENSOR VAGINÆ FEMORIS,

Arifes, by a narrow tendinous, and flefhy beginning, from the external part of the anterior fuperior fpinous procefs of the os ilium.

Inferted, a little below the trochanter major, into the inner fide of the membranous fafcia which covers the outfide of the thigh.

Ufe. To ftretch the membranous fafcia, to affift in the abduction of the thigh, and fomewhat in its rotation inwards.

Mufculus fafciae latae, Winflow.

On

On the inſide are,

1. Sartorius,

Ariſes, tendinous, from the anterior ſuperior ſpinous proceſs of the os ilium, ſoon grows fleſhy, runs down for ſome ſpace upon the rectus, and going obliquely inwards, it paſſes over the vaſtus internus, and about the middle of the os femoris, over part of the triceps, it runs down farther between the tendon of the abductor magnus and that of the gracilis muſcle.

Inſerted, by a broad and thin tendon, into the inner ſide of the tibia, near the inferior part of its tubercle.

Uſe. To bend the leg obliquely inwards, or to bring one leg acroſs the other.

2. Gracilis,

Ariſes, by a thin tendon, from the os pubis near the ſymphyſis of theſe two bones: ſoon grows fleſhy; and, deſcending by the inſide of the thigh, is

Inſerted, tendinous, into the tibia under the ſartorius.

Uſe. To aſſiſt the ſartorius.

Gracilis internus, ſive *Rectus internus*, Winſlow.

Before are,

1. Rectus,

Ariſes, fleſhy, from the inferior anterior ſpinous proceſs of the os ilium, and tendinous from the dorſum of the ilium, a little above the acetabulum; runs down over the anterior part of the cervix of the os femoris, the fibres not being ſtraight, but running down like the plumage of a feather obliquely outwards and inwards, from a tendon in the middle.

Inſerted,

Inferted, tendinous, into the upper part of the patella, from which a thin tendon runs down, on the fore-part of this bone, to terminate in a thick ſtrong ligament, which is ſent off from the inferior part of the patella, and inferted into the tubercle of the tibia.

Uſe. To extend the leg, and in a powerful manner, by the intervention of the patella, like a pully.

Rectus, ſive *Gracilis anterior*, Winflow.

2. Vastus Externus,

Ariſes, broad, tendinous, and fleſhy, from the root of the trochanter major, and upper part of the linea aſpera, its origin being continued from near the inſertion of the gluteus minimus, the whole length of the linea aſpera, by fleſhy fibres which run obliquely forwards to a middle tendon, where they terminate.

Inſerted into a large ſhare of the upper part of the patella; and part of it ends in an aponeuroſis, which is continued down to the leg, and in its paſſage is firmly fixed to the head of the tibia.

Uſe. To extend the leg.

3. Vastus Internus,

Ariſes, tendinous and fleſhy, from between the fore-part of the os femoris and root of the trochanter minor, and from almoſt all the inſide of the linea aſpera, by fibres running obliquely forwards and downwards.

Inſerted, tendinous, into the upper and inſide of the patella, continuing fleſhy lower than the vaſtus externus. Part of it likewiſe ends in an aponeuroſis continued down to the leg, and fixed in its paſſage to the upper part of the tibia.

Uſe. To extend the leg.

4. Cru-

4. Cruralis,

Arifes, flefhy, from between the two trochanters of the os femoris, but nearer the minor, and firmly adhering to moft of the fore-part of the os femoris, and connected to both vafti mufcles.

Inferted, tendinous, into the upper part of the patella, behind the rectus.

Ufe. To affift in the extenfion of the leg.

Cruralis, Albinus.

N. B. Thefe four mufcles *before*, being inferted into the patella, have the fame effect upon the leg, as if they were immediately inferted into it, by means of the ftrong tendon, or rather ligament, which is fent off from the inferior part of the patella to the tibia.

Behind are,

1. Semitendinosus,

Arifes, tendinous and flefhy, in common with the long head of the biceps, from the pofterior part of the tuberofity of the os ifchium; and fending down a long roundifh tendon, which ends flat, is

Inferted into the infide of the ridge of the tibia, a little below its tubercle.

Ufe. To bend the leg backwards and a little inwards.

Seminervofus, Winflow and Douglas.

2. Semimembranosus,

Arifes, tendinous, from the upper and pofterior part of the tuberofity of the os ifchium, fends down a broad flat tendon, which ends in a flefhy belly, and, in its defcent, runs at firft on the fore-part of the biceps, and, lower, between it and the femitendinofus.

Inferted,

Inserted, tendinous, into the inner and back-part of the head of the tibia.

Use. To bend the leg, and bring it directly backwards.

N. B. The two last form what is called the *inner ham-string.*

3. Biceps Flexor Cruris,

Arises by two distinct heads. The first, called *longus*, arises, in common with the semitendinosus, from the upper and posterior part of the tuberosity of the os ischium. The second, called *brevis*, arises from the linea aspera, a little below the termination of the gluteus maximus, by a fleshy acute beginning, which soon grows broader as it descends to join with the first head, a little above the external condyle of the os femoris.

Inserted, by a strong tendon, into the upper part of the head of the fibula.

Use. To bend the leg.

Biceps cruris, Albinus.

Biceps, Winslow and Douglas.

N. B. This muscle forms what is called the *outer ham-string;* and between it and the inner, the nervus popliteus, and arteria and vena poplitea, are situated.

4. Popliteus,

Arises, by a round tendon, from the lower and back part of the external condyle of the os femoris; then runs over the ligament that involves the joint, firmly adhering to it, and part of the semilunar cartilage. As it runs over the joint, it becomes fleshy, and the fibres run obliquely inwards, being covered with a thin tendinous membrane.

Inserted, broad, thin, and fleshy, into a ridge at the upper and internal edge of the tibia, a little below its head.

Use. To assist in bending the leg, and to prevent the cap-

sular

ſular ligament from being pinched. After the leg is bent, this muſcle ſerves to roll it inwards.

CHAP. XXXI.

MUSCLES *ſituated on the* LEG.

THESE are called *Muſcles* of the *Foot;* and may be divided into *two claſſes*, viz. *Extenſors* and *Flexors* of the *Foot*. 2. *Common Extenſors* and *Flexors* of the *Toes*.

Firſt Claſs.

Extenſors.

Theſe conſiſt of three:

1. GASTROCNEMIUS EXTERNUS, *ſeu* GEMELLUS,

Ariſes by two diſtinct heads. The firſt head ariſes from the upper and back part of the internal condyle of the os femoris, and from that bone, a little above its condyle, by two diſtinct tendinous origins. The ſecond head ariſes tendinous from the upper and back part of the external condyle of the os femoris. A little below the joint, their fleſhy bellies unite in a middle tendon; and, below the middle of the tibia, it ſends off a broad thin tendon, which joins a little above the extremity of the tibia with the tendon of the following.

2. SOLEUS, *ſeu* GASTROCNEMIUS INTERNUS,

Ariſes by two origins. The firſt is from the upper and back part of the head of the fibula, continuing to receive many

many of its flefhy fibres from the pofterior part of that bone for fome fpace below its head. The other origin begins from the pofterior and upper part of the middle of the tibia; and runs inwards along the inferior edge of the popliteus towards the inner part of the tibia, from which it receives flefhy fibres for fome way down. The flefh of this mufcle, covered by the tendon of the gemellus, runs down near as far as the extremity of the tibia; a little above which the tendons of both gaftrocnemii unite, and form a ftrong round chord, which is called *tendo Achillis*.

Inferted, into the upper and pofterior part of the os calcis; by the projection of which the tendo Achillis is at a confiderable diftance from the tibia.

Ufe. To extend the foot, by bringing it backwards and downwards.

Gemellus and *Soleus*, Albinus.

Gaftrocnemii and *Soleus*, Winflow.

Extenfor tarfi furalis, vel *Extenfor magnus*, Douglas.

3. Plantaris,

Arifes, thin and flefhy, from the upper and back part of the root of the external condyle of the os femoris, near the inferior extremity of that bone, adhering to the ligament that involves the joint in its defcent. It paffes along the fecond origin of the foleus, and under the gemellus, where it fends off a long, flender, thin tendon, which comes from between the great extenfors, where they join tendons; then runs down by the infide of the tendo Achillis.

Inferted into the infide of the pofterior part of the os calcis, below the tendo Achillis.

Ufe. To affift the former, and to pull the capfular ligament of the knee from between the bones. It feems likewife to affift in rolling the foot inwards.

Tibialis gracilis, vulgo *Plantaris*, Winflow.

Extenfor tarfi minor, vulgo *Plantaris*, Douglas.

N. B. This muſcle has been ſometimes found wanting on both ſides.

Flexors:

Theſe conſiſt of four; two that belong to the tibia, and two to the fibula.

1. Tibialis Anticus,

Ariſes, tendinous and fleſhy, from the middle of that proceſs of the tibia, to which the fibula is connected above; then it runs down fleſhy on the outſide of the tibia; from which, and the upper part of the interoſſeous ligament, it receives a number of diſtinct fleſhy fibres; near the extremity of the tibia, it ſends off a ſtrong round tendon, which paſſes under part of the ligamentum tarſi annulare near the malleolus internus.

Inſerted, tendinous, into the inſide of the os cuneiforme internum, and poſterior end of the metatarſal bone that ſuſtains the great toe.

Uſe. To bend the foot, by drawing it upwards, and, at the ſame time, to turn the toes inwards.

2. Tibialis Posticus,

Ariſes, by a narrow fleſhy beginning, from the fore and upper part of the tibia, juſt under the proceſs which joins it to the fibula; then paſſing through a perforation in the upper part of the interoſſeous ligament, it continues its origin from the back-part of the fibula next the tibia, and from near one half of the upper-part of the laſt named bone; as alſo, from the interoſſeous ligament, the fibres running towards a middle tendon, which ſends off a round one that paſſes in a groove behind the malleolus internus.

Inſerted,

Inserted, tendinous, into the upper and inner part of the os naviculare, being further continued to the os cuneiforme internum and medium; besides, it gives some tendinous filaments to the os calcis, os cuboides, and to the root of the metatarsal bone that sustains the middle toe.

Use. To extend the foot, and to turn the toes inwards.

3. Peroneus Longus,

Arises, tendinous and fleshy, from the fore-part of the head of the perone, or fibula, the fibres running straight down; also from the upper and external part of the fibula, where it begins to rise into a round edge; as also, from the hollow between that and its anterior edge, as far down as to reach within a hand's breadth of the ankle, by a number of fleshy fibres, which run outwards towards a tendon, that sends off a long round one, which passes through a channel at the outer ankle, in the back-part of the inferior extremity of the fibula; then, being reflected to the sinuosity of the os calcis, it runs along a groove in the os cuboides, above the muscles in the sole of the foot.

Inserted, tendinous, into the outside of the root of the metatarsal bone that sustains the great toe, and by some tendinous fibres in the os cuneiforme internum.

Use. To move the foot outwards, and to extend it a little.

Peroneus maximus, vulgo *Peroneus posterior*, Winslow.

Peroneus primus, seu *Posticus*, Douglas.

4. Peroneus Brevis,

Arises, by an acute fleshy beginning, from above the middle of the external part of the fibula; from the outer side of the anterior spine of this bone; as also, from its round edge externally, the fibres running obliquely outwards towards a tendon on its external side; it sends off a

round

round tendon which paſſes through the groove at the outer ankle, being there included under the ſame ligament with that of the preceding muſcle; and a little farther, it runs through a particular one of its own.

Inſerted, tendinous, into the root and external part of the metatarſal bone that ſuſtains the little toe.

Uſe. To aſſiſt the former in pulling the foot outwards, and extending it a little.

Peroneus medius, vulgo *Peroneus anticus*, Winſlow.

Peroneus ſecundus, ſeu *Anticus*, Douglas.

Second Claſs.

Common extenſors.

Theſe conſiſt of two.

1. Extensor Longus Digitorum Pedis,

Ariſes, tendinous and fleſhy, from the upper and outer part of the head of the tibia, and from the head of the fibula where it joins with the tibia, and from the interoſſeous ligament; alſo from the tendinous faſcia, which covers the upper and outſide of the leg by a number of fleſhy fibres; and tendinous and fleſhy, from the anterior ſpine of the fibula, almoſt its whole length, where it is inſeparable from the *peroneus tertius*. It ſplits into four round tendons, under the ligamentum tarſi annulare.

Inſerted, by a flat tendon, into the root of the firſt joint of each of the four ſmall toes; and is expanded over the upper ſide of the toes, as far as the root of the laſt joint.

Uſe. To extend all the joints of the four ſmall toes.

Extenſor longus, Douglas.

N. B. A portion of this muſcle, which

Ariſes,

Ariſes, from the middle of the fibula, continues down to near its inferior extremity, and ſends its fleſhy fibres forwards to a tendon, which paſſes under the annular ligament, and is

Inſerted into the root of the metatarſal bone that ſuſtains the little toe: it is called by Albinus *Peroneus tertius*; and by others, the *Nonus Veſalii*.

Uſe. To aſſiſt in bending the foot.

2. Extensor Brevis Digitorum Pedis,

Ariſes, fleſhy and tendinous, from the fore and upper part of the os calcis; and ſoon forms a fleſhy belly, diviſible into four portions, which ſends off an equal number of tendons that paſs over the upper part of the foot, under the tendons of the former.

Inſerted, by four ſlender tendons, into the tendinous expanſion from the extenſor longus, which covers the ſmall toes, except the little one; alſo into the tendinous expanſion from the extenſor pollicis that covers the upper part of the great toe.

Uſe. To extend the toes.

Extenſor brevis, Douglas.

Flexors.

Theſe may be reckoned three.

1. Flexor Brevis Digitorum Pedis, Sublimis Perforatus,

Ariſes, by a narrow fleſhy beginning, from the inferior and poſterior part of a protuberance of the os calcis, between the abductors of the great and little toes; ſoon forms a thick fleſhy belly, which ſends off four tendons that ſplit for the paſſage of the flexor longus.

Inſerted

Inferted into the fecond phalanx of the four leffer toes. The tendon of the little toe is often wanting.

Ufe. To bend the fecond joint of the toes.

Perforatus, feu *Sublimis*, Douglas.

2. Flexor Longus Digitorum Pedis, Profundus, Perforans,

Arifes, by an acute tendon, which foon becomes flefhy, from the back part of the tibia, fome way below its head, near the entry of the medullary artery; which beginning, is continued down the inner edge of this bone by fhort flefhy fibres, ending in its tendon; alfo by tendinous and flefhy fibres, from the outer edge of the tibia; and between this double order of fibres the tibialis pofticus mufcle lies inclofed. Having paffed under two annular ligaments, it then paffes through a finuofity at the infide of the os calcis; and, about the middle of the fole of the foot, divides into four tendons, which pafs through the flits of the perforatus; and, juft before its divifion, it receives a confiderable tendon from that of the flexor pollicis longus.

Inferted into the extremity of the laft joint of the four leffer toes.

Ufe. To bend the laft joint of the toes.

This mufcle is affifted by the

Flexor Digitorum Accessorius, feu Massa Carnea Jacobii Sylvii,

Arifes, by a thin flefhy origin, from moft part of the finuofity at the infide of the os calcis, which is continued forwards, for fome fpace on the fame bone; alfo by a thin tendinous beginning, from before the tuberofity of the os calcis externally; and, foon becoming all flefhy, is

Inferted

Inserted into the tendon of the flexor longus, juſt at its diviſion into four tendons.

Uſe. To aſſiſt the flexor longus.

3. Lumbricales Pedis,

Ariſes, by four tendinous and fleſhy beginnings, from the tendon of the flexor profundus, juſt before its diviſion, near the inſertion of the maſſa carnea.

Inſerted, by four ſle der tendons, into the inſide of the firſt joint of the four leſſer toes, and are loſt in the tendinous expanſion that is ſent from the extenſors to cover the upper part of the toes.

Uſe. To increaſe the flexion of the toes, and to draw them inwards.

CHAP. XXXII.

Muscles *which are chiefly ſituated on the* Foot.

THESE may be divided into the *muſcles* of the *great toe*, of the *little toe*, and of the *metatarſal bones.*

Muſcles of the great toe.

Theſe are five;

1. Extensor Proprius Pollicis Pedis,

Ariſes, by an acute, tendinous, and fleſhy beginning, ſomeway below the head and anterior part of the fibula, along which it runs to near its lower extremity, connected to it by a number of fleſhy fibres, which deſcend obliquely towards a tendon.

Inſerted, tendinous, into the poſterior part of the firſt and laſt joint of the great toe.

Uſe. To extend the great toe.

Extenſor longus, Douglas.

2. Flexor Longus Pollicis Pedis,

Ariſes, by an acute, tendinous, and fleſhy beginning, from the poſterior part of the fibula, ſome way below its head, being continued down the ſame bone, almoſt to its inferior extremity, by a double order of oblique fleſhy fibres; its tendon paſſes under an annular ligament at the inner ankle.

Inſerted into the laſt joint of the great toe, and generally ſends a ſmall tendon to the os calcis.

Uſe. To bend the laſt joint of this toe.

Flexor longus, Douglas.

3. Flexor Brevis Pollicis Pedis,

Ariſes, tendinous, from the under and fore-part of the os calcis, where it joins with the os cuboides, from the os cuneiforme externum, and is inſeparably united with the abductor and adductor pollicis.

Inſerted into the external os ſeſamoideum and root of the firſt joint of the great toe.

Uſe. To bend the firſt joint.

4. Abductor Pollicis Pedis,

Ariſes, fleſhy, from the inſide of the root of the protuberance of the os calcis, where it forms the heel; and tendinous from the ſame bone, where it joins with the os naviculare.

Inſerted,

Inserted, tendinous, into the internal os sesamoideum, and root of the first joint of the great toe.

Use. To pull the great toe from the rest.

Thenar, Winslow.

5. Adductor Pollicis Pedis,

Arises, by a long thin tendon, from the os calcis, from the os cuboides, from the os cuneiforme externum, and from the root of the metatarsal bone of the second toe.

Inserted into the external os sesamoideum, and root of the metatarsal bone of the great toe.

Use. To bring this toe nearer the rest.

Antithenar, Winslow.

Muscles of the little toe.

These, besides the common extensors and flexors, are two, viz.

1. Abductor Minimi Digiti Pedis,

Arises, tendinous and fleshy, from the semicircular edge of a cavity on the inferior part of the protuberance of the os calcis, and from the root of the metatarsal bone of the little toe.

Inserted into the root of the first joint of the little toe externally.

Use. To draw the little toe outwards from the rest.

Parathenar major, and *Metatarsus*, Winslow.

2. Flexor Brevis Minimi Digiti Pedis,

Arises, tendinous, from the os cuboides, near the sulcus or furrow for lodging the tendon of the peroneus longus; fleshy from the outside of the metatarsal bone that sustains this toe, below its protuberant part.

Inserted into the anterior extremity of the metatarfal bone, and root of the firft joint of this toe.

Ufe. To bend this toe.

Parathenar minor, Winflow.

Mufcles from the metatarfal bones.

Thefe are four external and three internal interoffei, and one mufcle which is common to all the metatarfal bones.

Interoffei Pedis externi, Bicipites.

1. Abductor Indicis Pedis,

Arifes, tendinous and flefhy, by two origins, from the root of the infide of the metatarfal bone of the fore toe, from the outfide of the root of the metatarfal bone of the great toe, and from the os cuneiforme internum.

Inferted, tendinous, into the infide of the root of the firft joint of the fore toe.

Ufe. To pull the fore toe inwards from the reft of the fmall toes.

2. Adductor Indicis Pedis,

Arifes, tendinous and flefhy, from the roots of the metatarfal bones of the fore and fecond toe.

Inferted, tendinous, into the outfide of the root of the firft joint of the fore toe.

Ufe. To pull the fore toe outwards towards the reft.

3. Adductor Medii Digiti Pedis,

Arifes, tendinous and flefhy, from the roots of the metatarfal bones of the fecond and third toes.

Inferted,

Inserted, tendinous, into the outſide of the root of the firſt joint of the ſecond toe.

Uſe. To pull the ſecond toe outwards.

4. ADDUCTOR TERTII DIGITI PEDIS,

Ariſes, tendinous and fleſhy, from the roots of the metatarſal bones of the third and little toe

Inſerted, tendinous, into the outſide of the root of the firſt joint of the third toe.

Uſe. To pull the third toe outwards.

Interoſſei Pedis interni.

1. ABDUCTOR MEDII DIGITI PEDIS,

Ariſes, tendinous and fleſhy, from the inſide of the root of the metatarſal bone of the middle toe internally.

Inſerted, tendinous, into the inſide of the root of the firſt joint of the middle toe.

Uſe. To pull the middle toe inwards.

2. ABDUCTOR TERTII DIGITI PEDIS,

Ariſes, tendinous and fleſhy, from the inſide and inferior part of the root of the metatarſal bone of the third toe.

Inſerted, tendinous, into the inſide of the root of the firſt joint of the third toe inwards.

Uſe. To pull the third toe inwards.

3. ABDUCTOR MINIMI DIGITI PEDIS,

Ariſes, tendinous and fleſhy, from the inſide of the root of the metatarſal bone of the little toe.

Inſerted, tendinous, into the inſide of the root of the firſt joint of the little toe.

Uſe. To pull the little toe inwards.

The

The muſcle which brings the extremities of the metatarſal bones towards each other, is named

TRANSVERSALIS PEDIS,

Ariſes, tendinous, from the under part of the anterior extremity of the metatarſal bone of the great toe, and from the internal os ſeſamoideum of the firſt joint, adhering to the adductor pollicis.

Inſerted, tendinous, into the under and outer part of the anterior extremity of the metatarſal bone of the little toe, and ligament of the next toe.

Uſe. To contract the foot, by bringing the great toe and the two outermoſt toes nearer each other.

N. B. The muſcles ſituated on the ſole of the foot are covered by a ſtrong tendinous aponeuroſis, which is extended from the os calcis to the firſt joints of all the toes, and ſerves to preſerve the ſubjacent parts from being compreſſed in ſtanding and walking.

OF

MUSCULAR MOTION.

MOTION in the human body is not performed by one individual organ. In every animal and vegetable fibre, even in hair, feathers, membranes, the cellular texture, and in the humid muſcular fibre, in ſhort, in animal and vegetable gluten, there is a contractile or elaſtic power, which preſerves the fibre in its natural ſtate, preventing it from being too much extended, and reſtoring it again to its proper dimenſions, when the ſtretching power is removed. This power never ceaſes endeavouring to bring the elementary particles into the cloſeſt contact that the mechaniſm of the part can admit. It continues even many days after death; ſo that fibres of a divided muſcle contract towards each extremity, leaving a wide gap in the middle. An artery, when cut, likewiſe contracts itſelf in length.

This force may be called *vis mortua*, becauſe it continues to be efficacious after death, and is different from the powers of life. In the living animal, indeed, it is ſomewhat briſker; for, both from cold and fear, the ſkin trembles, grows harder, and has its papillae erected; and along with this hardneſs it contracts itſelf in length. Again, the cellular fibres are animated with this perpetual niſus to ſhorten, always endeavouring to contract themſelves. Hence, when the ſkin

or

or any other membrane is extended, as foon as the caufe of extenfion is taken off, it returns by a gentle effort to its former fhortnefs. But it even fomewhat refifts the attempt to perpetual diftenfion; and by a gentle, but continual, approach of its elements to one another, it propels the contained fat, or water, or other bodies accidentally introduced into it. The fame power alfo feems to limit the excretion of vapour; for the fibres and plates of the cellular texture being preternaturally relaxed, an immenfe quantity, either of fat or of watery humour, is depofited in that texture. And this debility feems to be the principal caufe of a dropfy. The fame caufe being always efficacious, and at work in the heart, joints, and every where throughout the body of the embyro, brings into nearer contact the arteries, auricles, and verticles; produces flexures; and contracts the heart into the form of a cone. The fame caufe, by an unknown or hidden power, feems to form the fhape of moft parts of the human body; and while it expels the gluten received into the cells, it brings the terreftrial particles nearer to one another, and gives the proper folidity, curvature, and fituation, to the different parts.

It is the nature of this power to act continually by gentle but uninterrupted efforts. It is common for it alfo to be excited by poifons, in every membrane, fibre, and in the cellular texture; but never by cutting or puncturing with a fharp inftrument. Thefe are the known properties of the red mufcular fibre. The ftructure of this fibre, then, it is now neceffary for us to confider.

By the name of *mufcular* or *moving fibres* in the human body, we call bundles of reddifh coloured threads, which perform all the motions vifible in the human body. When many of thefe fibres are collected together, and appear more evidently red, they are called *a mufcle.* The extreme fimplicity of the texture in thefe parts has been the caufe of the obfcurity

obfcurity in underftanding how a fmall foft portion of flefh, can produce fuch ftrong and ample motions as we fee in man, and more efpecially in the cruftaceous infects.

In every mufcle we meet with long foft threads of *fibres*, fomewhat elaftic, or extenfible, and almoft conftantly difpofed parallel with each other; and thefe, being furrounded with a good deal of cellular fubftance, are by that faftened together into little bundles, called *lacertuli*; which are again tied together into larger bundles, by a more loofe cellular net-work, that contains fome fat; and between thefe we conftantly perceive membranous partitions and ftripes of the cellular fubftance removing them farther from each other, till at laft a number of them combined together, either parallel or inclined, are furrounded with a more thin and denfe cellular membrane, continuous with that of their partitions; and this being again furrounded by a thicker plate of the cellular fubftance, parts the whole bundle from the adjacent flefh, and gives it the denomination of a *fingle* or *entire mufcle*. In every one of thefe threads there appears a leffer feries of filaments, which, by oblique extremities, are cemented to others of the fame kind, forming together a large fibre *.

The generality of the mufcles but more efpecially thofe which are inferted into the bones, have other fibres fixed to them; but thefe are condenfed into a more flender, hard, and fhining fubftance, of a filver colour, which has the name of *tendon*. When the tendinous fibres expand into a broad flat furface, they form what is called an *aponeurofis*.

* Swammerdam, Lyonet, and Roefel, have elegantly painted the appearance of the mufcular fibres in frogs, and other animals, which Leeuwenhoeck, Cowper, and Muyfs, have fhewn in man. But their ftructure is more particularly defcribed and delineated in a fmall work by Profchafka, *De Carne mufculari*, publifhed at Vienna 1778.

neurosis. The cellular texture which covers the whole tendon, is called its *vagina* or *sheath*, and resembles the coat of a muscle.

That fleshy fibres truly change into such as are tendinous, says Dr Haller, is evident from comparing a foetus, in which there are few tendons, with a child of some years growth, in which there are many more; and both with an adult, in which there are the greatest number. But Dr Wrisberg observes, in opposition to this, that many tendons are found in a foetus, which could not assume this nature by muscular action; as the tendo Achillis, aponeurosis plantaris, centrum diaphragmatis, &c. Besides, in various parts of the body there are tendons found without corresponding muscles.

Muscles which are not inserted into any of the bones, have commonly no tendons, as the sphincters and muscular membranes of the viscera and vessels. But those commonly end in long tendons, which are required to pass round the joints and heads of the bones, to be inserted in those extremities which are more moveable. In a foetus the muscles are evidently inserted into the periosteum only; but in adults, where the periosteum is more closely joined with the bone itself, the tendons, being confused with the periosteum, pass together with that even into the foveoli of the bone.

The tendinous fibres, indeed, often lie in a straight line with the fleshy ones, and are as it were a continuation of them. But in many parts of the body the fleshy fibres are obliquely inclined to the tendon, and adhere to it; and the tendon itself grows thicker in its progress by continually receiving new fibres. This is called a *tendinous muscle*. Other tendons lie in the middle between two plates of fibres, which are inserted on each side of the tendon at angles obtuse downward; and this is called a *pennated*

muscle,

muſcle. There are inſtances of numerous tendons, pennated in different places, formed into one muſcle. There are alſo other methods by which the tendinous fibres are joined with the fleſhy ones.

Within the cellular tunic that ſurrounds the fibres, the arteries and veins, running in company with each other, are ſubdivided into net-works. From the ſmaller of theſe veſſels a vapour is exhaled into the thinner, and the fat is transfuſed into the thicker, cellular ſubſtance; from whence again they are both abſorbed by the lymphatic veſſels; which can be diſtinctly ſeen both on the ſurface and in the ſubſtance of the muſcles.

The nerves of the muſcles are ſtill more evident. They are commonly very large; and enter by ſo many branches, that ſome anatomiſts have conſidered the muſcular fibres as formed by them. Several arguments are now offered againſt this opinion: One of the ſtrongeſt is, that muſcles in the limbs of animals do not ſhrink, although the nerves entering theſe muſcles have been cut through for a conſiderable length of time. (See *Monro's Obſervations on the Nervous Syſtem*). The nerves enter the muſcles in a way ſomewhat ſimilar with that of the arteries and veins; but it is impoſſible to trace them a great way among the fleſhy fibres, for they at length depoſite their harder covering, and become ſoft, and diſappear before they can be traced to their terminations.

The fabric of the leaſt fibres, which are ſuppoſed to be the elementary particles of a muſcle, being inveſtigated by the microſcope in man and other animals, is found to be ſimilar to that of the larger fibres, and they are all joined together by the intermediate cellular ſubſtance. The ſurface of theſe fibres, however, puts on a curious waved or zigzag appearance, as was formerly mentioned. This undulated appearance Proſchaſka thinks is nothing elſe than

 impreſſions

impreffions made by the veffels and cellular fubftance and perhaps by the nerves: But Dr *Monro*, in the work above quoted, has defcribed and delineated a fimilar appearance in the tendons and nerves; and is of opinion, that they are to be confidered as folds or joints, ferving to accommodate the parts to the different ftates of flexion and extenfion. In proof of this, he finds, that thofe parts which appear thus in their relaxed ftate, lofe it when they are much ftretched.

With regard to the nature of the ultimate moving fibres, there have been many difputes. Some anatomifts think them folid; others, hollow, formed of a feries of veffels or rhomboidal chains communicating with each other: Some, again, have been of opinion, that they are full of a kind of down or woolly fubftance, &c.

It may be afked, Whether they are hollow? whether they are continued from the arteries? or whether the difference between mufcular and tendinous fibres, lies in the latter being rendered more denfe, and beat cloffer together by an expulfion of the fluids? That thefe are not probable, appears from the minutenefs of the fibres, which are found lefs than the red-blood globules, and from the whitenefs of a mufcle after the blood is wafhed out of it; to which add the phyfiological reafons, after mentioned, (p. 385.) And, in general, more ftrength may be expected from a folid fibre.

The ftructure of the tendons and aponeurofes agrees in fome refpects with, but differs in others from, that of the mufcles. We obferve their fibres regularly difpofed, and feparated by cellular fubftance and blood-veffels; and without doubt they have lymphatics and nerves: But the tendinous fibres are cloffer together than thofe of the mufcles, the cellular fubftance which feparates them is finer, their red veffels are fewer in number, and the nerves cannot be traced, without difficulty, into their fubftance.

It

It has been doubted whether the fibres of tendons are a continuation of the moving fibres, or of a different nature. Many, both ancients and moderns, have embraced the firſt opinion, others the ſecond; but if we conſider that the tendinous fibres are not irritable, have no contraction, that they differ little from thoſe which conſtitute the ligaments, and that they degenerate ſometimes into a ſubſtance truly cellular, we would be inclined to adopt the latter opinion.

According to Dr Haller, a muſcle therefore is endowed at leaſt with a threefold force. Firſt the *vis mortua*, in common to it with other animal fibres. Another, which he has called the *vis inſita*, and which has different phenomena from the former *. It is more peculiar to life; and though it may continue for a few hours after death, yet it diſappears much ſooner than the former. Again, in moſt caſes, it acts by alternate oſcillations; ſo that, being driven hither and thither, it ſometimes contracts the muſcle towards the middle; ſometimes again it extends the muſcle from the middle towards the extremities, and ſometimes alſo it has a reiterated motion. Moreover, it is manifeſtly quicker, and performs the greateſt motions *. It is excited both by the pricking with a ſharp inſtrument, and in the hollow muſcles by inflated air, by water, and every kind of acrimony, but moſt powerfully of all by a torrent of electrical matter. Laſtly, it is peculiar to the muſcular fibre, and is found in no other part of the human body with the qualities above mentioned. But we muſt give a more particular explication of its phenomena.

It is natural to every muſcle to ſhorten itſelf, by drawing the extremities towards its belly or middle. But to diſcover the moving power of a muſcle from the fabric which we have deſcribed, it will be of uſe to conſider the appearances obſervable in the muſcular contraction. Every muſcle then becomes

* See obſervations on this ſubject in the ſubſequent pages of this Chapter.

becomes ſhorter and broader in its action. But this contraction of its length is various; in ſome more, in others leſs; and is very conſiderable in ſome of the ſphincters, inſomuch that they appear to be contracted more than one third of their extent.

The inteſtines are exceedingly tenacious of their vis inſita, as they continue to contract themſelves long after they are taken out of the body, and even after they are cold; and the heart is even more tenacious of this principle than the inteſtines, as is evident in a young chicken, and in cold animals. Different muſcles are beſt excited into action by different ſtimuli; as the bladder by urine, the heart by the blood, and the inteſtines by air. Though the nerves are removed, or the connection, made by them between the muſcles and the brain, cut off, the muſcles loſe but little of their irritable nature. It appears alſo from the example of polypi and other inſects, that the ſame irritable diſpoſition extends very widely through the animal fibres. In many of theſe creatures, neither brain nor nerves can be traced, yet they are exceedingly affected by ſtimulus. Laſtly, we perceive this vis inſita in vegetables, many of which expand and contract their flowers and leaves according to the different ſtates of the atmoſphere; and ſome plants exert ſudden and violent motions from ſtimuli externally applied, appearing little inferior in this reſpect to animals. This vis inſita does not depend upon weight, attraction, or elaſticity; for it is ſeated in a ſoft fibre, and vaniſhes as the fibre grows hard.

That the cauſe of motion is conveyed through the nerves into the muſcles, is certain from the experiments made on the brain and nerves. For the nerve alone has feeling; this alone carries the commands of the ſoul; and of theſe commands there is neither intimation nor perception in that part, whoſe nerve is either tied or cut, or which has no

nerve.

nerve. Moreover, on irritating the nerve or ſpinal marrow, even in an animal that has been dead for ſome time, the muſcle or muſcles which have nervous branches from thoſe parts are moſt vehemently convulſed. When the nerve of any muſcle is cut or tied, or the baſis of the ſpinal marrow compreſſed, or that part of the brain from whence the nerve has its origin, the muſcle becomes paralytic, and languiſhes, and cannot by any force be recalled into an action ſimilar to the vital one. But if the ligature be taken off from the nerve, the force by which the muſcle is put into action is again recovered. The nerve being irritated below the place where it is cut, the muſcle to which that nerve goes is contracted. This appears from numerous experiments, eſpecially thoſe made on the phrenic and recurrent nerves.

This force, called *vis nervea*, is not the ſame with the vis inſita. The former comes to the muſcle from without: whereas the other reſides conſtantly in the muſcle itſelf. The nervous power ceaſes when life is deſtroyed; the other appears, from certain experiments, to remain for ſome time after death: it is alſo ſuppreſſed by tying a ligature upon the nerve, by hurting the brain, or by taking opium. The *vis inſita* ſuffers nothing from all theſe circumſtances; it remains after the nerve is tied: it continues in the inteſtines though they be taken out of the body and cut in pieces: it appears with great ſtrength in ſuch animals as are deſtitute of brain: that part of the body is moved which has no feeling; and the parts of the body feel which are without motion. The will excites and removes the nervous power, but has no power over the *vis inſita*.

In the motion of the muſcles, whether owing to the *vis inſita* or the *vis nervea*, the fibres are contracted towards the middle of their belly, and recede from one another outwards; they are alſo diverſified with various tranſverſe

wrinkles:

wrinkles: the whole mufcle alfo becomes fhorter, and draws its extremities towards the middle; hence it draws towards each other thofe parts with which it was connected: the mufcle alfo fwells by its contraction, becoming hard at the fame time, and as it were increafes its circumference on every fide. Haller has never obferved it to turn pale. Whether on the whole it is increafed in bulk, or acquires more in breadth than it lofes in length, is difficult to be known. It draws after it the tendons, which are obfequious to its motions, though of themfelves neither moveable nor irritable. The whole mufcle is alfo capable of being moved at once, or only a part of it; if one extremity is fixed to an immoveable part, that only is moved which is capable of yielding.

If it be demanded, Whether the arteries conduce any thing to mufcular motion? and whether the palfy of the lower limbs after a ligature upon the aorta, be not an argument of this opinion? we anfwer, No farther than as they conduce to the found ftate of the mufcle, or to the confervation of the mutual ftructure and habit of the parts, which they fupply with vapour, fat, &c.: for the irritation of an artery does not affect or convulfe the mufcle to which it belongs; nor does a ligature on it caufe a palfy, unlefs after a confiderable time, when the mufcles begin to be deftroyed by a gangrene. Moreover, it is impracticable to explain the motion of peculiar mufcles from a caufe derived with an equal force from the heart to all parts of the body. Laftly, the influence of the will is confined to the nerves, without refiding in the arteries or other folid parts of the body.

But the direct manner by which the nerves excite motion in the mufcles, is fo obfcure, that we may almoft for ever defpair of its difcovery. The opinion, that the nervous veficles fwell by a quicker flux of the nervous fpirits, is in-

confiftent

consistent with anatomical truth, which demonstrates the least visible fibres to be cylindrical, and in no part vesicular; it is likewise repugnant to the celerity with which muscular motion is performed; and it seems to be completely refuted by the well known fact, that the bulk of a muscle is rather diminished than increased during its action. Again, the inflation of rhomboidal chains in the fibres is equally repugnant to the celerity of muscular motion, and to anatomy; they would also occasion an immense waste of strength, and after all render the muscle but little shorter. The nerves want that irritable nature which is observed in the muscular fibre. Finally, it is by no means demonstrable, that the fibres, from so few nerves, can be so numerous, or distributed in so many different transverse directions, with respect to the muscular threads, as those hypotheses require to be allowed. A complication of the nerves round the extremities of fibres, so as to contract them by their elasticity, is founded upon a false structure of the muscular fibre, supposing the nerves to be distributed, where filaments of the cellular substance only can be demonstrated. Moreover, the phenomena of animals, which, having neither brain nor nerves, are yet very apt for motion, apparently demonstrate the intrinsic fabric of the muscles to be sufficient for their motion, without other assistance from the nerves. Other explanations, derived from spherules of air in the blood, are founded on a false hypothesis, for the blood contains no elastic air. (See article *Respiration*). The animal spirits are not of the nature of an electric torrent.

If we may add any thing to these phenomena, we may suppose the nervous fluid to be of a stimulating nature, by which means it forces the elementary particles of the muscular fibre to approach nearer to each other. The motive cause which occasions the influx of the animal spirits into the

the mufcle fo as to excite it into action, feems not to be the foul, but a law derived immediately from God. For animals newly born, or newly transformed, without any attempt, or exercife, know how to execute compound motions, very difficultly to be defined by calculation; whereas the foul knows not how to perform any actions until fhe has learnt, by making experiments, the methods of performing them. A mufcle then is contracted when in a given time it receives more of the nervous fluid, whether that be occafioned by the will, or by fome irritating caufe arifing in the brain, or applied to the nerve.

But though we may fuppofe the foul to be the caufe of the nervous motion, we cannot do the fame with regard to that arifing from the vis infita. The heart and inteftines, and alfo the organs of generation, are governed by a vis infita, and by ftimuli. Thefe powers do not arife from the will; nor are they leffened, or excited, or fuppreffed, or changed by it. No cuftom nor art can make thefe organs fubject to the will, which have their motions from a vis infita; nor can they be made to obey the commands of the foul, like attendants on voluntary motion. It is fo certain that motion is produced by the body alone, that we cannot even fufpect any motion to arife from a fpiritual caufe, befides that which we fee is occafioned by the will; and, even in that motion which is occafioned by the will, a ftimulus will occafion the greateft exertions, when the mind is very unwilling.

There feems to be this difference between the mufcles obeying the will, and thofe which are governed by a vis infita; namely, that the latter, being more irritable, are very eafily excited into motion by a gentle ftimulus; as for inftance, the heart and inteftines; which organs are moft manifeftly, and greatly, and conftantly, irritable. On the other hand, the mufcles, which obey the will, are neither

endowed

endowed with fo great nor fo durable a power of this kind. Hence they either ftand in need of the power of the will, or of a ftronger ftimulus; when they are excited by a ftimulus, they are animated to motion againft the will. Thus it happens, that in apoplexies the mufcles which obey the will languifh, and become paralytic, as being deftitute of all influx from the brain; while the vital mufcles, having no occafion for the operation of the brain, continue to be excited into contraction by their ftimuli, independent of the will, as the heart by the blood, and the inteftines by the air and aliments.

The ftrength of the mufcles is very confiderable in all perfons, but more efpecially phrenetic and robuft men; fince frequently, with the ufe of a few mufcles only, they will raife a weight equal to, or much greater than, that of the whole human body. In a healthy man, very flender mufcles fuffice to lift 200 or 300 pounds. The mufcles of the back will even fuftain 3000. Notwithftanding this, we fee, that much the greater part of the force or power exerted by a mufcle is always loft without producing any vifible effect. For all the mufcles are inferted nearer the point or centre of motion, than the weights they are applied to; and therefore their action is weaker, in the fame proportion as they move a fhorter part of the lever than that to which the weight is applied. Moreover, in moft of the bones, efpecially thofe of the limbs, the mufcles are inferted at very acute angles; whence again the effect which a mufcle exerts in action is proportionally lefs as the fine of the angle intercepted between the bone and the mufcle is lefs than the whole fine. Again, the half of all mufcular force is loft, becaufe a mufcle, like an extended cord, exerts as much force at its fixed as at its moving extremity. Befides, many of the mufcles are feated in the angle of two bones; and when the joint is bent, the mufcle becomes alfo bent; confequently a quantity of force muft be firft applied to ftretch the mufcle, before the mufcle can act on the bone in which it is inferted. Many of them pafs over feveral joints, each of which they bend in fome degree, whereby a lefs part of their remaining force goes to bend the joint to which they are particularly deftined. The flefhy fibres themfelves of the mufcles frequently intercept angles with the tendon in which they terminate; whence their force is diminifhed in proportion to the fine of the angle of their infertion. Finally, the mufcles move their oppofed weights with the greateft velocity and expedition, fo as not only to overcome the equilibrium, but likewife to add a confiderable celerity to the weight.

All thefe loffes of power being computed, make it evident, that the force exerted by mufcles in their contraction, is exceeding great, and almoft beyond any mechanical computation. The effect is fcarce one-fixtieth of the whole force exerted by the mufcle, and yet only a fmall number of thefe mufcles, weighing but a few pounds, are able not only to raife fome thoufands of pounds, but alfo with a confiderable celerity. Nor is this to be reputed any defect of wifdom in the Creator: For all thofe loffes of power were neceffary for a juft fymmetry or proportion of the parts, and for various motions and celerities in different directions. But we may, however, conclude from hence, that the action of the nervous or animal fluid is very powerful, fince, in an engine fo fmall, it can exert a force equal to fome thoufand pounds for a confiderable time, even for many days together; nor does this feem to be otherwife explicable, than by the incredible celerity by which the influx of this fluid obeys the command of the will. But how or whence it acquires fuch a velocity, is not in our power to fay; it is fufficient that we know the laws of its motion are fuch, that a given action of the will produces a new and determinate celerity in the nervous fluid.

There are various means by which the motions of the mufcles are rendered more fafe, certain, and eafy. The large long mufcles, by which the greater motions of flexure are performed, being included in tendinous capfules or cafes, drawn and tightened by other mufcles, are thus fecured and ftrengthened; and thus the mufcle, in a ftate of contraction, remains preffed againft the bone all the time that the limb is bent, and confequently avoids a confiderable lofs of its power. The long tendons, which are incurvated or extended over joints in their motion, are received and confined by peculiar ligaments, which retain them within their flippery channels; and in thefe fheaths a particular liquor is feparated for the lubricating of the tendons. Nature makes a fimilar provifion for thofe mufcles which perforate others in their courfe. In other parts, the tendons are either carried round certain eminences of the bone, in order that they may be inferted at greater angles into the bone which they move; or elfe they are inferted into another bone, from whence a different tendon defcends under a larger angle into the bone to be moved. In other parts, the mufcles which are derived from convenient fituations, have their tendons carried round in a contrary direction by nature, fo that they pafs into the part to be moved as it were round a pulley. Nature has likewife furrounded the mufcles on all fides with a confiderable quantity of fat, which is fpread alfo between their bundles of fibres, and alfo between the fmall fibres themfelves: Which fat, being preffed out by the turgefcence of the mufcles and fibres, renders them foft, flexible, flippery, and fit for motion.

Moreover, the power and action of one mufcle is determined by the co-operations or oppofitions of others, which

ferve

ſerve either to hold firm ſome part from whence the muſcle ariſes, or to bend it together with the muſcle, or elſe to change its action from the perpendicular to the diagonal, by concurring to aſſiſt its force at the ſame time. Remote muſcles often aſſiſt each other, the ſuperior muſcles keeping the bone, whence the inferior acting muſcles ariſe, firm and ſteady. Therefore, the action of no one muſcle can be underſtood from conſidering it alone; but all the others, which are either inſerted into the muſcle itſelf, or into any of the parts to which the muſcle adheres, muſt likewiſe be brought into the conſideration.

By theſe muſcles, variouſly conſpiring and oppoſing each other, are performed walking, ſtanding, flexion, extenſion, deglutition, and all the other geſtures and offices of the ſeveral parts in the living body. But the muſcles have likewiſe ſome common actions, by which they are of uſe to the whole animal. They haſten the return of the venous blood, by preſſing it out both from the veins of the muſcles themſelves, and from the veins which lie between them; for the blood in theſe veſſels, diſtributed between the turgid bundles of a contracted muſcle, is, by the valves, determined towards the heart: They likewiſe return the fat to the blood;. and ſhake, grind, or condenſe the arterial blood, and return it quicker to the lungs; they contribute in a great degree to the ſecretions and excretions: Again, in the liver, meſentery, womb, &c. they promote the courſe of the contained blood, bile, and other juices, ſo as to leſſen the danger of their ſtagnation: They ſerve alſo to increaſe the ſtrength of the ſtomach, by adding their own ſtrength to it, whereby digeſtion is promoted; inſomuch that all ſedentary and inactive courſes of life are contrary to nature, and pave the way to diſeaſes from a ſtagnation of the humours, or from a corruption or crudity of the aliments. The large muſcles, which are generally

generally placed round any of the cavities of the body, propel the blood contained in that cavity, and prefs it towards the heart. By too much exercife or action, the mufcles themfelves grow hard and tendinous on all fides; they render the parts upon which they are incumbent cartilaginous, or elfe change thofe which are membranous into a bony nature; they increafe the roughnefs, protuberances, and proceffes, of the bones which lie next to them, and excavate their flat parts; they dilate the cells of the diploe, and incurvate the bones.

The mufcle which the ftimulus has ceafed to irritate, or for the action of which the mind has no occafion, is relaxed, and grows foft; its wrinkles grow plain; its fibres are rendered longer, receding from the middle towards the fixed extremities: and its fwelling falls. Whatever is the caufe of additional contraction is then taken away; but the vis infita remains. It may be afked, What becomes of the fpirit that is fent from the brain? A part of it perhaps exhales; a part of it may be fufpected to adhere to the fibre; and thus it happens that the mufcles grow ftrong with exercife, and their brawny parts become thicker.

"The three noted claffes of animal powers, *elafticity*, *irritability*, and *fenfibility*, Dr Wrifberg obferves, have been and are yet too much confounded, although it is no difficult tafk to diftinguifh thefe affections from one another. The elafticity and cohefion of the fibres, which in different degrees, are found in every part of the body, was fully known to Bellini, Baglivi, Stahl, Pacchioni, Juncker, &c. That power, known to Stahl's followers under the appellation of *tone*, has no fimilarity to irritability, fenfibility, and what is called vital power. It either alone performs the various actions of the animal and vegetable body, or adds ftrength and vigour to them: The former is manifeft in the motion of the ribs

and

and cartilages; and the latter in the conftruction of the uterus, veffels, and membranes. It by no means depends on the vital powers, but may endure long after death; it is not completely deftroyed even by putrefaction. During life it is diminifhed by various caufes, and again reftored by feveral remedies. Irritability, which Haller thought exifted in the fibres of the mufcles alone, and which indeed was known by name, but not in reality to Gliffon, is a kind of animal power, unknown to earlier anatomifts, and is different from that power which Hippocrates calls ενορμουν. It is proved, from the experiments of Lups, Haller, Fontana, Hoffman, and feveral others, to differ from elafticity in its rife, duration, feat, caufes, effects, and phenomena. We fhall add a few remarks:

1. It is moft powerful in the mufcular fibres of the whole body, but not equally difperfed through all; more powerful in the heart, mufcles of refpiration, and inteftines, but becomes gradually weaker among the voluntary mufcles; and it exifts perhaps, in a fmall degree, in the veffels and membranes, as appears from the doubts offered by Whyte, De Haen, Van Doeveren, &c. which Haller and the learned Cigna have anfwered.

2. The phenomena of irritability, and the irritations themfelves by which thefe phenomena are produced, are not always the fame: In fome parts we conftantly perceive a manifeft irritability produced by every irritation, as is the cafe in almoft all the mufcles. In many other parts you fee the greateft inconftancy and very irregular effects, varying differently, at different times, being fometimes increafed and fometimes diminifhed, at one time yielding to, and at another refifting the irritations: All which is evident in the fkin, vifcera, veffels, and iris.

3. The learned pathologifts Eller, Tiffot, and Gerhard, have long ago acknowledged the great ufe of the doctrine of

of irritability. It would be of much importance to know the remedies, which particularly conduce to excite irritability, when it is languid, or to diminiſh it when it is too great. Opium, and the other narcotics, camphor, cantharides, acrid poiſons, bark, the electric ſhock ſhew a clear influx of animal ſpirits in the production of irritability.

4. That it is different from the ſentient faculty, and therefore by no means depends upon the nerves, appears partly from other reaſons, and partly from the irritability of vegetables. Though I even wiſh to take into account ſome phenomena of the dionaea muſcipula, according to Ellis's obſervations, or of the hedyſarum or the antherae of certain other plants, I would be averſe to compare this contractile power of ſome parts of vegetables with irritability; for the internal tremor of the conſtituent parts, which makes the particular character of irritability, is wanting in all vegetables; we ſee contraction and motion alone, which are alſo obſervable in other elaſtic bodies, where we ſuppoſe no irritability to exiſt. The ſentient faculty, depending ſolely upon the nerves, although it has been regarded as one and the ſame thing with irritability, has been more ſtrongly oppoſed by Haller's opponents, De Haen, Whyte, Le Cat, Gerhard, &c. than irritability itſelf. The ſenſibility of the parts is to be referred both to the various quantity of the nerves, their ſituation and ſtate, according to Haller's and Caſtell's experiments, and to the various violence of irritation, and the nature of the irritating or offending body; for ſome parts are frequently much affected at one time and leſs at another, and Haller thinks that ſome of them may ſometimes be altogether inſenſible. I ſhall not repeat what has been often offered on the opinion, that a greater pain having preceded, abſorbs a leſs pain following; thus we do not feel the taſte of a drop of wine if we have taken a very ſmall quantity of rectified alcohol upon the tongue a little before. It cannot however be denied, that in

inflammatory

inflammatory difeafes, affections of the mind, and other caufes, it may happen, that hurt parts may feel, which, under any other condition, feem infenfible. The *vital power* of certain learned men of later times, as Vanden Bos, Bikker, Gaubius, Albinus, &c. feems rather compounded of all the animal powers comprehended together; which opinion, except in fome minutiae, the great Boerhaave and Simpfon have more exactly adopted."

As the doctrine delivered above, concerning the exiftence of a *vis infita* different from the *vis nervea*, has been the caufe of confiderable debate, and is at prefent called in queftion by feveral anatomifts, particularly by Dr Monro, we think it neceffary to give a few objections as ftated in his Obfervations on the Nervous Syftem. The chief experiment, fays the Doctor, which feems to have led Dr Haller to this opinion, is the well known one, that the heart and other mufcles, after being detached from the brain, continue to act fpontaneoufly, or by ftimuli may be roufed into action for a confiderable length of time; and when it cannot be alleged, fays Dr Haller, that the nervous fluid is by the mind or otherwife impelled into the mufcle.

That in this inftance, we cannot comprehend by what power the nervous fluid or energy can be put in motion, muft, perhaps, be granted; But has Dr Haller given a better explanation of the manner in which his fuppofed vis infita becomes active?

If it be as difficult to point out the caufe of the action of the vis infita as that of the action of the vis nervea, the admiffion of that new power, inftead of relieving, would add to our perplexity.

We fhould then have admitted, that two caufes, of a different nature, were capable of producing exactly the fame effect;

effect; which is not in general agreeable to the laws of nature.

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

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

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

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

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

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

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

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

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SYSTEM OF ANATOMY,

WITH THE

PHYSIOLOGY.

PART III.

CONTAINING

EIGHT ANATOMICAL TABLES

OF THE

HUMAN BODY;

Exhibiting the Principal PARTS of the

SKELETON AND MUSCLES

REPRESENTED IN THE

LARGE TABLES OF ALBINUS.

TO WHICH ARE ADDED

CONCISE EXPLANATIONS.

BY JOHN INNES.

WITH THE ADDITION OF

TWO TABLES AND EXPLANATIONS,

EXHIBITING

The differences between the Male and Female Bones of the Pelvis.

TO THE

MEDICAL SOCIETY.

GENTLEMEN,

I EMBRACE this opportunity of expreſſing my gratitude for the many favours I have received from you, both in your collective and individual capacity; but I am unwilling to offend either by encomiums on the utility of your inſtitution, or by exhibiting the private friendſhips with which I have been honoured by many of your number.

IN compliance with your ſolicitations, I lately publiſhed a ſhort Deſcription of the Human Muſcles, which has been fortunate enough to receive your approbation. It was, however, your opinion, that a ſet of Tables would render the deſcriptions ſtill more perfect and uſeful. I have, therefore, cauſed the following plates to be engraved; and I hope they will not altogether diſappoint your expectations.

THE Tables of Albinus, though accurate and complete, are not, perhaps, on account of their ſize, the prolixity of the deſcriptions, and the number of references, ſo fully ſuited to the purpoſes of private diſſection as could be wiſhed.

To remedy this inconvenience, I have copied eight of Albinus's tables on a ſmaller ſcale. Two of them contain a fore and back view of the ſkeleton; and the other ſix are repreſentations of the muſcles.

To each plate I have prefixed an explanation; and I have avoided, as much as was conſiſtent with perſpicuity, loading the figures with an unneceſſary quantity of referring letters. For this purpoſe, I have all along made uſe of one alphabet only.

To prevent the defacing of the muſcles, and to enable the learner to diſtinguiſh them without the aſſiſtance of references, the figures are only lettered on one ſide.

IF this little work be of uſe in facilitating your anatomical ſtudies, it will give the greateſt pleaſure to,

GENTLEMEN,

Your very much obliged humble ſervant, and
Fellow-member,

JOHN INNES.

TAB. I.

D Lizars Sculp.

EXPLANATIONS

OF THE

SKELETON AND MUSCLES,

AS REPRESENTED IN THE

TABLES.

TABLE I.

THIS figure reprefents a front view of the human ſkeleton, with ſome of the ligaments and cartilages, which connect the bones to each other.

HEAD AND NECK.

a, Os frontis.

b, Os parietale.

Between *a* and *b*, part of the coronal ſuture.

c, The pars ſquamoſa of the temporal bone.

Between *b* and *c*, the ſquamous ſuture.

Below the pars ſquamoſa, the zygoma; and, lower down above *f*, the maſtoid proceſs.

Between the pars ſquamoſa and the cavity, which contains the eye-ball, called *orbit*, the temporal proceſs of the ſphenoid bone is ſeen.

d, Os

d, Os malae.

Above *d*, a portion of the tranſverſe ſuture.

e, Os maxillare ſuperius, with the eight teeth of the right ſide.

The naſal proceſs of the ſuperior maxillary bone has the os naſi joined, by the lateral naſal ſuture, to its inſide; and at the outſide, within the orbit, the os unguis.

The oſſa naſi joined to each other before, by the anterior naſal ſuture.

f, Os maxillare inferius with ſixteen teeth; the four anterior named *inciſores*, the two corner ones *canini*, and the five poſterior on each ſide, *molares*.

Oppoſite to *f*, the angle of the lower jaw; above *f*, the condyloid proceſs, by which the jaw is connected to the temporal bone, at the root of the zygoma; and behind the os malae, the coronoid proceſs.

g, The ſeven cervical vertebrae, with their intermediate cartilages.

Oppoſite to *g*, their tranſverſe proceſſes.

TRUNK.

a, Sternum.

a, Its middle piece, to which one half of the cartilage that connects the ſecond rib, the whole of the cartilages of the third, fourth, fifth, ſixth, and one half of the ſeventh, are fixed.

Above *a*, the firſt or upper triangular piece, to which the clavicle and one half of the cartilage that connects the ſecond rib are fixed.

Below *a*, the extremity, or third piece of the ſternum, named *cartilago enſiformis*, to which one half of the cartilage that connects the ſeventh rib is fixed.

b, The ſeventh or laſt true rib.

c, The

c, The twelfth, or laſt of the five falſe ribs.

d, The five lumbar vertebrae, with their intermediate cartilages.

Oppoſite to *d*, their tranſverſe proceſſes.

e, The os ſacrum, with its five diviſions.

f, Os innominatum, divided into

g, Os ilium,

h, Os pubis,

i, Os iſchium.

Oppoſite to *i*, the foramen thyroideum.

SUPERIOR EXTREMITY.

a, The clavicle fixed before, to the firſt piece of the ſternum, and outwards to the acromion of the ſcapula.

b, The ſcapula.

Above *b*, the cervix of the ſcapula.

Oppoſite to it, the inferior coſta; and below the outward extremity of the clavicle, the ſuperior coſta, and coracoid proceſs are ſeen.

c, The os humeri.

The upper end of it, which is connected to the cavity of the ſcapula, named *glenoid*, below the acromion, is named its *head* or *ball*; on each ſide of which is ſeen a tubercle, named *external* and *internal*; and between theſe, a groove for lodging the long head of the biceps flexor cubiti.

d, The internal condyle.

e, The external condyle.

Between *d* and *e*, the trochlea, upon which the ulna moves.

f, The radius.

The upper end, which moves on the external condyle of the os humeri, is named its *head*; below that, the tubercle for the inſertion of the biceps flexor cubiti, and between theſe the cervix.

The inferior end of it is connected to the carpus.

g, Ulna.

The upper end of it forms the coronoid proceſs for the inſertion of the brachialis muſcle.

The inferior end has a proceſs named *ſtyloid*, which is connected to the carpus by a ligament.

h, The carpus, formed of eight bones.

i, Metacarpal bone of the thumb.

k, The metacarpal bones of the four fingers.

l, The two joints of the thumb.

m, The three joints or phalanges of the fore-finger; and the ſame are ſeen in each of the other three.

INFERIOR EXTREMITY.

a, Os femoris.

The upper end of it is named its *head* or *ball*, which is lodged in a deep ſocket of the os innominatum, named *acetabulum*.

Between the head and trochanter major, the cervix.

b, Trochanter major.

c, Trochanter minor.

d, Internal condyle.

e, External condyle.

f, Patella.

The place where it moves upon the os femoris, is named *trochlea*.

g, Tibia.

Between the tibia and the condyles of the os femoris, the ſemilunar cartilages are ſeen; and below the joint, the tubercle of the tibia.

h, Fibula.

i, Malleolus internus.

k, Malleolus

TAB. II.

D. Lizars Sculp.

k, Malleolus externus.

l, Os calcis.

Between *l* and *m*, the other ſix bones of the tarſus.

m, Metatarſal bones of the four toes.

n, The three joints, or phalanges of the four toes.

o, Metatarſal bone of the great toe.

p, The two joints of the great toe.

TABLE II.

THIS Table repreſents the firſt Layer of Muſcles ſituated on the anterior part of the whole body, immediately under the common Integuments and tendinous Faſciae.

MUSCLES *ſituated on the* HEAD *and* NECK.

a, The anterior fleſhy belly of the occipito-frontalis ſituated on the os frontis.

Above *a*, the tendinous oponeuroſis of the occipito-frontalis, covering the upper part of the parietal bones.

b, Attollens aurem.

Under it, the tendinous aponeuroſis covering the temporal muſcle.

Anterior auris between *c* and the ear.

c, Orbicularis palbebrarum.

Its tendon is ſeen at the inner canthus, fixed to the naſal proceſs of the ſuperior maxillary bone.

Levator labii ſuperioris alaeque naſi.

Seen divided into two portions running down along the ſide of the noſe; and on the outſide of it, the levator anguli oris.

Next this, the

Zygomaticus minor.

Farther outwards,

Zygomaticus major.

On the ala and tip of the noſe, the

Compreſſor naris.

d, Depreſſor anguli oris.

And beneath it, a portion of the depreſſor labii inferioris.

e, Orbicularis oris.

f, Platyſma-myoides.

Behind *f*, the sterno-cleido-maſtoidaeus is ſeen through the platyſma-myoides.

TRUNK.

a, Pectoralis major.

The upper part of it is covered by the origin of the platyſma-myoides.

b, Serratus magnus.

The other portions reſemble this.

c, Latiſſimus dorſi.

d, Obliquus externus deſcendens.

e, Linea ſemilunaris.

f, Linea alba.

Below *f*, umbilicus.

Between *e* and *f*, the rectus abdominis; and, at the inferior part of the linea alba, oppoſite to *g*, the pyramidales appear through the tendons of the oblique muſcles.

g, Ring of the external oblique muſcle; with the ſpermatic chord, paſſing through it, and covered by the cremaſter muſcle.

SUPERIOR

SUPERIOR EXTREMITY.

a, Deltoides.

Above the clavicle, a portion of the trapezius is ſeen.

b, Biceps flexor cubiti.

At the bending of the arm are ſeen its tendon going towards the radius; and the part, from which the tendinous aponeuroſis that covers the fore-arm, is cut off.

On the inſide of the biceps, part of the triceps extenſor cubiti; and on the outſide, part of the brachialis internus.

c, Supinator radii longus.

d, Pronator teres.

e, Palmaris longus.

f, Palmaris brevis.

On the palm of the hand, the aponeuroſis palmaris is ſeen extended from the annular ligament at the wriſt, to the roots of the metacarpal bones of the four fingers.

g, Flexor carpi radialis.

h, Part of the flexor ſublimis perforatus.

i, Inſertion of the flexor carpi ulnaris.

k, Abductor pollicis.

INFERIOR EXTREMITY.

a, Tenſor vaginae femoris, the vagina or tendinous faſcia being cut off.

On the outſide of it a portion of the glutaeus maximus.

b, Part of the iliacus internus.

On the inſide of it, between *b* and *c*, part of the pſoas magnus.

c, Pectinalis.

d, Triceps longus.

e, Gracilis.

f, Sartorius.

g, Rectus

g, Rectus cruris.

Its tendon is ſeen inferted into the patella, from which a ſtrong tendon is ſent to be fixed to the tubercle of the tibia.

h, Vaſtus externus.

i, Vaſtus internus.

k, Tibialis anticus.

l, Peronaeus longus.

On the outſide of it, a portion of the ſolaeus.

m, Extenſor longus digitorum pedis, with the peronaeus tertius, and extenſor proprius pollicis pedis.

n, Gaſtrocnemius externus, ſeu Gemellus.

o, Solaeus.

p, Ligamentum tarſi annulare.

q, Abductor pollicis pedis.

TABLE III.

THIS Table repreſents the ſecond Layer of Muſcles on the anterior Part of the whole Body.

MUSCLES *ſituated on the* HEAD *and* NECK.

a, Corrugator ſupercilii.

b, Temporalis.

c, Maſſeter.

d, Levator anguli oris.

e, Buccinator.

f, Orbicularis oris.

Oppoſite to the right ala naſi, the portion of this muſcle which Albinus names

Naſalis labii ſuperioris.

g, Depreſſor

TAB. III.

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g, Depreſſor labii inferioris.

h, Sterno-cleido maſtoideus, which is

Seen below, ariſing frcm the ſternum and clavicle, by two heads.

i, Sterno-hyoidaeus.

On the outſide of it, the

Omo-hyoidaeus.

Further out, a portion of the

Hyo-thyroidaeus.

k, Levator ſcapulae.

TRUNK.

a, Subclavius.

b, Pectoralis minor.

c, Serratus magnus.

d, Rectus abdominis, divided into ſeveral fleſhy portions by its tendinous interſections.

e, Pyramidalis.

f, Obliquus aſcendens internus.

g, Spermatic cord, with the origin of the cremaſter muſcle.

SUPERIOR EXTREMITY.

a, Biceps flexor cubiti.

b, Short head of the biceps.

Beneath the upper part of it, a portion of the coraco-brachialis.

Beneath the under part, a portion of the brachialis internus.

c, Long head of the biceps.

At the bending of the arm, the tendon of the biceps, and the place where the tendinous aponeuroſis was cut from it, are ſeen.

d, Extenſor carpi radialis longior.

Beneath

Beneath it a portion of the
Extenfor carpi radialis brevior.

e, Flexor fublimis perforatus.

f, Infertion of the extenfor carpi ulnaris.

g, Extenfors of the thumb.

h, Opponens pollicis.
On the infide of it a portion of the
Flexor pollicis brevis.

i, Tendon of the flexor longus pollicis manus, after paffing through the flexor brevis pollicis manus.

k, Abductor minimi digiti manus.

l, Flexor parvus minimi digiti manus.

m, Ligamentum carpi annulare.

INFERIOR EXTREMITY.

a, Iliacus internus.
Between *a* and *b*, part of the pfoas magnus.

b, Pectinalis.

c, Triceps longus.

d, Gracilis.

e, Rectus cruris cut off near its origin.

f, Tendon of the rectus cruris cut off above the patella, from which a ftrong tendon is fent to be inferted into a tubercle of the tibia.

g, Portion of the glutaeus medius.
On the infide of it, part of the glutaeus minimus.

h, Vaftus internus.

i, Vaftus externus.

k, Cruraeus.

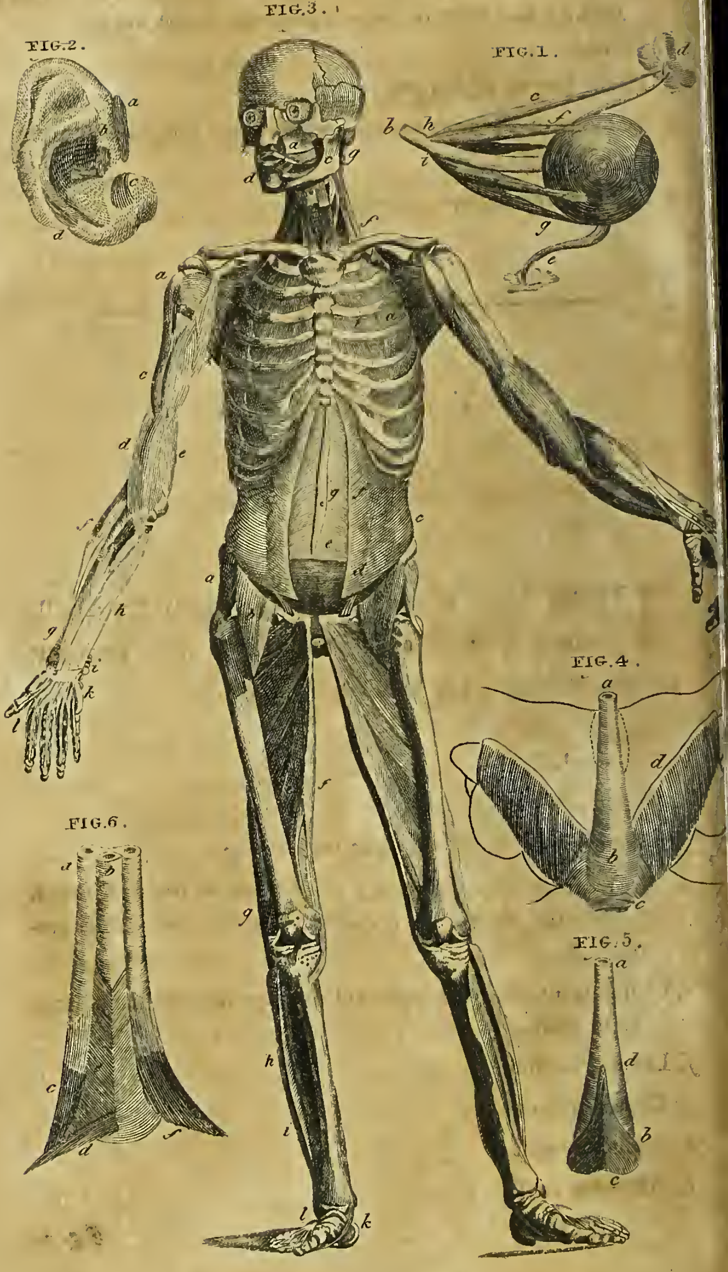
l, Infertion of the biceps flexor cruris into the fibula.

m, Tendons of the gracilis and femitendinofus inferted into the tibia.

n, Solaeus.

o, Peronaeus longus.

TAB. IV.



D.Lizars Sculp!

p, Extenſor longus digitorum, with the peronaeus tertius on the outſide, and extenſor pollicis proprius on the inſide.

q, Solaeus.

r, Flexor longus digitorum.

ſ, Tendons of the tibialis poſticus and flexor longus digitorum pedis.

t, Flexor brevis digitorum pedis.

TABLE IV.

Fig. 1.

THIS Figure repreſents the right Eye-ball, the ſix Muſcles which move it, taken out of the orbit, with the Optic Nerve.

a, The eye-ball,

b, Optic nerve.

c, Muſculus trochlearis, ſeu obliquus ſuperior.

d, The trochlea, or pully, with a piece of the os frontis through which the tendon of the muſcle paſſes towards the eye-ball.

e, Obliquus inferior, with a piece of the ſuperior maxillary bone, from whence it ariſes.

f, Levator oculi.

g, Depreſſor oculi.

h, Adductor oculi.

i, Abductor oculi.

Fig. 2.

Fig. 2.

Reprefents the anterior Part of the Cartilage of the right Ear, with its proper Mufcles.

a, Helicis major.

b, Helicis minor.

c, Tragicus.

d, Antitragicus.

Tranfverfus auris, *vid.* Tab. viii. fig. 3.

Fig. 3.

Reprefents the third Layer of Mufcles, with fome of the Ligaments, Cartilages, and naked bones on the anterior Part of the whole Body.

a, Depreffor labii fuperioris alaeque nafi.

b, Orbicularis oris, after moft of the mufcles, which are fixed to it, and affift to form it, have been taken away.

c, Buccinator.

Above *c*, part of the pterygoidaeus externus is feen paffing behind the coronoid procefs of the lower jaw.

d, Levator labii inferioris.

e, Sterno-thyroidaeus.

Immediately above, and feemingly the continuation of it, the

Hyo-thyroidaeus.

f, Scalenus anticus.

Contiguous to it, on the infide, the

Scalenus medius.

Above it, a portion of the

Trachelo-maftoidaeus.

Between the fcalenus anticus, and fterno-thyroideus, and and hyo-thyroidaeus, the

Rectus

Rectus capitis anterius major, and
Longus colli.

TRUNK.

a, Third row of external intercoſtal muſcles.
The reſt appear in the ſame manner between the other ribs.

b, Third row of internal intercoſtal muſcles.
The reſt appear between the other ribs.

c, Tranſverſalis abdominis.

d, The place from which the inferior part of the tendon of the tranſverſalis, that paſſes before the rectus and pyramidalis muſcles, is cut off.
Between theſe portions of each ſide, the peritonaeum is laid bare, and the ligaments of the bladder which were formerly the umbilical arteries and urachus.
Between this portion and the os pubis, the ſpermatic cord is ſeen cut.

e, The inferior edge of the upper part of the tendon of the tranſverſalis, which paſſes behind the rectus, and immediately adheres to the peritonaeum.

f, The anterior lamella of the internal oblique, which joined the tendon of the external to paſs over the rectus.
Between *f* and *g*, the poſterior lamella of the internal oblique, joining with the tendon of the tranſverſalis, to paſs behind the rectus.

g, The place at the linea alba, from which the tendon of the external oblique, and anterior lamella of the internal, were cut off.
At *g*, Umbilicus.

SUPERIOR EXTREMITY.

a, Subſcapularis.

b, Teres minor.

c, Coraco-brachialis.

The part from which the ſhort head of the biceps flexor cubiti was cut off from it, is ſeen at its upper end.

d, Brachialis internus.

e, Brachialis externus, or third head of the triceps.

f, Extenſor carpi radialis longior, and with it the extenſor carpi radialis brevior.

Both theſe are diſtinctly ſeen in the right hand.

Between the tendon of the brachialis internus and extenſor radialis, the

Supinator radii brevis is ſeen.

g, Flexor longus pollicis manus, with the fleſhy portion of it which ariſes from the internal condyle of the os humeri.

h, Flexor profundus perforans, which ſplits into four tendons, which paſs under the ligamentum carpi annulare.

i, Pronator quadratus.

k, Adductor minimi digiti manus.

l, One of the lumbricales.

The other three appear in the ſame manner, along the tendons of the flexor profundus.

Behind theſe, the internal interoſſei are ſeen.

INFERIOR EXTREMITY.

a, Glutaeus minimus.

b, Iliacus internus.

On the inſide of it, between *b* and *c*, the pſoas magnus.

c, Obturator externus.

d, Adductor brevis femoris.

e, Adductor magnus femoris.

f, Gracilis which is

Seen inſerted into the inſide of the head of the tibia.

g, The ſhort head of the biceps flexor cruris.

h, Peronaeus

h, Peronaeus longus.

i, Peronaeus brevis.

Between thefe two peronaei and tibia, the tibialis pofticus is feen.

k, Tendon of the tibialis pofticus, covering the tendon of the flexor longus digitorum pedis.

l, Extenfor brevis digitorum pedis.

Fig. 4.

Reprefents the Lavatores Ani cut off from the Bones before, with their connection to the Extremity of the Rectum, and Bulb of the Urethra.

a, The urethra and its corpus cavernofum cut off.

b, Bulb of the urethra.

c, The circular fibres which furround the verge of the anus; by fome named *fphincter internus*.

d, The anterior edge of the levator ani, cut off from the os pubis, and fide of the pelvis.

Fig. 5.

Reprefents the anterior part of the fphincter Ani, and Bulb of the Urethra.

a, The urethra, and its corpus cavernofum cut.

b, Bulb of the urethra.

c, Left half of the fphincter ani, running obliquely upwards, to join with the right half.

d, The acute portion, which is inferted into the perinaeum.

Fig.

Fig. 6.

Reprefents the Corpora Cavernofa of the Penis, Corpus Cavernofum Urethrae, Acceleratores Urinae Tranfverfales and Erectores Penis.

a, Corpus cavernofum penis cut.

b, Urethra, and its corpus cavernofum cut.

c, Erector penis covering the crus.

d, Tranfverfalis penis.

e, Accelerator urinae.

f, Tranfverfalis penis alter, running along the infide of the left erector.

TABLE V.

REPRESENTS a Back View of the Human Skeleton, with fome of the Ligaments and Cartilages which connect the Bones.

HEAD AND NECK.

a, Os parietale, joined to its fellow by the fagittal future.

b, The os occipitis, joined to the parietal bones by the lambdoid future, which is between *a* and *b*.

c, Os malae.

d, Maxilla inferior, with a view of the teeth of both jaws from behind.

e, The feven cervical vertebrae.

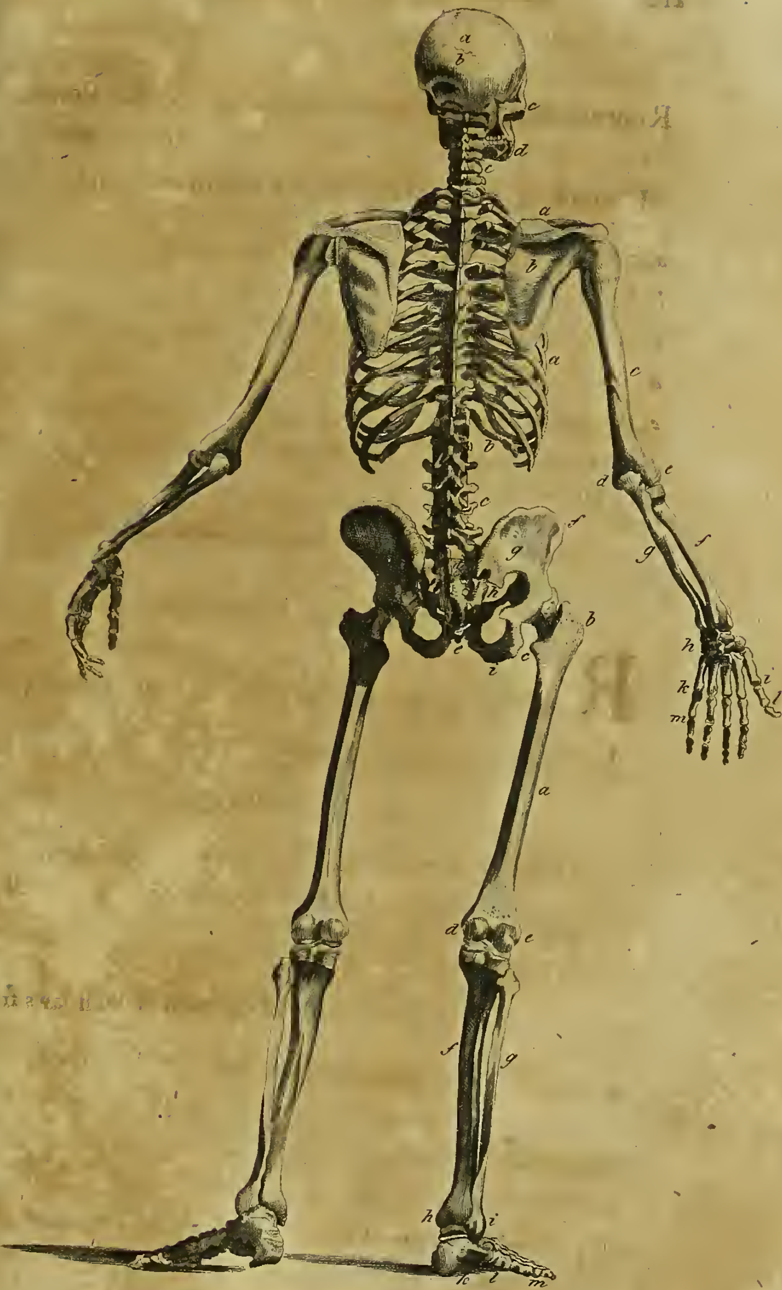
TRUNK.

a, The feventh or laft true rib.

b, The twelfth or laft rib.

c, The

TAB. V.



D. Lizars Sculp.

c, The five lumbar vertebrae.
d, Os ſacrum.
e, Os coccygis.
f, Os innominatum, divided into
g, Os ilium.
h, Os pubis.
i, Os iſchium.

SUPERIOR EXTREMITY.

a, The clavicle, joined outwards to the acromion of the ſcapula.
b, The ſcapula.
c, Os humeri.
d, Internal condyle.
e, External condyle.
f, Radius.
g, Ulna, its upper end, named *olecranon* ; and near the wriſt, its ſtyloid proceſs.
h, The eight bones of the carpus.
i, The metatarſal bone of the thumb.
k, The metatarſal bone of the four fingers.
l, The two joints of the thumb.
m, The three joints or phalanges of the four fingers.

INFERIOR EXTREMITY.

a, Os femoris.
b, Trochanter major, and at the inſide of it the cervix.
c, Trochanter minor.
d, Internal condyle.
e, External condyle.
f, Tibia.
g, Fibula.
h, Malleolus internus.
i, Malleolus externus.

k, The ſeven bones of the tarſus.

l, The metatarſus.

m, The joints or phalanges of the toes.

TABLE VI.

REPRESENTS a Back View of the Muſcles which are immediately ſituated below the common Integuments.

HEAD AND NECK.

a, Part of the occipito-frontalis muſcle, with its aponeuroſis.

b, Attollens aurem.

c, Anterior auris.

d, Retrahentes auris.

TRUNK.

a, Trapezius, ſeu cucularis.

b, Its tendinous edge joining with its fellow in the nape of the neck, which is called *ligamentum nuchae* ſeu *colli*.

c, The fleſhy belly of the latiſſimus dorſi.

d, The tendon of the latiſſimus dorſi, which ariſes in common with the ſerratus poſticus inferior.

e, Part of the obliquus externus abdominis.

SUPERIOR EXTREMITY.

a, Deltoides.

b, Infraſpinatus, with a portion of the teres minor and major below it.

c, Triceps

TAB. VI.

D. Lizars Sculp.

c, Triceps extenſor cubiti.

Its tendon is ſeen inſerted into the head of the ulna, called *olecranon*; and, on the inſide of it, the *anconaeus*.

d, Extenſor carpi radialis longior, covered by a portion of the ſupinator radii longus; and, under it, a portion of the extenſor carpi radialis brevior.

e, Extenſor digitorum communis manus, which ſplits into four tendons, and paſs with the indicator, under the ligamentum carpi annulare externum, at the extremities of the metacarpal bone, under ligaments proper to themſelves; and are loſt in a broad tendon, which covers the back of the four fingers.

f, Extenſor oſſis metacarpi pollicis manus.

g, Extenſor primi internodii pollicis manus.

h, Extenſor ſecundi internodii pollicis manus.

i, Extenſor carpi ulnaris.

k, Part of the flexor carpi ulnaris.

Under it, part of the

Flexor profundus perforatus.

And on the inſide, part of the

Flexor ſublimus perforatus, which are more diſtinctly ſeen on the right fore-arm. Likewiſe, on the right hand, are ſeen part of the abductor pollicis manus, abductor minimi digiti manus, and the aponeuroſis palmaris.

INFERIOR EXTREMITY.

a, Glutaeus maximus.

b, Part of the glutaeus medius.

c, Part of the tenſor vaginae femoris.

d, Vaſtus externus.

e, The long head of the biceps flexor cruris;

And beneath it,

f, Part of the ſhort head.

g Semitendinoſus;

g, Semitendinoſus:

And beneath it, on each ſide,

A portion of the ſemimembranoſus is ſeen.

h, Gracilis.

On the outſide of it,

A portion of the adductor magnus is ſeen.

i, A ſmall part of the vaſtus internus.

k, Gaſtrocnemius externus, ſeu gemellus;

And within its outer head,

A Portion of the plantaris.

l, Solæus ſeu gaſtrocnemius internus.

m, Tendo Achillis, with the plantaris.

n, Peronaeus longus.

o, Peronaeus brevis; between it and the tendo Achillis, a portion of the flexor longus digitorum pedis.

p, Tendons of the extenſor longus digitorum pedis, with the peronaeus tertius paſſing under the ligamentum tarſi annulare; and the flexor brevis digitorum pedis is ſeen beneath them.

q, Abductor minimi digiti pedis; and above it the tendons of the peronaeus longus and brevis, paſſing under proper ligaments of their own.

TABLE VII.

REPRESENTS the ſecond Layer of the Muſcles on the Back-part of the Body.

HEAD AND NECK.

a, Temporalis; its tendon is ſeen paſſing below the zygoma.

b, Maſſeter.

TAB. VII.

D. Livar. Sculp.

b, Maſſeter.

c, Splenius capitis et colli.

d, Portion of the complexus.

e, Levator ſcapulae, ſeu muſculus patientiae.

TRUNK.

a, Rhomboides major.

b, Rhomboides minor.

And immediately above it, the upper edge of the ſerratus poſticus ſuperior is ſeen.

c, The ſerratus poſticus ſuperior on the right ſide.

d, Serratus poſticus inferior.

e, Part of the ſpinalis dorſi.

f, Part of the longiſſimus dorſi.

g, Part of the ſacro lumbalis.

h, Serratus magnus.

i, The broad tendon, by which the latiſſimus dorſi begins, and from which the tendon of the ſerratus poſticus inferior is inſeparable.

k, Part of the obliquus internus aſcendens abdominis.

l, The ſphincter ani, fixed to the point of the os coccygis; at the ſide of which the coccygaeus, and a portion of the levator ani, are ſeen; and lower down, oppoſite to *l*, part of the tranſverſalis penis.

SUPERIOR EXTREMITY.

a, Supra-ſpinatus.

b, Infra-ſpinatus.

c, Teres minor.

d, Teres major.

e, Triceps extenſor cubiti.

f, Its head called *longus*.

g, The brevis: And,

h, A ſmall portion of the third head, named *brachialis externus.*

i, The tendon of the triceps, inſerted into the olecranon.

k, Part of the brachialis internus.

l, Anconaeus, which ſeems to be continued from that part of the brachialis externus immediately above it.

m, Extenſor carpi radialis longior; and beneath it, the brevior; both are ſeen at the wriſt, inſerted into the metacarpal bones of the fore and middle fingers.

n, Flexor carpi ulnaris.

o, Part of the ſupinator radii brevis.

p, Extenſor oſſis metacarpi pollicis manus.

q, Extenſor primi internodii pollicis manus.

r, Extenſor ſecundi internodii pollicis manus.

ſ, Indicator, inſerted into the root of the firſt joint of the fore-finger.

t, One of the three external interoſſei manus. The other two are diſtinctly ſeen without letters.

u, One of the tendons of the extenſors of the fingers cut; and the ſame is ſeen in each of the other three fingers, joining with the tendons and aponeuroſes of the interoſſei and lumbricales, and ſpread upon the back of the fingers.

N. B. On the right hand, part of the flexors of the fingers, the abductor pollicis and minimi digiti, are ſeen.

INFERIOR EXTREMITY.

a, Glutaeus medius.

b, Pyriformis.

c, The two muſcles called *gemini*, between which the tendon and fleſhy belly of the obturator internus paſſes over the tuberoſity of the os iſchium, are ſeen within the pelvis, partly covered by the coccygaeus and levator ani.

d, Quadratus femoris.

e, Vaftus externus.

f, *f*, Parts of the triceps magnus.

g, Long head of the triceps flexor cruris, and beneath it part of the fhort head is feen.

h, Semitendinofus, and beneath it parts of the femi-membranofus are feen on each fide of it.

i, Gracilis.

k, A fmall portion of the vaftus internus.

l, Poplitæus.

m, The flefhy belly of the plantaris; and its long flender tendon is feen paffing over the infide of the folæus.

n, Solæus.

o, The place where the tendon of the gemellus was cut off; but the flefh of the folæus runs farther down.

p, Tendon Achillis, with the plantaris.

q, Peronæus longus, paffing at the outer ankle to the fole of the foot; beneath it, the peronæus brevis to the root of the metatarfal bone of the little toe; and, between it and the tendo Achillis, a portion of the flexor longus digitorum pedis.

r, Tendons of the extenfor longus digitorum pedis, with the peronaeus tertius; and beneath thefe, the extenfor brevis digitorum pedis.

f, Flexor brevis minimi digiti pedis.

TABLE

TABLE VIII.

Fig. 1.

REPRESENTS the third Layer of Mufcles on the pofterior part of the Body, with fome of the Ligaments and naked Bones.

MUSCLES *on the* HEAD *and* NECK.

a, Part of the buccinator.

b, Complexus.

c. Trachelo-maftoidaeus; on the outfide of it, the tranfverfalis colli.

d, Scalenus medius.

e, Scalenus pofticus.

TRUNK.

a, Spinalis dorfi; and beneath it, the multifidus fpinae.

b, Longiffimus dorfi, which fends off a flefhy flip to the trachelo-maftoidaeus.

c, Sacro lumbalis, with the cervicalis defcendens fent off from it along the fide of the neck, and outfide of the tranfverfalis colli.

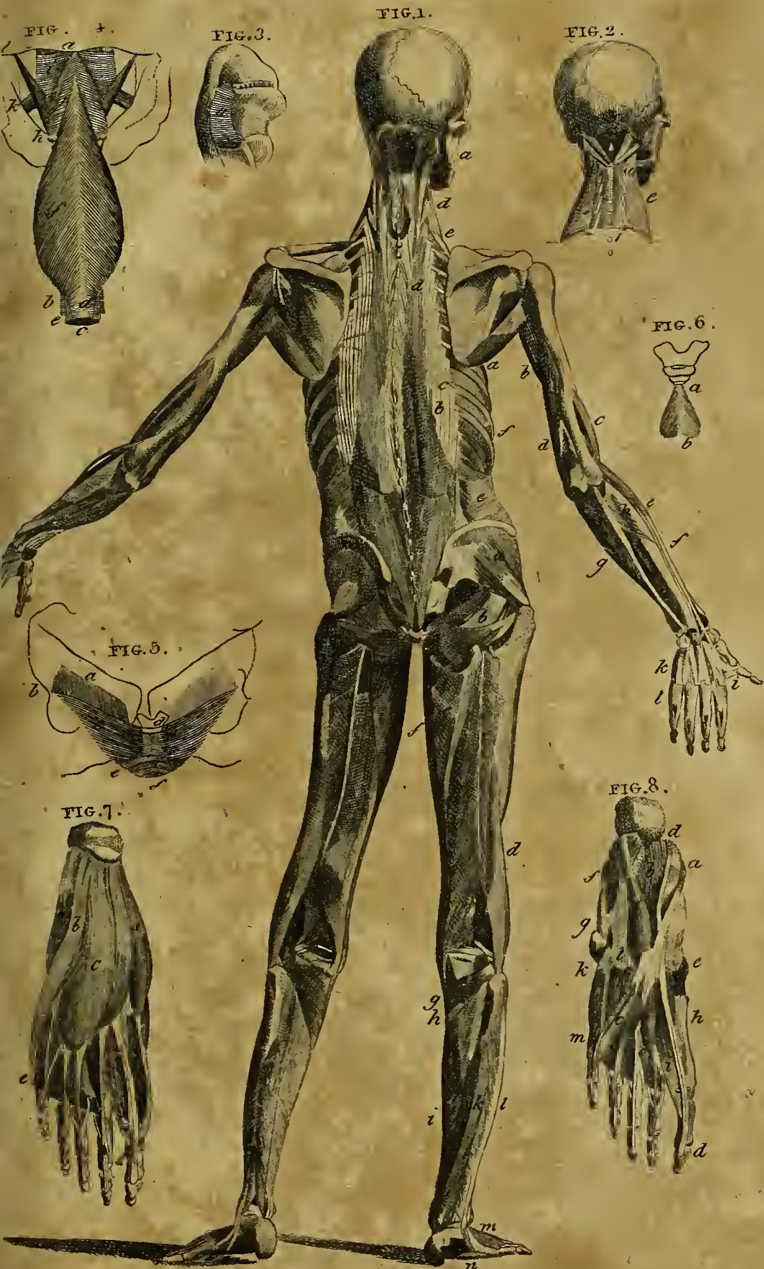
d, Semifpinalis dorfi.

e, Tranfverfalis abdominis.

N. B. The fpaces between the fpinous proceffes of the vertebrae have mufcular fafciculi between them, particularly thofe of the neck; and are named *interfpinales colli*, *dorfi*, and *lumborum*; but thofe of the back feem to be tendinous and ligamentous.

SUPERIOR

TAB. VIII.



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SUPERIOR EXTREMITY.

a, Teres major.

b, Part of the coraco-brachialis.

c, Part of the brachialis internus.

d, The third head of the triceps extenſor cubiti, called *brachialis externus*, after the longus and brevis have been cut off.

e, Extenſor radialis longior.

f, Extenſor radialis brevior.

g, Part of the flexor profundus perforans.

h, Supinator radii brevis.

i, Part of the adductor pollicis manus.

k, One of the three external interoſſei; the other two may be eaſily diſtinguiſhed without letters.

l, Tendons of the extenſors of the fingers, joining with thoſe of the lumbricales and interoſſei, which form a tendinous expanſion on the back of the four fingers.

N. B. On the right hand, part of the flexors of the fingers and thumb, part of the adductor pollicis, and the whole of the adductor minimi digiti, are ſeen.

INFERIOR EXTREMITY.

a, Glutaeus minimus.

b, Obturator internus; its fleſhy belly is ſeen within the pelvis. Beneath *b*, the tendon of the obturator externus.

c, Semimembranoſus.

d, The ſhort head of the biceps flexor cruris.

e, Triceps magnus.

f, Gracilis.

In the ham, the origins of the two heads of the gaſtrocnemius externus and plantaris are ſeen.

g, Poplitaeus.

h, Tibialis poſticus.

i, Flexor

i, Flexor longus digitorum pedis.

k, Flexor pollicis longus.

l, Peronaeus longus, running down to be inferted into the metatarfal bone of the little toe.

Beneath it, the peronaeus brevis, paffing to the fole of the foot.

m, Extenfor brevis digitorum pedis.

n, Part of the flexor longus digitorum pedis.

Fig. 2.

Reprefents the fourth Layer of Mufcles on the pofterior part of the Neck.

a, Rectus capitis pofticus major.

b, Rectus capitis pofticus minor.

c, Obliquus capitis fuperior.

d, Obliquus capitis inferior.

e, Scalenus medius.

f, Part of the multifidus fpinae, covered by the femifpinalis colli.

Between the fpinous proceffes of the vertebrae, the interfpinales colli are feen double; becaufe thefe proceffes are bifurcated.

Between the tranfverfe proceffes, the pofterior row of the intertranfverfales colli is feen.

Fig. 3.

Reprefents a portion of the pofterior part of the cartilage of the ear, to fhew,

a, Tranfverfus auris.

Situated on the parts oppofite to the antihelix and fcapha.

Fig.

Fig. 4.

Repreſents an outline of the Baſe of the Os Occipitis, and inſide of the Lower Jaw; with a view of the Muſcles which ſurround the back Part of the Larynx and Pharynx.

a, The upper part of the membrane of the pharynx.

b, The trachea, cut.

c, The oeſophagus, cut.

d, The inner tranſverſe fibres of the oeſophagus, laid bare.

e, The outer fibres deſcending obliquely backwards.

f, Conſtrictor inferior pharyngis.

g, Conſtrictor medius pharyngis.

h, The cornu of the os hyoideus.

i, Conſtrictor ſuperior pharyngis.

k, The part of it which joins with the buccinator.

l, Stylo-pharyngaeus.

Fig. 5.

Repreſents an outline of the Inſide of the Os Pubis, Os Iſchium, and Back of the Os Coccygis, after the Os Sacrum and Ligaments have been taken away; with a poſterior view of the Levatores Ani, and Extremity of the Rectum, reſembling the ſhape of a funnel.

a, The anterior portion of the levator ani, viewed on its inſide within the pelvis, ariſing from the os pubis and upper part of the foramen thyroidaeum.

b, Its origin from the ſpinous proceſs of the os iſchium.

c, The poſterior part ſeen on its outer ſide.

d, Its

d, Its infertion into the os coccygis, below which the flefhy fibres are continued with its fellow.

l, The circular flefhy fibres furrounding the extremity of the rectum, which authors name *fphincter internus ani.*

m, The anus.

Fig. 6.

Reprefents an outline of the Back of the Os Coccygis and pofterior part of the fphincter Ani.

a, The infertion of the fphincter ani into the extremity of the os coccygis; to which, from

b, The anus,

The fibres meet from each fide, in angles; which are more acute as they point upwards.

Fig. 7.

Reprefents the firft Layer of Mufcles on the Sole of the Foot, after the Aponeurofis Plantaris has been taken away.

a, Abductor pollicis pedis.

bb, Abductor minimi digiti pedis.

c, Flexor brevis digitorum pedis, which fplits into four tendons, that are perforated by the tendons of the flexor longus digitorum pedis.

Between thefe tendons the lumbricales are feen.

d, Tendon of the flexor pollicis longus.

And beneath it, the flexor pollicis brevis.

e, Tranfverfalis pedis.

TAB. IX.

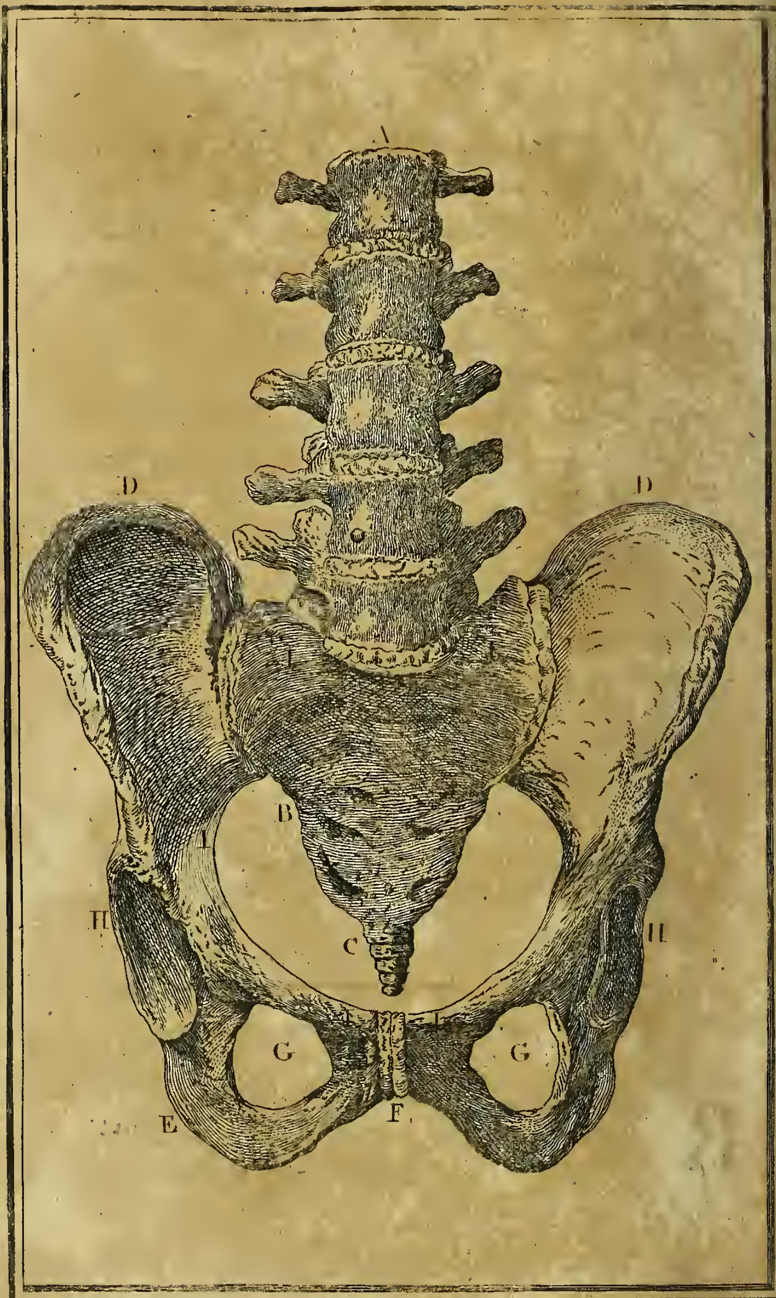

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Fig. 8.

Reprefents the fecond Layer of Mufcles on the Sole of the Foot, after the Abductor Pollicis Pedis, and Abductor Minimi Digiti Pedis, and the Flexor Brevis Digitorum Pedis, have been taken away.

a, Tendon of the flexor longus digitorum pedis.

bb, Flexor acceflorius, feu mafla carnea Jacobi Sylvii.

cccc, The four lumbricales arifing from the tendons of the flexor longus digitorum.

dd, Tendon of the flexor pollicis longus ; which, in its progrefs, joins the tendon of the flexor longus digitorum pedis.

e, Tendon of the tibialis anticus.

f, Tendon of the peronaeus longus.

g, Tendon of the peronaeus brevis.

h, Flexor pollicis brevis, with a portion of the abductor pollicis, on the infide of the great toe.

On the outfide of *i*, is the abductor pollicis.

k, Flexor brevis minimi digiti pedis.

l, A ligament which fupports the bones of the tarfus.

Before *l*, two of the interoflei are feen.

m, Tranfverfalis pedis.

TABLE IX.

REPRESENTS a front view of the Bones of the Pelvis in a Female Skeleton.

A, The five vertebrae of the loins.

B, The os facrum.

C, The os coccygis.

DD, The oſſa ilium.

EE, The oſſa iſchium.

F, The oſſa pubis.

GG, The foramina magna.

HH, The acetabula.

IIII, The brim of the pelvis, or that circumference of its cavity which is deſcribed, at the ſides by the inferior parts of the oſſa ilium, and at the fore and back parts by the ſuperior parts of the oſſa pubis and ſacrum.

In this table, beſides the general ſtructure and figure of the ſeveral bones, the dimenſions of the brim of the pelvis, and the diſtance between the under parts of the oſſa iſchium, are particularly to be attended to; from which it will appear, that the cavity of the brim is wider from ſide to ſide than from the back to the fore part; but that the ſides below are in the contrary proportion. In general, the brim of the female pelvis meaſures about five inches and a quarter from ſide to ſide, and four inches and a quarter from the back to the fore part, there being likewiſe the ſame diſtance between the inferior parts of the oſſa iſchium. All theſe meaſures, however, muſt be underſtood to be taken from the ſkeleton; for, in the living ſubject, the cavity of the pelvis is conſiderably diminiſhed by the integuments and contents.

TABLE

TAB. X.

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TABLE X.

REPRESENTS a lateral and internal View of the Pelvis, divided longitudinally.

A, The three lower vertebrae of the loins.

B, The os ſacrum.

C, The os coccygis.

D, The left os ilium.

E, The left os iſchium.

F, The left os pubis.

G, The acute proceſs of the os iſchium.

H, The foramen magnum.

III, The brim of the pelvis.

This plate ſhews the diſtance from the ſuperior part of the os ſacrum to the oſſa pubis, as well as from the laſt mentioned bones to the os coccygis, which in each amounts to about four inches and a quarter. The depths of the poſterior, lateral, and anterior parts of the pelvis are likewiſe ſhewn, not in the line of the body, but in the line of the pelvis, from its brim downwards, which is generally three times deeper on the poſterior than the anterior part, and twice the depth of this laſt on the ſides.

In this figure appears alſo the angle made by the projection of the laſt vertebra of the loins, and firſt of the ſacrum; and likewiſe the concavity or hollow ſpace in the poſterior internal part of the pelvis, ariſing from the curvature of the ſacrum and coccyx: Finally, the diſtance from the coccyx to the poſterior parts of the oſſa iſchium are alſo here expreſſed.

A
SYSTEM OF ANATOMY.

PART IV.

OF THE DIFFERENT CARTILAGES, LIGAMENTS, &c. OF THE FRESH BONES*.

OF THE HEAD.

THE condyloid proceffes of the os occipitis, the glenoid cavities or articular foffulae of the offa temporum, the eminences next thefe cavities, and the condyloid proceffes of the lower jaw, are all covered over with very white and fmooth cartilages; and there is likewife an interarticular or moveable cartilage in each articulation of the lower jaw with the temporal bones.

This cartilage is thick near the circumference; very thin and tranfparent, and fometimes perforated in the middle. The lower fide is uniformly concave, anfwering to the oblong convexity of the maxillary condyle; but the upper fide is partly concave, and partly convex, fuited to the foffula and eminence of the temporal bone. It is fixed by its circumference to the inner fide of the capfular ligament.

The

* The anatomy of the Frefh Bones in general, has been confidered in the firft part of this Work.

The remaining cartilages of the bones of the head, viz. the cartilaginous feptum, and other cartilages of the nofe, the fmall cartilaginous pulley in each orbit, the cartilages of the outer ear, and thofe which are joined to the os hyoides, muft be referred to the defcription of the vifcera.

The ligaments of the bones of the head are, Thofe of the articulation of the lower jaw with the temporal bones; thofe between the occipital bone and vertebrae of the neck; thofe by which the os hyoïdes is connected to the ftyloid procefs.

LIGAMENTS BY WHICH THE LOWER JAW IS FIXED TO THE TEMPORAL BONES.

Ligamentum capfulare, compofed of firm and ftrong fibres, fixed by one extremity round the glenoid or articular foffula and eminence of each temporal bone; by their middle round the interarticular cartilage, and by their other extremity round each condyle of the lower jaw, in fuch a manner as to allow the intermediate cartilage to follow the motions of the condyles, and to change their fituation from the glenoid cavities to the tubercles of the zygomatic proceffes, and to return again, as was mentioned in the defcription of the bones.

Ligamentum laterale maxillae inferioris, which arifes from the inner furface of the angle of the lower jaw, near the paffage where the veffels and nerves go into the bone, is fixed to the root of the ftyloid procefs, and to the pofterior margin of the articular cavity of the temporal bone. It affifts in keeping the jaw in its proper place.

LIGAMENTS BETWEEN THE OCCIPITAL BONE AND VERTEBRAE OF THE NECK.

Ligamenta capfularia, arife from the edges of the condyloid

loid procefs of the os occipitis, and are fixed to the edges of the fuperior oblique proceffes of the firft vertebra.

Ligamentum latum anterius, arifes from the fore part of the foramen magnum occipitis, and runs down to be fixed to the anterior arch of the firft vertebra of the neck.

Ligamentum latum pofterius, arifes from the pofterior margin of the foramen magnum occipitis, and is inferted into the upper part of the pofterior arch of the firft vertebra.

Ligamentum proceffus odontoidis feu perpendiculare, arifes from the fore-part of the foramen magnum, and runs down to be fixed to the proceffus dentatus of the fecond vertebra. This ligament is fhort, but remarkably ftrong; it affifts in fixing the head to the fpine, but is twifted in the rotation.

Ligamenta lateralia, are two fhort, but very ftrong ligaments, which run over from each fide of the proceffus dentatus to be fixed to the inner fide of the firft vertebra, and to the edge of the foramen magnum. See defcription of the Vertebrae.

Ligamentum cervicale feu nuchae, arifes from the fpinous procefs of the os occipitis, runs down upon the back-part of the neck, adhering to the fpinous proceffes of the cervical vertebrae, and giving origin to part of the trapezius mufcle.

The bones of the head, as well as all the other bones of the body, are covered by a particular membrane; but that which covers the cranium is termed *pericranium*, while that furrounding the other bones is called fimply *periofteum*.

The internal ftructure of the bones of the head being for the moft part cellular, they contain alfo diftinct portions

tions of marrow included in membranous cells lying in the diploe.

The ſynovial glands of the maxillary and occipital articulations have nothing particular to them; they are proportioned to the joints to which they belong, and lie between the capſular ligaments and circumference of the cartilages.

OF THE VERTEBRAE.

The cartilages of the vertebrae in general are of two kinds; one proper to each vertebra, the other common to two vertebrae that lie next each other. The firſt may be termed *cartilages of articulation;* the others, *cartilages of ſymphyſis.*

The proper articular cartilages of each vertebra of the ſpine, are thoſe four which cover the ſurfaces of the oblique proceſſes. In the natural ſtate, they are very white and ſmooth, and much thicker than in dry bones. Their circumference is the ſame with that of the articulated ſides of the proceſſes, except in thoſe places where there are ſmall ſuperficial notches. In the firſt vertebra of the neck, and vertebrae of the loins, theſe cartilages are thicker than in the reſt.

The cartilages of the two inferior oblique proceſſes of the firſt vertebra, and of the two ſuperior oblique of the ſecond, ſeem to be diſproportionate, though not ſo much as in dry bones; and in ſome ſubjects we find moveable or interarticular cartilages between the proceſſes of theſe two vertebrae.

The firſt vertebra of the neck has a cartilaginous covering on the back-part of the anterior arch, correſponding with another on the fore ſide of the proceſſus dentatus of the next vertebra; ſo that each of thoſe two vertebrae has

five

five articular cartilages, besides the interarticular ones already mentioned.

The vertebrae of the back, besides the four cartilages of their oblique processes, have others which do not belong to their articulations with each other, viz. those that cover the lateral fossula in the bodies of these vertebrae, and the fossulae of their transverse processes, by both of which they are articulated with the ribs.

The cartilages of symphysis lie between the bodies of the vertebrae, uniting them closely together; their breadth and circumference answering exactly to that of the surfaces to which they are connected; but their height or thickness is different in each class of the vertebrae. Between the vertebrae of the loins, they are a third or fourth part of an inch in thickness, according to the size of the subject: In those of the neck, they are not so thick; and the thinnest of all are between the vertebrae of the back.

These cartilages are not of an equal thickness in all their parts. Those on the neck and loins appear to be thickest on the anterior side, and those of the back rather thickest on the posterior side, but these differences are most remarkable in the vertebrae that lie near the middle of each class.

The internal structure of these cartilages is different from that of all the other cartilages of the body; and indeed they resemble the rest in nothing but in whiteness and elasticity. When we view their circumferences only they seem to be one uniform mass, as the others generally are; but when they are divided by an incision parallel to that surface of the vertebrae to which they are joined, we see they are composed of many cartilaginous concentrical lamellae contained within each other. The most external lamellae are fibrous, thickest, and firmest, and separated by considerable intervals: the internal approach nearer and nearer together,

becoming

becoming gradually thinner, and of a fofter confiftence, till at laft they are almoft in the form of a glairy liquor in the centre.

Thefe rings do not form an entire circumference; being turned inwards on the back-part, anfwering to the fore-part of the paffage for the fpinal marrow. They lie horizontally between the vertebrae. The interftices of the rings are filled with a mucilaginous fubftance, lefs fluid than that of the joints. Each lamina taken feparately is very pliable, according to its length; but taken together, they are not fo eafily bent, partly becaufe of their circular figure, and partly becaufe of their vicinity and multiplicity. They yield, however, in the inflections of the fpine; and their external furface, which in the ordinary fituation of the fpine is even with the furface of the vertebrae, becomes prominent or juts out on that fide towards which the inflection is made, the cartilages being then compreffed by the vertebrae.

They likewife yield on all fides, without any inflection of the fpine, to the weight of the upper part of the body: but this is done by very fmall and imperceptible degrees, and efpecially at the under part of the true vertebrae, and when the body is loaded with an additional weight.

They reftore themfelves afterwards merely by being freed from compreffion: So that a man is really taller after lying, than after he has walked or carried a burden for a length of time; the moft natural and fimple reafon that can be given for the different height of the fame perfon at different times, firft obferved in England, and afterwards confirmed by Mr Morand, a member of the Royal Academy of Sciences, being the different ftate of the intervertebral cartilages. According to Sabatier, &c. the fame perfon is fometimes more than four or five lines, or twelfths of an inch, higher in the morning than in the evening. The intervertebral cartilages of the neck, lying for the moſt part between the convex ſide of one vertebra, and the concave ſide of another, are of a greater extent in proportion to the ſize of theſe vertebrae, than thoſe of the back and loins. Without this convexity and hollowneſs in theſe vertebrae, which are the leaſt of all, the cartilages could not have been made large enough to reſiſt ſtrains and great exertions.

Ligaments *of the* Vertebrae.

The vertebrae are ſtrongly connected to each other by different kinds of ligaments; ſome of which are proper to a certain number of them, others are common to the whole.

Ligamentum tranſverſum vertebrae colli primae, ariſes from a rough protuberance on the inner ſide of the firſt vertebra, and goes acroſs to the other ſide behind the proceſſus dentatus, which it prevents from wounding the ſpinal marrow in the rotation of the head. About the middle of the fore-ſide, its texture is very cloſe where the proceſſus dentatus plays upon it.

The ligaments of the proceſſus dentatus of the ſecond vertebra have been already deſcribed.

Ligamentum anticum commune vertebrarum. One of the moſt remarkable is a ſtrong ligamentous band, which embraces their convex ſurface from the upper to the under end of the ſpine. It begins at the ſecond vertebra of the neck, and paſſes down as low as the os ſacrum, becoming gradually larger and ſtronger in its deſcent. The fibres of this ligament have a longitudinal direction; but it is much thicker in its middle that at its ſides. After it has arrived at the laſt lumbar vertebra, it ſpreads over the anterior ſurface of the os ſacrum, where it becomes thinner, and by degrees vaniſhes near the under end of this bone. Through its whole courſe it ſends off many ſmall proceſſes to be fix-

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ed to the bodies of the vertebrae, by which their connection is made more ſecure.

Ligamenta intervertebralia. Behind the former ligament each vertebra is connected to that above and below it by numerous, ſhort, but ſtrong ligaments, which croſs each other obliquely, and are fixed round the edges of the body of each vertebra. Theſe crucial ligaments cover the circumference of the intervertebral cartilages, and adhere cloſely to them. They ſeem to be looſer in the cervical and lumbar vertebrae than in thoſe of the back; and by that means yield to the cartilages in the different flexions of the ſpine already mentioned.

Ligamentum poſticum commune vertebrarum. The ſpinal canal is lined with a ligament ſomewhat ſimilar to that which covers the anterior convex ſurface of the vertebrae. It begins at the ſecond vertebra of the neck; and after having ſent a conſiderable proceſs, which paſſes behind the tranſverſe ligament of the firſt vertebra, to be fixed to the anterior part of the foramen magnum, it deſcends on all the other vertebrae, to end at the lower part of the os ſacrum. The real ligamentous fibres occupy little more than the middle of the bodies of the vertebrae. Thoſe which are ſtretched over the lateral parts are very thin, and properly ſpeaking purely membranous. Winſlow deſcribes this as a complete tube, while Weitbrecht denies its exiſtence at the back part of the canal; but admits of an additional membrane there adhering firmly to the dura mater. It is only attached to the ſuperior and inferior edges of the vertebrae, leaving at their middle a ſpace occupied by a kind of tranſverſe ſinus, which communicates with others ſituated longitudinally upon the ſides of the poſterior part of the whole canal.

Ligamenta interſpinoſa, are ſhort and firm ligaments, which run from the whole upper edge of the bony bridge and ſpin-

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ous proceſſes of one vertebra, to the correſponding parts of the vertebra next; and thereby joining the different vertebrae together, and dividing the muſcles on the right from thoſe on the left ſide of the ſpine.

Ligamenta intertranſverſalia, are ſhort ſmall ligaments placed between the extremities of all the tranſverſe proceſſes.

Ligamenta capſularia, are formed of numerous ſhort, ſtrong, ligamentous faſciculi, ariſing from and ſurrounding the oblique proceſſes of all the vertebrae. The two oblique proceſſes of the os ſacrum are joined to the inferior oblique proceſſes of the laſt vertebra of the loins, in the ſame manner as thoſe of the lumbar vertebrae.

Of the STERNUM and RIBS.

The ſternum of an adult has commonly ſixteen cartilages; fourteen of which are articular, the other two ſymphyſes. Of the articular cartilages, two belong to the articulations of the clavicles; and twelve to thoſe of the true ribs, from the ſecond to the ſeventh incluſive. The two ſymphyſes are thoſe between the ſternum and the firſt rib on each ſide.

There is likewiſe another ſymphyſes, by which the upper portion of the ſternum is connected to the lower; the cartilage of which is often obliterated in an advanced age. But at an early period of life this cartilage can be diſtinctly ſeen; and it allows a conſiderable degree of motion between theſe two bones.

The cartilago enſiformis is often bony towards the ſternum, and more or leſs cartilaginous at the other end. In very aged perſons it has been found entirely oſſified, and ſometimes wholly cartilaginous even in adults.

All the ribs have cartilaginous portions, which differ from each other in length, breadth, incurvation, adheſion,

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and in their extremities; all which were explained in the defcription of the fkeleton. We have only to obferve here, that thefe cartilages are whiter, more polifhed, broader, and thicker in the natural ftate than when they are dried. The cartilages of the falfe ribs are naturally more flender and pliable than thofe of the true ribs: The middle or inner fubftance acquires the confiftence of bones in old age; and their extremities fometimes offify, and are immoveably fixed to the fternum. The pofterior extremities of the ribs are likewife tipped with cartilage where they are joined to the vertebrae.

Ligaments *proper to the* Sternum.

Membrana fterni propria, is a firm expanfion, compofed of many tendinous fibres, running in different directions, but chiefly longitudinally, covering both the external and internal furface of the fternum. On the fore-part of the fternum the external fibres begin at the articulation of the cartilages of the ribs, and run acrofs in a radiated manner to their fellows on the oppofite fide, while the internal fibres have a longitudinal direction.

Ligamentum cartilaginis enfiformis, is compofed of tendinous fibres fimilar to the former, arifing from the cartilaginous extremity of the feventh rib and correfponding part of the fternum; and which, after defcending obliquely, are fixed to the cartilago enfiformis. The fibres of this are intermixed with thofe of the membrana fterni.

Ligaments *between the* Sternum *and* Ribs.

Ligamenta capfularia cartilaginum coftarum verarum, arife round the cartilages of the feven true ribs, to be fixed to the articular pits in the fides of the fternum. On the upper and under fide of each articulation, thefe ligaments are very fhort; but on the anterior fide many fibres are produced, which

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run in a radiated manner on the fore-part of the ſternum to the cartilages on the oppoſite ſide.

Ligaments *proper to the* Ribs.

Ligamenta coſtarum ipſarum propria, are ligaments by which the ribs are joined to each other. They deſcend ſomewhat in a perpendicular direction from the cartilage of each rib to that of the next; but the ligaments between the three laſt ribs are longer and looſer than thoſe of the reſt. Hence the two laſt ribs are leſs ſteady in their motions.

Ligaments *between the* Ribs *and* Vertebræ.

Ligamenta capſularia capitulorum majorum coſtarum, are ſhort ligamentous faſciculi which ariſe round the cartilaginous ſurface of the head of each rib, and are fixed to the circumference of the ſmall pits in the ſides of the bodies of the vertebrae and intervertebral cartilages.

Ligamenta capſularia capitulorum minorum, ariſe from the tubercles of the ten uppermoſt ribs, and are fixed round the articular pit on the point of the tranſverſe proceſſes of the vertebrae of the back; much in the ſame manner with thoſe between the heads of the ribs and vertebrae.

Ligamenta interna colli coſtarum, ariſe from the upper part of the neck of the ribs, and are fixed to the inferior ſurface of the tranſverſe proceſſes.

Ligamenta externa colli coſtarum, ariſe from the outer ſurface of the ſuperior margin of the neck of all the ribs. They aſcend obliquely, to be fixed near the inferior oblique proceſſes of all the vertebrae excepting the firſt.

Ligamenta duo ſpecialia, ariſe by a broad origin from the inferior margin of the laſt rib, and are fixed to the tranſverſe proceſs of the firſt and ſecond lumbar vertebrae.

The ligamentous expanſions of the vertebrae are in place

of

of a perioſteum: at leaſt they are blended together both on the inner and outer ſide of the ſpine. The ſternum and bony portions of the ribs have a perioſteum like the other bones.

The cartilaginous portions of the ribs are covered by a membrane of the ſame kind, termed *perichondrium.* As the internal ſtructure of theſe bones is cellular or ſpongy, they contain only ſmall ſeparate portions of marrow, or a red medullary juice, like that in the vertebrae.

The ſynovial glands of all theſe articulations are very ſmall; but are accompanied by many other fatty moleculae lying round each joint. The inner ſurface of the ligamentous ſubſtance which lines the bony canal of the ſpine, is lubricated by an oily, or adipoſe ſubſtance, which ſhall be mentioned hereafter.

Of the SUPERIOR EXTREMITIES.

The ſcapula in many ſubjects has a ſmall cartilaginous border along its whole baſis; which in children is tolerably diſtinct, but in adults it diſappears.

The glenoid cavity of this bone is covered with a cartilage, which is thicker towards the circumference than in the middle, and a little raiſed above the edge of the bone. This thickneſs of the cartilaginous circumference makes the cavity greater than it appears in the ſkeleton; and ſometimes, in its place, there is an additional border, which is thickeſt at the circumference of the cavity, thin toward the bottom, and very narrow. It is of a pliable ſlippery ſubſtance, yet ſomething different from that of a cartilage: reſembling, in ſome meaſure, the border of the acetabulum of the os innominatum.

The ſmall cartilaginous ſurface of the acromion, mentioned in the treatiſe of the dry bones, is thicker in the natural ſtate, and very little convex, and the triangular ſurface at the extremity of the ſpine of the ſcapula, near the baſis, is covered with a very thin cartilaginous lamina; but, being tranſparent, it does not appear very white. There are no other cartilages commonly found in the ſcapula: though we ſometimes obſerve in dry bones ſeveral places which ſeem to have been cartilaginous; but this is owing to the dried remains of ligaments and tendons.

The ſternal extremity of the clavicle is cruſted over with a cartilage which is a little convex, and covers its whole triangular ſurface; beſides which it has another moveable interarticular cartilage, reſembling that at the articulation of the lower jaw, and in ſome meaſure ſerving the ſame purpoſe. The ſmall cartilaginous ſurface of the ſcapular extremity of the clavicle, anſwering to that of the acromion, is much thicker in freſh than in dry bones, and appears, like that of the acromion, to be a little convex.

Between theſe two cartilages of the clavicle and acromion, there is in ſome ſubjects a thin interarticular cartilage very ſmooth on both ſides.

LIGAMENTS *of the* CLAVICLE *and* SCAPULA.

Ligamentum interclaviculare, is a long narrow ſtrong ligament which goes behind the furca of the ſternum, from the internal angle of one clavicle to that of the other.

Ligamenta capſularia antica claviculae, are ſhort and ſtrong ligaments ariſing round the ſternal extremity of the clavicle, near the edge of the triangular ſurface; and from thence paſſing over the interarticular cartilage, to which they adhere, are inſerted round the clavicular cavity of the ſternum.

Ligamentum rhomboideum, ariſes from the inferior rough ſurface at the anterior extremity of the clavicle, and running obliquely, is fixed to the cartilage of the firſt rib.

Ligamenta capſularia poſtica. The articulation of the

ſcapulary

ſcapulary end of the clavicle with the acromion, is ſtrengthened quite round by thick ſtrong ligaments which go from one bone to the other.

Ligamentum trapezoideum ſcapulae, ariſes from the internal ſurface of the coracoid proceſs of the ſcapula, and ends at the poſterior extremity of the clavicle.

Ligamentum conoideum ſcapulae, ariſes from the root of the coracoid proceſs, is inſerted into the rough protuberance of the poſterior extremity of the ſcapula.

Ligamentum proprium ſcapulae anticum, ariſes from the external ſurface of the coracoid proceſs, and is fixed to the poſterior margin of the acromion.

Ligamentum proprium ſcapulae poſticum, ariſes from the middle of the ſuperior margin, and terminates at the root of the coracoid proceſs. Under this ligament the veſſels and nerves paſs to the ſhoulder.

The cartilage which covers the head of the os humeri is thick in its middle; but becomes gradually thinner towards its edges.

The four ſurfaces of the tuberoſities which appear cartilaginous in dry bones, ſerve only for the inſertion of the tendons of the four muſcles which move the os humeri on the ſcapula.

The channel through which the tendon of the long head of the biceps muſcle runs between the tuberoſities, is covered partly by a thin cruſt, which appears rather ligamentous than cartilaginous; and partly by a tendinous ſtratum.

LIGAMENTS *between the* SCAPULA *and* OS HUMERI.

Ligamentum capſulare humeri, ariſes from the whole margin of the glenoid cavity of the ſcapula, and is fixed round the under end of the neck of the os humeri, looſely incloſing the head of this bone. The upper part of the ligament ſends down a ſheath between the two tuberoſities of the humerus, over the tendon of the long head of the biceps muſcle, which it accompanies as far as the fleſhy part and prevents it from ſliding out of the groove in which it is placed. The capſular ligament is ſtrengthened by other ligamentous bands which adhere firmly to its anterior ſurface; but what ſeems to give moſt force to the capſule are the tendons of the neighbouring muſcles, which increaſe its thickneſs conſiderably.

The trochlea, and ſmall head of the lower extremity of the os humeri, are covered by a common cartilage, in which the ſame proportion of thickneſs is obſervable as in that of the upper extremity. This is generally the caſe in all the convex articular cartilages. The foſſulae near the pulley are likewiſe covered with a kind of cartilaginous varniſh. The two ſigmoid cavities in the upper extremity of the ulna are covered by a cartilage common to both; which is a little interrupted, about the middle of the edges of the cavities, by the tranſverſe notches mentioned in the deſcription of the bones. This cartilaginous cruſt ſeems to be thicker at the edges than in the middle. The cartilage which covers the head of the radius is likewiſe turned over its cylindrical border; and a lateral portion of the muſcular tuberoſity, immediately below the neck, is alſo covered with a thin ſhining cartilage.

Ligaments *of the joint of the* Elbow.

Ligamentum capſulare, ariſes from the lower end of the os humeri, above the edge of the cartilaginous ſurface, and is fixed to the top of the ulna round the edge of the great ſigmoid cavity, including both the apex of the olecranon and that of the coronoid proceſs. It likewiſe runs over the head of the radius, and is fixed to the coronary ligament quite round. Thus it completely ſurrounds the articulation

culation of theſe three bones; and ſerves to contain the mucilaginous liquor in the cavity of the joint. It appears to be ſtrengthened by a ligamentous web; the fibres of which croſs each other in different directions: Beſides this, there are ſome tendinous fibres of muſcles to which the capſular ligament adheres very cloſely.

Near the under end of the body of the os humeri, there are two particular intermuſcular ligaments, which are long, narrow, and thin; but ſtrong, fixed by one end along the two lower thirds of the bone, and reaching to both condyles. They increaſe the ſurface for the origin of muſcles, and thereby ſupply the place of bones.

The lower extremity of the os humeri is alſo joined to the bones of the fore-arm by the two following faſciculi of ligamentous fibres.

Ligamentum brachio-cubitale ſeu laterale internum, ariſes from the fore-part of the internal condyle of the os humeri; and running down over the capſula, to which it cloſely adheres, is ſpread out in a radiated manner to be fixed to the inſide of the coronoid proceſs of the ulna. It is covered on the outſide by ſeveral tendons, which are connected cloſely to it, and ſeem to ſtrengthen it.

Ligamentum brachio-radiale ſeu laterale externum, is diſpoſed much after the ſame manner; but is of a greater extent. It is expanded from the external condyle of the os humeri, as from a centre, and is inſerted round the coronary ligament, and from thence down to the neck of the radius; and alſo in the neighbouring parts of the ulna. Through all this paſſage, it covers the capſular ligament, and is covered by ſeveral tendons, adhering cloſely to both.

Ligaments *joining the* Head *of the* Radius *to that of the* Ulna.

Ligamentum coronarium ſeu orbiculare. The head of the radius is joined to that of the ulna, and the following ligament ſurrounds the head of the radius, reaching from one ſide of the ſmall lateral ſigmoid cavity of the ulna to the other, in an arch which is about three quarters of a circle. It is very ſtrong, and comes near the ſolidity of a cartilage. The ſide next the radius is very ſmooth; and though it connects that bone cloſely to the ulna, yet it leaves it room enough to turn in the motions of pronation and ſupination.

Ligamentum obliquum, ariſes from the tubercle of the ulna, which gives riſe to the bracheus internus muſcle, and is inſerted into the tubercle of the radius.

Ligaments *between the* Bodies *of the* Radius *and* Ulna.

Ligamentum interoſſeum fills up the ſpace between the two bones of the fore-arm. It is fixed by one edge along the ſharp angle of the radius, and by the other along that of the ulna. The greater number of the fibres which compoſe it deſcend from the radius to the ulna. Some, however, aſcend and croſs the former obliquely, ſo as to make it appear as if compoſed of two planes. Small ſpaces are left in different parts of it for the paſſage of blood veſſels; and a large opening is left above, which is occupied by the oblique ligament, &c. The interoſſeous ligament ties the two bones together, and gives inſertion to muſcles. In the ſupination of the hand, it is ſtretched; and in the pronation, it is relaxed.

All the concave ſide of the baſis of the radius is cartilaginous, and often divided by a ſmall cartilaginous prominent line.

line. The lateral notch of the bafis is alfo covered by a continuation of the fame cartilage.

At this end of the radius, there is likewife a particular additional cartilage, or triangular production, longer than it is broad, very thin, and rather flat than concave on both its fmooth fides. It is fixed by its bafis, or fhorteft fide, to the lateral figmoid notch of the bafis of the radius, in fuch a manner, that one fide of it is on a level with the large cartilaginous furface of the bafis of the bone, and its apex directly oppofite to the ftyloid procefs. The other fide touches the flat extremity of the fmall head of the ulna, but is not fixed to it. This cartilage may be termed the *interarticular cartilage* of the joint of the wrift. It is tied to the radius by very fhort ligaments; and, playing the fmall head of the ulna, it follows all the motions of the radius. It is therefore a fort of particular production of the lower fide of the bafis of the radius, and fills, in the natural ftate, the void fpace which, in the fkeleton, appears between the end of the ulna and the neighbouring bone of the carpus. The inferior extremity, or fmall head of the ulna, is crufted over by a cartilage round its cylindrical border, in the notch near the ftyloid procefs, and for fome fpace on the procefs itfelf.

LIGAMENTS *of the inferior extremity of the* BONES *of the* FORE-ARM.

Ligamentum capfulare, arifes round the edge of the glenoid cavity of the lower end of the radius and head of the ulna. It is fixed to the cartilaginous edges of the three firft bones of the carpus.

Ligamentum capfulare feu facciforme, arifes from the edges of the femilunar cavity, at the under end of the radius, and furrounds the head of the ulna.

Ligamenta duo tranfverfa. One of thefe arifes from the ftyloid ſtyloid proceſs at the under end of the radius, and is inſerted into the os naviculare. The other ariſes from the ſtyloid proceſs at the lower end of the ulna, and is fixed to the os cuneiforme and unciforme.

All the bones of the carpus, metacarpus, and fingers, are cruſted over with cartilages at the places which play upon each other; but in freſh ſubjects, they are thicker, ſofter, and whiter, than in the ſkeleton. In adults, their figure remains the ſame in both; but it changes in the dry bones of younger ſubjects; and in thoſe of children it is quite different. The impreſſions and notches in which the bodies called *mucilaginous glands* are lodged, are moſt ſenſible in the cartilages of freſh bones, becauſe of their thickneſs.

Ligaments *of the* Carpus.

Ligamenta oſſium carpi brevia, are ſmall ſhort ligaments, running in various directions, and joining the carpal bones; firſt of the ſame row, then of the two rows together. They have their names from their figure and the direction of their fibres; as *obliqua*, *tranſverſa*, *capſularia*, and *propria oſſium carpi.*

Ligamentum oſſium carpi commune capſulare, ariſes from the cartilaginous edges of the firſt row of carpal bones, and is inſerted into thoſe of the ſecond row.

Ligaments *between the* Carpus *and* Metacarpus.

Ligamenta articularia, ſhort firm ligaments, by which the ſecond ſeries of carpal bones are joined to the poſterior extremities of the metacarpal bones. On account of the variety in ſituation, and diverſity of the direction of their fibres, they have got the name of *Ligamenta dorſi manus*, *lateralia*, *recta*, *perpendicularia*.

Ligamenta interoſſea metacarpi, are ſmall ligaments which join

join the poſterior and anterior extremity of the metacarpal bones together.

LIGAMENTS *of the* BONES *of the* FINGERS.

Ligamenta capſularia phalangum digitorum, ariſes from the anterior extremities of the metacarpal bones with the poſterior extremities of the firſt phalanx of the fingers.

Ligamenta lateralia phalangum digitorum, are ſtrong ligaments, which lie between the bones of the firſt phalanx of the fingers. They are fixed at each end to the capſular ligaments.

Ligamentum capſulare pollicis, ariſes from the poſterior extremity of the firſt bone of the thumb, and is fixed round the os trapezium of the carpus.

LIGAMENTS *retaining the* TENDONS *of the* MUSCLES *of the* HAND *and* FINGERS *in ſitu.*

Ligamentum carpi tranſverſale externum, ariſes from the ſtyloid proceſs of the ulna and os piſiforme of the carpus, and, running tranſverſely on the back of the wriſt, it ſpreads broad to end in the ſtyloid proceſs of the radius. Between this ligament and the bones, the tendons of the extenſor muſcles of the carpus and fingers paſs.

Ligamenta vaginalia, adhere to the former ligament and bones, and ſerve as a kind of ſheaths to the tendons.

Ligamenta tendinum extenſorum tranſverſa, are ſhort tendinous ligaments, running tranſverſely on the back of the hand behind the roots of the fingers, and ſerving to join the tendons of the muſculus extenſor digitorum communis together.

Ligamenta palmaria tranſverſa, are fixed to the anterior extremities of the metacarpal bones, from which they run tranſverſely. In their paſſage, they cover the muſculi lum-

bricales,

bricales, and are inſerted into the metacarpal bones and ſheaths of the tendons of the flexor muſcles.

Ligamenta vaginalia tendinum flexorum, ariſe from the internal tranſverſe ligament of the wriſt, and as ſheaths embrace the tendons of the flexor muſcles of the fingers; they terminate at laſt with the tendons of the muſculus perforans.

Ligamenta vaginalia ſeu cruciata phalangum, run in a circular and crucial direction over the former vaginae and tendons, and are fixed to the ridges on the concave ſide of the bones of the fingers. They ſerve as fraena to the tendons while their muſcles are in action.

Ligamentum tendinum flexorum acceſſoria, are ſmall but firm tendinous ſubſtances, which ariſe from the firſt and ſecond phalanx of the fingers; they are covered by the vaginal ligaments of the tendons, and terminate in the tendons of the two flexor muſcles of the fingers.

All the bones of the ſuperior extremities are covered with their perioſteum, and the quantity of marrow correſponds with the ſhape of the bone. All the joints have likewiſe ſynovial ſubſtances; but they are ſmall when compared with thoſe in the inferior extremities. The moſt conſiderable are placed in the cavities at the under end of the os humeri, for lodging the coronoid proceſs and olecranon of the ulna, in the flexion and extenſion of the fore-arm.

Of the PELVIS and INFERIOR EXTREMITIES.

The cartilages of the oſſa innominata are not ſo numerous as one might imagine on examining the ſkeleton. We are apt to think we ſee the dried remains of cartilages on the ſpine of the os ilium, on the tuberoſity of the os

ischium,

iſchium, and on the grooves and notches which give paſſage to the tendons of muſcles: but none of theſe incruſtations are true cartilages, being for the moſt part tendinous, aponeurotic, or ligamentous; which being dried, look more like cartilages than the true cartilages themſelves.

The cruſt which covers the ſpine of the os ilium is chiefly tendinous in adult bodies; but in children, and in very aged perſons, it appears cartilaginous. In children, the parts which are not completely oſſified are eaſily taken for true cartilages; and in old age, the tendons are often hardened to ſo great a degree, as to have the very ſame appearance. The ſubſtance which covers the tuberoſity of the os iſchium is almoſt entirely tendinous; and that which lines the grooves and notches of the tendons is chiefly ligamentous.

The true cartilages of the oſſa innominata are five in number; three common, and two proper. The firſt and principal common cartilage is that which makes the ſymphyſis of the oſſa pubis. It reaches from the interval between the ſpines of theſe two bones to the angle formed by the crura where they begin to ſeparate. It is ſomething thicker or broader at its upper part than for a conſiderable ſpace lower down; but the inferior part is by much the broadeſt. It fills the angle already mentioned, and forms a kind of arch, which is more conſiderable in women than in men.

The two other common cartilages join the oſſa ilium to the os ſacrum, but are thinner than that of the oſſa pubis.

The proper cartilages are thoſe that line the acetabula. Concerning theſe, it has been already obſerved in the deſcription of the Skeleton, that in the edge of each there is a notch or opening between the anterior and inferior parts; and that, in the cavity itſelf, there is a broad unequal ſhallow depreffion for the fynovial gland, reaching from the notch beyond the middle of the cavity. All the reft of the furface is covered with a very white fhining fmooth cartilage, which terminates precifely at the edge of the cavity.

The circumference of the acetabulum has, befides, a border of a particular kind; the fubftance of which is neither wholly cartilaginous, nor wholly ligamentous; but it may be rather placed among the ligaments. The os facrum has no cartilage, excepting that between its upper end and the laft vertebra of the loins, and thofe by which it is connected with the offa innominata. The intervertebral cartilages of this bone are, for the moft part, entirely obliterated in the adult. The cartilages which join the different portions of the os coccygis, are preferved in fome fubjects to a very great age; in others they foon become entirely offified.

No part of the os femoris is covered with cartilage, excepting the uniform convexity of its head; and here the cartilage runs as far as the union between the head and neck of the bone. The trochanters have no true cartilage; what looks like it being only the remains of tendinous infertions, as was obferved of the fpine of the os ilium. The cartilaginous fubftance which, to a certain age, unites the epiphyfes to the body of the bone, does not belong to this place, becaufe it is only found in the time of youth, and in adults is converted into bone. The cartilaginous matter by which the head of the os femoris is cemented, deferves, however, to be obferved; becaufe that epiphyfis has been feparated by violent falls.

LIGAMENTS *proper to the* BONES *of the* PELVIS.

Ligamenta ileo-facra, are ftrong ligaments arifing from the pofterior part of the fpine of the os ilium, which is oppofite to the fide of the os facrum, and defcending ob-

liquely,

liquely, are fixed to the firft, third, and fourth fpurious tranfverfe proceffes of the os facrum.

Ligamenta pelvis tranfverfalia fuperius et inferius, are two ligaments arifing from the pofterior fpinous procefs of the os ilium; the fuperior is fixed to the tranfverfe procefs of the laft vertebra of the loins; the inferior is fixed to the firft tranfverfe procefs of the os facrum.

Ligamenta facro-ifchiatica. Between the os ifchium and os facrum, we find two very ftrong ligaments called *Sacro-fciatic;* one broad and external, the other fmall and internal. The external arifes from the anterior and external edge of the falfe tranfverfe proceffes of the os facrum. From thence diminifhing in breadth, it defcends obliquely towards the tuberofity of the os ifchium, and is inferted immediately below the finus, which lies between the tuberofity and fpine of that bone. This infertion is afterwards continued over the whole internal labium of the inferior portion of the os ifchium, and of the crus of that bone, and the inferior portion of the crus of the neighbouring os pubis. When it arrives at the os ifchium, it produces a kind of falx; one edge of which is fixed to the bones, the other lies loofe; and by this infertion of the falx, it forms, together with the bones, a kind of deep channel or groove.

The internal facro-fciatic ligament adheres clofely to the infide of the pofterior portion of the former. It arifes internally from the edge of the inferior part of the fourth falfe tranfverfe procefs, and from the whole fide of the os facrum, and from the bafis of the upper part of the os coccygis. From this it runs up a little obliquely to the fpine of the os ifchium; to the fharp point and upper part of which it is fixed.

By thefe two ligaments two openings are formed; a large one, with the fuperior fciatic finus, through which the pyriform mufcle, the pofterior crural veffels, and the fciatic nerve, paſs out of the pelvis; and a ſmall one for the paſſage of the internal obturator muſcle.

Ligamentum obturans foraminis ovalis. The obturator ligament fills up all the foramen thyroideum, except the oblique notch at its upper part for the paſſage of the obturator veſſels and nerves. It is fixed to the edge of that hole from the anterior part of the oblique notch, as far as the ſymphyſis between the os pubis and os iſchium. From thence to the poſterior part of the inferior notch, it is fixed to the internal labium of the edge of the circumference, forming a kind of ſmall channel with the external labium; and afterwards it is fixed to the common edge of the foramen ovale and cotyloid notch. This ligament not only aſſiſts in ſupporting the parts contained in the pelvis, but alſo gives origin to the two obturator muſcles.

On the inſide of the upper and anterior part of the os pubis, there is a tranſverſe ligament fixed by its upper part to the os pubis, from the oblique notch of the foramen ovale, all the way to the lower part of the ſymphyſis, at a ſmall diſtance from the circumference of the laſt-mentioned hole. This ligament is about half an inch broad in an adult body, and, poſteriorly, below the ſuperior oblique notch of the foramen ovale, it joins the obturator ligament by means of a particular fold; and by parting from it afterwards, a deep narrow groove is formed between them; the tranſverſe ligament being at this place ſupported by ligamentous fraena of different ſizes.

Ligamentum inguinale, ſeu Poupertii, ſeu Fallopii, the inguinal ligament, is chiefly the under end of the tendon of the external oblique muſcle of the abdomen. It is fixed by one end to the anterior ſuperior ſpinous proceſs of the os ilium, and is ſtretched over to be fixed by its other end to the ſpine of the os pubis. The middle portion of it is very narrow, but expands conſiderably towards both extremities.

Under

Under this ligament the femoral veſſels and anterior crural nerve go out of the pelvis.

Ligamentum capſulare coccygis, ariſes from the upper end of the os coccygis, and is inſerted round the under end of the os ſacrum.

Ligamenta longitudinalia coccygis, ſmall ligaments ariſing from the inner ſurface of the os coccygis, and terminating in the os ſacrum. They fix the two bones firmly together.

LIGAMENTS *between the* PELVIS *and Head of the* OS FEMORIS.

The capſular ligament is the moſt conſiderable, largeſt, and ſtrongeſt, of all the articular ligaments of the human body. It ariſes quite round the outer edge of a thick ſtrong cartilago ligamentous border, on the brim of the acetabulum, and from thence largely ſurrounds the whole head and ſuperior portion of the neck of the os femoris, and is cloſely inſerted to the lower portion of the neck that is between its baſis and middle narrow part. This ligament is made up of ſeveral ſorts of fibres, the chief of which are longitudinal and oblique; and it is much thicker and ſtronger in ſome parts than in others. It is very thick on its fore-part, on account of two ligamentous bands which run downwards and outwards from the inferior anterior ſpinous proceſs of the os ilium to the further extremity of the neck of the thigh bone. It is ſomewhat thinner on its outer and back-part, and thinneſt of all at the inner and back-part.

Ligamentum teres ſeu rotundum. This ligament is not round as the name expreſſes; it reſembles a flat cord, being compoſed of a bundle of fibres cloſely interwoven; one end of it is in a manner divided into two flat bands, which are fixed to the inner corners of the notch of the acetabulum, and alfo to the edge of the rough impreffion at the bottom of the acetabulum. From the infertion it runs obliquely backwards and a little upwards, between the fynovial gland within the acetabulum and the cartilaginous convexity at the head of the os femoris, and ends in the upper part of the fmall femilunar notch. This infertion is oblique, a little rounded on the upper part, and flat on the lower; and in fome fubjects there is a fort of depreffion in the head of the bone for the paffage of the ligament.

The periofteum of the bones of the pelvis agrees with that on other flat bones.

The rough unequal depreffion at the bottom of the acetabulum is filled with a broad fynovial gland, bordered with a fatty fubftance, and covered by a fine membrane, through which a mucilaginous liquor paffes to moiften the joint and facilitate its motions. This membrane rifes above the gland, and gives a fort of covering to the ligament contained in the joint.

The blood-veffels of this gland pafs between the bottom of the acetabulum and the ligament at the inner edge of that cavity.

The blood-veffels pafs chiefly through the fmall holes in both convex and concave furfaces of thefe bones; and ramifying upon the bony cells, they end in a great number of fmall capillary tubes, which make the medullary juice appear red.

The cartilage which covers the lower extremity of the femur is exactly fitted to the femi-oval convexity of the inferior furface of each condyle, and to the pulley formed by their union.

The two cartilages which cover the two fuperior furfaces of the head of the tibia are gently hollow; but the internal is more depreffed than the external: The back-part of the

the latter is fenfibly depreffed, by which a fort of convexity is formed. The cartilage is abfent where the crucial ligament of the patella has a thick cartilage on its pofterior fide, divided by a fuperficial longitudinal rifing, proportioned to the two portions of the pulley of the os femoris; at the outer and under part of the head of the tibia another cartilage appears, where the head of the fibula is articulated. The cartilage at the head of the fibula feems to be thicker than that at the lower extremity.

The femilunar cartilages, which get their name on account of their figure, are thick at their outer edge where they are tied to the capfular ligament; thin at their inner edge, particularly at the middle; concave fuperiorly next the condyles of the femur; flatted below next the tibia; and tied together by a fmall ligament. Thefe cartilages are in fhape of a crefcent, or Roman C. Their convexity or greateft curvature is very thick; their concavity or fmalleft curvature very thin; fomething like the edge of a fickle. They lie on the two upper furfaces of the head of the tibia; their thickeft part or convexity correfponding with the edges of the head, and their thin fharp edges to the middle of each furface; their extremities or cornua being turned toward each other. Each cartilage covers about two thirds of the furface of the tibia on which it lies, leaving one third bare in the middle. Their under fides are flat, the upper fides hollow; and, together with the middle portions of the furfaces of the head of the tibia, form cavities proportional to the convexities of the condyles of the os femoris.

LIGAMENTS *within the* JOINT.

Ligamenta cruciata. One of thefe, called *pofterius*, is fixed to the internal fuperficial impreffion in the notch between the condyles of the femur; and running almoft

ftraight

ſtraight down, is fixed by its other end to the notch in the head of the tibia, behind the cartilaginous tubercle which lies between the two ſuperficial ſurfaces for receiving the condyles of the femur.

The other, called *anterius*, is fixed by one end to the external impreſſion in the notch of the os femoris; and running obliquely downwards and forwards, croſſing the former, is fixed by the other end to the head of the tibia a little before the other ligament. Theſe two ligaments croſs each other when we turn the point of the foot inwards, and they ſeparate from each oiher when the foot is turned outwards. They prevent the leg from being bent forwards on the thigh, and from rolling too much inwards.

Ligamentum alare majus et minus: are two broad ligaments ariſing from the inner ſides of the capſular ligament, and are fixed to the ſides of the patella, and to the fatty ſubſtance placed there.

Ligaments *at the* Joint *of the* Knee.

The internal is fixed to the femur under the tuberoſity, which is near its internal condyle; the fibres ſpread out in deſcending, aud terminate at the upper and inner part of the tibia; along which they ſlide from behind forwards, till they have got more than two inches and a half under the head of this bone.

The external is narrower and ſhorter. It is fixed above to the external tuberoſity of the femur, and deſcends to embrace the anterior part of the head of the fibula, where it enlarges a little, though its fibres are not radiated like thoſe of the external ligament. Its length is about two inches, and it is ſomewhat looſe. Theſe two ligaments are not placed in the middle of the articulation; they are a little farther back, ſo as to allow the ready flexion and ex-

tenſion

tenfion of the limb. They are quite loofe in the flexion, and put upon the ftretch in the extenfion of the limb.

Ligamentum pofticum, has an irregular form. It defcends from the pofterior, inferior, and external part of the outer condyle of the femur; and having croffed the pofterior part of the articulation, it terminates in the pofterior, fuperior, and internal part of the tibia. Some fibres go by the fide of the former, to end in the upper and back part of the tibia. The three ligaments above defcribed are firmly glued to the capfular ligament.

The capfular ligament is fixed quite round the inferior extremity of the os femoris, at a fmall diftance above the anterior, lateral, and pofterior parts of the cartilage, and above the pofterior part of the great notch; from this it runs down to be fixed round the edge of the head of the tibia and in the edge of the patella, in fuch a way that the patella itfelf forms a part of the capfula of the joint. It is ftrengthened by the tendinous aponeurofis and tendons of the mufcles which furround the joint, and likewife by the ligaments already mentioned; internally, it adheres to the femilunar cartilages, and fends off a very fine vagina over the ligaments, &c. within the joint.

Ligamenta cartilaginea, are two fmall ligaments which join the femilunar cartilages to each other, and likewife to the os femoris and tibia.

Ligamentum patellae, is a very ftrong ligament which arifes from the point of the patella, and is fixed to the upper and fore-part of the tibia.

The marrow of the os femoris lies in a large mafs in the middle cavity of the bone, and in fmall diftinct clufters in the cells of each extremity. The firft is penetrated at different diftances by the bony filaments or ramifications of the reticular texture, and thereby fuftained in the violent motions of the body.

The ſynovial ſubſtances of the knee, which lie near the edges of the patella, are the moſt conſiderable of any in the body; being diſpoſed in form of fringes, and ſupported by a great quantity of fatty matter.

This common maſs is contained within the capſular ligament; and on the ſide of the joint is covered by a very fine membrane which likewiſe lines the inner ſurface of the ligament.

The ſuperior portion of this fat is as it were ſupported by a ſmall ligament fixed in the anterior part of the great notch between the condyles of the femur, and which runs to the upper part of the patella.

There are other fatty ſubſtances both above and below the edges of the ſemilunar cartilages, and likewiſe in the ham; ſome of which ſerve for the joint, the reſt for the crucial ligaments. Theſe laſt lie in folds formed by the internal membrane of the capſular ligament, which give particular coverings to the crucial ligaments, and to the other bundles of ligamentous fibres near them.

Ligaments *of the* Fibula.

Ligamentum capſulare extremitatis ſuperioris, is a very ſtrong ligament, which runs from the head of the fibula to be fixed to the external condyle of the tibia.

Ligamentum interoſſeum, fills up the ſpace between the tibia and fibula. One ſide of it is fixed to the poſterior external angle of the tibia, the other to the internal angle of the fibula. It is compoſed of ſtrong tendinous fibres, which croſs each other obliquely, and in various parts leave ſmall ſpaces for the paſſage of veſſels and nerves. At its upper part there is a large opening, where the veſſels and nerves paſs to the fore-part of the leg, and where the muſcles on oppoſite ſides are contiguous. It ſerves chiefly as a ligamentous

mentous ſeptum for the origin of muſcles; in which reſpect it ſupplies the place of bones.

Ligamentum extremitatis inferioris, conſiſts of four ſhort ſtrong ligaments, two of which are anterior and two poſterior; they ariſe from the malleolus externus of the fibula, and are inſerted into the under and outer part of the tibia.

The marrow of theſe bones lies in large maſſes in the great cavities, and in diſtinct moleculae in the ſpongy parts, as in other bones of the ſame ſhape. The ſynovial glands lie in the ſmall ſpaces, depreſſions, and ſuperficial notches; near the edges of the cartilages of each joint they are covered by the capſular ligaments, and more or leſs mixed with a fatty ſubſtance.

Ligaments *of the* Inferior Extremity *of the* Bones *of the* Leg.

Ligamentum fibulae anticum, ariſes from the fore-part of the malleolus externus of the fibula, and is fixed to the upper and outer part of the aſtragalus.

Ligamentum fibulae medium, ariſes from the point of the malleolus externus, and runs ſtraight down to be fixed to the outſide of the os calcis.

Ligamentum fibulae poſticum, ariſes from the under and back-part of the malleolus externus, and is bent obliquely backwards to be fixed to the outer and back-part of the aſtragalus.

Ligamentum tibiae deltoideum, ariſes from the malleolus internus, and is fixed to the aſtragalus and os naviculare.

Ligamentum capſulare, ariſes from the whole edge of the articular cavity of the tibia, and is fixed entirely round the aſtragalus.

Liga-

Ligaments *of the* Bases *of the* Metatarsal Bones.

Ligamentum capſulare, joins the metatarſal bone of the great toe to the os unciforme internum.

Ligamenta articulatoria, join the poſterior extremities of the metatarſal to the anterior edges of the tarſal bones. On account of their different ſituations, they have the name of *ligamenta plantaria, pedis dorſalia, lateralia.*

Ligamenta tranſverſa dorſi pedis, are three in number, and are ſituated on the upper part of the foot, and join the baſes of all the metatarſal bones together, excepting that which belongs to the great toe.

Ligamenta tranſverſa plantae are likewiſe three, but placed in the ſole; and lie partly in the interſtices of the bones.

Ligamenta interoſſea metatarſi, like the former, are alſo three in number, but run immediately from the ſide of one bone to that of the bone next it, filling up the interſtitial ſpaces.

Ligaments *of the* Bones *of the* Toes.

Ligamenta capſularia, ariſes from the poſterior extremities of the firſt phalanx of the bones of the toes, and are fixed to the anterior extremities of the metatarſal bones.

The ſecond and third phalanges of all the toes are joined by capſular ligaments, much in the ſame manner with thoſe already mentioned.

Ligamenta lateralia, lie at the ſides of the ſecond and third joint of each of the toes; they ariſe from the ſides of the baſes, and are fixed to the ſides of the heads of the bones of each of theſe joints.

All theſe ligaments, in the ſame manner as in the hand, are covered and ſtrengthened on the dorſum pedis by an expanſion of the tendons of the extenſor muſcles, and in the ſole by the ſheaths of the tendons of the flexor muſcles.

LIGAMENTS *retaining the* TENDONS *of the* MUSCLES *of the* FOOT *and* TOES *in ſitu.*

Ligamentum vaginale tibiae. This ſtrong ligament is part of the tendinous ſheath that covers the muſcles on the fore-part of the leg; one ſide of it is fixed to the anterior angle at the lower part of the tibia, the other is fixed to the outer part of the fibula.

Ligamentum tranſverſum tarſi ſeu cruciatum. This is a double ligament; one part ariſes in the outer part of the foot above the malleolus externus of the fibula, the other from the proceſs of the os calcis. They run over, the one to be fixed to the malleolus internus, the other to the inner ſide of the os naviculare; they ſerve to keep the tendons of the muſcles in their places.

Ligamentum tendinum peroneorum, ariſes from the fore-part of the os calcis, and is fixed to the outer ſide of an eminence of this bone.

Ligamentum laciniatum, ariſes from the edge of the malleolus internus, and runs down in a radiated manner to be loſt in the fat ſituated there, then in the membrana propria of the abductor muſcle of the great toe, and at laſt in the inner ſide of the os calcis; it covers the tendons, veſſels, and nerves, running in the hollow of the os calcis.

Ligamentum vaginale extenſoris pollicis, ſurrounds the tendon of this muſcle.

Ligamentum vaginale flexoris proprii pollicis, ſurrounds the tendon of the flexor longus pollicis in the hollow of the os calcis; it is fixed to the under and inner part of this bone.

Ligamenta vaginalia tendinum flexorum. Theſe are ligamentous ſheaths ſurrounding the tendons of the flexor muſcles of the toes, and are ſimilar to thoſe of the flexors of the fingers.

Ligamenta

Ligamenta acceſſoria tendinum flexorum, are ſhort, but ſtrong ligaments, like thoſe on the fingers, ariſing from the phalanges of the toes; and being included in the ſheaths of the tendons, they terminate in the tendons.

Ligamentum tendinum extenſorum tranſverſa, are ſmall ligaments running between the tendons of theſe muſcles, and ſerving to bind them together, and to keep them in their places.

The perioſteum of all theſe bones is of the ſame kind with that of the bones of the leg.

The marrow is ſuitable to their internal ſtructure; that is, in moleculae in the cavernous portions, and in maſſes in thoſe which have large cavities. Thus the marrow of all the tarſal bones is diſperſed in moleculae, becauſe their internal ſtructure is ſpongy. In the metatarſal bones and firſt phalanges of the toes, it is diſpoſed in the ſame manner as in the tibia and fibula; that is, it lies in moleculae in the extremities, the ſtructure of which is cavernous; but in the middle portions of them it lies in maſſes greater or leſs, according to the ſize of the cavities. In the other phalanges, which are entirely ſpongy, it is accordingly diſpoſed in moleculae.

The ſynovial ſubſtances anſwer in number and figure to the depreſſions between the cartilaginous edges and ligaments.

A

A

SYSTEM OF ANATOMY.

PART V.

Containing a DESCRIPTION of the

COMMON INTEGUMENTS.

ALL the parts of the human body are invefted by feveral common and univerfal coverings, to which anatomift give the name of *integuments*.

There have been many difputes about the number of thefe integuments. The ancients reckoned up five, viz. the *epidermis*, *fkin*, *membrana adipofa*, *panniculus carnofus*, and *membrana mufculorum communis*.

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

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

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

CUTI-

Cuticula.

The outſide of the ſkin is covered by a thin tranſparent inſenſible pellicle, cloſely joined to it, which is called *epidermis*, *cuticula*, or *ſcarf-ſkin*.

The ſubſtance of the cuticle appears to be very uniform on the ſide next the ſkin, and to be compoſed on the other ſide of a great number of very fine ſmall ſquamous laminae, without any appearance of fibrous or vaſcular texture, unleſs we take into account the numerous ſmall veſſels by which it is connected to the parts under it.

This ſubſtance is very ſolid and compact, but yet capable of being extended and thickened, as we ſee by ſteeping it in water, and by the bliſters raiſed on the ſkin by veſicatories or any other means; and from thence it would ſeem that it is of a ſpongy texture. It yields very much in ſwellings, but not ſo much as the ſkin without breaking or cracking. It is not readily deſtroyed by putrefaction.

Hard and reiterated frictions looſen it inſenſibly, and preſently afterwards a new ſtratum ariſes, which thruſts the firſt outward, and may itſelf be looſened and thruſt outward by other ſtrata.

It is nearly in this manner that calloſities are formed on the feet, hands, and knees; and the ſeveral laminae or ſtrata obſervable at the ſame time on many other parts of the body, are owing to the ſame cauſe, though many anatomiſts have thought them to be natural. But it muſt be acknowledged, that, on the palms of the hands and ſoles of the feet, the cuticle is commonly thicker than on any other part.

The cuticle adheres very cloſely to the cutaneous papillae under it; but it may be ſeparated by boiling, or ſteeping for a long time in cold water. It is not impoſſible to ſeparate it with the knife; but this management teaches us nothing of its ſtructure.

It adheres ſtill cloſer to the corpus mucoſum, which is eaſily raiſed along with it; and they ſeem to be true portions or continuations of each other.

The colour of the cuticle is naturally white; and its apparent colour is owing to that of the corpus mucoſum. For, if we examine the European and African, we find the cuticle to be nearly of the ſame colour in both, whereas their corpus mucoſum is very different.

The cuticle covers the ſkin through its whole extent, excepting at the nails. It is marked with the ſame furrows and lozenges as the ſkin, and has the ſame openings and pores; and may be ſaid to cover not only the whole external part of the body, but to line many of the large paſſages, as the alimentary canal, the lungs, vagina, urethra, &c. In theſe paſſages, however, it is ſomewhat different. The cuticle on the external parts of the body gives paſſages to the ducts of the ſebaceous glands, while that lining the cavities already mentioned, is pierced with the ducts of the mucous follicles.

When we examine narrowly the ſmall paſſages through which the ſebaceous matter of the ſkin paſſes, the cuticle ſeems to enter theſe, in order to complete the ſecretory tubes. The foſſulae of the hairs have likewiſe the ſame productions of the cuticle, and it ſeems to give a kind of covering to the hairs themſelves. Laſtly, the almoſt imperceptible ducts of the cutaneous pores are lined by it.

If the ſkin be macerated for a long while in water, the cuticle, with its elongations, may be ſeparated from it. By this obſervation we may explain how bliſters may remain for a long time on the ſkin without giving paſſage through theſe holes to the matter which they contain;

which holes one would think ought to be increafed by this dilatation and tenfion of the cuticle.

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

With refpect to its origin, fome authors have fuppofed it to be formed by a moifture exhaled from the whole furface of the body, which gradually hardens when it is expofed to the air; but the foetus in utero, where no air is admitted, is a proof againft this opinion; and it grows readily under plafters applied to any part of the body. Leeuwenhoeck fuppofed its formation to be owing to the expanfion of the extremities of the excretory veffels, which are found every where upon the furface of the true fkin. Ruyfch attributed its origin to the nervous papillae of the fkin; and Heifter thinks it probable that it may be owing both to the papillae and the excretory veffels. Morgagni, on the other hand, contends, that it is nothing more than the furface of the cutis, hardened and rendered infenfible by the liquor amnii in the uterus, or by the preffure of the air. In fact, we know little about its origin; but the regeneration of it is very evident, fudden, and furprifing; for, let it be deftroyed ever fo often, it ftill grows again.

Corpus Mucosum.

Under the cuticle, we meet with a fubftance of a greyifh colour, which has been thought to reprefent a net-work; hence it has got the name of *corpus reticulare*, or *mucofum*. It is of a foft, mucilaginous, and vifcid nature; and fills up the interftices of the fibres running between the cutis

vera

vera and cuticula. After raiſing the cuticle in a negro, where it is thickeſt and moſt diſtinct, this ſubſtance appears of a black colour, and is compoſed of two layers. It is this that chiefly gives the colour to the ſkin; for it is black in the African; white, brown, or yellowiſh, in the European.

The origin of this mucous ſubſtance has not hitherto been ſufficiently explained; nor has it been fully determined what purpoſes it ſerves in the hman body. Haller thinks it probable, that it is compoſed of a humour tranſuding from the ſurface of the cutis vera. The reaſon why it is black in the negro has been ſuppoſed to be for ſerving as a defence againſt the external heat, by preventing the rays of the ſun from penetrating his body; but the matter ſtill lies hid in obſcurity.

Cutis Vera.

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

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

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

The

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

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

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

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

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

There is another particular kind under the nails; the papillae being there more pointed, or in a manner conical, and

and turned obliquely toward the ends of the fingers. Thofe which are found in the hairy fcalp, fcrotum, &c. are ftill of other kinds.

In inflammations, we obferve a reticular texture of capillary veffels, more or lefs extended on the furface of the fkin; and curious anatomifts demonftrate the fame thing by fine injections, which may be looked upon as artificial inflammations. Something fimilar to this has been injected lately by Mr Baynham of London, who thought it *rete mucofum*; and afterwards by Mr Cruickfhank, who calls it *cuticula quarta*. (See Mr Cruickfhank's letter to Mr Clare.) But neither of thefe methods prove, that, in the natural ftate, thefe veffels are blood-veffels; that is, that they contain the red portion of the blood.

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

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

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

Befides thefe, it is perforated by an infinite number of fmall holes, called *pores*, which are of two kinds. Some

are

are more or lefs perceivable by the naked eye; fuch as the orifices of the milky ducts of the mammae, the orifices of the excretory canals of the cutaneous glands, and the paffage of the hairs.

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

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

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

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

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

Glands of the Skin.

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

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

Befides the febaceous glands, anatomical writers mention other fmall fpherical bodies placed every where over the furface of the body, in much greater abundance than thofe juft mentioned, and named *miliary*. They are faid to have excretory ducts that open on the furface of the cuticle, and diftil the fweat and matter of infenfible perfpiration; but after all that has been faid by different authors about them, it is certain there are no diftinct glands that can be traced by the knife.

Uses of the Skin.

It is chiefly and properly the filamentary fubftance, called the *body of the fkin*, which is the univerfal integument of the body, and the bafis of all the other cutaneous parts; each of which has its particular ufes.

The fkin is able to refift external injuries to a certain degree, and fuch impreffions, frictions, ftrokes, &c. to which the

the human body is often liable, as would hurt, wound, and diforder the parts of which it is compofed, if they were not defended by the ſkin.

The papillae are the organs of feeling, and contribute to an univerfal evacuation, called *infenfible tranfpiration.* They likewife ferve to tranfmit from without, inwards, the fubtle particles or impreffions of fome things applied to the ſkin. The firft of thefe three ufes depends on the extremities of the nerves; the fecond, on the arterial productions; and the third, on the origin of the abforbent fyftem.

The cutaneous glands fecrete an oily humour of different confiftencies. But without the epidermis, both papillae and glands would be difturbed in their functions; on which great diforders muft enfue.

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

Another ufe of the epidermis is, to regulate the cutaneous evacuations already mentioned; the moft confiderable of which is infenfible tranfpiration.

Membrana Adiposa, and Fat.

The laft univerfal integument of the human body, is the membrana adipofa, or corpus adipofum. This is not, however, a fingle membrane, but a congeries of a great number of membranous laminae, joined irregularly to each other at different diftances, fo as to form numerous interftices of different capacities, which communicate with each other

other. Thefe interftices have been named *cellulae*, and the fubftance they compofe the *cellular fubftance.*

The thicknefs of the membrana adipofa is not the fame all over the body, and depends on the number of laminae of which it confifts. It adheres very clofely to the fkin; runs in between the mufcles in general, and between their feveral fibres in particular; and communicates with the membranes which line the infide of the thorax and abdomen.

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

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

It is generally known, that the illuftrious Malpighi took a great deal of pains about this fubftance; that in birds and frogs, the vifcera and veffels of which are tranfparent, he thought he faw a kind of ductus adipofi; and that, by preffing thefe ducts, he obferved oily drops to run diftinctly into the fmall ramifications of the mefenteric veins; fuch ducts, however, have not been feen by later anatomifts.

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

Fat is more fluid in living than in dead bodies. It melts with the heat of the fingers in handling it; and its fluidity is in part obſtructed by the ſacculi which contain it. The method to take it entirely out of theſe bags is, to ſet the whole over a fire in a proper veſſel; for then the bags burſt, and ſwim in cluſters in a true oily fluid.

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

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

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

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

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

The appearance of a perfon moderately fat, of a perfon extremely lean, and of a dead carcafe from which all the fat has been removed, proves fufficiently what has been faid.

In fome parts of the body the fat ferves for a cufhion, pillow, or matrefs; as on the buttocks, where the laminae and cells are very numerous. In other parts, this membrane has few or no laminae, and confequently little or no fat; as on the forehead, elbows, &c.

In fome places it feems to be braced down by a kind of natural contraction in form of a fold; as in that fold which feparates the bafis of the chin from the neck, and in that which diftinguifhes the buttocks from the reft of the thigh. We obferve it likewife to be entirely funk, or as it were perforated by a kind of dimple or foffula, as in the naval of fat perfons.

Thefe depreffions and folds are never obliterated, let the perfon be ever fo fat; becaufe they are natural, and depend on the particular conformation of the membrana adipofa, the laminae of which are wanting at thefe places.

The fat is likewife of great ufe to the mufcles in preferving the flexibility neceffary for their actions, and in preventing or leffening their mutual frictions. This ufe is of the fame kind with that of the unctuous matter found in the joints, which was explained in the defcription of the frefh bones.

Laftly, the fat, as a fine oily fubftance in its natural ftate, may be fome defence againft the cold, which we find makes more impreffion on lean than on fat perfons. It is for this reafon, that, to guard themfelves againft the exceffive colds of hard winters, and to prevent chilblains, travellers rub the extremities of their bodies, and efpecially their feet, with fpirituous oils, fuch as that of turpentine, &c.

This

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

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

The Nails.

Some authors think the nails are productions of the cutaneous papillae; and others, that they are a continuation of the epidermis. This laſt opinion agrees with experiments made by maceration; by means of which the epidermis may be ſeparated entire from the hands and feet, like a glove or ſock.

In this experiment we ſee the nails part from the papillae, and go along with the epidermis, to which they remain united like a kind of appendix; and yet their ſubſtance and ſtructure appears to be very different from that of the epidermis: But like it, they are alſo inſenſible, and renewable after having been cut, or after having fallen off.

Their ſubſtance is like that of horn, and they are compoſed of ſeveral planes of longitudinal fibres ſoldered together. Theſe ſtrata begin with a ſquare root intermixed with the perioſteum a little before the laſt joints, and end at the extremity of each finger; they are nearly all of an equal thickneſs, but of different lengths.

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

The

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

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

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

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

The principal uſe of the nails is to ſtrengthen the ends of the fingers and toes, and to hinder them from being inverted towards the convex ſide of the hand or foot, when we handle or preſs any thing hard. For in the hand, the ſtrongeſt and moſt frequent impreſſions are made on the ſide of the palm; and in the foot, on the ſole; and therefore the nails ſerve rather for buttreſſes than for ſhields.

The Hairs.

The hairs belong as much to the integuments as the nails. The roots or bulbs lie toward that ſide of the ſkin which is

next

next the membrana adipofa. The trunk or beginning of the ftem perforates the fkin, and the reft of the ftem advances beyond the outer furface of the fkin to a certain diftance, which is very various in the different parts of the body.

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

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

Within the root, we obferve a kind of glue, fome very fine filaments of which advance toward the fmall extremity, where they unite and form the ftem, which paffes through this fmall extremity to the fkin. As the ftem paffes through the root, the outer membrane is elongated in form of a tube, which clofely invefts the ftem, and is entirely united to it.

The ftem having reached the furface of the fkin, pierces the bottom of a fmall foffula between the papillae, or fometimes a particular papilla; and there it meets the epidermis, which feems to be inverted round it, and to unite with it entirely. A fort of unctuous matter tranfudes through the fides of the foffula, which is beftowed on the ftem, and accompanies it more or lefs, as it runs out from the fkin in form of an hair.

Hairs are fcattered almoft over the whole furface of the body, the palms of the hands and foles of the feet excepted. They differ in length, thicknefs and folidity, in the different parts of the body. Thofe on the head, are called in Englifh by the general name of *hairs;* thofe which are dif-

pofed

posed archwise above the eyes, *supercilia* or the *eye-brows*; those on the edges of the palpebrae, *cilia* or the *eye-lashes*; and those which surround the mouth, and cover the chin, the *beard*. In other parts of the body, they have no particular names; and their different lengths, thicknesses, &c. in all these parts, are sufficiently known.

Their natural figure seems to be rather cylindrical than angular, which is chiefly accidental. Their colour is probably the same with that of the glue, or medullary matter of the root, the different consistence of which makes the hairs more or less hard, flexible, &c. Their straight or crooked direction must depend on that of the holes through which the stems pass. The hairs grow continually, and are renewed again after being cut, by a protrusion of their medullary substance from the skin outwards under a production of the cuticle. When they are destitute of this medulla in old people, they dry up, split, and fall off. They seem to perspire through their extremities, and possibly through their whole surface; as we may conclude from the constant force of protrusion in their medulla, which in the plica polonica wants a boundary to terminate it.

The use of the hairs, with respect to the human body in general, is not sufficiently known to be determined with certainty. Their uses with regard to some particular parts may be discovered; as we shall see in the description of these parts.

The supposed Integuments of the Antients.

Besides the integuments which have been already described, the antients reckoned the panniculus carnosus, and membrana communis musculorum.

The panniculus carnosus is found in quadrupeds, but not in men, whose cutaneous muscles are of a very small extent, except that which is called *platysma myoides* in particular; but even

even that mufcle cannot in any tolerable fenfe be reckoned a common integument.

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

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

Feeling.

The fenfe of feeling is to be underftood in a two fold manner. Every change of the nerves, produced by the heat, cold, roughnefs, fmoothnefs, weight, moifture, or drynefs of external fubftances applied to any part of the body, is commonly called feeling. In this fenfe, feeling is afcribed to almoft all parts of the human body; to fome more, to others lefs, as in different places of the body the nerves are more numerous and bare, or covered with more tender membranes; and thus even pain, pleafure, hunger, thirft, anguifh, itching, and the other fenfations, belong to the fenfe of feeling.

In a more peculiar fenfe, feeling is faid to be the change arifing in the mind from external bodies applied to the fkin, more efpecially at the ends of the fingers. For, by the fingers, we more accurately diftinguifh the qualities of tangible fubftances than by other parts of our body.

Uses of the Skin, and the Nature of Touch.

The papillae, regularly difpofed in the fpiral folds at the ends of the fingers, on the infide of the hand, may, by the attention of the mind, become erect or elevated *; and being

* This erection appears from fhiverings, frights, and from fimilar erections in the nipples of the breafts.

ing in this ſtate gently preſſed or rubbed againſt a tangible ſubſtance, they receive an impreſſion from that ſubſtance into their nervous fabric, which is thence conveyed, by the trunks of the nerves, to the brain. This is what we call the *touch*, whereby we become ſenſible chiefly of the roughneſs of objects. Some perſons have this ſenſe ſo acute as to be able to diſtinguiſh colours by touching the ſurface only. By this ſenſe we perceive heat in thoſe bodies which exceed the heat of our fingers; and weight, when the body preſſes more than is uſual. Humidity we judge of by the preſence of water; ſoftneſs, by a yielding of the object; hardneſs, from a yielding of the finger; figure, from the limits, or rough circumſcribed ſurface; diſtance, from a rude calculation or eſtimate made by experience, to which the length of the arm ſerves as a meaſure. The touch ſerves to correct the miſtakes of our other ſenſes; but yet it ſometimes errs itſelf, and then the other ſenſes ſhew themſelves to be true guides to the animal without touch.

The corpus mucoſum moderates the action of the object touched, and preſerves the ſoftneſs and ſound ſtate of the papillae. The cuticle excludes the air from withering and deſtroying the ſkin; qualifies the impreſſions of bodies, ſo that they may be only ſufficient to affect the touch, without cauſing pain. When, therefore, the cuticle is become too thick by uſe, the ſenſe of feeling is either loſt or leſſened; and if it be too thin and ſoft, the touch becomes painful. The hairs ſerve to defend the cuticle from abraſion; to preſerve and increaſe the heat; to cover what ought to be concealed; to render more irritable the membranes of thoſe parts, which ought to be defended againſt the injuries of inſects; and perhaps to exhale ſome uſeleſs vapours, or oil. The nails ſerve to guard the organs of feeling, that the papillae and ends of the fingers may not be ſent back by the reſiſtance of

 tangible

tangible objects: at the fame time they increafe our power of grafping large objects, and affift in the handling minute objects. In brute animals, they generally ferve as weapons of offence, and might be of the fame ufe to man, if they were not cut off.

One moft important office of the fkin is, to exhale from the body a large quantity of humours, and to reforb vapours from the air. The fkin is replete with an infinite number of fmall arteries, either coiled up into papillae, or paffing directly through it, which afford a paffage to the exhaling vapour; and left this vapour fhould be collected, as it is in fome difeafes, between the fkin and the cuticle, there are pores in the cuticle correfponding with the exhaling arteries of the fkin, through which it freely paffes. Thefe exhaling veffels or arteries, are eafily demonftrated by an injection of water or ifinglafs into the arteries, which fweat out from all parts of the fkin, in an infinite number of fmall drops; and thefe fubftances being transfufed under the cuticle, rendered impervious by death, raife it up into a blifter.

In a living perfon, this exhalation is many ways demonftrable. A clean looking glafs placed againft the warm and naked fkin, is quickly obfcured by the moift vapour. In fubterraneous caverns, where the air is more denfe, it is evidently feen to fly off from the whole furface of the body, like a thick cloud.

Whenever motion of the blood is increafed, while at the fame time the fkin is hot and relaxed, the fmall cutaneous pores, inftead of an invifible vapour, difcharge *fweat*, confifting of minute but vifible drops, which run together into larger drops by joining with others of the fame kind. The hotteft parts are moft fubject to fweat, as the head, breaft, and foldings of the fkin. The experiment before mentioned, of injecting the arteries, the fimplicity of nature, and the apparent cutaneous and pulmonary

monary exhalation, ſufficiently perſuade us, that the perſpirable matter and ſweat are diſcharged through one and the ſame kind of veſſels, and that they differ only by the quantity and celerity of the matter. The humour of the ſebaceous glands and the ſubcutaneous oil, which being more plentifully ſecreted, and diluted with the arterial juice diſcharged with the ſweat, are of an oily and yellow conſiſtence, and chiefly give ſmell and colour to the ſweat. Hence we find the ſweat more fetid in the arm-pits, groins, and other parts, where thoſe glandules are moſt numerous or abundant. Both blood and ſmall ſand have been known to proceed from the ſkin along with the ſweat.

The nature and quality of the perſpirable matter may be inveſtigated by experiments, and by conſidering its analogy to the pulmonary exhalation. What flies off from the lungs in this exhalation is chiefly water, as appears from experiments, by which the breath, being condenſed in large veſſels, forms into watery drops. That the perſpirable matter is alſo chiefly water, is demonſtrated by its obſcuring a glaſs on which it is received; by obſtructed perſpiration producing a diureſis or diarrhoea; by the ſpeedy paſſage of liquors drank warm, through the ſkin if the body be kept warm, or through the kidneys if the body be cold; and by ſeveral other phenomena. The water of theſe vapours is chiefly from what we drink, but is in part ſupplied from what is inhaled by the ſkin. The particular ſmell of the aliments may be ſometimes plainly perceived in the perſpiration.

That there are, beſides water, ſome volatile alkaline particles, is evident, as well from the nature of our blood, as from the conſiderable miſchiefs which follow an obſtructed perſpiration. This volatile alkaline matter ariſes from the finer particles of blood, attenuated by perpetual

tual heat and triture, and changed into an acrimonious nature. Thefe afford the fcent which is clofely followed by dogs, who would not know their mafters unlefs fomething of a peculiar nature perfpired from each perfon.

The quantity of our perfpiring moifture is very large, whether we confider the extent of the organ by which it is feparated; the abundance of vapours derived from the lungs only; or barely take a review of the experiments made by Sanctorius. This indefatigable man concluded, that five pounds out of eight of the aliment was difcharged in a healthy perfon by the infenfible perfpiration alone, independent of the vifible fweat, and other excretions. In colder climates, the quantity perfpired was found to be $4\frac{2}{7}$ out of 8. But the cutaneous exhalation is even much larger than this; fince it not only throws off a quantity of the aliment, but likewife what is added to the blood by inhalation, which entering, often in a very confiderable quantity, is thus again expelled. But different difpofitions of the air, and of the human body, caufe great variations in thefe proportions. In warm countries, in the fummer months, and in young perfons ufing much exercife, more goes off from the body by perfpiration, and lefs by the urine; while in cold climates, during the temperate or winter feafons, in aged or inactive perfons, more goes off by the urine than by the infenfible difcharge. In temperate countries, making a computation throughout the whole year, fomething more is perfpired than what paffes off by urine; and joining together all the experiments made in different countries, both excretions are almoft alike. The difference of time after feeding alfo in fome meafure varies the quantity perfpired; but in general it is moft copious when the greater part of the digefted nourifhment is conveyed into the blood, and there attenuated fo as to be fit for exhalation. It is naturally diminifhed in fleep, even in the warmer climates; but it is increafed by the heat of bed-cloaths.

In

In general, a plentiful and uniform perſpiration, with ſtrength of body, are good ſigns of health. According to writers on this ſubject, if the perſpiration be increaſed by the weakneſs of the body, it is more hurtful than if it were altogether obſtructed. It is a ſign of health, becauſe it denotes a free pervious diſpoſition of the veſſels throughout the whole body, together with a complete digeſtion of the nouriſhment, the greater part of which is perfectly attenuated into a vapour. When it is diminiſhed, it indicates either a conſtriction of the ſkin, a weakneſs of the heart, or an imperfect digeſtion of the aliments. Perhaps in too great a perſpiration the nervous ſpirits themſelves are evaporated. This diſcharge is, by moderate exerciſe, increaſed to ſix times that of an idle perſon, even to an half or whole pound in an hour. It is likewiſe increaſed by the veſſels being ſtrong and pervious; by warm, watery, and vinous drinks; by animal food of an eaſy digeſtion; by a heavy, temperate, or moderately warm air; and, laſtly, by joy and a tranquil ſtate of mind. The contrary of theſe either leſſen or ſuppreſs the perſpiration; as a thick ſkin, a moiſt air, or a cold and dry one; reſt; more frequent bathing than uſual; a ſupervening diarrhœa; and, laſtly, a diſagreeable nervous affection of the mind. The continuance of life, however, does not depend on a ſcrupulous exactneſs in the quantity of this diſcharge, which is ſo eaſily increaſed or diminiſhed by ſlight cauſes. It is ſhut up by paints in many Indian nations; and it is inconſiderable in many animals without any ſenſible injury. When ſuppreſſed, it is extremely hurtful; producing fevers of the worſt kind. The miſchiefs ariſing from its ſuppreſſion, depend on the putreſcent quality of the particles which are retained along with it.

The ſweat is evidently of a ſaline nature; as appears from the taſte; from the minute cryſtallizations on the cloaths of people who work in glaſs-houſes; and from diſtillation, which

which ſhews the ſweat to be of an alkaline nature. Hence it is, that by this diſcharge the moſt malignant matter of many diſeaſes is thrown off from the body. But, in reality, ſweat is always a preternatural or morbid diſcharge, from which a perſon ought always to be free; unleſs by violent exerciſe, or other accidents, his conſtitution is for a ſhort time thrown into a diſeaſed ſtate. Nor is it unfrequent for ſweats to do conſiderable miſchief in acute diſeaſes, by waſting the watery parts, thickening the reſt of the blood, and at the ſame time rendering the ſalts more acrimonious. By a too violent motion of the blood, the ſweat is rendered extremely fetid; and is ſometimes even red, or mixed with blood itſelf; and being electrified, it is ſometimes lucid.

The uſes of perſpiration are, to free the blood from its redundant water, and throw out thoſe particles, which, by repeated circulations, have become alkaline or otherwiſe acrimonious; and poſſibly to exhale therewith an extremely volatile oil, prepared from the ſame blood. Perſpiration likewiſe qualifies and ſoftens the cuticle, which is a neceſſary medium extended before the tender ſenſible papillae.

Beſides the exhalent veſſels before mentioned, the ſkin is full of ſmall veſſels, which inhale or abſorb thin vapours from the air, either perpetually, or at leaſt when it is not very cold; more eſpecially when the air is damp, the body unexerciſed, the mind oppreſſed with grief, or both under conditions contrary to thoſe which increaſe perſpiration before mentioned. Theſe veins, ſays Haller, are demonſtrated by anatomical injections, which, if thin or watery, ſweat through them as through the arteries: But, according to latter phyſiologiſts, abſorption is performed ſolely by the lymphatic veſſels. That abſorption takes place, is ſufficiently proved by the manifeſt operation of medicines, pervading the air, or applied to the ſkin; ſuch as the vapours of mercury, turpentine, ſaffron, waters of baths, mercurial plaſters, tobacco, coloquintida, opi-

um,

um, cantharides, arſenic, with the fatal effects of contagious or other poiſons entering through the ſkin; as in the venereal infection. Another proof of abſorption by the ſkin is, that animals live in hot moiſt climates without drink, and yet diſcharge a conſiderable quantity of humours both by perſpiration and urine. Laſtly, abſorption has been proved in ſome diſeaſes where a much greater quantity of urine has been diſcharged than the quantity of drink taken in. It is difficult to aſcertain the quantity of this inhaled matter in animals; in plants it appears, from well-authenticated experiments, to be very conſiderable, eſpecially during the night.

Theſe cutaneous veſſels, both exhaling and inhaling, are capable of contraction and relaxation by the power of the nerves. The truth of this appears from the effects of the paſſions of the mind; which, if joyful, increaſe the circulation, and relax the exhaling veſſels, ſo as to yield eaſier to the impulſe of the blood; from whence, with a ſhortening of the nerves, there follows a redneſs, moiſture, and turgeſcence of the ſkin. Thoſe paſſions, on the contrary, which are ſorrowful, and retard the circulation, contract the exhaling veſſels; as appears from the dryneſs and corrugation of the ſkin, like a *gooſe-ſkin*, after frights; and from a diarrhoea being cauſed by fear. And the ſame affections ſeem to open and increaſe the power of the inhaling veſſels, whence the variolous or peſtilential contagions are eaſily contracted by fear.

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